Vol. 3

SYMPTOMS IN GYNECOLOGY
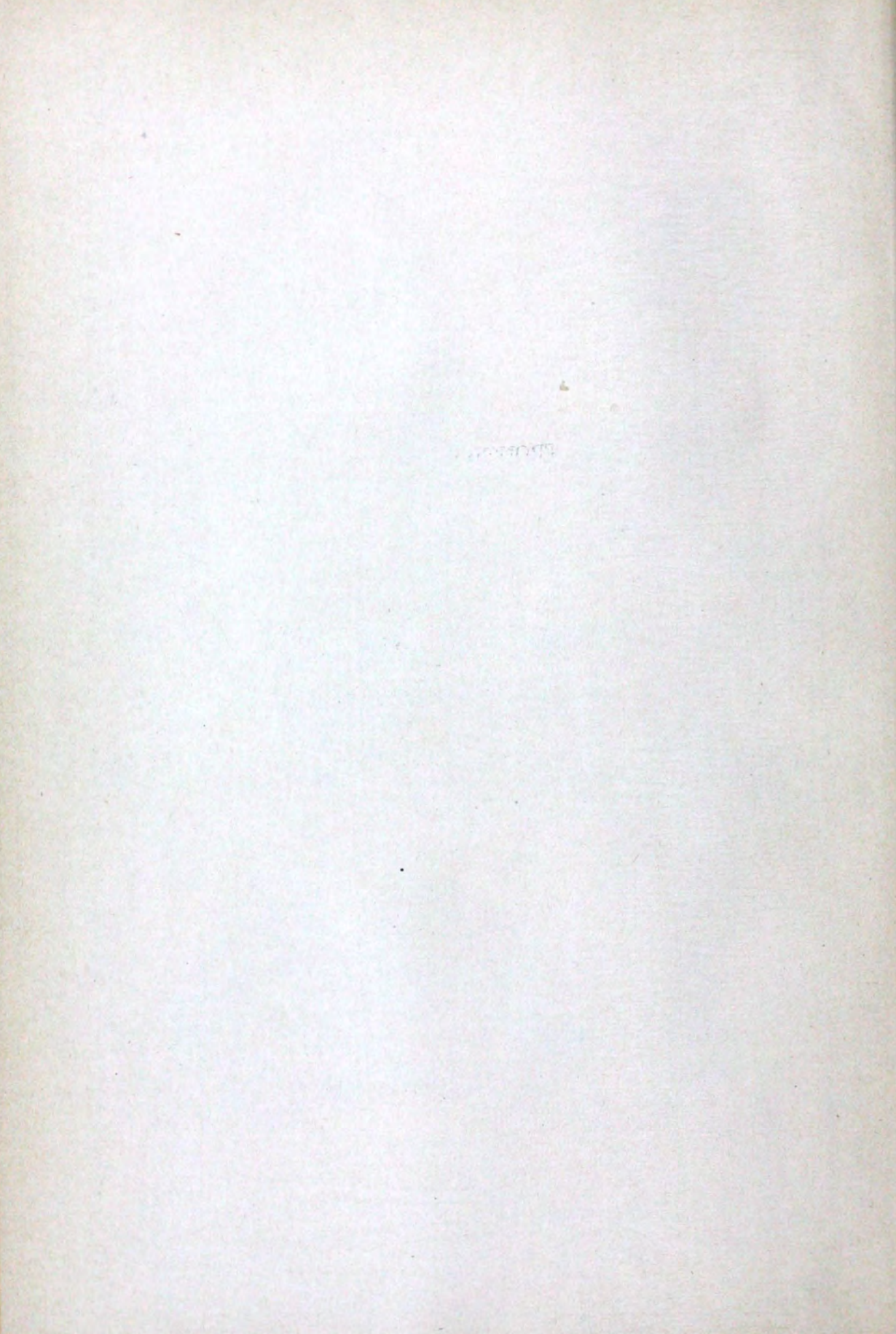## ETIOLOGY AND INTERPRETATION

Mallonee

LEGENDS FOR FRONTISPIECE

Fig. 1.—Uterus and Ovary in a Case of Puberty Bleeding Showing the Well-marked Hypertrophy of the Ovary Due to Hyperplasia of the Follicle Cysts. The ovary is practically as large as the uterus of this individual.

Fig. 2.—The Ovary of a Case of Puberty Bleeding Bisected in its Long Axis. Note the absence of corpora lutea and the presence of follicle cysts.

Fig. 3.—Ovary Bisected in its Long Axis Showing Large Slightly Cystic Corpus Luteum of Pregnancy (third month).

Fig. 4.—Rupture of an Early Tubal Pregnancy at the Isthmical Portion. This tube could not be palpated. The history of disturbed menses, extreme pallor, tenderness of the right fornix and bulging culdesac of Douglas were sufficient to make the diagnosis.

SYMPTOMS IN GYNECOLOGY
ETIOLOGY AND INTERPRETATION

With Notes on Diagnosis

BY

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GYNECOLOGICAL AND OBSTETRICAL MONOGRAPHS

PREFACE

SYMPTOMS in gynecology as presented in this monograph are embraced in three main groups: genital, extra or paragenital and remote. They are here as in other branches of medicine broadly classified as subjective, objective, and structural; reflex, direct, and indirect. The reciprocal relations between genital symptoms and those arising in other organs or systems cannot well be considered apart, therefore they have been included.

As clear conceptions of pathology facilitate interpretation of symptoms, a brief account of anatomical and pathological changes has been interspersed throughout the monograph. Knowledge of etiology is obviously, also of great help in correct interpretation. For this reason special attention has been paid to causation, both general and special, of genital symptoms. The manifestations of genital function and its abnormalities have been utilized as an aid in the differential diagnosis of complicated lesions. To the standard diagnostic methods as already well established, the newer methods of diagnosis offered by the combined use of gas and the X-ray (transuterine and transperitoneal pneumoperitoneum) have been given in full detail.

In the more recent advances in endocrinology has been found an adequate explanation for a number of gynecological symptoms which were hitherto altogether obscure. The ovary has been described more fully than the other glands of internal secretion because of its great importance as the keystone of the primary and secondary sex characters.

An effort has been made to include all practical hints in the identification of type lesions and in the differentiation of overlapping and complicated symptoms. Cases illustrating special points have been incorporated in the text. In this respect a fairly large clinical experience combined with gleanings from classic contributions will, it is hoped, be of service to those who seek greater accuracy in diagnosis and more precise understanding of the gynecologic patient's complaints.

In planning the text a great deal of valuable material has been drawn from Aschner's monograph on *Internal Secretory Diseases in Women*. Aschner has the completest bibliography in the matter of the endocrines in relation to gynecology and his own interpretations are not the least important feature of his book. Winter's classic *Textbook of Gynecologic Diagnosis* has been freely followed in the part embraced by analytic diagnosis and in the description of typical structural symptoms. Mackenzie's little volume on *Symptoms and Their Interpretation* is the source of the interpretation of the symptom, pain. The book by Forbe-Massabuau has been helpful in the matter of the gynecological examination.

To Dr. Josef Novak, Vienna, I am indebted for the matter on backache

and on constitutional anomalies in relation to gynecology. Professor Fritz Kermauner's description of the histology of the ovary here has been embodied *in toto,* as it has seemed to me to be the most concise treatment of that subject available in medical literature. The descriptive articles in *The Index of Differential Diagnosis of Main Symptoms,* by various writers and edited by Herbert French, have also been helpful. To these authors I am glad to express my heartfelt gratitude. For the privilege of using the clinical material from their respective services at Mount Sinai Hospital as illustrative cases, I wish to acknowledge my thanks to my former chief, Dr. H. N. Vineberg, and to my present chief, Dr. Joseph Brettauer.

Finally it is a pleasure to thank my friend Dr. Eli Moschcowitz for revising the manuscript. To my secretary, Mrs. Margaret P. J. Green, I am also indebted for valuable assistance.

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ETIOLOGY OF SYMPTOMS

CHAPTER I

INTRODUCTION

In this monograph an attempt has been made to present the symptomatology of the diseases peculiar to women and to describe its mechanism. This includes not only a consideration of the symptoms due to disorders of the female generative organs, but takes account as well of the reactions of these diseases upon the organism. The complaints of the patient as they affect the body economy as a whole are as important as their interpretation of isolated visceral disease. In recent years more intensive study has been devoted to the psychic as well as the physical disturbances to which woman is subject, for the one influences the other often to a striking degree. Whether symptoms arise chiefly as a result of physical alterations in the genital organs or in perversions of their physiological function, their effect upon the well-being of women is the same.

The practice of gynecology has come to include a great deal more than the relief of symptoms directly referable to the region of the internal or external genitalia. Remote symptoms as expressed by modification of the secondary sex characteristics not infrequently form the chief complaint of the patient. In gynecology, function and anatomy must be properly correlated. We cannot, for instance, regard the uterus as the cause of every disturbance that arises within it. For example, the irregularity in quantity and in the periodicity of the menstrual flow has received newer interpretation in the last decade or more. Clinical observation and findings have taught us that there are extra-uterine causes of disturbance in uterine function. We do not think of dysmenorrhea, of metrorrhagia, menorrhagia, amenorrhea, oligomenorrhea or even sterility as due to pathological conditions of the uterus alone. We do not longer ascribe a host of symptoms, regional and remote, to the deviations in the position of the uterus. The belief in purely mechanical causes of gynecological symptoms has been gradually abandoned and in its place has come a newer, perhaps more rational, interpretation.

Our conception of gynecological pathology has changed so that we may now avoid certain operations for the correction of gross anatomical abnormalities. We need only mention the revolutionary change in our notion of endometritis, thereby saving unnecessary curettage. This also holds true in regard to postural deviations, the flexions and versions of the uterus. We do not ascribe backache and sterility of comparatively recent date to a retroversion which may have been congenital or have existed for a long time.

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We know by liberal allowance that these symptoms do not obtain in many women who have retrodeviations of the most extreme type. Possibly the numerous procedures devised to overcome so-called malposition of the uterus and maldevelopment of the cervix are based upon a faulty estimation of associated symptoms. Rational criticism has been applied to gynecology in the past decade in a way to bring the genital tract of women in better relation to the whole organism and to the rest of the component tracts and systems of organs.

Formerly the only contact between gynecology and internal medicine was at the operating table or when considering operative contra-indications. Was the patient in a condition to stand operation, that is, were the heart and lungs in tolerably good condition? Were the kidneys functioning properly or was there diabetes? It was learned by experience, occasionally tragic, that certain cardiovascular, renal, pulmonary conditions and diabetes were, in general, contra-indications to operation. While these contra-indications were well recognized and were taught, we were at the same time still nurtured in the notion that "reflex association" of symptoms resulted chiefly from mechanical pressure. Thus came the habit of associating retroflexion with backache, dysmenorrhea with "conical cervix," uterine hemorrhage with endometritis.

Progress in our knowledge of gynecological diseases has increased in proportion to its correlation with general visceral pathology on the one hand, and with advances in general medicine on the other. Cardiac decompensation has long been a recognized contra-indication to serious gynecological operation; and at the same time, we may well regard it is a cause for disturbance of genital function. For example, the menorrhagias associated with chronic valvular disease have become well known. Pulmonary tuberculosis and chronic pyemia are well known to give rise to amenorrhea and oligomenorrhea. The Wassermann reaction has cleared certain gynecological symptoms which were hitherto obscure.

The relation between chlorosis and dysmenorrhea has received new interpretation since greater attention has been called to the rôle of the ductless glands. Diseases of metabolism, which by themselves were believed to have an important influence on gynecic physiology, have, in the light of the doctrine of the interrelation of the endocrine glands, received a different and more amplified interpretation. Psychic shock has been accorded a definite place as a cause for gynecological disturbance. The various psychoses of women have received new tests as applied to coexisting gynecological pathology. So-called sympathetic changes which the maternal organism undergoes during pregnancy are an excellent example of the vital and intimate interconnection of visceral physiology, normal and perverted.

The specialist in gynecology has been obliged to keep pace with the constant progress in his own field as well as in that of general medicine. He is no longer called upon to make a broad diagnosis; he is expected to evaluate the importance of the signs or symptoms, and to determine whether they may properly be the result of the pelvic findings. Moreover, he is expected to know enough general medicine to be able to determine whether other conditions, besides those of the pelvic organs, may explain the symptoms. Thus

the diagnosis of systemic conditions, such as typhoid fever, pyelitis, malignant endocarditis, diabetes or uremia, may properly be established by excluding the presence of pelvic disease.

An attempt to correlate pathological genital function with diseases of other organs and systems of organs, while dating perhaps from previous decades, has only recently found expression in monographs dealing with this newer scope of gynecological disease. The two volumes forming supplements to the Nothnagel system have been devoted to setting forth *The Diseases of the Female Genitals in Relation to Internal Medicine.* This is the work of the pupils and associates of the late Alphons von Rosthorn to whom the two volumes are dedicated. The interactions of gynecological disease and general medical affections have thus been stated concretely so that their reciprocal rôles as cause and effect might be properly understood and recognized. Following this monumental work, American authors have begun to incorporate chapters in their textbooks dealing with this newer phase of gynecology. The present monograph series, while not a direct outgrowth, reflects this recent tendency in America.

The scope of the gynecologist has therefore enlarged considerably. He has been obliged to add a very important factor to his special task. He must not only continue to strive for greater expertness in the accurate diagnosis of local gynecological disease and in correct local medical and surgical treatment, but he must also include all the pathological alterations incident to the sexual life of woman. Blair Bell has introduced the term "sex complex" to denote the correlation of the internal secretions and the sex functions. The "genital system," according to the same investigator, includes remote endocrine glands as well as the genital organs. The further study of the endocrine units in this "genital system" is of the utmost importance to internists. For, in this department of medical research, the aspirations and interests of both gynecologists and internists are practically the same.

The forward movement in the art and science of gynecology has been reflected in the attitude of the modern patient. Many questions are now raised by her that in previous decades were not even dreamed of. If she is to undergo an operation, she desires to know whether both local *and* remote symptoms will be eliminated. She may be told that she has a retroflexed uterus, but she is more concerned as to whether the correction will relieve her backache, constipation, etc.

There are numerous lesions that may not cause symptoms, and operations to correct such lesions are not only unnecessarily meddlesome but may do considerable harm. On the other hand, more remote symptoms may depend upon pelvic trouble not as well defined as, for example, carcinomata or ovarian tumors. Such lesions as corpus luteum cysts, cystic ovaries, bilateral hydrosalpinx, circulatory disturbances in the uterus, tubes and ovaries, etc., are nevertheless responsible for the subjective symptoms. These lesions may be the primary cause or they may be secondary and depend upon structural or functional changes in neighboring extragenital organs or in more remote viscera. To evalute these symptoms by tracing the connection between the genital organs and other viscera, as well as between them and the whole

organism, is the task set before us in the following pages. In this we have endeavored to pay special attention to the gain in our knowledge of the physiology of the female genital organs as gained by experimental surgery, biochemistry, serology and bacteriology. Most recently a decided aid in diagnosis was offered by causing pneumoperitoneum by the introduction of gas into the uterus. This has not only been of special help in female sterility but has also been serviceable in the differentiation of other pelvic conditions.

Progress in gynecology has been noted in two other directions: (1) the follow-up reëxamination of patients. There is no doubt that this has resulted in the most valuable service to patients and, at the same time, has taught us the limitations of our therapy and the accuracy of our therapeutic indications. It has, moreover, thrown light upon the relationship of symptoms to their definite causes. This innovation in medicine has proved of inestimable value both to the clinician and the gynecological operator and bids fair, if properly conducted, to establish a scientific rationale for surgical intervention to relieve female complaints. (2) Teamwork in group diagnosis. The credit for this progressive step belongs most notably to the Mayos, who have organized the plan and the method for group diagnosis. It is perhaps a modern development of the old established practice on the part of hospital staff physicians and surgeons to consult with each other on border-line and obscure cases.

These movements in gynecology have led, perhaps unconsciously, to an attempt on the part of individual clinicians to review their own particular specialty—to take inventory, as it were, of their knowledge. This, in turn, has led to a reinterpretation of symptoms as well as to a modification and improvement of technic. In the past decade, the writer has experienced several changes in his mental attitude toward gynecological symptoms and their meaning. It may be that he has felt the need of relieving the tedium of the ever-repeated complaints and conditions of the dispensary patient that most men tire of examining after five or ten years of dispensary work. If the pathological lesions are limited, and mastery in their recognition is attained after some practice, the symptoms are so manifold and often so diverse as to engage our undivided attention. Surely when we contemplate them in relation to the whole body, our interest becomes boundless. Our best efforts are often thwarted by the limitations of our present knowledge in pathology and physiology. Where these are lacking, we must depend upon careful and accurate clinical observations, which have the value of a complete laboratory test.

CHAPTER II

SYMPTOMS IN RELATION TO PHYSICAL FINDINGS

Winter asserts that, in diagnosis, the more certain the expert is of his physical examination, the less importance he attaches to the symptoms. Only when the objective findings are not definite should the symptoms be considered of importance in the diagnosis. The bimanual examination, says Winter, has made it possible to establish an undoubted diagnosis without the aid of the amanuensis, and it should take first place in the construction of the diagnosis.

There are undoubtedly certain conditions in the body that are associated with no frank or recognizable symptoms. Thorough physical examination discovers them and they may exhibit no tendency to change during the course of years. Such lesions are fibromyomata of the uterus of smaller or larger size; such are the traumatic injuries of the genital canal, etc. The question arises in a patient who presents both these conditions, whether the "fibroid" shall be removed or the laceration be repaired, or both. It happens only too often that the patient continues to have her symptoms after the operation. Disappointment is apt to be followed by a further train of symptoms left in the wake of the operation. The host of patients that may fall into this category are legion. If we cannot relieve or cure, let us not induce disease by untimely or ill-advised operation. Better to let the patient have her symptoms, seeking to remedy them by "unorthodox" methods, if she will, than to induce symptoms by orthodox surgery.

To carry the discussion further with regard to fibroids, we have learned enough of the life history of these tumors to be able to determine the changes in them which should cause symptoms.

An uncomplicated "fibroid," no matter of what size, does not necessarily cause trouble. Its situation within the uterus or pelvis has an important bearing on the causation of symptoms. If the fibroid develops within the broad ligament, it is very apt to press upon the vessels and nerves and cause venous and lymphatic stasis and pain. A submucous myoma is very apt to cause hemorrhage. If it has undergone circulatory disturbance (red degeneration), inflammation, necrosis, suppuration, cystic formation or perhaps malignant change (sarcoma, carcinoma), symptoms would in all likelihood be present. Or, on the other hand, a pedunculated fibroid becomes twisted and causes pain. When these conditions in the "fibroid" obtain, they give rise to symptoms. When they are not present, fibroids may exist harmlessly in the body for a very long period. Large fibroids, if situated subperitoneally and growing upward into the abdomen, may not be associated with any symptoms whatsoever. Such a case for example was the following:

A woman of forty-eight years, height five feet two inches, weight one

hundred and eighty-four pounds, was treated for obesity. In the course of a general physical examination by the family physician, it was discovered that the patient had several large fibroid tumors of the uterus, occupying the middle portion of the lower abdomen. The patient had lost fifty pounds in weight under dietary regimen, and, when I examined her, the upper level of the tumors reached the umbilicus in an abdomen which was very large. No symptoms, not even a sense of weight or discomfort, were experienced by this patient. In spite of the large size of the growths, they were amply accommodated and caused neither pressure symptoms nor functional disturbance. It is highly probable that the tumors were mostly subserous and that the uterine cavity was not encroached upon by any of them. It is not likely that a submucous myoma in conjunction with fairly large size intramural "fibroids" would be unproductive of menstrual disturbance.

If their growth is very gradual, the abdominal contents accommodate themselves readily and, except for a noticeable increase in abdominal girth, no other observable symptoms may be present. Large growths in large abdomens give no symptoms, but large growths in small abdomens give symptoms. A small submucous myoma, on the other hand, may cause the most inordinate hemorrhage. A diffuse adenomyomatosis may not increase the size of the uterus but may nevertheless induce the most intractable bleeding. Physical examination itself will not establish the diagnosis. The history of the case, together with our knowledge of pathology, will lead to a correct diagnosis and therapy.

Then there is a large class of patients who complain of pain in the pelvis without definite localization. In them no definite lesion can be located by bimanual palpation. This class perhaps preponderates.

Patients may be classified into several groups according to the relation between symptoms and the presence of physical data:

1. Those who present no apparent disease and yet in whom the symptoms are marked.
2. Those who present pathological lesions and yet in whom the symptoms may not, strictly speaking, be ascribed to them.
3. Remote symptoms which are thought to be due to gynecological lesions (consultation cases).
4. Cases with definite disease and more or less characteristic symptom complexes, such as ectopic, abortion, gonorrheal urethritis.
5. Scattered, generalized, vague symptoms in which the gynecological symptoms play some rôle. These are the constitutionally unfit (anomalous development); the physiological incompetent and the psychoneurotic; and the patient of multiple operations.

1. A patient complains of excruciating pain in the buttock or groin or in the iliac fossa. The most careful bimanual examination, including inspection and sounding, fails to detect an abnormality in the genital organs. Sigmoidoscopy, cystoscopy, roentgenography, all fail to reveal the cause of the pain. It may be constant or intermittent; and may not be affected particularly by walking or moving about. After the most careful search, one has to

confess his inability to establish a diagnosis. We will take up this question in discussing the mechanism of pain with special reference to regional location.

2. There is a not inconsiderable group of patients who complain of symptoms that have no direct reference to the pathological finding. For example, the only abnormality found is a moderate rectocele. It would be difficult to hold that condition responsible for such symptoms as irregular bleeding and backache or even obstinate constipation.

3. This is not a small group in which generalized vague symptoms are complained of, relief from which is sought at the hands of internists. The general physical examination fails to reveal any organic basis for them. Does the gynecological status throw any light upon their etiology? Such symptoms are migraine—periodic headache—abdominal pains, lassitude, depression, vasomotor disturbances, etc. May the genital organs be the seat of some chronic disease process which may be regarded as a focus of infection? Can asthma, for example, in certain instances be due to a chronic pyosalpinx. Can a chronic endocervicitis with retention cysts account for the same phenomenon? Only the most rigid observation after appropriate therapy will help to elucidate these points. In the present state of our knowledge, it would be simple speculation to express an opinion. This should form the basis of future research.

4. This class has a definite disease with more or less characteristic symptom complexes. Pregnancy and its accidents comprise the majority of this class of patients. Thus, ectopic pregnancy has a well-recognized syndrome and, while a number of conditions may simulate it, its occurrence is diagnosed or at least strongly suspected. Incomplete abortion is fairly easy to recognize. So to a much less extent is salpingitis when it ensues upon a characteristic history of exposure to infection. The same may be said of urethritis and other such conditions.

5. A special group, involving some of the symptoms expressed in group 3, is formed by individuals who may be said to be constitutionally unfit, physiologically incompetent; the anomalously developed. The psychoneuroses fit in well with this class of patients.

This group has perhaps received more serious attention since the modern era of surgery. It is not infrequently made up of patients who have been operated on two or more times without the slightest permanent relief. Multiple operations have failed also to establish the etiology of their troubles. It would seem as though the greatest weakness of surgery and surgical diagnosis is especially spent upon these unfortunates who have now an appendectomy or a cholecystectomy, then a ventrosuspension or curettage, now a nephropexy or again a gastro-enterostomy; a short-circuiting operation or ovarian resection presenting the scars of well-meant but unhappy operations upon an individual who has simply failed of normal development or who has failed to adapt herself to the exigencies of modern life. They are usually individuals who have a "thousand complaints" covering every region of the body and every imaginable tissue or organ within it.

Very often these patients appear to be benefited by operation. But this is only temporary and is due to autosuggestion or the suggestive virtue of

the postoperative recovery. The lying-in period and the excitement of convalescence help to keep that patient in a happier mental state. After a while the symptoms reappear and gradually the patient is convinced of her incurability.

The more we review our operative results, the more important this question becomes. While not wishing to relax on rigid self-criticism when viewing bad or unfavorable results, the fact nevertheless does hold true that certain patients will neither react immediately to the operation in the same favorable way, all factors being equal, nor will they benefit to the same extent from operative or nonoperative therapy.

The ancients, according to Joseph Novak, have recognized this fact and classified all individuals into four groups according to their temperament. We have come to regard these differences as being inherent in constitutional anomalies. The term "constitution," according to Tandler, implies those qualitative morphological and functional properties which have been brought together by the union of the ancestral germ cells at the moment of conception to produce the new individual. This constitution remains unalterable and, as Tandler expresses it, decides the somatic fate of the individual. By "condition" Tandler understands all those things that can modify the individual by external influences. By the term "disposition," we mean the responsiveness of the body through exogenous and endogenous factors to external stimuli or irritation, *predisposition* to disease, etc.

Stiller described a condition which he termed "asthenia universalis congenita" which includes floating kidney and spleen, Glénard's enteroptosis, gastroptosis and nervous dyspepsia, etc. They are one and the same manifestation of this constitutional weakness in structure. Asthenic individuals are recognized by their pallor, general weakness, narrow-chestedness, nervousness, tired expression with occasionally an expression as of suffering. The skeletal structure is delicate; that of the face frequently shows lack of development. The chest is long, narrow; the epigastric angle is sharp. The upper thoracic aperture is narrow; the costal margin, in relation to the horizontal plane, is greater than normal. The tenth rib is abnormally short and its cartilage is particularly movable. In especially marked cases, this change is also noticeable in the ninth rib. This structural abnormality, the "floating tenth rib," is according to Stiller a pathognomonic sign of asthenia. The breasts are weak, pendulous, and frequently present a livid hue at their peripheral margin.

The abdomen is scaphoid between the ensiform and the umbilicus and from this to the symphysis it is protuberant. The latter is due to ptosis of the stomach, kidneys, and transverse colon. Splashing of the stomach is easily elicited and is due to an atony of the stomach wall. The pelvic inclination is mild and is associated with flat nates.

In the female there is noted a flabbiness of the perineum, hypotonia of the levator ani, weakness and mobility of the vaginal walls, and easily displaceable portio vaginalis and uterus. The latter is very often retroflexed, the ovaries are prolapsed and are to be palpated in the pouch of Douglas as tender bodies.

The lower extremities often show knock-knees and flat feet. The hands and feet are cool, perspire easily, and are subject to chilblains and frostbite. A purple discoloration of the distal portions of the extremities is evidence of the asthenia of the vessel walls; hemorrhoids and varices of the legs are caused by the same mechanism. But it is chiefly in the nervous system that this asthenic constitution finds expression. The asthenic individual is easily tired, is unable to withstand all the unusual requirements of life, and is often depressed and pursued by hypochondriac imaginings.

To the family of asthenics belong many women who consult the gynecologist with complaints of discharge, a feeling of bearing down and urgency of urination. Upon examination one finds the above-mentioned stigmata alone, or occasionally a mild grade prolapse of the vagina with a retroflexed, somewhat (succulent) heavy uterus. Local operative therapy in such cases will fail to achieve a favorable result, for treatment must be directed against the psychasthenia as the source of the bizarre symptoms.

Infantilism is another expression of constitutional asthenia and is responsible for an equally large number of symptoms. The development of an organ may be viewed in an alteration of the form or of the inner differentiation or size, or of its situation. In the same way retardation in development may affect any one of these qualities or all four of them. The immaturity may involve the whole organism or it may affect isolated parts.

Infantile individuals are usually short and delicate. Infrequently, in cases where there is late ossification of the epiphyses, associated with retained tendency to growth, these individuals are abnormally tall (Tandler and Gross). The facial skeleton is small, the root of the nose is sunken, the jaws are poorly developed, and upper and lower jaws occasionally are badly joined. The teeth are frequently small or abnormal in shape or, as a result of lack of space, are irregularly arranged. Persistence of milk teeth and uneruption of permanent teeth are not infrequent. The external ear often shows various anomalies in development. The thorax shows an infantile configuration and is cylindrical, the ribs having a horizontal course. The heart is small, the large blood-vessels are narrow. There may be a patent foramen ovale, a faulty involution of the thymus, a slanting direction of the stomach, an abnormal mobility of the cecum with faulty separation from it of the appendix, a lobulation of the kidneys, an abnormal depth of the pouch of Douglas and deficient development of the curvatura perinealis of the rectum.

Of gynecological interest, especially in this connection of infantilism, is faulty formation of the pudendal hair, lack of fat of the large labia which do not cover the vulva, scant development of the labia minora, while the clitoris is relatively large. The perineum is inelastic and low, the vagina is narrow and inelastic, and the vault of the vagina is shallow. The uterus exhibits anomalies in form and size and is then known as uterus rudimentarius, fetal, infantile and pubescent; the cervico-uterine junction is either extended, leading to retroversion, or abnormally sharply flexed, leading to anteflexion. Not seldom the uterus is retroflexed and is not readily corrected to a forward position by the pessary or, if so corrected, it always has a tendency to fall

backward. Also the faulty union of Müller's ducts leading to malformation by duplication may be included in this group of infantilism. The tubes show narrow tortuosities. The ovaries are small, their surface is more or less smooth; follicle ripening and, more especially, corpus luteum formation is deficient and faulty. Occasionally one may notice an enlargement of the ovaries because of abundant increase in the connective tissue. The psyche of the infantile individual may be normal or there may be a childish behavior, an undeveloped character, inclination to phantasying and to hysterical disturbance.

The gynecologist is very frequently called upon to treat pathological sexual manifestations arising in the infantile subject. They are apt to set in with the onset of menstruation and express themselves in disturbances of that function. For example, there may be severe dysmenorrhea, or more or less protracted amenorrhea; not infrequently there may be excessive, even dangerous, hemorrhages (so-called "ovarielle bleeding"). Very often infantile girls complain of a whitish discharge. Sexual activity in the infantile is apt to be associated with dyspareunia and frigidity, vaginismus and, because of an undeveloped condition of the external genitals, there may be a mechanical obstruction of the sexual act leading to disturbances in the sexual sensation. Gonorrhea in these individuals is especially apt to be obdurate and particularly fulminating. A large number of the infantile remain sterile, or extra-uterine pregnancy takes place, owing to the tortuous, winding formation of the tubes. Intrauterine pregnancy is apt to be associated with complications, chiefly of hyperemesis; or they may have repeated early miscarriages. At labor they often require surgical help because of the narrowness of the pelvis and the rigidity of the soft parts. Extensive lacerations, atony of the uterus or puerperal infection are therefore frequent complications leading to sexual invalidism in some of the cases.

Through the disturbances in the sexual sphere of woman, common in infantilism, the gynecologist has long been acquainted with this constitutional anomaly. Internists have met it in the status thymicolymphaticus, which is characterized by an enlargement of the lymphadenoid tissues, the tonsils, lymph-nodes, the spleen and thymus, which constitute a connecting link between the epithelial internal secretory organs and those of the lymphadenoid group.

Newer investigations point to the chromaffin system as falling in this group. The significance of this constitutional anomaly is in the fact that the lymphatic individuals possess a very low resistance to traumata of various sorts. Thus can be explained sudden and unexpected death after a brief narcosis or minor operation or by moderate or mild infections upon the basis of a status lymphaticus. This condition is of the greatest practical interest to surgeons for the reason that whenever it is suspected in any case one should operate only when the indication is imperative.

Changes in the organs of internal secretion undoubtedly affect the general organism, both as to external manifestations and as to the internal biochemical changes. Here belongs the condition known as eunuchoidism which results from an inhibition of the inner secretory activity of the gonads. This may

be a temporary (prepuberty eunuch) or a lasting one resembling that obtained through castration. The eunuchoid male is easily recognized. The eunuchoid female is somewhat less readily identified but nevertheless may be distinguished. They are generally tall, apparently strong, individuals; the breasts are apt to be fat but poor in parenchyma; the skeleton resembles that of the male in that it is more coarse; and the genitalia are strikingly hypoplastic as compared with the general bodily development. These women get their menses late and irregularly and at long intervals and lose them often at an early age. Rarely, intractable uterine bleeding occurs in a eunuchoid individual. Sterility is the rule among them.

Other pathological affections based upon functional disturbances of the endocrins are Graves' disease, cretinism, myxedema, numerous mitigated forms of hyperfunction and hypofunction of the thyroid, acromegalia, obesity of hypophyseal origin, pituitary gigantism and dwarfism, and genuine Addison's disease. In all these diseases, changes in the genitals are partly coördinated and partly subordinated.

Two other constitutional diseases bear an intimate etiological connection with the ductless glands, namely, diabetes and obesity. These have a profound influence upon gynecological affections, such as eczema and genital pruritus of the diabetic. Their predisposition to all manner of menstrual anomalies and to sterility, and their susceptibility to fatal complications when operation is undertaken to relieve the symptoms, are well known. The bad prognosis of diabetes complicating pregnancy and the effects of obesity upon the gonads have also long been recognized.

A number of systemic infections have a profound temporary effect upon sex function. A number of others, while apparently of brief duration, appear to exert a permanent influence upon sex physiology. The occurrence of the recent influenza epidemic has brought to conspicuous notice, both of internists as well as of gynecologists, the menstrual disturbance during the height of the fever, and the later disturbances in menstrual irregularity; also the decided tendency to miscarriage or premature abortion or labor with practically always a dead fetus. The almost specific influence of infectious parotitis (mumps), occurring in infancy or later on in life, upon the gonadal function is a fact that has been repeatedly observed. Permanent amenorrhea, olignomenorrhea and sterility may be traced to an attack of mumps.

Chronic nephritis with high blood-pressure appears to influence the menstrual cycle, predisposing especially to hemorrhages. Tuberculosis and chronic wasting diseases, of whatever etiology, affect the menses by lessening their occurrence or causing them to stay away altogether. Malnutrition or starvation has the same effect. It would seem as though nature makes an intentional effort to conserve the loss of blood by suppressing ovarian function.

Here again it is well to emphasize the importance of treating a sick patient rather than treating a disease; that the gynecologist must make a conscious effort to avoid falling into the practice of viewing isolated special departments of surgery as of paramount importance. By bearing in mind the constitution of his patient, he will be in a position to render more efficient service.

CHAPTER III

PRINCIPLES OF PHYSICAL DIAGNOSIS AND INTERPRETATION OF SYMPTOMS

Consideration of the patient's complaints should include the most painstaking and detailed history of the physical status as well as a careful physical examination. These two factors usually complement or reënforce each other in the interpretation of the symptoms and the analysis of the physical findings. Occasionally the history at once suggests the proper diagnosis by the succession of events which are recorded. Thus, for example, given a young woman of the childbearing age with the history of amenorrhea, then slight staining, preceded or followed by agonizing pain in one side or the other of the lower abdomen and fainting, and the diagnosis of ectopic pregnancy comes to mind at once. The physical findings in such a case may be too indefinite to be helpful and without the history we might be at a loss. On the other hand, if, in addition to the typical history, one finds a tender mass to the side of the uterus, the latter not being appreciably enlarged, the diagnosis may be regarded as almost positive. If, besides these symptoms, the patient shows pallor or prostration, there can be very little doubt about the diagnosis. In the unmarried and in widows, the history of exposure is naturally to be substantiated. If we are sure that there has been no exposure, we must think of hemorrhage from a rupture of a graafian follicle or rupture of an ovarian cyst with or without twisted pedicle.

It is just in the conditions of abnormal pregnancy that the history is of prime importance. While the question of exposure to sexual intercourse can be checked up by digital and visual examination when the intactness or deflorescence of the hymen and the traversability of the vagina may be ascertained, caution must be exercised in an unmarried or widowed woman before one commits himself to the positive diagnosis of ectopic pregnancy. The diagnosis of incomplete abortion is, under the same circumstances, perhaps easier, but the same caution must also be maintained. The avowed statement in this regard by the patient has almost a pathognomonic value.

If one could be sure of the reliability as well as of the veracity of the patient concerning the evolution of her symptoms, accurate diagnosis would be possible in the vast majority of the cases. But it is fear of discovery and perhaps of eventual publicity that impel single women and widows to conceal or repress facts which would be helpful in diagnosis. There are times when one must perforce give up the idea of an accurate diagnosis because of the inability to decide one point, namely, the sexual conduct of his patient.

A unique case came under my observation some three years ago of a young unmarried woman who gave the history of four months' amenorrhea, slight increase in the girth of the lower abdomen, severe vomiting and marked loss of weight. The vomiting antedated the amenorrhea by three years and she had been exposed to very different climatic conditions in the past five months, coming as she did from South America. She had been observed and treated for gastric ulcer by physicians in her home town and indeed she gave every evidence of hematemesis of gastric ulcer origin. Vaginal examination was impossible because the hymen was intact and impassable to the finger. By recto-abdominal examination, a mass was found to be of the size of a four to four and one-half months' pregnancy which seemed to be continuous with the cervix. The latter was not softened to the degree of Hegar's sign and appeared to be rather small to the recto-abdominal touch. Colostrum was present in both breasts. Repeated questioning as to exposure was negative. The diagnosis of ovarian tumor, soft uterine myoma complicating a gastric ulcer, was the one made by several examiners. The third possibility was pregnancy with or without gastric ulcer. In favor of this diagnosis was the large tumor in the pelvis and lower abdomen, which appeared to be connected with the cervix; the incidence of amenorrhea of a duration corresponding to the size of the tumor; the presence of vomiting which, although excessive, nevertheless could arise as a result of the pregnancy; and the presence of fresh colostrum. Against these was the intact hymen and the absolute denial of the patient relative to the sexual act. There were no fetal movements nor could fetal heart sounds be heard. The patient appeared in wretched condition and, while my conviction pointed to pregnancy as the most probable diagnosis, I was urged by her family physician and the others in consultation to perform a laparotomy.

The presence of colostrum, it was argued, could be accounted for by any abdominal tumor, especially a dermoid. Indeed a large cystic dermoid might give the same physical findings in the absence of access to the vagina. As the dermoid tubercle and other matter cast shadows by the X-ray, and in the hope that the fetal skeleton might show up in the skiagram, I had a skiagraph made with the result that a four to a four and one-half months' fetal skeleton was demonstrated.

Had this patient only confessed to the fact of exposure, the diagnosis would have been simple. The fact was incidentally established in this case that, with certain technic, it was possible to show the fetal skeleton in utero in the middle stage of pregnancy. ·

On the other hand, a patient may be accused of being pregnant although her moral life is without blemish. Such was a widow of forty-two who was told she was pregnant, though her widowhood was of twelve years' standing. Her actual condition was a uterine carcinoma which had reached the point of inoperability and which was of such size as to give the impression to the inexperienced physician of incomplete abortion.

The honesty of the patient is also of considerable importance in the matter of gonorrheal infection. This forms one of the most elusive, and often insoluble, riddles in gynecology. Here the difficulty lies in settling whether

the husband or wife has strayed from the path of virtue. A confession in such instances is naturally of the greatest aid. The positive demonstration of the gonococcus establishes the fact of venereal infection. But what if the gram negative diplococcus cannot be demonstrated? It is, however, better to give the patient the benefit of the doubt when the positive evidence is lacking and to depend upon the history and other physical findings to establish a diagnosis that will not necessarily spell gonorrhea.

Sometimes the physician will lay too much stress upon incomplete laboratory evidence or perhaps upon inexpert evidence and at the same time be too ready to discount the patient's statement. Such was the case of a woman of forty-eight in whom the menopause was not yet established. One child was born to her twenty-two years before. There had been no other pregnancy. She had pelvic peritonitis and a large mass was palpable in the median line, fixed and tender to the touch. There was a profuse vaginal discharge. A smear made by one not trained in microscopy led him to report not only the presence of gonococci, but tailless and wholly intact spermatozoa, which implies recent exposure. Notwithstanding the patient's denial on the ground that her husband was sexually impotent and no coitus had taken place for a long period, this examiner confronted her with his laboratory evidence which in his opinion absolutely disproved her statements. Now had he known more about spermatozoa, he would have been aware of the fact that the head alone of spermatozoa is an exceedingly infrequent occurrence and that tailless spermatozoa would not be recognized in purulent discharge which is rapidly destructive to them. What is more interesting is the fact that the morphological structures in the methylene-blue stain which he saw were actually artefacts that had not the slightest resemblance to spermatozoa. These, when once properly studied and recognized, are unmistakable. The examiner in this particular case had no experience in microscopy, nevertheless he was quite willing to discredit the patient's history by his laboratory findings. The subsequent course developed that the patient was suffering from a necrotic fibromyoma with perimetritis, adhesions and a pelvic abscess.

Another case illustrative of the value of a statement of the patient follows. The patient was thirty-two years old; she had had one child aged four and no other pregnancy. Intelligent contraceptive precautions were taken to prevent another pregnancy. Nevertheless the patient skipped one period, stained for two days and suffered excruiating pain in the right side of her abdomen. Examination revealed a fullness in the culdesac but no tenderness. A posterior vaginal section for diagnosis was made and immediately upon opening the Douglas peritoneum, a tremendously large omentum prolapsed through it. Its edge was curled upon itself and protruded some eight inches before it was replaced. The tubes were inspected and found to be normal. There had been no collapse; the diagnosis was not sufficiently warranted by the history and the physical findings; therefore the exploration was done. But, had the statement of both husband and wife that the precautions were "well guarded" been heeded, the diagnosis of ectopic could have been positively excluded. This patient subsequently went through an ap-

pendectomy operation with unsuccessful result, after which attention focused upon her genito-urinary tract. A significant fact worthy of note in this case was the bradycardia which is most unusual in a case of ectopic pregnancy.

Thus the history and physical examination are closely linked. Where the one contradicts the other as, for example, when a soft, enlarged uterus say of two to two and a half months' pregnancy is found by bimanual examination and when the physical findings are absolutely satisfactory, the diagnosis of pregnancy may rest upon that finding alone, particularly in the hands of a careful and experienced examiner.

The definite relationship between pregnancy and amenorrhea, which are constantly coëxistent, renders the diagnosis presumptive upon the history of the patient. Such a close relationship in other gynecological conditions would naturally facilitate their diagnosis. As menstruation depends upon ovulation or rather ovarian activity, the disorders of menstruation will depend upon affections of the ovary. Attention to this fact has led to a clearer interpretation of the phenomena of menstrual irregularities. These will be described later.

It is well to keep in mind the histological and anatomical structure of the component parts of the genital tract and to correlate symptoms with the functional activity or purpose of these parts. For example, the vulva contains sweat and sebaceous glands and carries hair upon its surface. The sebaceous glands are very abundant. Hence they may be subject to any of the affections of the skin in general plus those special irritations to which they are exposed by virtue of their proximity to a discharging canal. The small labia are structurally similar to the large labia, except that they are devoid of sweat glands and of hair. The Bartholin gland is situated at the orifice of the vagina on either side and is a racemose gland with an excretory duct that opens at the lateral edge of the vagina near the introitus. Its secretion is a thin, pale or whitish mucus which is said, however, not to give the mucin reaction. On either side of the urethral meatus, Skene's ducts are situated, lined by a many-layered squamous epithelium and having a slight secretion because their terminal end vesicles are lined with one- or two-layered cylindrical epithelium. By their orifices, they may take in infective material.

The muscular planes have a definite function and partake of the function of voluntary muscles anywhere in the body. Being associated with the sexual act, they are subject to the erotic temperament of the individual, at times showing such marked hypertrophy as to render coitus impossible and interfering with satisfactory digital examination. Anesthesia is required sometimes to accomplish this. While sometimes occurring in athletic women, as a rule it is due to erotic stimulation, mental or physical, or both. Weak muscles occur in the generally debilitated, in cases of malnutrition and in the constitutionally handicapped already referred to. Trauma of labor and parturition cripples them so that the sexual act as well as defecation are impaired, while the pelvic support which depends upon them and their fascial covering also suffers.

The vagina is lined by stratified squamous epithelium with a cornified layer at the most superficial portion. It is tough and resistant to bacterial

infection when intact. A catarrhal process of the vagina differs from that occurring in the cervix or the intestine, for example, in the different types of mucosa. The occurrence of genuine mucous glands in the vagina has been reported by some observers, but this is too infrequent and too fragmentary to account for the vaginitis designated as catarrhal. Its surface is thrown into folds in the virginal state but becomes smoothed out by coitus, pregnancy and labor which stretch it and render it permanently wider. Its deeper portion or vault is ampullated and converted into fornices on all four sides by the projection into it of the vaginal portion of the cervix. This is lined practically by the same type epithelium as that covering the vagina and it stops at the exernal os where it joins sharply the single layer of cylindrical epithelium lining the cervical mucosa. The latter is thrown into long branching crypts, the arbor vitae, and secretes a mucous material of alkaline character which increases with sexual activity and varies with the stages of the menstrual cycle. Such is their formation that, if once infection finds its way there, it is difficult to eradicate it because the glands reach deep down into the parenchyma of the vaginal portion where medicinal agents fail of penetration. Also, here retention cysts are formed by the crypts being shut off by agglutination of diseased epithelium or by plugs of inspissated mucus giving rise to the ovula Nabothii. The squamous epithelium of the portio vaginalis may be laid bare by trauma or it may be destroyed by disease when the cylindrical-celled cervical mucous epithelium will replace it by contiguity or from deep-seated portions of the cervix glands which break out upon the surface and give rise to the condition known as erosion.

The cervical mucosa may be plugged through sexual overactivity and active pelvic congestion, thus preventing access of spermatozoa to the uterine cavity, and consequently causing sterility; or there may be an active inflammation due to bacterial invasion, leading to a chronic obdurate discharge of mucus and mucopus. This is to be distinguished from leukorrhea, which is due to a vaginitis associating cervical infection or that of a nonspecific character. The whitish discharge consists of desiccated epithelium which is produced by the churning and rubbing upon each other of the vaginal walls during the act of walking, during micturition, defecation and coitus. The type of infection, as a rule, is mild and is due to an avirulent microörganism, often of the anaërobic and nonpathogenic variety.

The high cylindrical epithelium of the cervix mucosa joins the low cylindrical and sometimes almost cuboidal epithelial lining of the uterine cavity at the internal os. The junction is most often sharply defined. Only occasionally the one or the other exceeds this limit for a short distance in an area designated as the isthmus of the uterus. The internal os forms a barrier to infection from the cervix, and only very rarely, except in the abortal infections or puerperal infections where this natural barrier is broken down, does infection spread to the corporeal endometrium. Curtis' studies have shown how free the uterine cavity is of infection, although the cervix and the tubes may both be involved in chronic inflammation.

A gross trauma, such as the introduction of the curet or other instrument introduced through infective areas into the uterine cavity, may carry septic

matter and cause an endometritis. This is, however, comparatively rare even in gonorrhea. When the cervix mucosa agglutinates, stenoses result with consequent pyometrium and hematometrium, and complete suppression of menses or very scanty and painful menstruation. The retention may, of course, extend to the tubes and peritoneum, causing salpingitis, pyosalpinx, hematosalpinx and peritoneal inflammation.

The uterine cavity is trifoil-shaped and its capacity is only 10:15 minims (Poirier) in the nulliparous uterus. This varies considerably with the size of the organ. Its musculature is very stout and it has a complex architecture which adapts it to the expansion engendered by the growing ovum or fibromyomatous tumors developing within its parenchyma.

The tube lumen penetrates the uterine musculature at either horn, where it has a diameter of one millimeter. It is star-shaped owing to four or five simple folds of epithelium projecting into it. The lumen begins to widen the moment it emerges from the uterine wall, where it forms the isthmic portion of the tube, and gradually reaches its widest diameter at the ampulla, emerging at the fimbriae. Throughout the greater portion of the tube, the lumen on cross section presents a labyrinth of spaces made by numerous tufts which almost touch each other in many parts. Any inflammation readily causes agglutination of these tufts, giving rise to strictures, while inflammation involving its muscular and peritoneal coats leads to external strictures by adhesions which render the tubes more or less tortuous, and, by occluding the fimbria, leads to hydrosalpinx or pyosalpinx. Incidentally the foundation is laid for sterility and ectopic pregnancy.

The ovaries are complex structures, differing rather radically in their histological make-up from the rest of the genital tract. They are connected with the uterine horn by a short ligament and lie more or less closely to the tube with which they are connected by a thin ligament, the fimbria ovarica, which serves as a bridge to convey the discharged ovum into the wide mouth of the fallopian tube. Here it may be caught into one of a great many troughs formed by the fimbriated longitudinal tongues of endosalpingium.

The ovaries contribute the ova or female germ cells. While that is their essential function, they are composed of other structures which have an associated function, partly to subserve the important function of reproduction by maintaining conditions favorable for its mechanism within the uterus, and partly to induce changes in associated organs after pregnancy and parturition take place to conserve the product of reproduction through *lactation*. Briefly stated, the corpus luteum induces decidual formation and controls its development till the impregnated ovum is thoroughly embedded and has made a good nutritional foothold. This is maintained actively till the placenta is developed in the second month. Its presence apparently prevents menstruation by inhibiting further ovulation during pregnancy and, therefore, removes the possibility of injury to the young ovum which hemorrhage might cause. The interstitial cells of the ovarian stroma influence by their secretory activity the secondary sex characteristics to a marked degree and, indirectly, also serve the all-important purpose of sex.

Menstruation is controlled by ovulation, that is, graafian follicle evolution

and regression, and has a negative importance. We cannot help accepting the declaration of Loewenthal that menstruation means the abortion of an unfertilized ovum. Failure of impregnation results in a lack of reciprocal stimulation of the corpus luteum which ordinarily responds to the demands of the impregnated, growing ovum.

Anomalies in development alter the mechanical function as well as the secretory function of the genital tract. Chief among the anomalies may be mentioned septate and impervious hymen, completely septate (duplex) vagina c_1 partially stenotic vagina, double cervix, double uterus, uterus bicornis, infantilism and gynaplasia.

The ovaries are of such vital importance to the function of the sexual apparatus, over which they may be said to be directly in control, and their histologic structure is so complex that it is deemed essential to give it in detail in a subsequent chapter.

Other structures to be borne in mind as causes of occasional disease are: the Gartner duct, which passes down through the uterus from near its horn to the vagina and through its lateral wall to a point near the external orifice, giving rise in the vagina to cystic formations and, in the uterus, to adenomyoma and occasionally carcinoma; accessory tubes with patent or nonpatent openings causing, in the former case, hydatid cysts of Morgagni and, in the latter case, a possible seat of an extra-uterine pregnancy. The parovarian ducts which form parovarian cysts in the broad ligament are also to be noted.

Finally the paracervical and parametrial tissues and broad ligaments which consist of connective tissue and fat, embedded in which are the lymphatics. blood-vessels and nerves (chiefly sympathetic). These bear the brunt of ascending infections or metastases of malignant growths of the genital tube leading to pelvic cellulitis (exudate) and abscess and carcinomatous lymph-node involvement. When the peritoneal surface or lymph-node barriers are broken through, peritonitis confined to the pelvis or of a spreading generalized character takes place.

The anatomical and histological appearance of the bladder, the pelvic portion of the ureters, the sigmoid and the rectum are also to be borne in mind. It is well to have a clear mental picture of the relationship in space and contiguity of these parts, for symptoms arising from disease of any one of them may resemble those of the others. Also physical findings in certain conditions may involve two or more of these structures. For example, a carcinoma of the cervix of the infiltrating, endophytic type may penetrate posteriorly the paracervical tissues and invade the sigmoid or rectum; it may perforate the vagina by spreading through the antecervical tissues involving the bladder and, through secondary inflammation of the cellular tissue of the broad ligament or perhaps by lymph-node metastasis, surround and constrict the ureters leading to hydronephrosis, etc. A knowledge of the mode of spread of infection and of malignancy along the established pelvic channels, lymph tracts, vessels and fascial planes, is essential to understand associated symptoms.

The muscles and fascial coverings must also be borne in mind. Finally

the bones and joints composing the pelvis are matters not to be lost sight of in the analysis of obscure symptoms.

The cecum, appendix, transverse colon and loops of small intestine with their appendices epiploicae and respective mesenteries occasionally become involved in pelvic inflammation, and due consideration of this fact may help in clearing up ill-defined symptoms or disputed points in the diagnosis.

The rôle of the appendix in pelvic disease deserves especial mention. One has to recall the frequency with which, especially in young women, right-sided pain referred to the pelvis may be of appendicular origin. When we reflect that the appendix is often a pelvic organ, that its mesenteriolum is also attached to the infundibulopelvic ligament of the right-sided adnexa, we may see that affections of that structure would give rise to symptoms simulating that of the tube and ovary. Furthermore, the sequelae of appendicular inflammations actually involve secondarily the pelvic structures, resulting in pathological alteration of their function. Note the sterilities that are due to tubal closure secondary to peritonitis of appendicular origin or the irregular hemorrhages that young women have, owing to the uterus and adnexa being buried in a mass of adhesions in which the intestines are also involved, following an attack of suppurative appendicitis with pelvic abscess during the premarital state. Both the primary control of the function of menstruation, which lodges in the ovaries, and the secondary effect upon the uterus, with its altered physiology, are due to this extragenital inflammation.

Finally, one must bear in mind the fact that pelvic symptoms may be due to more remote intra-abdominal lesions. Abdominal carcinosis and tuberculosis, no matter where the primary seat of the growth or infection, leads in a great many instances to involvement of the pelvic peritoneum and pelvic organs. Gravity plays an important part in the dropping down of fragments from a perforating tumor of the stomach or large gut. These fragments drop off spontaneously or they are dislocated toward the pelvis by the rubbing of the intestinal walls through peristalsis. Thus, abdominal carcinosis may be diagnosed by palpation of hard nodules in the pouch of Douglas or in the lateral pelvic walls. The occurrence of Krukenberg tumors, secondary to carcinoma of the stomach, by this route is well known. A similar mode of involvement takes place in tuberculosis.

The omentum is another structure that is very commonly found to be implicated in pelvic disease. Particularly where the omentum is long, and reaches down to the depth of the pelvis in the normal state will it completely or partially be wrapped about the diseased focus and help wall it off. In this protective sense, the appendices epiploicae may also be seen as beneficent agencies provided in the pelvis to meet the exigencies of bacterial attack to which the female is especially subject, owing to the connection of the peritoneal cavity with the outside world. It must be remembered that this one fact distinguishes the two sexes in regard to peritoneal infection.

Attachment of omentum to pelvic structures is responsible for a few definite symptoms referred to the stomach. The normal motility of the stomach is interfered with during digestion because of the fact that its greater curvature is anchored by the attached omentum to organs which are

practically fixed in the pelvis by firm adhesions. Thus can be explained pain in the pit of the stomach during the height of digestion and the sensation of nausea that dragging on the stomach occasions. If the right-sided edge of the omentum is the portion attached, stricture at the pylorus is apt to result in vomiting and gastric dilatation. By fixing the stomach, respiration is impeded indirectly. At least expiration may be attended by pain, because of the stretching of the adhesions which are more or less tender in the subacute inflammations.

Moreover, adhesions between the various portions of the intestine cause symptoms that have to do chiefly with interference of alimentation. The presence of adhesions, formerly more or less a matter of speculation, is now more readily diagnosed by the introduction of gas intraperitoneally.

Whenever symptoms are too obscure to be explained by the physical findings in the pelvis, it is well to examine the abdominal walls, especially in the inguinal regions. The presence of hernia is especially to be sought for, as its finding would account for certain instances of pain located in the lower abdomen and groin and, with that, the associated symptom of frequency of urination and perhaps dysuria. The presence of a tumor in the abdominal wall is an occasional occurrence where the mass appears to be superficial.

CHAPTER IV

HISTOLOGY OF THE OVARY, PHYSIOLOGY OF THE CORPUS LUTEUM, AND THE INTERSTITIAL GLAND

HISTOLOGY OF THE OVARY

The ovary is so important to the body economy, and its complex structure is so bound up with sex function, that it is well to give here a connected account of its histology. The description as given by F. Kermauner is here followed.

The ovary consists of a cortex and a parenchyma which permit, as a rule, a distinct differentiation. The surface is covered by a delicate single layer of cuboidal or short cylindrical epithelium, which is easily injured. No ciliae are present. In the newborn, this layer is relatively higher than in the adult. Its transition into peritoneal epithelium takes place at the Farre-Waldeyer line. Immediately beneath the epithelium, there lies a tunica albuginea or fibrosa which is poor in cells and of varying breadth and consists of a dense meshwork of connective tissue. In the newborn, this is absent and first appears in the second year of life.

The cortex possesses a very characteristic connective tissue stroma composed of short, spindle-shaped cells with oval nuclei, a delicate protoplasmic body and very little intercellular substance. The cells are arranged in a wavelike manner and are irregular and bizarre in appearance. Smooth muscle cells are not to be seen. The primordial follicles lie embedded in the stroma in an irregular manner and in a varying number. Waldeyer termed the cortex the zona parenchymatosa. In the newborn, the number of the primordial follicles was estimated by Sappey at 400,000 in one woman; by Haule at 36,000; by Kolliker at 6,000; by Grohe at 3,000; by Waldeyer first at 300,000 then at 100,000 (however, in the beginning of sexual maturity only 30,000 to 40,000); by Heyse at 35,000. When it is considered that there is approximately a total consumption of from 390 to 600 ova during the whole period of sexual activity (granted that with every menstruation one ovum is discharged), an enormous number of ova must undergo destruction in the ovary itself. In this respect, the comparative value of an ovum with respect to the spermatozoön is at once striking.

Historical Note.—The follicle was discovered by Regnier de Graaf in 1673, the ova in the follicle by Karl Ernst von Baer in 1827. The primordial follicle was first described by Schrön in 1803 and Waldeyer called attention to the peculiarity of the germinal epithelium. The primordial follicles are subcortical; in the deeper layers one meets with the larger follicles in varying stages of development, from large vesicles to the most varying degree of obliteration.

In the parenchyma or zona vasculosa, the connective tissue is much looser; the fibers are longer and thicker, and are likewise arranged in an aberrant fashion. In the hilum between the larger vessels, the fibers are almost parallel. Follicles are here totally absent. The major part of the parenchyma is taken up by the thick-walled blood-vessels and lymph spaces. In contrast to this, the cortex contains only capillary and precapillary vessels, whose development are frequently in proportion to the growth of the follicles and of the corpora lutea. In advanced age, the vessel walls show extensive areas of hyaline degeneration. In pregnancy similar processes are to be seen. After the puerperium there remains the so-called gestation sclerosis in the ovarian vessels as well as in the vessels of the uterine muscle which remain as a permanent landmark (Pankow, Sohma).

The nerves are throughout sympathetic; only in the hilum are isolated ganglion cells to be found (v. Herff, v. Ebner, Merkel, Vallet). In the hilum the nerves form plexus from which the nerve fibers run chiefly toward the vessels and as far as the cortex.

Elastic fibers are found for the most part in connection with the vessels, everywhere else only sparingly. Chromaffin cells have been found by Bucura in the hilum of the ovary.

The rete ovarii is an inconstant element in the adult. It is seen chiefly in the newborn; in the adult, very rarely (v. Winwarter, R. Meyer) and then they are analogous to the seminal canals of the testicle and bear a similar relationship toward the follicle epithelium in the ovary (Bubler). A positive diagnosis is possible only when a connection may be shown with the cortex on the one hand, and with the rete ovarii in the hilum on the other. Most commonly they form solid, less frequently canalized and winding, cell bands.

The rete ovarii consists of hollow tubes or solid cell bands which are found in the hilum of the ovary and in the mesovarium and which radiate from there toward the cranial pole of the ovary. They are analogous to the tubuli recti of the rete testis. In the adult they are found in one third of the cases. Sometimes, at least in the stroma, the connection with the epoöphoron may be demonstrated. The low, cuboidal, and sometimes cylindrical, epithelium is always surrounded by a covering of dense spindle-celled tissue. The origin of the rete is not settled; at the same time, the older opinion that they arise from sprouts of the glomeruli of the wolffian body has been more and more replaced by the theory that they arise from the germinal epithelium of the cranial portion of the ovary. Occasional proliferation of the rete into adenomata has led to the false notion of a true hermaphrodism.

Besides these structures, one finds not infrequently irregular cysts and epithelial tubes without their proper connective tissue stroma in various places under the surface of the ovary, especially in the neighborhood of the hilum. They are partly to be considered as altered lymph vessels or the result of endothelial proliferation, and partly as proliferation of isolated germinal or peritoneal epithelium. Sampson has claimed, with a great deal of histological data to support his contention, that these are dislocations of endometrial epithelium.

Follicle maturation.—The primordial follicles (ovisacs) are embedded in the ovarian stroma without an essential covering and consist of the egg cell and a single layer of delicate, mostly very flat, epithelium. They are apparently of the same size in all periods of life—0.048–0.069 mm. (Nagel).

The follicles arise through a splitting up of the egg balls (egg masses) of Waldeyer by means of the stroma. In the third year of life, egg balls are still to be found but in scattered areas. Toward the end of fetal life, but occasionally also at a later period, there are polynuclear egg cells and also many-layered follicles (Schottlaender). Kermauner found them in great abundance in a half-grown idiotic individual, exhibiting a high degree of hypoplasia of the genitals, who had a cystic ovary larger than a hen's egg. It is probable that gradually the division becomes complete. Certain authors assumed that the follicles first arise in postfetal life through division of the egg cells (Marchand, Stoeckel). This assumption is scarcely tenable to-day. Schottlaender has described a persistence of egg-ball type of follicles in a child one and one half years old; in his opinion, only one egg cell remains, while the other "nutritive ova" become destroyed.

Concerning the size of the follicles, especially the ova themselves, Schottlaender believes that to a certain degree they may be assumed to keep pace with the general bodily development.

The round ovum contains a pale, faintly nucleated protoplasm, a vesicular large round nucleus of 0.03 mm. diameter (vesicula germinatica), with distinct nucleolus and germinal spot and with a distinct nuclear membrane. Every primordial ovum is surrounded by smooth, tangentially lying cells with flat nuclei.

In a further stage of development, the follicle epithelium becomes cuboidal; the ovum, however, does not undergo any marked change. A maturing or growing follicle is recognized by the fact that the follicle epithelium has become increased through mitotic division resulting in an increased number of layers. As soon as three or four layers of cells are formed, a cavity results through the secretion of the *liquor folliculi* in the epithelium. The epithelial cells in the neighborhood of the ovum as a rule gather into a heap and form the *discus proligerus* (cumulus oöphorus), but this arrangement of cells is occasionally seen toward the hilum. The remaining lining of the cavity is called the membrana granulosa. Thus the mature graafian follicle is formed. The cells of the membrana granulosa continue to proliferate, resulting in a many-layered deposit of epithelial cells lining the cavity of the follicle. The basal cells of this follicle epithelium are arranged cylindrically. Here and there, vacuoli appear in the epithelium around which the neighboring follicle epithelium is grouped in a radiating fashion (Call, Exner, Flemming, Schottlaender). The thin fluid, protein-containing liquor folliculi increases in amount. In the discus proligerus, the cells which lie immediately next to the ovum appear to be cylindrical and radiating—corona radiata. (*Bischoff.*)

At the same time, the ovum itself matures. It becomes three times as large in the ripe follicle as it is in the primordial follicle (0.017–0.2 mm.),

when it attains the size of 0.06–0.08 mm. and a zona pellucida becomes apparent; this is formed from the follicle epithelium. It is a concentric, uniformly strong capsule with fine radiating lines about the formation of which there is considerable diversity of opinion (Kolliker, Retzius, Van Pelsden). The external aspect of this zona pellucida is not sharply outlined, but toward the ovum it is defined by a sharp line of demarcation. Between it and the ovum, there is a perivitelline space, which may be the result of a process of shrinking, inasmuch as it is not to be found in the fresh specimen (v. Ebner). Gradually the egg cell increases in thickness; the protoplasm increases and distinguishes itself by an external, pale, marginal zone and an inner, broader, granular zone, the so-called *deuteroplasm*.

Now the whole ovum is completed. The graafian follicle may attain the size of .25 cm. With the increased growth, it encroaches more and more on the surface of the ovary. Its covering, still rich in blood supply, now bulges; the outermost covering becomes poor in blood-vessels, pale and translucent (stigma, macula pellucida) and surrounded by a wreath of vessels. Finally the follicle bursts and empties itself of its content, that is, liquor and egg, as well as a portion of the membrana granulosa, into the abdominal cavity. The dislodgment of the egg has already been prepared, before the follicle bursts, by a loosening up of the cells of the discus proligerus.

The discharged ovum is not yet capable of fertilization. Out of the oögonia of the first variety, there results, through nuclear division, formation of the female egg-cell and simultaneous throwing off of equal amounts of sex cells or oöcytes and the "reserve" cells. It is these latter cells that are destined to multiply and to form the membrana granulosa and interstitial cells of the ovary.

The ripe ovum measures about 0.2 mm.; the nucleus, from 40 to 50 micra; the nucleolus, from 5 to 7 micra; the zona pellucida, 10 micra.

Along with the phenomena of maturation, in the interior of the follicle and the ovum itself, there is formed the *theca folliculi*. This consists of a coarse outer layer, poor in blood-vessels; the tunica externa, which is made up of concentric, numerously interwoven, small spindle-cells resembling those of the ovarian stroma and is surrounded at its outermost aspect by numerous capillaries; and an inner layer, the tunica interna, which consists of very many cells and blood-vessels. The cells of these are large, rich in protoplasm, epithelioid and much larger than the cells of the membrana granulosa. The larger the follicle becomes, the more lutein substance does it accumulate. Between the theca interna and the membrana granulosa there is still found a basal, structureless membrane whose origin is debatable. Rabl and Schottlaender assume that it arises from connective tissue. The bursting of the ripe follicle is believed, by the majority of authors, to take place not later than fourteen days after the beginning of the last menstruation (Fraenkel, Miller, R. Meyer, R. Schroeder and others).

Corpus luteum (Malpighii).—The rupture of the follicle is immediately followed by the process of its conversion into a yellow body which attains the size of from 15 to 20 or 30 mm. According to Sobotta, this

whole process lasts four days. The cells of the membrana granulosa proliferate by mitotic division and take on fatlike (lipoid) substances and the lutein to which they owe their yellow color. These lutein cells, which vary in size between 10 and 60 micra, are, therefore, of epithelial character (H. Rabl). In the proliferating stage they are larger, polymorphous, and have finely nuclear protoplasm with pigment granules and fat droplets, and a large vesiculated nucleus. The lutein is stained black by the osmium tetroxid; it belongs to the lipochromes.

Hitherto the conception concerning the formation of the corpus luteum was that it began before the bursting of the follicle, and that the proliferation of the theca interna contributed essentially to its rupture. According to Sobotta, this is not correct. It is claimed by Müller and R. Meyer that the lutein cells contain colloid during pregnancy, a finding which is assumed to be a positive sign for the epithelial origin of the lutein cells.

We sometimes distinguish a corpus luteum verum (of gravidity) from a corpus luteum of menstruation. As a matter of fact, J. Müller found neutral fat in a corpus luteum of menstruation and not in that of pregnancy. This neutral fat is, however, only a symptom of degeneration. In the corpus luteum verum, fat also appears during the puerperium. Moreover, it has been established that the corpus luteum of pregnancy does not always persist to the end of pregnancy. Ovulation during pregnancy is said to occur in 50 per cent of the cases (Ravand). This, however, is disputed by Seitz. As a decisive difference between the two forms cannot be demonstrated, not even in the matter of size, a number of authors have advised that the differential designation be dropped. In any event, the corpus luteum falsum should be applied to that of menstruation in contradistinction to the corpus luteum verum of pregnancy.

Simultaneous with the proliferation of the granulosa cells, blood-vessel sprouts push their way from the theca interna into the lutein layer and vascularize it (vascularization stage, R. Meyer), while, at the same time, they form a matrix for the cells. The lutein cells become surrounded in groups by the connective tissue. During this process, the cells of the theca interna may themselves be retained in more or less intact portions and thus strengthen the lutein-cell layer. These remain always, however, as a peripheral layer called theca lutein cells in contradistinction to granulosa lutein cells. Pfannenstiel, Seitz, Cohn and R. Meyer have advanced this double genesis of the lutein cells, while Sobotta speaks only of an epithelial origin.

The origin of the blood kernel of the corpus luteum still forms the subject of debate. It is found quite regularly in nonpregnant cases. R. Meyer alone has seen a very young corpus luteum without its blood coagulum. Hauswaldt then sought for it at autopsies. Up to the present time, all authors (Sobotta, R. Meyer, Aschoff, Hauswaldt) believed that this was due to accident and secondary to a trauma, that is, at operation, examinations, etc. Still, R. Meyer and C. Ruge have shown that, in the vascularization stage, typical blood foci gradually became larger; in other words, that this is physiological. In the pregnant woman, according to R. Meyer and Hauswaldt, a blood kernel is never to be found; and Kermauner also

affirms that he has never seen one. R. Meyer explains the circumstance by the more powerful formation of the blood-vessels and the connective tissue. Should this difference be substantiated by a sufficiently large material, the separation of a corpus luteum graviditatis from menstruation would be very simple. The connective tissue penetrates the lutein layer more and more, and finally fills the inner chamber of the follicle. The blood kernel itself is replaced by blood-vessels and gradually becomes absorbed. The lutein cells become larger and more swollen; soon they appear to be individually enmeshed by fine connective tissue fibrillae. The theca lutein cells, on the contrary, disappear; they are only preserved at the base of the convoluted lutein layer. The lutein margin is not always completely developed. Defects are particularly frequent on the superficial pole (Waldeyer); occasionally there appears only a relatively small portion which is well developed. Through uneven retrogression during pregnancy, such abortive types may occasionally be seen (R. Meyer).

In the stage of regression the lutein cells appear to be unevenly stained; in part they are darker, but the whole yellow border becomes spotted. The connective tissue undergoes hyaline change. The same takes place in the inner lining of the cavity which occasionally remains in the form of a small cyst. Instead of lutein, masses of pigment remain; hemosiderin crystals are sometimes demonstrable a long time after the complete regression of the corpus luteum. The lutein cells themselves become absorbed; only in the clefts of the hyaline connective tissue do shrunken cells remain for some time with irregularly dark nucleus, or finely granular fat-containing rests. Through further shrinking and resorption, the whole picture becomes converted into a whitish, homogeneous cicatricial mass, the corpus albicans fibrosum which finally also disappears. According to the newer acceptation, the development of the corpus luteum takes place in the interval between the tenth and the fourteenth day, after the onset of the menstrual bleeding. In four days it is complete, reaching the stage of ripening. In the first days following the menstrual bleeding, the regression sets in which takes from eight to thirteen days for completion. If pregnancy should take place, the corpus luteum is retained till well over the second month. Then begins a very slow regression. Yet at the end of pregnancy the yellow body is ordinarily at least pea-size, ultimately disappearing during the puerperium. In exceptional cases, it may have disappeared altogether in the course of the pregnancy. Müller has shown that the corpus luteum in pregnancy contains large masses of colloid; at times, also, large quantities of lime. Sometimes one can recognize a corpus albicans graviditatis, even after the puerperium, by its lime content.

Occasionally the whole corpus luteum appears to be expelled from the ruptured follicles and protrudes as an ectropium or prolapse of the corpus luteum; it may even be pedunculated (Gebhard, Schnell, Ihn, Pfannenstiel).

Obliteration of the follicle.—Beginning during fetal life, follicles may become destroyed at all times before reaching maturation (Valisner, Gegenbauer, Schottlaender, Rabl, von Kahlden, Boshhagen). In the pregnant

state, especially, all follicles in the process of growth are retarded and disappear, the primordial follicles alone remaining preserved.

The first thing to disappear is the ovum which is brought about through the expulsion of the liquor folliculi (Flemming, Schottlaender, Janosick, Rabl). (Corpus atreticum, Koelliker.) The zona pellucida becomes saturated with granulosa cells, the latter themselves becoming vacuolated. The whole follicle often collapses, and takes on an irregular appearance. In contrast to this, a very active proliferation of the theca interna cells takes place; this becomes a prominent feature. The cells become larger, turn into veritable lutein cells and form a many-layered membrane around the follicle; the latter is at first smooth and round but later becomes somewhat atrophic. It is noteworthy that the theca as well as the granulosa lutein cells contain "neutral fat," whereas, in the regression of the corpus luteum, there is no neutral fat in the theca cells (R. Meyer). The granulosa cells become invaded by the connective tissue in the form of a meshwork and, finally, the reticular connective tissue fills the whole space where the granulosa cells have undergone complete degeneration (corpus reticulatum). Between both forms of tissue, there is formed a glass membrane through a hyaline denegeration by a tryptic ferment produced by the theca interna cells.

The whole process takes but a comparatively short time, but ends either in the formation of small cysts or under pathological conditions into larger lutein cysts.

In pregnancy the theca interna cells become very markedly hypertrophied, but this process terminates during the puerperium. Extensive proliferation of the theca interna cells have been seen associated with hydatid mole, in which case they may be seen in all the follicles. The latter first attain considerable dimensions during the puerperium and form large multicystic tumors, which are of good prognostic omen because, as a rule, they regress completely.

These proliferated theca interna cells comprise the so-called *interstitial gland* (Limon, Bouin, Cohn, Seitz, Wallart) of the ovary, which in woman appears distinctly only during pregnancy.

A few words as to the senile ovary. After the onset of the menopause, the last follicles disappear in the course of months or even of a few years (Weber, Schuster). The arrangement of fibers in the stroma, however, remains the same.

The products of hyaline regressions may persist for a long time, but finally disappear altogether, so that the entire shrunken organ finally consists of only sclerotic vessels (Wendler) and the associated stroma which, to a certain extent, is still characteristic and shows areas of calcification. *De facto* the individual has now become unsexed.

Kermauner remarks that in certain pathological cases one is obliged to distinguish the ovary from other organs by its characteristic stroma. Yet he emphasizes that, under other conditions, for example, in cases of a young individual exhibiting other signs of hermaphroditism, ovarian tissue resembling stroma alone without ova may not be accepted as decisive in the diagnosis of the particular gonad which determines sex, that is, ovary or testes.

PHYSIOLOGY OF THE CORPUS LUTEUM

Prenant, in 1899, declared that the corpus luteum had a definite function and that it was not to be regarded as a regressive product or scar formation, so to speak, of the ruptured graafian follicle. Its function, according to Prenant, was to inhibit ovulation and at the same time prevent the interruption of pregnancy. Later, Born, and especially Fraenkel, were able, on experimental grounds, to establish the theory of the endocrine function of the corpus luteum. Its functions are briefly: (1) that it influences the periodic changes in the uterus which prevents its return to the infantile condition; (2) it prepares the uterine mucosa for the reception of a fecundated ovum; (3) in the latter event, it retains its function for some time and acts upon the uterus in such a way as to insure its nutrition and to further the embedding of the ovum and its progressive development. In the event of no impregnation, the hyperemia leads to menstruation while the corpus luteum undergoes regression.

The histological appearance of the corpus luteum indicates that it belongs to the glands of internal secretion; for it consists of cell complexes arranged like those of a gland with its characteristic vascularization. Lipoid secretion granules may be seen in the smaller vessels and lymph spaces. Every analogy leads to the assumption that it is an internal secretory gland.

The Born-Fraenkel hypothesis has been supported by some observers and denied by others. The work of Halban and Köhler substantiates the hypothesis that the corpus luteum inhibits menstruation. In forty patients from whose ovaries they removed the yellow body, menstruation set in from two to four days after the operation. Also a transplantation of the ovary containing the corpus luteum caused a delay in the onset of the menses; but the protracted interval was still one half the time of normal menstruation. The latter is due to the more rapid regression of the gland under its new environmental conditions as, for example, when it lacks normal vascular supply. According to Halban, the modus operandi is analogous to the phenomenon of the development of milk secretion. Halban believes that the placenta prepares the breast for the secretion of the milk but that this results only when the placenta is expelled from the uterus. So the ovary acts upon the uterine mucosa, which it first prepares, then stimulates; and, when the corpus luteum regresses, menstruation sets in. Another proof in favor of the inhibitory action of the corpus luteum upon menstruation is the fact that in cows, according to Tandler, a persistent corpus luteum prevents the onset of heat and artificial rupture of the cyst causes a return of heat. Similarly Halban noticed that these cases are clinically associated with amenorrhea. The menses in these women return soon after the intentional or accidental rupture of the cyst. Further, in cases of excessive hemorrhage from the uterus, there is practically never a corpus luteum in the degenerated ovaries, a fact that speaks against the hypothesis that the "yellow body" stimulates menstruation. If this were actually true, there should invariably be found in these cases at least one or more corpora lutea. Furthermore, the action of extracts of ovary and corpus luteum varies so that the former appear to

exert a stimulating effect upon menstruation and are never hemostatic, while extracts of corpus luteum produce both kinds of effects.

Aschner not only produced hyperemia and hemorrhage, but actual hematometra through hypodermic injection of ovarian extracts in guinea pigs, showing that these extracts have an elective action upon the genitals. But as similar effects have been obtained with other organ extracts, such as pituitrin, thyroidin, enteroglandol, etc., one may not properly speak of this effect as specific.

Seitz and his two pupils, Wintz and Fingerhut, have isolated two antagonistic substances from the corpus luteum: (1) luteolipoid which inhibits bleeding, and (2) lipamin which produces bleeding. They have actually controlled bleeding with the first in the menorrhagias of puberty and other periods of life. In the climacteric bleeding it worked as an inhibitory influence only when the blood coagulation time was reduced. Lipamin, belonging to the class of lipoproteids known as lecithalbumin, caused hyperemia and succulence of the genitals in animals, while in amenorrhoic women it brought on menstruation. These two substances appear to control, by their abundance of production or by their deficiency, variations in the quantity, intensity and duration of the menstrual flow. In the cases of excessive bleeding where there is no corpus luteum, the luteolipoids are said to be absent. *This indicates that the follicle itself is responsible for the menstruation while the corpus luteum inhibits menstruation.* Chemically these substances, lipamin and luteolipoid, have not been isolated from the corpus luteum alone. The probability is that the lipamin which acts as a stimulant to menstruation comes from the follicles and that luteolipoid, which has the antagonistic effect, namely, inhibitory upon menstruation, comes from the "yellow body."

Aschner believes that the active agency of the ovary, which produces the cyclical changes in the endometrium and the normal and pathological uterine bleeding, is not to be ascribed to the corpus luteum or to the interstitial ovarian gland; rather in the follicles or in the ova themselves is the internal secretory mechanism to be sought. Not only does the ovum predetermine the fate of the follicle and, in a wider sense, that of the female genitals, but, according to R. Meyer, it dominates the whole organism. In the event of the failure of impregnation, menstruation ensues because the ovum perishes (R. Meyer). Bucura maintains that this results because of the changes that take place in the granulosa cells. Should impregnation have intervened, it would not be followed by menstruation. Decidua formation in the endometrium, however, takes place whether the ovum becomes fertilized or not, showing that this process must have been instigated by the ovum or the granulosa cells of the ripening and freshly ruptured follicle. In all other mammalia, the phenomena attending heat are present before the corpus luteum is formed. The follicle first ruptures when these preparatory changes in the uterus, etc., are well established; hence, we cannot hold the corpus luteum responsible for their occurrence, but we must rather seek the cause in the follicle apparatus or, more likely, according to Aschner, in the ovum itself.

Pathological changes in the corpus luteum have been held accountable for certain symptoms and disturbances of the other endocrine glands, of metabolism and of the nervous system. Therapeutic application of extracts of the yellow body has been made in the endeavor to influence those conditions both by French and German investigators. Nothing specific, however, has so far resulted, for its effect upon extragenital affections would at best be but slight and temporary. One need only reflect upon luteal variability, and the cyclical changes which it undergoes not to accept it as a potent influence upon symptoms which are practically constant.

It is possible that, as Aschner says, this body plays a prominent part in the pathogenesis of chlorosis. As compared to the interstitial ovarian gland, it will, however, have a more important part in the body economy.

After the researches of Knauer, Halban, Cramer and others who showed that the effects of the activity of the ovaries upon the other organs were of a chemical nature and not through the medium of the nervous system, there began a more intensive inquiry to discover which of the constituent tissues making up the ovary is the motivating factor. Attention was chiefly focused upon the corpus luteum on the one hand, and upon the interstitial gland of the ovary on the other. The analogy between the ovary and the testicle and their relative importance to the whole sex complex was emphasized.

THE INTERSTITIAL OVARIAN GLAND

The interstitial ovarian gland in the ovary cannot be isolated as a definite gland structure in the same sense that the corpus luteum can. It consists of numerous, scattered, small-cell nests amidst the ovarian stroma and is not unlike the Leydig interstitial cells in the testes. In the human being it is found well marked and in characteristic fashion associated with gravidity. It is doubtful whether it exists to the same degree in different animals or whether it is constant for all animals. The best histological pictures of the interstitial ovarian gland may be obtained by staining frozen section with sudan for fat.

Bouin and Ancel (1901) called attention to the scattered cells found between the atretic follicles, and designated them the "interstitial ovarian gland." It was said to be analogous to the interstitial cells of Leydig in the testes. Limon later demonstrated this gland as a well-defined structure in the ovaries of rodents, rabbits, rats, mice, guinea pigs and certain insectivora. In these animals, this gland has been estimated to compose one tenth of its substance and, while it reaches its highest degree of development at the time of sexual maturity, it may be distinctly seen from soon after birth throughout their whole lifetime.

In woman this gland has been confused with atretic follicles and even with the corpus luteum on account of their fat-containing cells. This confusion is not surprising, since both the interstitial and the corpus luteum gland owe their origin to the follicle epithelium now arising from a mature or an atretic follicle. Both structures contain cells derived from the theca

interna as well as the granulosa cells but in varying proportions. In the corpus luteum, the granulosa cells predominate. In the interstitial gland, it is the theca cells that preponderate.

In the process of atresia formation, the ovum and granulosa cells degenerate; the theca interna with their fat-containing cells alone remain. These coalesce with the neighboring interstitial cells and form a more orderly structure consisting of cell nests or cell processes. The latter are abundantly supplied with blood-vessels, are grouped about blood-vessels and present the appearance of a gland of internal secretion; so much so that Limon characterized it as the interstitial ovarian gland.

L. Fraenkel, in 1905, came to the conclusion, as a result of extensive investigation embracing forty-five different animal species, that the interstitial ovarian gland is altogether too inconstant to possess the properties of an endocrine gland. Aschner, however, showed that this variability exists not only in different animal species but in the same individual. The interstitial gland may be seen in definitely ascertainable periods while, at certain other times, it will be found absent. Bouin and Ancel observed that the interstitial gland is particularly well developed in instances where the recurring corpus luteum is absent. But this observation is not substantiated in general, because, in guinea pigs, with their three weekly manifestations of heat, both structures are to be found. Aschner, who had the opportunity of studying the genitals of some 250 female dogs of various ages under normal and pathological conditions, made the very important observation that at the end of the first year of the dog's life, that is, the period of sex maturity, the interstitial gland is no longer the well-developed and easily recognizable structure that it is at an earlier stage. It becomes denser, more diffuse and scattered. This takes place as the follicles increase in development. As soon as a follicle bursts at the time of the first heat, the interstitial ovarian gland appears to lose its rôle. In the event of some of the ova becoming impregnated, corpora lutea of pregnancy result. In the event of no impregnation, the corpora lutea of heat result. In either case the interstitial gland disappears; at least it cannot be recognized with the ordinary staining methods. Aschner remarks that it appears as though all the supply of lipoid substances contained in the ovary is, at this time, used up in the formation of the corpus luteum. A striking picture is presented in the ovary of the pregnant bitch where the greater portion of ovarian substance is occupied by the corpora lutea, the spaces between them showing no trace of interstitial gland tissue.

This finding is in marked contrast to that of the ovary of woman during gestation, whereas Seitz, Wallart, R. Meyer, Keller have shown that the interstitial gland becomes appreciably greater and better developed. Aschner here observes that this may indicate a sort of atavistic reversion to the lower animals and that the hypertrophy of the theca interna in the human ovary reminds one of the multiple corpora lutea of pregnancy in animals. In older animals this gland is not present, or it exists only in traces, a fact which has led some observers to the erroneous conclusion that in certain species of animals it does not exist. These were evidently obser-

vations made upon animals toward the end of their natural life when the interstitial ovarian gland has long ceased to be active.

In young animals, the interstitial gland is well developed; in older animals, this is mostly supplanted by the corpus luteum. In the cat's ovary, there is a very dense interstitial tissue arranged about the numerous atretic follicles. This abundance of interstitial gland is in marked contrast to the ovary of animals who breed fewer young at one time. In the pig, which breeds often and many young at one time, there is a marked production of follicles and also follicle atresia; here the interstitial gland is well developed and has its origin from the theca interna. The fat-containing granules of the cells are easily recognized as arising from the theca interna. Even in these animals, toward the end of the first year of life, corpora lutea appear and, with their appearance, the rôle of the interstitial gland is at an end. In the adult pig, there develops between the widely dilated, cystic follicles a dense fibrillary tissue imbedded in which often several corpora lutea are found. Interstitial tissue, as such, is no longer evident.

In the lower animals, there appears to be a parallelism between (1) multiple fetation, (2) intensity of follicle production and hence follicle atresia, and (3) development of interstitial gland. The last is most conspicuous before sexual maturity is reached and becomes less evident after each birth act.

In contradistinction to these, the interstitial gland becomes less evident in animals that breed only one or two young at a time, as in certain quadrupeds, in apes and Man. This goes hand in hand with the lessened production of follicles, hence with lessened follicle atresia. Therefore, the formation of a well-developed, gland-resembling structure, such as the interstitial gland which is present in the ovaries of lower animals, distributed uniformly throughout the ovary is, in these higher animals, not to be found. When present it is to be regarded as a rudimentary interstitial gland which is equivalent to that of the rodents or of beasts of prey as seen soon after birth.

Furthermore they are never a parenchymatous structure, but appear early in life before sex maturity as circular areas or ringlike cells containing fat which surround atretic follicles. As soon as the fist corpus luteum appears at puberty, even this rudimentary type of interstitial gland loses its identity and becomes replaced by the corpus luteum of menstruation. The higher the animal development, the more the corpus luteum predominates over the interstitial gland of the ovary.

The theories of the importance of the interstitial ovarian gland to the integrity of the genitals, as well as to the body economy as a whole, have been advanced some ten years. These were vague and not founded upon fact, chiefly because proper morphological studies had not been made. From a comparison with the study of lower animals and human embryos, it has been demonstrated that the follicles develop and regress at an early stage of life. In the theca interna, there appear at first scattered fat granules; these then coalesce and form crescentic, then circular, rings about the degenerating membrana granulosa of the follicles. Aschner remarks that

at this early stage there appear already to be differences in point of time and in point of intensity on the part of the interstitial cells.

In the newborn, the follicles appear to be further advanced than in premature infants. In children of two to five months the ovary becomes considerably larger, reaching the size of a hazelnut or a cherry. The graafian follicles, as well as the interstitial gland, take on a decided development at that stage of life. As Wallart, Seitz and Runge had previously shown, Aschner found later that the lipoid-containing cells of the interstitial gland vary with the nutrition of the child before death; that in certain conditions, where emaciation was pronounced, the fat content as demonstrated by sudan stain was altogether missing and that then there was no trace of an interstitial gland. On the other hand, abnormal conditions that make for hyperemia may cause excessive follicle ripening and small cyst formation which may be distinguished with the naked eye. At other times, follicle atresia with a resulting increase in the interstitial gland elements may take place. These effects may be noted associating diphtheria, intestinal catarrh, eczema, tuberculosis, osteomyelitis and a number of other diseases. This fact makes clear the difficulty with which normal ovaries can be found at this stage of life. In the second half of the first year of life, the ovary shows scarcely any structural change outside of increase in size.

Ovaries from the third, fifth, seventh, ninth and fourteenth year of life show a progressive increase of masses of indifferent stroma cells which characterize the ovaries of adult life.

Aschner repeats that, contrary to the statement of some authors, the interstitial ovarian gland reaches its highest point of development at the stage of sexual maturity. The gland in reality reaches this point within the first years of life, decreasing in structural development before puberty and becoming reduced to a minimum at the onset of menstruation.

In a study of ninety ovaries of adult women, Aschner was unable to demonstrate an increase in atretic follicles at the time of menstruation, or a reduction between menstrual periods. When atresia of the follicles is encountered in these cases, it is occasional and, as a rule, many sections of the ovary must be inspected before one is seen.

In woman, during adult life, the interstitial gland appears only during pregnancy when, because of increased atresia formation of follicles of all stages of development, the theca lutein elements proliferate. For not only does ovulation not take place during pregnancy but many follicles, perhaps all follicles, become atretic.

Stratz went so far as to say that except in certain pathological cases, when one finds all graafian follicles atretic, one may be sure to be dealing with pregnancy. The fluid content of the follicle becomes absorbed, the follicle walls collapse. The theca cells undergo fatty change and become larger and finally surround the glassy membrane with the rest of the ovum and the granulosa cells. Seitz, who described this in great detail, was also able to observe the conversion of the stroma into theca elements and vice versa.

Seitz further described two types of atresia: the cystic form and the

obliterating form. The follicles are said to become as large as peas and to undergo atresia; the yellow appearance of their walls is manifest to the unaided eye. In the case of the cystic formation, which is most apt to affect the follicles of middle size or larger, the fluid content is not absorbed; the ovum and granulosa cells degenerate, whereupon the theca interna begins to proliferate. In the obliterative type, the fluid content first absorbs, the walls of the follicle collapse and there arise the most varied forms of atretic follicles, from the star-shaped to the flattened sickle form.

The proliferation of the theca lutein cells, according to Seitz, is evident as early as the second month of pregnancy and advances toward its termination. During the puerperium, the theca interna begins to regress through hyaline degeneration and part of it is converted into stroma cells. But this increase in lutein cell formation is regarded by him as due to a hypertrophy and hyperplasia of the cells containing fat granule, occasioned by the hyperemia of pregnancy rather than as producing any specific secretion. In this idea he has the support of F. Cohn, A. Schoeffer, R. Meyer and R. Keller.

Wallart found that the lutein gave an iron reaction chemically and concluded that the lutein pigment was derived from the blood pigments; furthermore, that it was also present in milk.

In forty-one cases of gravidity, Aschner found that the one or the other ovary was occupied for the greater part by a corpus luteum; that the rest of the ovary shows a trifle more fat granules than is normal and perhaps a small quantity of atretic follicle material, both of which take the sudan stain. The other, unoccupied, ovary shows perhaps a small increase in the interstitial ovarian gland, but in relatively slight degree. Only toward the end of gravidity do the theca lutein cells appear to take on an appreciable increase. But, as Aschner remarks, this occurs at a time when the other inner secretory organs also show a marked increase in the lipoid substances. Such are particularly the hypophysis and adrenals, etc. The corpus luteum also attains its greatest size and fat content at this time.

The theca lutein cell proliferation, during normal pregnancy and under certain pathological conditions (such as hydatid mole and chorio-epithelioma) appears to be dependent upon fetal, that is placental, stimulation. In the latter instances, the frequent presence of cystic atretic follicles may be assumed to take the place of the numerous corpora lutea graviditatis of the mammalia which bear multiple, simultaneous offspring.

What portion of the ovary is responsible for the secondary sex characteristics? From Steinach's castration experiments on male guinea pigs and rats, where he transplanted ovaries and produced what he termed a "somatic and psychic femination," he claimed that the interstitial cells were responsible for the maintenance of sex characteristics. But, as was proved by control experiments, the ovaries retained their follicles for months; corpora lutea were even noted, although they had the tendency to undergo cystic change, chiefly because, through faulty circulation, the stroma became denser and interfered with their rupture. The interstitial cells, however, are not so well preserved, owing to the change in the stroma cells. More-

over, the lack of proper nerve supply in the transplanted ovaries appears to have a further deleterious effect upon the interstitial cells.

In the cases of uterus extirpation, where the ovaries are left *in situ,* they are not infrequently followed by menopause symptoms. Burger and Mandl demonstrated that these ovaries show anatomically a connective tissue change similar to that which is observed after transplantation.

Aschner explains this by some experiments on animals where he severed the nerve supply of the ovaries and left the blood supply intact. Two to three months later he found that the follicles were retained while the interstitial gland was the only one to be damaged. This conforms to the findings of Bouin, Ancel and Willemin in their work along similar lines with the testes. As the nerves that lead from the uterus to the ovaries are cut in the hysterectomy, we may understand how the changes in the gonads come about.

The interstitial gland of the ovary, which is apparently stimulated through the hyperemia of pregnancy, can, under certain pathological and even physiological circumstances, practically disappear. Such conditions are hunger and inanition, especially after protracted illness; certain poisons; and, in instances where there is a deprivation of other internal secretory organs, as, for example, the hypophysis, the lipoid substances in the interstitial cells may disappear to such an extent as no longer to take the sudan stain.

Chronic hyperemia of the genitals associated with pregnancy, in intestinal catarrh of children, in artificial hyperemia due to the injection of organ extracts and, finally, when weak doses of X-ray are administered (irritation, provocative dose), an increased production of follicle atresia is caused and, at the same time, a noteworthy increase of interstitial cells.

The action of the X-rays upon the interstitial cells of the ovary is practically the same as that upon the follicles and corpus luteum. Changes in the interstitial cells, however, are apt to be seen at a later date than in the other ovarian elements. Biedl found the follicles of the ovary of rabbits practically degenerated in fourteen to eighteen days after short X-ray exposure. The interstitial cells showed, however, very little changes at this stage. After longer exposures, the same degenerative effects in the interstitial cells were seen as are present in transplanted ovaries examined some months after operation. The increase in the interstitial cells of the ovary following X-ray exposure is to be explained by the fact that there is an increase of follicle atresia which means more interstitial cell formation. Practically, the theca lutein cells may be assumed to act like the corpus luteum, namely, to inhibit bleeding.

CHAPTER V

GENERAL ETIOLOGY OF SYMPTOMS

The causes of gynecological symptoms may be classified broadly into eight groups:

1. The congenital, chiefly, developmental errors.
2. Traumatic lesions.
    a. Traumatic in prepuberty period.
    b. Traumatic in postpuberty period.
        Coitus, masturbation, rape and accident.
3. Venereal infection.
4. Sexual excess.
5. Neoplasms.
6. Neoplasms incidental to abnormal pregnancy.
7. Neoplasms secondary to neighboring organs.
8. Neoplasms secondary to remote organs and systemic disease.

FAILURE IN DEVELOPMENT

Total absence of reproductive apparatus.
Partial absence of reproductive apparatus.
Total gynaplasia is very rare. In its extreme form, the external genitals are devolped as in the infantile type. The vagina is absent and there is no vaginal portion of the uterus. The uterus itself is indicated by a small nipplelike structure as large as a bean; there is a transverse septum palpable by the recto-abdominal route. The secondary sex characters are poorly developed, the form resembling that of the prepuberty stage as in the first five years of life.

The next grade of maldevelopment is the rudimentary stage when mere indications of the generative organs are present. The uterus shows the most conspicuous change from the normal. It has a cervix and a body, but these are incompletely developed histologically and do not perform any function. The ovaries are represented by very atrophic bodies which are devoid of a follicle apparatus. The infantile type of generative apparatus is one in which development and further differentiation in postnatal life have not progressed beyond the congenital degree. The pubescent type is one in which the generative organs are subnormal. Through some intercurrent affection, as prolonged suppurative tuberculosis, malnutrition, etc., maturity is inhibited. In this stage, menstruation takes place; it is often scanty, irregular and painful. These individuals may be well developed sexually as far as the feminine type is concerned. The rudimentary type is almost hopelessly asexual; neither menstruation, ovulation nor pregnancy is the rule in these cases.

The infantile type may menstruate occasionally, seldom ever gets pregnant; menstruates irregularly, and occasionally gets pregnant late in the childbearing period. In this class belong those women who have been known to have their first child fifteen or more years after marriage. From these, however, must be excluded patients who have been healed of an infection acquired soon after marriage. Apareunia and dyspareunia, analgesia, etc., are other symptoms which are common to these cases of arrested development.

A duplication of the sex apparatus does not militate against normal function as these patients have been known to bear one or more healthy children and do not necessarily have dystocia. The type that may have difficulty during labor is that in which a rudimental uterus is anteverted low down in the pelvis, and acts as a fibroma would.

Habitual abortion is a frequent occurrence in patients with arrested development. This will be discussed later.

It not infrequently happens, amongst the rudimentary and infantile type of the maldeveloped, that the urethra is tremendously dilated. The writer has seen two cases in which intercourse was practically performed through the urethra. Digital examination was made by several assistants without their recognizing that they palpated the interior of the bladder.

A woman of twenty-four years who had never menstruated complained of dyspareunia. I was asked to see her because the family physician believed she had an atresia of the cervix. To my surprise I found a total absence of the vagina, the urethra dilated to the width of a finger and a half, and the interior of the bladder easily accessible to the examining finger. On further questioning the patient, it was learned that she frequently had a foul-smelling discharge which clearly was sedimented urine.

In Early Life.—Traumatic lesions result chiefly from accidents, as in falling upon spiked fences or other sharp bodies, causing scar formation and distortion of the genital tube. Fractures of the hip incurred by being run over or falling from heights may have the same result. Severe burns occasionally result in permanent injury to the genitals. I have seen one case of extreme dystocia, due to a thick and rigid scar in the vagina continuous with a well-marked keloid of the vulva and thigh which resulted from a severe burn in early puberty.

Other traumata are attempts at rape which cause deflorescence alone, if the patient is fortunate enough to escape infection. If, in addition, the patient is infected also, the whole gamut of sequelae may follow and ruin the subject sexually.

Occasionally the first coitus after marriage causes severe hemorrhage. For this, two conditions must obtain: an unequal adaptation of the male and female parts and a brutal or awkward act. A great many nervous sexual symptoms may follow upon this unhappy experience.

Sexual excess without infection undoubtedly causes changes in the pelvis. Chiefly of a congestive character, they are, from without inward, a vaginitis, an endocervicitis, a myohypertrophy, circulatory disturbances in the ovaries with resulting vaginal discharge, painful menstruation, menorrhagia and

metrorrhagia and sterility. Backache occurs often in those cases in which the act is forced upon them by the male partner and, when present, the patients as a rule shrink from coitus. In metrorrhagia, the symptoms depend on the excess and on whether the act is indulged voluntarily or simply to accommodate the unusual demands of the husband, etc.

Other effects, as abortion resulting from excess, will be taken up later.

Genital infection is brought about chiefly through coitus and obstetric and surgical trauma. The bladder, rectum, peritoneum, blood stream, lymphatics and more remote organs are other sources of infection.

It is well to keep in mind that the urethra and rectum are within close range of the vagina. Originally emptying into the same cloaca, their separation into distinct canals with separate outlets took place in Man and some of the higher animals.

Infection from either urethra or rectum may spread to the vagina and ascend, via the uterus, to the peritoneal cavity. The same holds true for the reverse effect upon the urethra and rectum of primary vaginal infection.

Chief amongst the agencies of genital infection is coitus with its "hand-maid," the gonococcus. The urethra is practically always simultaneously affected; occasionally, when the act is incomplete, it alone may bear the brunt of the contagion. It is undoubtedly true that a urethritis may run its course without the deeper invasion of the cervix. This can exist in rare cases when intercourse is abstained from, after the initial attack and proper care is taken to prevent its spread. As a rule, however, ignorance of this one point and the continuance of the sexual act cause the infection to be deposited upon the cervix and, when there, it is very difficult to cure it. The necessity of rest, here as anywhere else in the body, to circumscribe and cure inflammation, is not heeded. The worst possible effect results from the double irritation that coitus induces—the mechanical by the husband and the hyperemia that occurs in the female pelvis during the sex act.

The spread upwards proceeds either through contiguous portions of the mucosa or through the lymphatics or both. A blood stream infection by the gonococcus is the greatest rarity. Other pathogenic organisms, however, do succeed in getting into the blood stream; but a special pathological change in the blood-vessels of the pelvis, which obtains in puerperal and abortal infections, brings about this possibility. For these it requires three factors: first, an increased vascularity of the uterus with engorged, dilated vessels (in pregnancy wide blood sinuses at the placental site); second, a gross trauma, as a laceration by forceps; and third, a virulent type of infection, such as, for example, the streptococcus hemolyticus, although the bacillus coli communis, ordinarily nonpathogenic but always present in the vicinity of the genital tube, may attain virulent pathogenic properties and gain entry into the circulation.

Occasionally infection is introduced by unclean douche tips, contraceptive instruments, the finger and perverse sexual practice. Fungus and microscopic parasites are other organisms responsible for vaginitis and vulvitis.

The contraceptive instruments, especially those that enter the uterus, not infrequently cause infection in certain classes of women.

SPECIAL ETIOLOGY OF SYMPTOMS—IRREGULAR UTERINE·BLEEDING
DUE TO OVARIAN DISEASE AND ADNEXITIS—MYOMATA IN RELATION
TO THE OVARIES

POSITIONAL CHANGES OF THE UTERUS

To judge by the multiplicity of operations devised for the correction
of the abnormal position of the uterus, one would be led to the conclusion
that this deformity is responsible for serious and numerous symptoms.
Judging from the failure to accomplish relief by operation and by the
absence of pelvic symptoms when the deformity is very marked, we believe
their importance has been overestimated.

Undoubtedly a certain proportion of the flexions without complicating
disease cause well-defined symptoms. A certain number of the versions,
especially the retroversions, are responsible for clear-cut symptoms. But the
fact that the uterus is pushed somewhat to the rear, or to the front, or to
one side or the other, though retaining its normal cervical-uterine angula-
tion, can scarcely be held accountable for symptoms. If there is, and there
often is, some pathological condition which causes this displacement or dis-
location, symptoms will naturally be traceable to these influences rather than
to the mere mechanical dislocation of the uterus. One of the commonest
causes of posterior displacement of the uterus is an overfilled bladder. If
one needed an experimental test of the effect of a retroposed uterus, he
could not want for better proof as to the negative importance of this condi-
tion. Tumors of the uterus or ovaries, inflammation of the adnexa, para-
metric exudates, perimetritic adhesions and cicatrices resulting from these
processes, especially when involving the sacro-uterine and broad ligaments,
are the most common causes of uterine displacement. The last is merely
accidental and symptoms ascribable to it result from the primary cause in
the majority of instances; cicatricial shortening of the round ligaments is
far more rare than relaxation and stretching.

In what way may symptoms be explained as arising from uterine dis-
placements and dislocations? What disorder of function may, properly
speaking, be ascribed to them?

Menstrual Disturbances.—The acute anteflexions, whether congenital
or inflammatory or due to tumors distorting the cervico-uterine angle, may
cause dysmenorrhea. It is conceivable that, even without an associating
inflammation, the uterus would be compelled to contract more violently to
expel the menstrual discharge and that very often retention would take place
with more or less inspissation or clot formation, which induces uterine con-

tractions that cause colic. In retroflexion the same phenomenon takes place with the additional feature that stasis is exaggerated; for, in the extreme type, the uterine vessels are most probably constricted. The passive congestion present in the intermenstrual period becomes aggravated during menstruation, when there is always active turgescence and hyperemia.

Not only is there dysmenorrhea in the acute retroflexion, but the flow is very apt to be profuse and prolonged.

Uncomplicated retroversions and lateral deviations do not cause menstrual disturbances. Associated pathological conditions, however, may induce pronounced changes in the menses either by increasing the hyperemia, as in multiple fibromyomata, especially the submucous variety, by atony of the uterine musculature occasioned by myometritic and perimetritic infiltration and especially by inflammation of the adnexa. In the latter case, the menses may become very irregular. This will be described in further detail elsewhere.

Sterility.—Pregnancy has been known to result in the presence of every possible displacement or dislocation of the uterus including prolapse. Nevertheless, in certain instances, the mechanical deformity is responsible for the sterility, for appropriate correction is rapidly followed by relief. Many factors enter into the problem of sterility, especially consideration of the responsibility of the husband. Without going into detail, the most important reason for the sterility in these cases of dislocation is the fact that the seminal discharge does not immediately strike the external os. Failing immediately to reach the cervical canal, the semen mixes with the acid secretion of the vagina and before long the spermatozoa are rendered motionless and paralyzed. In several instances, the author saw strikingly favorable results by simply restoring a completely retroverted and partially retroflexed uterus and keeping it in position by a properly fitting pessary. After several years of sterility following one childbirth, it was possible to restore fertility by correcting the uterine displacement, pregnancy taking place soon afterwards. Theoretically the secretions from the cervix, so important in the mechanism of reproduction, may be altered to such a degree in the displacements of long standing as to be inimical to the spermatozoa. Another reason for assuming that sterility is due to the uterine dislocation is that pregnancy follows when the patient takes the genupectoral position soon after coitus, etc. The semen in this posture has a better chance of reaching the open mouth of the cervix and at least a goodly number of spermatozoa escape the destructive effect of the vaginal secretions.

Pain.—The uncomplicated displacements cause no pain. This symptom is due to the primary cause of the dislocation. Backache is not due to pressure of the uterus upon the sacral nerves. One has only to remember that the uterine body is not large enough to cause pressure symptoms by sheer weight. The fetal head at term dipping down into the pelvic brim seldom causes backache, although it is many times larger than the average uterus. Pain is due to intraligamentary tumors, to adnexitis, to posterior perimetritis.

There is one condition, however, which causes excruciating backache

and even colic without the presence of associated inflammation. That is what may be termed acute *retrotorsion* and *incarceration of the uterus*. The writer has seen several such instances and relief comes only when the uterus is restored to its normal position. Sometimes it is possible to accomplish this by bimanual manipulation. Sometimes one is forced to resort to laparotomy. The torsion takes place, as a rule, in a somewhat enlarged, subinvoluted uterus with atony of the musculature at the cervico-uterine junction combined with weakness in the fascial supports at that level. Sometimes it occurs with a fibromyoma lodging in the posterior wall, weighing the uterus downwards and backwards so as actually to somersault it. These cases are diagnosed as adherent retroflexion because the uterus appears to be not only fixed but also tender. It is possible, after several gentle attempts combined with tampon support, to free the incarcerated uterus and replace it in its normal anterior position. The symptoms are thus removed almost instantly. The size of the uterus becomes rapidly reduced, showing that engorgement played the chief rôle.

A dull sensation of discomfort in the back and drawing sensations down the thighs are experienced by the patient whose uterus has become heavier through prolonged passive congestion. To this fact is also due the chronic *discharge* that is associated with retropositions and retroflexions.

An indirect cause of symptoms not yet accurately defined but nevertheless conceivable is the prolapse and displacement of the ovaries and tubes which accompany the uterine displacement. For chronic vascular stasis in the dependent ovaries must have an effect upon at least two of the uterine functions; namely, menstruation and ovular nidation. But this will be considered in the special chapter on the dysfunctions of the ovary in relation to uterine bleeding.

Elevation of the uterus is not infrequently seen, as after ventrosuspensions, after caesarian section and, very occasionally, in the presence of tumors which arise below the cervix and push it upwards. Its chief significance lies in the fact that it interferes with the natural excursions of the bladder, causing now increased frequency of urination and, again, retention. Especially is the latter noticeable immediately following ventrosuspension. Greater attention to this point should perhaps be given. Should pregnancy intervene, the uterus is impeded in its expansion and the natural contractions are apt to be exaggerated and are felt as mild labor pains. During parturition, the pains are more apt to be ineffectual, leading to uterine inertia and eventually to postpartum hemorrhage.

The retroflexed gravid uterus is liable to empty itself the third or fourth month if not early restituted. It must be borne in mind, however, that a retro-uterine hematocele can so closely resemble this condition that the greatest care must be exercised to make certain that the condition is a retroflexed uterus and not an ectopic gestation.

An almost tragic result was averted, in the case of S. J. (see page 301), by timely opening of the peritoneal cavity, disclosing the presence of a ruptured ectopic pregnancy which had been treated as a retroflexed gravid uterus.

FIBROMYOMATA AS CAUSE OF SYMPTOMS

Do fibroids cause symptoms by their presence alone, or are the symptoms which are usually ascribed to them the result of indirect or associating factors? The occurrence of fibroids, particularly of the subserous or even intramural variety, though multiple, has been observed without any disturbance to the patient. On the other hand, a small fibroid protruding into the uterine cavity from the fundus, or a similar tumor projecting into the cervical canal, may cause serious symptoms (Fig. 5). In general, the submucous variety causes the gravest symptoms, while the subserous fibroids are often without any effect upon uterine function. The intramural fibroids, in this respect as well as anatomically, occupy a middle point, for at some time
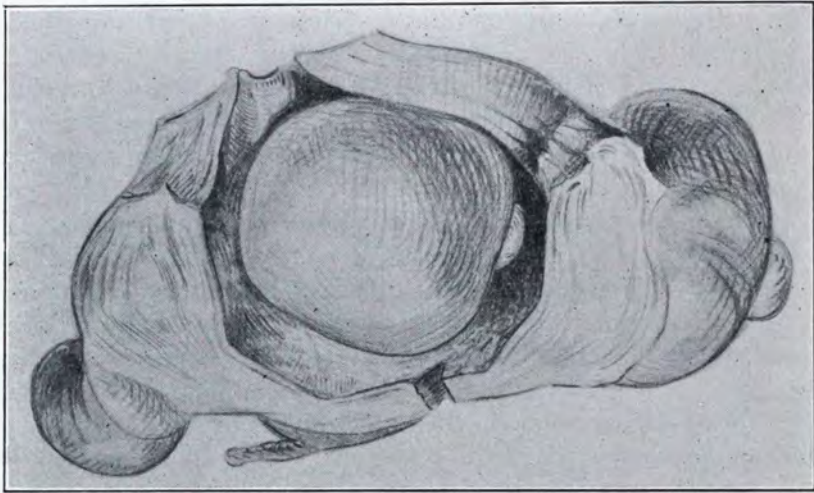
FIG. 5.—A SUBMUCOUS MYOMA IN AN UNMARRIED WOMAN OF 42 YEARS. Only enlargement of the uterus could be elicited by recto-abdominal examination, the hymen being intact. From the symptoms, excessive and prolonged menses, dysmenorrhea and the passage of clots, the diagnosis of submucous myoma was justified.

the interstitial fibroid may extend far enough into the uterine cavity to become submucous, while, at other times, the extension is outward, the tumor losing the covering of uterine musculature to be lined by serosa, even becoming pedunculated. Not infrequently all varieties are simultaneously present.

The situation, rather than the size, of the tumor is more important from the point of view of causation of symptoms. For a large fundal myoma developing toward the diaphragm and expanding in all directions equally (concentric expansion), as these tumors have the tendency to do, thus appearing as globular or spherical tumors for the most part, elevates the uterus into a location where pressure is not apt to take place. The intestines accommodate themselves within the abdominal cavity as easily as in pregnancy so that some women bear large fibroid tumors without the slightest subjective or objective symptoms. Perhaps a sense of weight or some slight disturbance in urination, such as increased frequency, may be experienced.

Occasionally the presence of the growths is noticed by the patient, who may chance to feel by self-palpation a hard mass in the abdomen.

A smaller tumor, if situated at the cervix, in the rectovaginal septum, in the broad ligament or one which may extend into the vesico-uterine pouch, may give rise earlier to very noticeable symptoms. These are chiefly due to pressure upon the hollow viscera of the pelvis, bladder, ureters and rectum as well as upon vessels, nerves and lymphatics. The great majority of fibroid growths do not cause pressure symptoms unless they have the tendency to develop in tight places. Perhaps the severest pressure symptoms are caused by the cervical myoma, particularly if it reaches the size of a fetal head, for, unlike this body, it is not movable, its fixation and incarceration are progressive, and the chief strain is upon the bladder, although the rectum and sigmoid may also be compromised.

If pressure effects are produced by their growth within fixed points, other symptoms are due for the great part to pathological changes to which fibroids are subject.

Hemorrhage is not necessarily present in the purely subserous variety; it is fairly constant in the interstitial form and most serious in the submucous variety. In the last, the growth may be as large as a hazelnut and give rise to the most profuse flooding. This is particularly true in young unmarried women when no appreciable enlargement of the uterus is made out. Menstruation, in these cases, is apt to be attended by uterine colic, for not only does clot formation take place but the uterus attempts to extrude the offending mass.

What actually causes the hemorrhage? It is easy to understand how a vascular tumor can give rise to hemorrhage, how bleeding can occur from a breaking down, infiltrating, carcinoma, for example. How is the excessive bleeding to be explained in fibroids? Both clinical and pathological evidence point more and more to the secondary part played by the uterine tumor itself. The cause of this disturbance is to be sought in a pathological alteration of the ovaries. This will be discussed in the general subject of uterine bleeding. Here it may simply be mentioned that several anatomical changes take place in the uterus which account to some degree for the increased menstrual flow. If the tumor is of large size or if there are several tumors of moderate size, the uterine mucosa is stretched over a greater surface than it is normally. There need be no real mucosal hypertrophy, but the bleeding area is quantitatively increased. There is increased vascularity, because of the muscular hypertrophy of the myometrium which results from repeated efforts at expulsion. The submucous myoma increases both the spread of the mucosa as well as the local blood supply to a more marked degree in this sense than the other varieties. Besides, after attaining a certain size, say, as large as its host, the uterus itself or larger, it must become a burden to it; it must be treated as a foreign body. Has not this some influence upon the ovaries? If not controlled entirely by the gonads, may the fibroids not exert an irritative influence if not some change in the nutritional vascular supply to the ovaries? That is a question which may well be borne in mind in view of the well-known shrinking effects of castra-

tion upon the growth and size of the tumors on the one hand; and, conversely, the effect of pregnancy, which causes a decided increase in the size and perhaps in the number of the fibroid tumors.

The chief diagnostic point of value for palpation lies in its normal consistence, which is like that of the uterus itself. This depends on its two component elements: connective tissue and musculature.

Hardness or firmness distinguishes this growth from other pelvic tumors when there is no unusual deviation in their histology. Thus, for example, the more the amount of connective tissue, the harder the fibroid tumor feels; if the muscular element predominates, the softer it is. In the latter case, it differs but slightly, if at all, from the consistence of the normal uterus and hence gives rise in some cases to confusion in the diagnosis of pregnancy. When the tumors contain little connective tissue and are edematous, they may be so soft as to be mistaken easily for cystic masses. Indeed cyst formation may and does take place in them; under such circumstance, it becomes impossible by palpation to distinguish them from ovarian cysts. Mistakes in this respect are unavoidable if reliance is based merely on the bimanual examination.

The densest or firmest tumors are palpable in senility when the muscular substance is replaced in most part through senile atrophy into fibrous tissue. Not uncommonly, calcification appears either scattered through the tumor or upon the surface in scale formation, making the tumor stony hard. The subserous variety is particularly prone to this lime infiltration, owing to its relatively poorer blood supply. This extreme hardness is encountered much less frequently than softening, especially in the puerperium or pregnancy. Fatty change and central necrosis with almost cheesy formation follow upon local nutritional starvation, while edema, suppuration and liquefaction or gangrene follow infection. The latter are more apt to occur during the puerperium or postabortive state, particularly where there has been interference. Cyst-formation is due to necrosis and liquefaction or massive edema through widely dilated lymph spaces. Actual fluctuation may be thus elicited, especially where the cystic tumor is free from a covering of uterine musculature. Telangiectatic tumors may give the same physical signs and are often a source of confusion in pregnancy.

A woman twenty-four years old, who was married three years, had one child sixteen months old. Her periods became irregular six months ago and scanty. Two months ago patient was told that she was pregnant four months. Indeed she felt "life" a month ago. For the past two weeks no quickening. Nausea began two months ago. On examination, the fundus of the uterus was midway between the ensiform and the umbilicus; the uterus was freely movable as though it were pedunculated. It was of a very firm consistence. There were no fetal motions or heart sounds. The cervix admitted the finger and there was slight bleeding. X-ray examination failed to show evidence of fetal skeleton. The diagnosis of fibromyoma complicating pregnancy was made. A fetus of two and a half to three months' gestation was removed from the uterus and, under anesthesia, it became evident that the tumor was mostly subserous. Its consistence, how-

ever, was that of a cyst. At the laparotomy, a globular tumor about the size of a honeydew melon was found occupying the top of the uterus. It was cystic, but permitted of its enucleation *in toto* without entering the uterine cavity. The tubes and ovaries remained attached in their normal relations to the uterus. It was, therefore, possible to leave the uterus and appendages in practically normal condition.

Another case of telangiectatic fibromyoma complicating pregnancy was
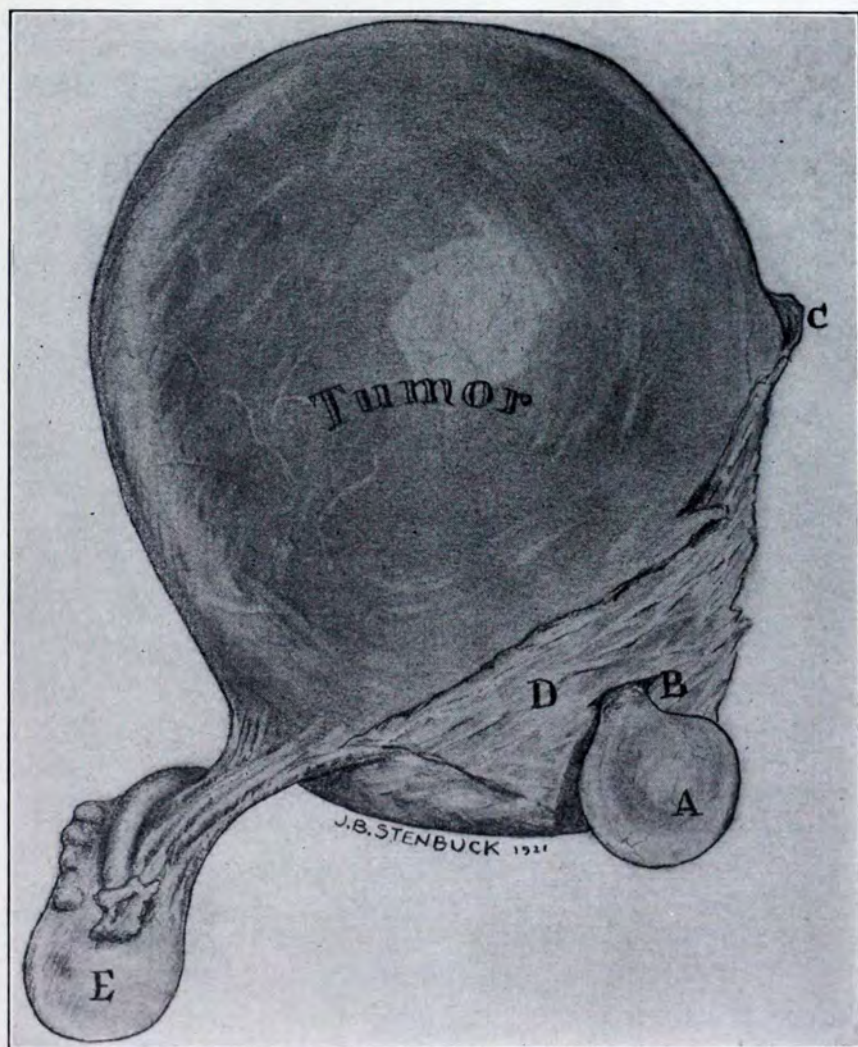
Fig. 6.—Telangiectatic Fibromyoma Complicating Early Pregnancy. Axial torsion of the uterus.

seen by the author on December 11, 1920. A woman, thirty-one years old, who was married fourteen years, had had five children, the youngest of whom was four years of age. Her last menstrual period was September 25. She began to bleed December 6 and spotted irregularly to date. For two days she complained of cramps, especially on the left side. On examination, the fundus was found to reach a level four fingers above the umbilicus. Intermittent contractions of the uterus were elicited. The

cervix of the uterus was displaced upward against the symphysis, the external os was patulous to the finger and there was moderate bleeding. At operation a hysterectomy was done because it was impossible to enucleate the tumor without mutilating the uterus (Figs. 6 and 7).

The association between fibroids and adnexal disease is not only of common occurrence but also has an important bearing upon symptoms. For the irregular bleedings are occasioned more through the diseased adnexa than through the fibroids themselves. The fibroids need not necessarily cause
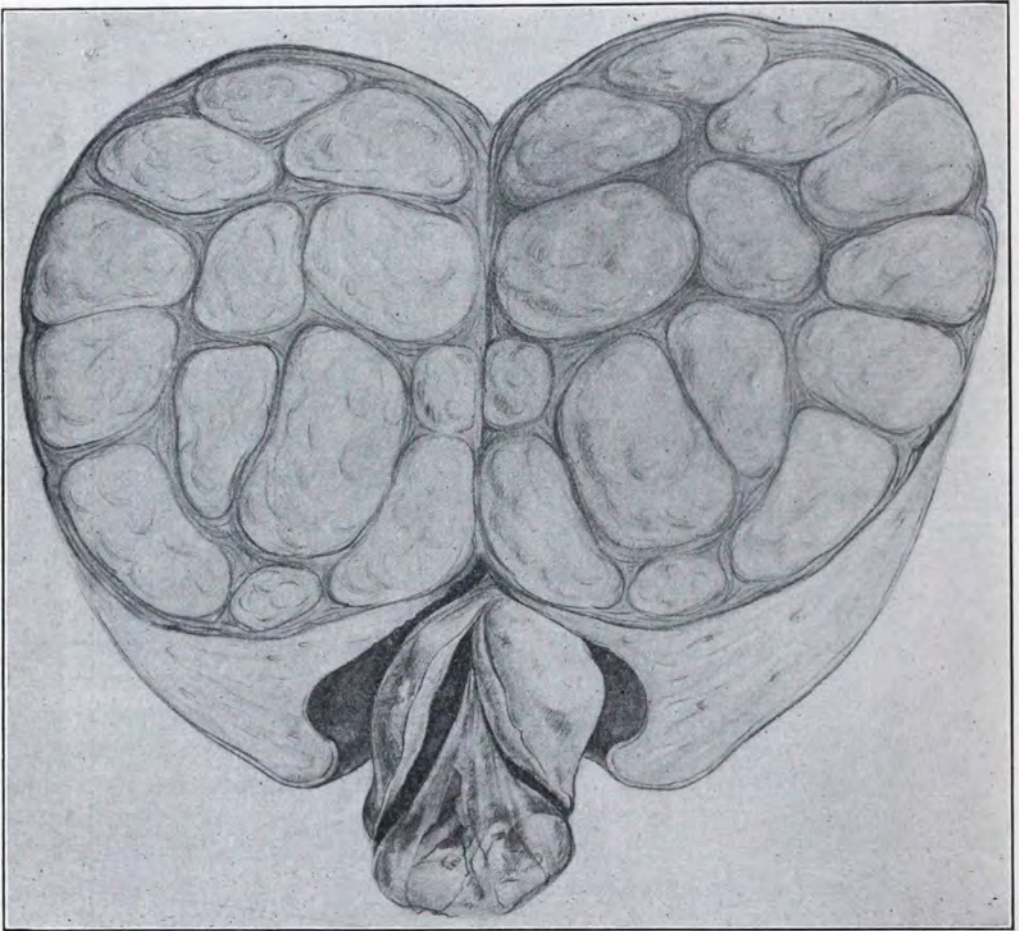
FIG. 7.—SAME AS FIG. 6 WITH THE UTERUS CUT OPEN AND THE FETAL SAC EXPOSED.

the adnexitis. The primary focus of infection may have been in the tubes, leading to bilateral pyosalpinx with perimetritis and exudate formation, to which the fibroid may become adherent. On the other hand, in a small proportion of cases, the fibroids predispose to perimetritis, partly through the changes that accompany tumor inflammation and partly through accidental trauma, as when the subserous fibroid becomes twisted, edematous, hemorrhagic. Serous exudation ensues with resulting adhesive peritonitis. In this process, the tubes and ovaries may become involved. Occasionally

fibroids are so situated as to cause obstruction to the tubes, giving rise to hematosalpinx, closure of the tubes and mild grade peritonitis. But whatever the *modus operandi,* the fibroids themselves play a secondary rôle to the affected ovaries which are, in reality, responsible for the prominent symptoms.

Mobility of the tumor is enjoyed by the subserous type, particularly when the pedicle is very long and thin. The intramural and submucous variety naturally move with the uterus from which they are inseparable. The motion of the pedunculated subserous fibroid in the free peritoneal cavity causes ascites which fills the small pelvis and the lower abdominal cavity. It is simply the result of a mechanical irritation in the same way that the presence of any foreign body might induce it. When, through torsion of the thin pedicle, the tumor becomes separated from the uterus, it may find a new attachment to any neighboring area of the abdomen. Most frequently the omentum wraps itself about the wandering tumor, or it becomes embedded by the peritoneum, usually in the vicinity of the pouch of Douglas, where it may cause, by its incarceration, obstruction upon the lower bowel.

Adhesions to the omentum or a coil of intestine, especially the mesentery of the large gut, are not an infrequent occurrence in the absence of any inflammatory process in the adnexa. Thus intestinal obstruction or obstipation may arise through a partial kink to an otherwise benign fibroid.

When the fibroids undergo sarcomatous degeneration, they cause independent symptoms. Their rapid growth, the invasion of blood-vessels and increased hemorrhage cause systemic effects which soon become evident. The incidence of sarcoma is estimated at between 4 and 8 per cent. Carcinoma is associated with fibroids in from 2 to 4 per cent of the cases and forms another cause of the hemorrhage which may have been innocently ascribed to the fibroids.

While these associated lesions concern us only from the viewpoint of symptomatology, it is readily seen that they must be seriously considered in any contemplated plan of treatment. Particularly must this fact be taken into consideration when it is a question of pursuing a nonoperative course, as, for example, the resort to radiotherapy. A more accurate knowledge of the causal relation between fibroids and symptoms, which they definitely produce, will lead to better therapeutic results.

IRREGULAR UTERINE BLEEDING DUE TO OVARIAN DISEASE

During the premenstrual stage, certain substances are taken up in the decidual cells, the result of corpus luteum secretion, which prepare the nutritive soil for the possible pregnancy. In the event of the ovum being impregnated, the corpus luteum continues to exert this trophic influence over the uterine mucosa. It becomes hypertrophied and a better organized gland of internal secretion. A glance at its morphology is sufficient to convey the impression of an endocrine gland.

What happens when the ovum is not impregnated? The corpus luteum

begins to undergo regressive change; the substances which have been accumulated in the uterine mucosa now begin to release ferments which digest the blood capillaries and cause them to rupture, resulting in the outflow of blood. A certain amount of this bleeding is also brought about through diapedesis; small hematomata may be seen between the small blood-vessels at first; and the blood loses its power of coagulation. In other words, when the menses occurs, it means that the ovum of that particular month's production has perished.

While the ferment substances have not been isolated, there can be no doubt of their presence in the uterine mucosa, because, if the uterine artery is cut, the escaping blood will coagulate within the normal time. On the other hand, puncturing the vaginal portion causes bleeding which does not readily stop, owing to the lessened coagulability. Only through the uterus, then, must this change in coagulability have taken place. This is, however, not to be confused with the free bleeding that follows incision of the abdominal wall during menses. In the latter case it is simply due to increased, general hyperemia of the abdomen. During menstruation, the superficial portion of the mucosa gets cast off, while the middle and deeper portions remain to regenerate the mucosa.

While the pathological diseases of the ovaries have been amply described by a number of authors, notably Pfannenstiel, the question of functional disturbances is barely hinted at. Up to fifteen years ago, this was a very obscure matter. Our knowledge during this time of physiological and pathological function has progressed so that we are now in a position to explain a number of things which were without meaning before. If there are still many points about the relation between the ovaries and uterus that are obscure, our knowledge concerning the relation of remote endocrine glands to genital function is indeed vague. The advantage offered, in the gynecological field at least, is that the organs are readily accessible to physical examination by comparison with, for example, the adrenals or hypophysis. Moreover, because they are frequently removed by operation, they may be studied grossly and histologically, so that any special changes noted in the ovaries or the uterus or in both, occurring uniformly in association with certain clinical symptoms, may lead to proper correlation and interpretation. Thus, the gynecologist has an immeasurably greater opportunity for the study of the relationship between the ovaries and uterus than any other specialist in surgery, with the possible exception of the thyroid gland surgeon.

If menstruation is the normal, regularly recurring expression of normal ovarian function, the variation of intensity, duration and time interval of the atypical uterine bleeding must be due to disturbed ovarian function. According to Aschner, it was Kanji who first advanced the notion that menses are due to the changes in ovaries; Halban, Adler, Novak, Aschner and others corroborated him.

Anatomical evidence.—In the vast majority of instances, there is cystic degeneration in the follicles. In every case so far examined, there is constant absence of any corpus luteum. Incidentally, this finding contradicts the old theory that the corpus luteum stimulates menstruation.

I have elsewhere shown that corpus luteum cysts have caused a delay in menstruation in a way which simulates the occurrence of ectopic pregnancy. In several instances where menses were delayed in the presence of corpus luteum cysts, I have seen menstruation reëstablished shortly after the accidental rupture or after the spontaneous regression of the cysts.

In this connection it will be interesting to mention an instance of pregnancy of two months' duration complicated by a subserous pedunculated myoma in which I was able deliberately to cause uterine bleeding by the excision of the corpus luteum. It was an instance in which interruption of pregnancy was eminently desirable and, before resorting to a curettage for this purpose, I seized the opportunity of utilizing a procedure which has been repeatedly shown to be efficacious in animal experimentation. I removed the corpus luteum of pregnancy by laparotomy, and bleeding followed in two days with a complete discharge of the uterine contents, making curettage needless.

UTERINE BLEEDING DURING PUBERTY

It is now firmly established that bleeding at the onset of puberty and adolescence is associated with persistent degeneration and absence of corpus luteum formation. In the ovaries which have been examined in instances of pathological bleeding, these changes were constant. What is the explanation of this? The corpus luteum normally hinders ovulation and hence menstruation. When the ovum does not become ripe and no corpus luteum formation results, there is an incomplete inhibitory influence upon the other ova; hence the other ova either fail completely to develop, in their turn, into ripe corpora lutea, or the follicles ripen incompletely. The normal regular mechanism breaks down; the fermentative substances in the endometrium are formed in these cases through the agency of the follicle epithelium which is, however, inadequately developed as compared to that of the corpus luteum.

By curettage, one can cause a cessation of menses because one removes the ferment-containing substances. It is this superficial part of the mucosa from which bleeding is most free. The deeper layers of the mucosa remain after the curettage, and these contain normal coagulable blood. What eventually takes place in the bleeding of puberty is that a follicle ultimately succeeds in normally ripening and a well-developed normal corpus luteum results. It is then that the bleeding stops and becomes more regular. The effect of curettage is also duplicated in X-ray therapy in such instances, but the effect of the latter is to cause a destruction of the follicles and hence excludes their influence over the endometrium. The follicles observed in these instances are dwarfed, show an incomplete maturation and are not easily impregnated. Permanent injury from X-ray therapy does not necessarily follow, because the X-ray dosage has been better regulated on the one hand and, on the other, because the primordial follicles of the ovary are more resistant to the X-ray than are the graafian follicles. The bleeding, which is due to small cystic degeneration of the ovaries, is not so common in the mature, sexually ripe individual.

Adnexal Disease.—In adnexal disease, follicles are disturbed through the inflammation. Incomplete follicle maturation and abortive types of corpus luteum formation, with the tendency to cyst production, are very common.

In the climacterium, the follicles appear to be not as well developed; they do not rupture readily and a rudimentary corpus luteum is apt to form. There are some cases in which primordial follicles are scanty, hence the long intervals between menstrual periods. On the other hand, there are cases in which there are a great many primordial follicles which ripen, releasing the ferment substances more freely, and cause prolonged bleeding.

At the initial onset of menstruation (puberty), and at its ultimate cessation (menopause), there is apt to be a disturbance in the harmonious relationship between the gonads and the rest of the endocrine system of glands. At both these periods, there is exhibited the same tendency to bleed; there are also manifestations of disturbances of the other ductless glands. For example, it is well known that, at these two periods in life, women are apt to have goiter, Basedow's disease, dysplasia-adiposis genitalis, diabetes mellitus and insipidus, chlorosis, acromegaly, metabolic disturbances, such as acne, obesity, etc.

The anatomical findings in the uterus are of two kinds:

1. In strong, well-nourished patients with vasomotor symptoms pronounced, a rather abundant endometrium is occasionally found.

2. In weakly, anemic girls, there are scarcely any noticeable changes in the endometrium. This fact points to the irresponsibility of the uterine mucosa as a cause of uterine bleeding. The general examination of such individuals fails to show any special characteristic features, excepting perhaps, as Schickele pointed out, the presence of an abnormal degree of irritability of the nervous system, especially the vasomotor functions. Aschner believes that, in eight of the ten cases reported by Schickele, chlorosis was an important factor. One case was apparently a mild Basedow's disease, exhibiting vasomotor phenomena. Aschner further remarks that, while in these individuals there may be no organic disease, the future will show that these girls have a congenital predisposition to degenerative processes based upon an inadequate congenital foundation, and they may, therefore, be distinguished from individuals with healthy organs.

Adler emphasizes the importance of the increased irritability of the autonomic nervous system as manifested by a strong reaction to vagotrope measures, eosinophilia and negative reaction to adrenalin (0.1–0.5 mg.). Adler also found a slowing of the coagulation time in these individuals. Frequent association of chlorosis and obesity with this type of bleeding led Adler to the conclusion that, in these cases, bleeding was due to causes outside the ovaries, and he characterizes it as a constitutional defect.

Prognosis.—Some get well spontaneously; in others, the bleedings are controlled by rest in bed, styptics and antichlorotic remedies; in others, the X-ray helps, although occasionally a refractory case will yield only to extirpation of the uterus or castration. Curettage in these early, virginal cases of bleeding is inefficient and, for obvious reasons, ought never to be

resorted to. The favorable results reported by von Graaf of treatment of uterine bleeding, occurring in young women up to the twentieth year of life, by "proper" X-ray dosage, give hope that by better technic it may be possible to control such bleeding and reëstablish regular monthly periods. Organotherapy may also yield similarly good results and possibly, by a combination of these two measures, we may cure what was formerly a most intractable and eventually tragic symptom in young women. Subtotal oöphorectomy has proved successful in my experience in controlling the metrorrhagias of young individuals.

TYPES OF PUBERTY BLEEDING CASES

1. The chlorotic (although oligomenorrhea and amenorrhea are more common).
2. Basedow, formes frustes, Basedowoid, etc.—hyperthyroid.
3. Mild grade obesity with peripheral vessel dilatation.
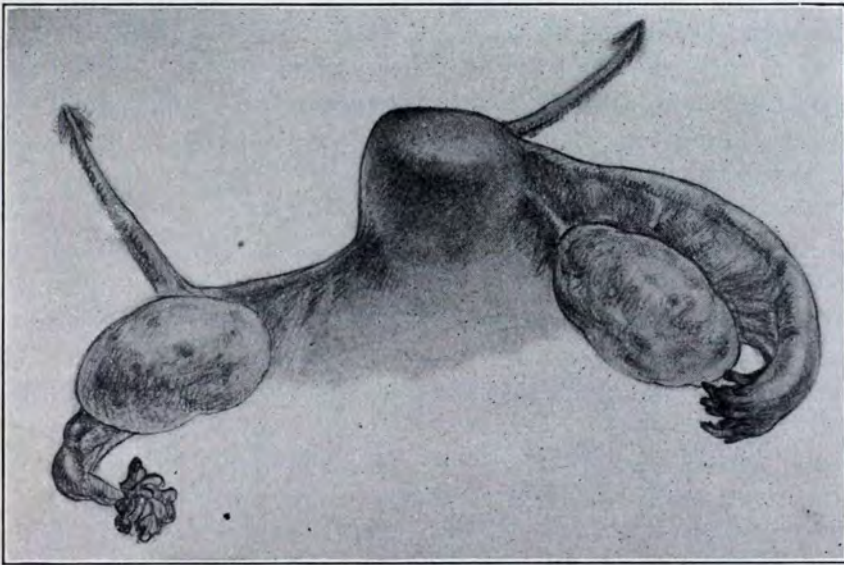
FIG. 8.—AN ANOMALOUS TUBE ON THE LEFT SIDE IN A CASE OF PUBERTY BLEEDING. The abdominal end alone was present. The uterine end of the fallopian tube was entirely lacking. The ovaries present the appearance of follicle cyst hyperplasia and general hypertrophy.

4. All sorts of asthenic-hypoplastic conditions and disturbances in the equilibrium of the internal secretory glands.

All these point to some degree of hypoplasia (degenerative symptoms) in the whole body; for example, masculine hair lines, especially on the genitals. Bartel and Hermann have described a hypoplasia of the ovaries in those individuals with puberty bleeding; the relatively large size of the ovaries; their smooth surface and poverty in follicle contents (Fig. 8). Aschner adds that there was always an excessive ripening of follicles and small cystic degeneration. The corpus luteum is always absent. The interstitial gland probably plays no rôle because narrow theca lutein cell-borders may be seen in association with the regression of the cystic atretic follicles.

UTERINE BLEEDING OF OVARIAN ORIGIN DURING ADULT LIFE

Uterine bleeding in women during the period of sexual and reproductive activity has been ascribed to many conditions hitherto. Until recently there was great confusion concerning the pathology and great diversity regarding the etiology. A great many conditions were held responsible for the bleeding; for example, endometritis "hemorrhagica" and "glandular" hypertrophy were the conditions found associated with and the cause of irregular menses. Later the conditions known as "metritis," "metropathia hemorrhagica" and "essential or idiopathic uterine bleeding" were in vogue. It has been shown, on the one hand, that the changes in the uterine mucosa which were held accountable for the bleeding are actually normal physiological changes which the endometrium undergoes monthly and which are controlled by ovarian function. Furthermore, in many cases, there is neither an endometritis, nor an actual metritis, nor was the change in the relationship between the connective tissue and muscle element in the uterine wall characteristic or constant. This has been demonstrated by Pankow, who, unfortunately, added another term "metropathia"; the latter, however, fails to describe the cause. But, as Aschner points out, Pankow ascribed to the ovaries the ultimate source of the bleeding, hence the term "metropathia" was misleading. Aschner, therefore, proposes the term "ovarielle" instead.

The types of uterine bleeding are the following:

1. Those in which there is a reduced time interval between the periods, although the duration is the normal bleeding time.

2. Those in which there are four-weekly intervals with prolonged bleeding.

3. Those types in which the interval becomes entirely irregular. The duration becomes variable. The intensity is so excessive that it affects the general constitution and, therefore, can no longer be regarded as a physiological process. Even in some of these cases, however, a certain rhythm may sometimes be observed. In the severe cases, there appears to be an excessive follicle activity without, however, the occurrence of real ripening or ovulation. In such individuals, the flow is continuous or there ensues the normal period, giving an atypical metrorrhagia.

There are certain conditions which predispose especially to uterine bleeding of ovarian origin: (1) One in every three women has an enteroptosis. This, according to Aschner, is indicative of an asthenic hypoplastic habit which also points to some primary disturbance in the ovarian secretion or some disturbance in the interrelation of the endocrine glands. (2) Sudden temperature changes, sexual excitement, operations, psychic and emotional disturbances, sudden fear, even marriage in normal individuals, under unusual circumstances or possibly in ordinary circumstances. The neuropathic woman is particularly disposed to these disturbances, owing to the more debile condition (Falta) of her nervous, and also of her endocrine, system. Pregnancy and multiparity also influence the menses; with each increasing pregnancy, menstruation is apt to get worse. Bleeding can

become more irregular after a pregnancy; on the other hand, menstruation may first become regular through the intervention of pregnancy. The irregular bleedings following abortions have long been observed, also the next ensuing period after an abortion is not only irregular in point of occurrence, but is also very apt to be irregular in point of duration and intensity. The same may be said to occur following pregnancy. There need be no endometritis postabortive or postpartum, since, in some of these cases, curettage reveals no disease in the endometrium, nor has pathology in the uterus itself been demonstrated. Cases of retained placental rests, etc., do not, of course, enter into this discussion.

A woman, twenty-nine years old, had passed through childbirth during the recent influenza epidemic. Her pregnancy was attended by nervous phenomena, chiefly apprehensiveness, tremor and sleeplessness. The labor was uneventful; the child suffered from an attack of encephalitis when a week old. The post-partum course was uneventful, but bleeding continued for several weeks following her confinement and was protracted well beyond the normal limits when she later began to menstruate.

A similar thing took place after a second childbirth. No operation was deemed necessary.

The bleeding in this case was associated with a retroflexion which had been discovered before marriage; a noteworthy fact was the presence of severest type of headache which was only absent during her two pregnancies and during the time in which menstruation did not make its appearance while she was lactating. This patient could very well be classed under the term "enteroptotic asthenia, constitutional anomaly."

The secretion of the ovary appears to elevate vagotonia and, vice versa, irritation of the vagus stimulates ovarian secretion, hence stimulating menstruation. Enteroptosis is commonly associated with vagotonia, that is, with hyperacidity, hypersecretion and atony of the stomach, obstipation, hypersecretion of the sweat, salivary, sebaceous glands, etc. We may, in like manner, assume that there is a vagotonic condition associated with enteroptosis of the genitals, especially retroflexion. This is expressed in hypersecretion of the uterine glands (noninfectious fluor albus) and, above all, in hyperfunction of the ovaries, with or without hyperemia, or excessive follicle ripening, that is, small cystic degeneration of the ovaries, absence of corpus luteum and increased uterine bleeding. The fluor albus is probably not due to nervous irritation, but rather a result of increased ovarian action upon the uterine secretion. These cases involve the second and third decades of life.

Climacteric Bleeding.—"Chronic metritis," a term connoting an enlarged uterus in which no distinct fibroid or myomatous nodules are to be found, is a frequent finding in cases of excessive bleeding, but is rather to be regarded as an expression of ovarian hyperfunction or of increased ovarian activity. In some cases, there is an actual infiltration of inflammatory products; in others, there is an increase in size, following successive pregnancies, due to the hyperemia associated with the uterus and ovaries during gestation. On the other hand, cases occur in which neither of these findings

are present. In these there must have been a primary cause in the ovaries. Although the term "metritis" appears to be popular with the French, it has been strongly disavowed by Teilhaber, Pankow, Schickele, Keller, Aschner, Lauth and others. Hence, Aschner proposed the term "ovarian hypertrophic uterus." It is interesting to note that von Graff found, in 18 cases of irregular uterine bleeding in women over thirty years of age, only 1 instance of normal genitalia, 2 cases only of an enlarged uterus and 15 cases of what he termed "metritic enlarged uteri." These are cases termed variously by different gynecologists, "hypertrophic metritic" or "myomatous uteri," where the enlargement is diffuse and the uterine wall thicker than normal. Curettage, caustic applications, etc., are first tried without success and finally extirpation has to be done. In many cases, such uteri contain more connective tissue than muscle. This fact probably first led Teilhaber to the opinion that the bleeding was due to an insufficient uterine muscle. The blood-vessels, however, show no characteristic changes, and the lipoid contents of the uterine muscle is not constant enough to indicate any etiological relationship to the bleeding.

Coagulation of the blood in the uterus is inhibited in these cases and ferment substances were actually found by Schickele in these uteri. The uterine mucosa, as well as the uterine wall, contained these coagulation-inhibiting substances. But this may be due, as Halban first showed and as substantiated by Aschner, to the fact that the more hyperemic or succulent any organ is, as for example the uterus, the more intensive will be the tryptic effect and the tendency to lessen blood coagulability. The hypertrophy of the uterine mucosa is not the primary cause of the bleeding, because, in many uteri, the endometrium is very thin and atrophic and bleeding is just as active, curettage being useless.

Uterus hyperplasia and myoma formation are both due to diseased ovarian function. Both these conditions are found in women of the fourth and fifth decades, never after the menopause or before puberty, and seldom in the second and third decade of life. In both these conditions, we frequently get increased bleeding, typical as well as atypical. On the other hand, there are many cases both of uterine hypertrophy, as well as of myomata, without increased uterine bleeding.

There appears to be no decided histological difference in the uterine wall in the case of the hypertrophic uterus and of the myomatous uterus. Another point in common between myoma and "metritis" is the condition of the ovaries. These are abnormally large and contain numerous half mature follicles or even multiple cystic follicles.

A woman of thirty-eight years, married eighteen years, one child seventeen years old, two miscarriages, fifteen and six years ago respectively, each time at six weeks' gestation. For six months, the patient has bled profusely, passing clots the second day of the menses. On examination, the uterus was found to be enlarged to about the size of a three months' gravidity and was studded by several larger and smaller nodules. Owing to the nature of the bleeding with the passage of clots, the diagnosis of a submucous fibroid, in addition to the other varieties, was made. At opera-

tion the specimen was found. The appearance of the ovaries was particularly interesting in that they bore a striking resemblance to the ovaries of individuals suffering from oöphogenic uterine bleeding.

A corpus luteum is always absent. All of this indicates that the disturbance in corpus luteum formation is responsible for the increased and irregular bleeding, especially as, in the cystic degeneration of the ovaries, there is often to be found one or more small cysts with a lutein border. Also, for both uterine hypertrophy and myoma, there is the characteristic prolongation of the menopause over several years. This is to be interpreted as being due, not to the hypertrophy of the uterus, but rather to the abnormally increased vitality of the ovaries.

In anemic women, particularly those who have lost a great deal of blood, with yellowish complexion, and especially with simultaneous swelling of the thyroid, great weakness and disturbed heart action, there may be a toxic effect from a pathological ovarian secretion (dysfunction) upon blood formation and upon the heart and vascular system.

Aschner ascribes the whole tendency to bleed to a constitutional anomaly because, in many of these cases, there are other stigmata, as chlorosis, infantilism and hyperplasia. Recently Benthin and H. Freund showed the common occurrence of myomata in such individuals.

The Submucous Myoma or Mucous Polypus.—While mechanical trauma may cause the bleeding as, for example, rupture at the insertion of the pedicle, both by small and larger polypi, a great many patients continue to bleed after removal of the polypi because the coagulation reducing and blood-vessel dilating substances remain. Hence, the polypi are a secondary and, in many cases perhaps, accidental cause of the bleeding. Bleeding, hypersecretion and mucosal hypertrophy (polypus formation) are, therefore, to be put on the same basis and all three depend upon diseased and increased ovarian function. When the ovaries are removed or when their function ceases, the further development of such new formations ceases (Seitz, Schickele). Whether fluor albus ceases after castration remains to be seen.

BLEEDING ASSOCIATED WITH INFLAMMATION OF THE ADNEXA (ADNEXAL BLEEDING)

Irregular bleeding has long been known to follow gonorrhea of the genitals and especially of the adnexa. How is this to be explained? It has been conceived that the inflammation led to greater rush of blood to the uterus and thus to increased tendency to hemorrhages.

If one causes a hyperemia by artificial means, as, for example, by subcutaneous injection of placental extract or ovarian extract, one gets a marked hyperemia of the uterus, tubes and ovaries (elective action), and an increased formation of follicles. There may also result small cystic, dilated follicles in the ovaries as an expression of an increased follicle activity brought about by the hyperemia. An increased hypertrophy and hyperplasia of the uterine mucosa is also noticed. But fresh corpora lutea are never seen in such

cases. Follicle ripening and atresia are so overlapped that there is no complete ripening and regular ovulations.

In the guinea pig, Aschner, by using an aqueous extract of ovary, was able to produce hemorrhage of the uterus and hyperemia of the ovaries, while with corpus luteum extract or lipoid he could not get this result.

The increase in interstitial glands found in cases of adnexal bleeding associated with inflammatory ovaries is due to increased atresia of the follicles and has nothing to do with the bleeding. The bleeding is induced by the activity of the granulosa cells of the intact follicles and not from the theca cells.

The bleeding abates after conservative treatment of the inflammation. Radical operation is always to be deferred. When, however, operation is necessary, one should leave portions of the ovaries with or without extirpation of the tubes. This is particularly important, as this process is most apt to attack women at the height of their sexual life.

Bleeding Associated With Neoplasms of the Ovaries.—Tumors of the ovary very seldom cause increased menses, but rather cause amenorrhea, especially congenital tumors, such as dermoids, which also impede the normal ovarian development. One of the commonest neoplasms of the ovaries is the simple thin-walled cyst, commonly as large as a hen's egg. Corpus luteum cysts lead to amenorrhea (Halban, Kohler, Adler, Latzko, Werner, Rubin and others) and, after their removal, normal menses set in.

Small cystic degeneration causes by far the most frequent and excessive bleeding. When X-ray therapy fails to arrest bleeding, the cause has been laid to these follicular cystic degenerations of the ovary. Sarcoma and carcinoma in children may lead to early menses. In the climacterium, there has occurred bleeding due to new formations of the ovaries.

MYOMATA IN RELATION TO THE OVARIES

Until very recently it had not occurred to any one that there might be a causal connection between myomata and the ovaries. Yet Popoff, in 1896, had already shown in 40 cases that the ovaries removed for the purpose of curing myomata showed, for the most part, evidences of disease, the follicles being either lacking or the seat of cystic degeneration. The same findings were recorded by Bulius in 50 cases. A larger number of cases studied from this viewpoint is reported by Burger and Mandl who stated that, out of the 400 cases of myomata at Schauta's Klinik, they found the ovaries affected in so large a proportion that a causal connection between them and the uterine disease must be considered. But they regarded the ovarian disease secondary to the myomatous disease, the latter supposedly originating in the same way as all other benign neoplasms, namely, from a congenital rest or through local irritation in the genitals. This view was maintained in spite of the fact that castration had already been practiced to check the growth of the myomata (Trenholme and Hegar), and in spite of the numerous observations which showed that myomata receded after the menopause and occasionally during lactation.

Jouin, in 1897, pointed out the relationship between the thyroid gland and the ovary and endeavored to explain atypical bleeding on the basis of a disturbance in endocrine balance between the two. Hegar, as far back as 1887, spoke about the formation of myomata in the uterus as the result of an irritation in the ovaries. Bulius considered both the changes in the ovaries and the fibromyomata the result of the same cause. It was Seitz, in 1911, who first definitely expressed the opinion that the myomata arise through a qualitatively altered ovarian secretion. This conclusion was based upon the reasoning that the growth of the uterus depends at all times upon the activity of the ovaries. Aplastic ovaries are associated with an absent uterus or rudimentary form. After castration or following the menopause, the uterus becomes atrophic. The same effect is not produced via the nervous system, but rather by a chemical action of ovarian hormones. Myomata respond to stimuli from the ovaries in the same way as the uterus. An interesting thing bearing upon the causal relation between ovaries and myoma growth is the fact that this neoplasm has never been observed before puberty. Their earliest clinical appearance is during the first half of the thirtieth year of life and they are most frequently encountered during the second half of the fourth decade of life and in the beginning of the fifth decade. In other words, they are associated with the reproductive period when the ovaries exhibit their greatest activity. After the menopause, these growths practically never develop, rather they tend to shrink with the atrophy of the uterus; the muscle elements disappear, leaving only the connective tissue matrix with evidences of calcification and other regressive changes. The rapid growth of myomata during pregnancy is due to the increased hyperemia. This does not contradict the general notion as expressed by Seitz, because during gestation the ovaries continue to function. During the puerperium, the growths tend to diminish in size in the same way as the uterus. Pregnancy, however, although it furthers the growth of myomata, is not essential for its development, because numerous virgins and nullipara have these tumors. Indeed, it is even claimed that they are more predisposed to fibroids which bear a causal relation to sterility.

The delayed onset of the menopause in cases of myomata is not due to the presence of the tumors but to the increased and protracted vitality of the ovaries (Fig. 9). The effect upon the ovaries of the extirpation of the uterus has been studied both in animal experiments and in women. A great diversity of opinion has been expressed regarding the vitality of the ovaries without a uterus. While, in some women, menstrual molimena were present for a varying length of time, from a few months to a few years; in others, the symptoms of menopause were said to appear early and even to be worse than after simple castration. Retention of part of the endometrium was claimed to ameliorate the symptoms. On the other hand, the retained ovaries were said to be prone to degenerative changes, chiefly because of nutritional deprivation incident to the operation, so that it was necessary to operate again after a few years in order to remove the diseased ovary.

The one fact remains, nevertheless, that a maturation and advanced development of the follicles takes place; hence, the ovary may be said to

be functioning. Yet this function cannot be said to be a normal one and, because of the degenerative processes, it will last a comparatively shorter time (Burger and Mandl). Fellner claimed that there is a reciprocal chemical action between the uterus and the ovaries by a sort of internal secretion derived from the uterine mucosa which contains lipoids. According to Bucura, the parovarian gland has an internal secretory action, since removal of the ovaries alone with careful retention of the parovarium results in a better nutritional condition of the uterus.

The majority of myomata are associated with irregular bleeding, either during the menses or in the interval. But that the bleeding is not due to the tumors but to the ovaries must be evident from the fact that removal of the ovaries alone results in a cessation of hemorrhages. In contrast to the occurrence of myomata in the period of sexual activity, ovarian tumors
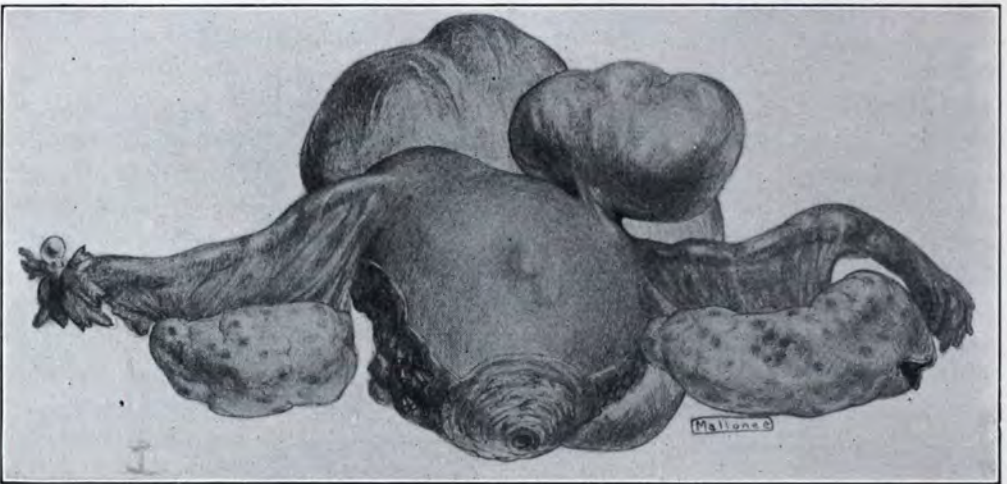
FIG. 9.—MULTIPLE FIBROIDS OF THE UTERUS WITH HYPERTROPHIED OVARIES DUE TO FOLLICLE
CYST HYPERPLASIA. Excessive bleeding is almost identical with that as met in bleeding of
puberty (cf. Fig. 1.)

may occur at any time before puberty or after the menopause. This would point to a causal connection between fibroids and ovarian activity. Stimulation of certain muscle elements in the uterus, which are predisposed congenitally (Cohnheim's theory) to proliferate, do so through the agency of pathologically engendered chemical substances derived from the ovaries (pathological ovarian secretion). The normal ovary influences normal growth and, especially, the cyclical menstrual changes in the uterine mucosa, while diseased ovaries and perverted ovarian activity must produce pathological function and abnormal growth of the uterus. In cases where fibromyomata have occurred early in life, puberty has also been known to have set in at an unusually early period, hence function and growth go hand in hand not only under normal but also under pathological circumstances.

Sterility is not necessarily due to the fibroids. Rather it is secondary to the ovarian degeneration. Mechanical factors contributed by the tumor can certainly account for certain cases, since enucleation may cure sterility.

But the bleeding cannot be ascribed to the tumor or associated mucosal hypertrophy, because there are many cases of myomata which do not bleed, contrary to the general rule. Removal of the fibroid does not always cure the bleeding, although the intramural and submucous types are associated with greater bleeding than the subserous. Schickele maintains that there is in these cases an ovarian dysfunction whereby the uterus becomes saturated with an abnormal quantity of substances which reduce the coagulability of the blood and also dilate the blood-vessels. The anticipated menses is to be explained by the excessive follicle ripening associated with altered ovarian activity, the interval becoming shorter and, in serious cases, even obliterated.

The frequent association of myoma and struma may be explained on the basis of an internal secretory change. Freund called attention to this and points out that the size of the struma is proportionate to the abundance of connective tissue content of the myoma. The thyroid changes are said to regress after myomectomy but not altogether. The *association of Basedow's or thyroid alteration with myomata is maintained by Aschner to arise from a pathological correlation between the diseased ovaries and the thyroid gland.* This perhaps accounts for the changes in the heart noticed in certain cases of myoma and heart disorders. In the following case, the hemoglobin was reduced to 28 per cent.

A young woman of twenty-one years, married six months, stated that she had always had irregular periods which were always prolonged. Menses began at fifteen; were at first delayed, and then more frequent. At times bleeding lasted three to four weeks, the one period merging into another. She complained of shortness of breath and faintness and appeared pale and anemic. The uterus was forward, apparently not enlarged; both adnexa were palpable; the ovaries appeared enlarged, prolapsed and somewhat tender. After her marriage, six months previously, her periods were almost continuous. A curettage performed by her family physician four months before resulted in relief of a month's duration, since which time she continued to bleed. At the laparotomy, June 26, 1919, the uterus and tubes were practically normal, the ovaries were enlarged to the size of hen's eggs and occupied by numerous small cysts, varying from the size of a pin's head to a split pea. Her hemaglobin before the operation was 28 per cent. The bleeding stopped shortly after operation and has since been of the regular menstrual type.

The following case is an example of multiple fibromyomata with profuse and excessive bleeding associated with cystic ovaries.

A woman of twenty-two years, married two years, the only pregnancy resulting in miscarriage at three and a half months followed by curettage two months before examination. Her periods began at fourteen, were always regular, though profuse, lasting for five days. Her present illness dates from the performance of the curettage, since when she has bled a great deal, compelling her to stay in bed for ten days. The bleeding was less while she rested, but became profuse when patient was up and about. On examination, the uterus was found to be the seat of a number of fibroid tumors, the largest one of which was about the size of a tangerine. At operation, November 9,

1921, the pelvic cavity was found bathed by old blood. Four tumors were removed from the uterus. The ovaries were found to be cystic and enlarged from at last one and a half times to twice the normal size. Some of the cyst follicles were hemorrhagic and others contained clear fluid. Partial resection of the cyst-bearing area of each ovary was done. Following the operation, bleeding continued; the temperature rose to 102; cramps were complained of, suggesting the presence of a submucous myoma. One was then actually found to be partially extruded through the cervical canal and was removed. The bleeding then stopped. The patient was last seen July 3, 1922, when she reported that her menses were practically normal, lasting for five days, the bleeding being very moderate.

The blood changes in the case of fibroids, where anemia follows excessive
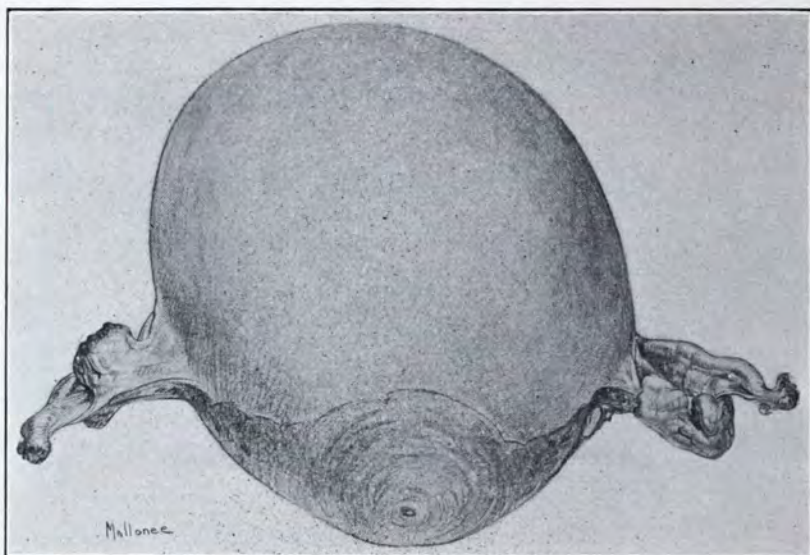
FIG. 10.—HARD, SCLEROTIC OVARIES, WITH DEEP FURROWS FROM SHRINKING FOLLOWING INTENSIVE TREATMENT WITH X-RAY. The uterus was occupied by a solitary large submucous myoma (the variety that does not yield to Radiotherapy). Bleeding continued in spite of the treatment, therefore suggesting the true nature of the tumor.

bleeding, are practically the same as those found in the case of cystic ovaries. The chief difference is that with resection it is impossible to retain normal primordial follicle and hence cause sterility; perhaps this would be obviated by the use of the X-ray. The latter destroys the follicles but not the primordial ova which are more resistant to the X-ray and can later develop into mature follicles with pregnancy eventually taking place. The submucous myoma has been long recognized as not yielding to X-ray therapy (Fig. 10).

It is claimed that myomata cause glycosuria, and so their removal is said to cure the glycosuria (von Graff's grape-sugar tolerance in cases of myomata). Cristofoletti, Adler and Aschner explain this sugar mobilization on the basis of the *increased vagotonia for which the ovaries are responsible.* The ovaries are therefore said to inhibit sugar mobilization. If we assume a hyperfunction of the ovaries in uterine myomata, then we can understand, with Stolper, why there is an increased carbohydrate tolerance in myomata.

Against these remedies may be brought the organotherapeutic measures. Mammin (Poehl) is chiefly lauded by the Russian authors, Tederoff, Meckertschianz, Jr., Mammin (Poehl) 0.5 c.c. t. i. d. or b. i. d. and in bad cases also subcutaneously. Bell reported favorable results from its use in 1897, and claimed that the tumors not only diminished in size but that bleeding was also relieved; pains disappear and the general condition improves. Pituitrin and adrenalin have also been used with success as styptics (Hofstatter). Jouin is said to have used thyroid extract with good results. On the basis of his theory of the antagonism between the thyroid and the ovaries, ovarian substances are obviously not to be used in these cases.

Aschner believes that the myomata belong to the constitutional diseases; his view is based upon morphological, experimental and clinical evidence. The very frequent association with other developmental defects, such as infantilism, hypoplasia, asthenia (struma and other endocrine disturbances), indicates that it is contingent upon a constitutional disease.

CASES ILLUSTRATING RELATIONSHIP BETWEEN OVARIAN DISEASE AND ATYPICAL UTERINE BLEEDING

Bilateral Dermoid Cysts; Left-sided Ovarian Dysfunction; Scanty Menses

S. F., thirty-nine years old, was admitted May 19, 1921. She had been married eighteen years, had four children living and two dead. The youngest child was ten years at the time of admission. There had been four miscarriages since the last child was born, at from seven to nine weeks of pregnancy; no curettages. The patient had fever for several days following the last miscarriage two and half years before admission. She also had pneumonia in September, 1920, but no other complications. Her menses began at twelve years, regular every two months until her marriage, since when they have been regular but of one day's duration and very painful. The last period was May 1.

The patient's chief complaint was pain in the right lower abdomen, dull and constant for the past seventeen years, since the birth of the first child. There were no other symptoms. Examination showed a gaping vulva, with the uterus somewhat retroposed and not enlarged. On the right side there was a firm globular mass, freely movable, not connected with the uterus and about the size of a large orange. The *diagnosis* was a dermoid cyst against a pedunculated fibroid. Against the fibroid was the scanty menses.

At operation on May 20 the findings were as follows: a right-sided dermoid ovarian cyst the size of a large orange. In its center was a ruptured corpus luteum cyst the size of a plum. A moderate quantity of sanguineous fluid was noted in the pelvis. There was a left-sided dermoid cyst two thirds the size of the right one and attached to an elongated ovary which had a small organized corpus luteum. The cysts contained fluid, cheesy material and hair.

Note.—The patient used to bleed for two and three days scantily, but later only one day. She also had a burning sensation in the lower abdomen

and dyspareunia the past two and a half years. (Psychic? fear of more children?)

Small Dermoid; Very Young; No Menstrual Disturbance; Not Detected by Physical Examination

R. S. was admitted December 27, 1919. She was twenty-six years of age, had been married eight years and had one child four and a half years of age; no miscarriages. Her menses began at fifteen years, took place every four weeks and was of from four to six days' duration. Patient complained of sense of prolapse and pain and difficulty in walking.

Examination showed a moderate rectocystocele, the cervix slightly lacerated and the uterus retroflexed to third degree and retroverted.

At laparotomy, on December 30, the right ovary was found converted into a tumor of grayish yellow appearance twice as large as a normal ovary; it contained one small tooth, cheeselike substance and black hair. The tumor looked more like a graafian follicle cyst. The left ovary had a small hemorrhagic corpus luteum.

Teratoma of the Left Ovary; Menstrual Irregularity

M. B., aged twenty-seven years. She was married seven years and, when she was admitted, had two children, one six and one four years old.

Fig. 11.—Very Young Dermoid in a Case of Bilateral Dermoids of the Ovaries Associating Irregular Bleeding. The hypertrophied ovary is occupied by the small dermoid for one-fifth of its volume.

The patient had nursed both babies, the first one a year and the second for nine months. She got her period as soon as she weaned the baby each time. The patient had taken contraceptive measures later. Her menses began at

fifteen years, the bleeding being of three days' duration with severe pain the first day or two. The periods became irregular after marriage, always three to five days late, but the pain was just as severe. She bleeds profusely for three days, is clean for one day and then bleeds three more days. The last menstrual period was November 12 to 19, being six days late. The patient suffers from frequent headaches, worse during the period, and feels great weakness at the time of menstruation. There are no breast symptoms.

The findings at laparotomy were: a left ovarian cyst the size of an orange with thick, tense walls and large follicle cysts. This proved to be a benign teratoma. Cf. with Fig. 11.

SEVERE ANEMIA FROM EXCESSIVE BLEEDING, ASSOCIATING BASOCELLULAR CARCINOMA IN A DERMOID OVARIAN CYST; PREVIOUS STAY IN HOSPITAL WITH INTERESTING BLOOD EXAMINATIONS

M. D., aged forty-three years. Her history taken on previous admission, June 19, 1916, was as follows: frequent nosebleeds, and frequent black and blue marks. Her last menstrual period before admission was nine weeks before; five weeks before she bled for two weeks; and two weeks before she began to bleed and had continued to time of examination. The blood examination showed hemaglobin 21 per cent, red blood corpuscles 1,520,000. A blood transfusion of 500 c.c. was given when the hemaglobin index rose to 35 per cent. The diagnosis was: purpura with menorrhagia. At that time she had a small retroverted uterus. To the right of the uterus there was a mass the size of an orange and to the left a doughy mass the size of a lemon. The spleen was felt at the edge of the costal margin. The right kidney was palpable and there were several large glands in the axilla. Another blood examination showed 2,660,000 red blood corpuscles, hemaglobin 37 per cent, 7,200 white blood corpuscles, 71 per cent polynuclears, 29 per cent lymphocytes. The color index was 0.69; poikilocytosis, anisocytosis; and no nucleated red cells were demonstrated. The blood-pressure was 110/70; blood-platelets, 11,500; bleeding-time, three and a half minutes; coagulation time eleven minutes; no blood in the stools. The Wassermann reaction was negative and the urine examination negative. The patient was discharged from the medical service of the hospital July 8, 1916, with the diagnosis of hemorrhagic diathesis and secondary anemia.

The history, taken in January, 1922, was as follows: Her menses began at fourteen years; it was regular and not painful till 1916. Her last menstrual period came at the regular time in November. In December she began to spot irregularly at intervals of a week or more. For four weeks the patient has bled constantly with the passage of clots. She has been married eighteen years, has had one child, now seventeen years old, no miscarriages and no other pregnancies. The patient had a curettage for metrorrhagia five years before. She was again curetted at home for irregular and profuse bleeding a week before readmission to the hospital.

January 22, 1922, blood examination showed hemaglobin 35 per cent

red blood corpuscles 2,000,000, white blood corpuscles 5,200, polynuclears 80 per cent, lymphocytes 20 per cent. A transfusion of 300 c.c. of blood was done and on January 28 the hemaglobin was 30 per cent. Coagulation time was four minutes and bleeding time one minute.

February 1, the hemaglobin was 30 per cent and there were 2,176,000 red blood corpuscles, 5,000 white blood corpuscles, 72 per cent polynuclears, 22 per cent lymphocytes, 6 per cent myelocytes, 64,000 platelets. The smears showed marked achromia, anisocytosis and some poikilocytosis.

General Condition.—At best the patient only weighed 110 pounds. She was poorly developed, emaciated, pale, yellow-colored; her teeth were in poor condition with pyorrhea; she had hypertrophied tonsils; the left patellar reflex was more marked than the right; there was left ankle-clonus; ecchymosis on the lower extremities; ganglion on the right hand; and slight generalized adenopathy.

February 2, the gastric routine was done; for fasting contents and for Ewald nothing was obtained.

February 5, the examination showed the uterus slightly deviated to the right, not very freely movable and irregular in outline; above it and behind the symphisis, there was a cystic mass the size of an egg.

February 3, the blood examination showed hemaglobin 33 per cent, red blood corpuscles 1,792,000, white blood corpuscles 9,000, platelets 40,000, polynuclears 70.5 per cent, eosinophils 1.5 per cent, myelocytes 5 per cent, neutrophils 1.0 per cent, lymphocytes 23.0 per cent, monocytes 3.5 per cent, monoblasts 2.0 per cent, megaloblasts 1.0 per cent (200 white blood-cells counted), moderate anisocytosis and slight poikilocytosis, coagulation time eleven minutes, bleeding time three and a half minutes, tourniquet test negative, clot retraction normal, severe secondary anemia and thrombopenia as a result of some local condition responsible for the hemorrhage. There was no evidence of the presence of a hemorrhagic diathesis as far as the blood examination was concerned.

February 6, a bilateral oöphorectomy for right dermoid cyst and severe secondary anemia was done by Dr. B. A right-sided dermoid cyst, the size of a grapefruit, adherent to the broad ligament was found. The left ovary was sclerotic (ovary gyratum), the uterus slightly larger than normal, and no fibroid nodules were seen.

January 25, urine examination of a catheterized specimen was clear acid, had a specific gravity of 1.018, no albumen, no sugar and a negative microscopic examination. The blood for grouping was group two, and Wassermann reaction was negative. The blood examination for urobilin and bile showed bile.

February 4, urine examination for bile and urobilin showed no bile and no urobilin.

February 6, the pathological examination of the dermoid cyst showed basocellular carcinoma.

February 13, the bleeding stopped after operation for five days and then began again moderately on the sixth day.

PROLAPSED CYSTIC OVARIES CAUSING PROFUSE BLEEDING; DIAGNOSED AS ECTOPIC ON ADMISSION; ECTOPIC DIAGNOSIS EXCLUDED BECAUSE OF PROFUSE BLEEDING

On March 21, 1922, A. De S., aged twenty-four years, was admitted. The patient had been married six months; the husband was living and well. There had been no miscarriages. Her menses began at seventeen years and were always regular every three weeks until two and a half years before when they became monthly. The bleeding was usually of five to six days' duration. The last menstrual period was March 10; it was regular in every respect, and of four days' duration; she stopped for half a day and then she began to bleed profusely, especially while out of bed. Three days before the last period she had pains in both groins. There were no clots.

On March 22, the examination showed a normal vulva and vagina, a nulliparous cervix, the uterus anteflexed, not enlarged, firm in consistence and movable. To the right of the uterus, there was a soft indefinite mass. The diganosis of ectopic was made, but, owing to the profuse bleeding, the laparotomy was deferred. Instead the cervix was packed with iodoform gauze which controlled the bleeding.

The blood examination showed hemaglobin, 95 per cent; white blood corpuscles, 15,000; polynuclears, 74 per cent; lymphocytes, 16 per cent; mononuclears, 6 per cent; and unclassified cells, 4 per cent.

On March 25, the examination revealed cystic ovaries.

PUBERTY BLEEDING; RESECTION OF A SMALL GRAAFIAN FOLLICLE CYST OF THE RIGHT OVARY; SOLITARY CYST IN ONE OVARY; NO CORPUS LUTEUM SEEN

Y. Y., sixteen years old, was admitted to Mt. Sinai Hospital March 20, 1922. Her menses began July, 1920, at fourteen years, and lasted only a few hours; since then there was amenorrhea till October, 1920. Following a tonsillectomy in October, 1920, she menstruated for three days. For the next three months, normal menses occurred. For the last two months, she has been bleeding daily. At times she bleeds enough to require four napkins, and at other times she notices only a few drops. She complains of weakness; there is no dyspnea, vertigo or edema. The chief complaint is metrorrhagia of two months' duration. There are no bleeders in her family.

Examination revealed a systolic murmur over the entire precardium, exaggerated reflexes, vaginal bleeding, enlarged uterus and blood-pressure 105/55. On April 4, 1921, blood examination showed: hemaglobin, 63 per cent (Kuttner corrected); red blood corpuscles, 4,048,000; white blood corpuscles, 8,200; polynuclears, 58 per cent; polynuclear eosinophils, 3 per cent; lymphocytes, 30 per cent; monocytes, 9 per cent. The introitus was normal and the hymen intact. Rectal examination showed a retroverted, normal-sized uterus. Coagulation time was eight minutes; bleeding time one minute. There were 544,000 blood-platelets; clot retraction was very good. No abnormalities were present as far as the blood coagulation was

concerned. The bleeding can be considered secondary to some local condition. The Wassermann reaction was negative. The patient was kept in the hospital for ten days when the bleeding practically stopped.

March 30, 1922; for a year the menses had been irregular and prolonged. For three months, there has been a constant bloody vaginal discharge with blood-clots. Physical examination showed a small cervix, the uterus in retroversion, normal in size, and the adnexa negative. On March 31, at operation, the uterus was curetted and fairly large fragments of mucosa obtained. The uterus was enlarged 150 per cent. The right ovary contained a cyst the size of a plum. The cyst with thin walls and clear fluid was resected intact.

Fibromatous Change of Corpus Luteum; Attacks of Pain in the Left Lower Quadrant; Bleeding Following Removal of Fibromatous Corpus Luteum

R. J., twenty-nine years old, was admitted March 1, 1922. Her mother died of jaundice and stomach trouble; the cause of her father's death is unknown. The patient had influenza three years before, and an abortion four years before, at ten weeks of gestation. Seven months later she was operated upon for uterine displacement and, at the same time, her coccyx was removed for dislocation following a fall. The patient was married nine and a half years, has two children, seven and a half and five and a half years old. She also had a miscarriage nine years before without curettage. Her menses began at fourteen years, always regular every twenty-eight days of five days' duration. Her chief complaint was sharp, severe cramps in the left lower quadrant coming in attacks of which there were about five in eleven months. The last attack was during her last period, February 23 to 28.

March 6, a cystoscopy showed the bladder to be normal. A number five ureteral catheter was blocked and a number four passed through. The findings on examination, March 8, were an old median laparotomy scar, the uterus slightly enlarged, the left ovary prolapsed and somewhat enlarged and tender.

March 10, a *resection of the ovarian tumor* was done. The findings were: the uterus forward, attached to the anterior abdominal wall by the round ligament, a right corpus luteum cyst; the left ovary contained a white nodular firm mass about the size of a small walnut, covered with a few dilated vessels. On section, this mass showed homogeneous substance with a small cavity in the center (lymph space against an old corpus luteum cyst cavity). The pathological report was: a fibroma containing a small cyst, probably the remains of an old corpus luteum, and one atretic follicle.

March 13, three days after the operation, the patient began to bleed and continued for ten days as much as when she menstruates.

PROFUSE BLEEDING ASSOCIATING DISEASED ADNEXA; CYSTIC DEGENERATION
OF THE OVARIES ASSOCIATING AN ENLARGED UTERUS WRONGLY DIAGNOSED
AS SUBMUCOUS AND SUBSEROUS FIBROIDS

A. M., thirty-two years old, was admitted to Mt. Sinai Hospital on
March 21, 1922. She was married fourteen years, and had four children;
also she had one miscarriage in June, 1921, at three months, for which she
was curetted. An appendectomy had been performed nine years before. The
patient had always been regular in her menses until June, 1921. In November,
1921, she began to bleed irregularly and spotted. She had bled in
October and had no other symptoms of pregnancy. She was curetted three
weeks after the bleeding began but without result. *Her chief complaint was
bleeding for fifteen weeks.* There was no pain or vomiting.

Examination showed a roomy, relaxed vagina, and profuse bleeding.
The cervix was patent and allowed the introduction of one finger. The
uterus was rather large, round and hard. To the right, there was a distinct
cystic mass, freely movable. March 22, the patient was given 20 c.c. of
30 per cent sodium citrate. There was not much, if any, improvement.
Then the cervix was packed with iodoform gauze. Her hemaglobin was
45 per cent. The patient was a fat woman with great pallor.

On March 24, Dr. B. performed a supravaginal hysterectomy and bilateral
salpingoöphorectomy. The findings were as follows: The uterus was
symmetrically enlarged to almost the size of a two months' gravidity. The
right adnexa showed a partial hydrosalpinx and a parovarian cyst the size
of an orange. The ovary was cystic (both follicle and small corpus luteum
cysts). They were adherent to the posterior broad ligament and in the deep
pelvis. The left adnexa was similarly changed. The ovary was about the
same as on the right side; it was adherent to the tube. The tube was closed
and slightly distended. In the uterus no fibroids were found but soft,
mushy, degenerated endometrium, especially of the fundal portion.

HEMORRHAGIC CYST ASSOCIATING AMENORRHEA OF FOUR MONTHS' DURA-
TION IN AN UNMARRIED WOMAN WHO PREVIOUSLY HAD HAD MENORRHAGIA
DUE TO PERIOÖPHORITIS AND PERISALPINGITIS; PERSISTENCE OF
MENSES FOR A FEW MONTHS FOLLOWING BILATERAL
SALPINGOÖPHORECTOMY

R. K., single, twenty-six years of age, was admitted May 26, 1921. The
patient had been operated at another hospital one and a half years ago for
uterine displacement. Her menses began at seventeen years and were regular
every four weeks, and of six to seven days' duration, until four months before.
Sometimes the bleeding lasted over a week and it was always profuse, with
clots. The last regular menstrual period was January 20. For a month, there
has been a slight leukorrheal discharge and for four months amenorrhea, pain
in the lower abdomen, weakness and loss of weight.

On May 2, vaginal examination showed a small uterus, anterior, with
fundus to the right of the median line. Filling the entire pouch of Douglas

was a mass which was semifluctuant, reaching halfway to the umbilicus. A second mass was also found which was irregular in contour and filled the right side of the pelvis. The diagnosis was a left-sided ovarian cyst and a possible right-sided pyosalpinx.

On May 27, Dr. B. performed a bilateral salpingoöphorectomy with the removal of a hemorrhagic ovarian cyst; appendectomy. Pathology: Both tubes showed a perisalpingitis. The right-sided cyst was hemorrhagic and sprang from a graafian follicle cyst. The left ovary showed a perioöphoritis.

Bleeding for Three Months; Findings Adnexal Disease; One Ovary Carbuncular, the Other Has a Small Hemorrhagic Corpus Luteum Cyst

M. C., thirty-four years old, was admitted December 23, 1921. She had been married eight years and had two children, one miscarriage four years before and another three months before, both followed by curettages. The patient suffered from the usual children's diseases, had small-pox at the age of three and scarlet fever at the age of six; appendectomy took place nine years ago. There were no symptoms referable to the cardiorespiratory or gastro-intestinal tract. Her menses began at fourteen years, always regular every twenty-eight days and of four days' duration. She underwent severe dysmenorrhea the first day. The last regular menstrual period was July, 1921.

Seven years ago, the patient had a severe instrumental delivery with laceration, which was repaired. For four years she has complained of severe pain in the back and the right lower quadrant. The patient claimed "she had blood poisoning and was very ill" at the time of her first miscarriage. She had chills, fever and other symptoms, was ill at another hospital for twelve days and later at home for three months. Since then, she was well until six months before when she became pregnant. The patient had hyperemesis; she vomited blood several times. A therapeutic abortion was performed at another hospital three months before, after which the patient bled continuously, though in small amounts. She had persistent fever, sweats and chills. Four days before, the bleeding became so severe that she had to have tamponade and again two days before. There was slight urgency and frequency of urination. The white blood count was 17,000, with polynuclears 75 per cent and lymphocytes 25 per cent.

Examination on December 23 showed a moderate rectocele and slight cystocele. The cervix was well preserved, and the uterus was forward, not appreciably enlarged and displaced somewhat to the left by a smooth hard rounded mass about the size of an orange. The mass is firm, movable from above downward and slightly from side to side. The left side of the pelvis is free.

The findings at operation on December 27 were as follows: The uterus was adherent to both adnexa, the bladder slightly adherent, the right ovary enlarged to the size of an orange, very hard and with a smooth capsule, adherent deep down in the pelvis. The left adnexa was not so large

and the left ovary was about normal size with a hemorrhagic corpus luteum and small atretic follicles. Both tubes were found closed. The right ovary on section was honeycombed with small abscesses (carbuncular). The sigmoid was so adherent that a hole was torn into it. The uterus was slightly larger than normal, and, on section, was seen to lodge a small papillomatous tumor adherent to the fundus which resembled a placental polypus and to which a clot of old blood was adherent.

PROFUSE BLEEDING INDICATIVE OF INFLAMMATORY CONDITION AND NOT ECTOPIC. BILATERAL PYOSALPINX VS. ECTOPIC, OR BOTH

E. B. was admitted October 31, 1919. She had two children, the older being six years and the younger three years. Menses started at twelve years, every four weeks and of seven days' duration. Patient had one curettage in March for an incomplete abortion. The last period was two weeks before. A few days before patient suddenly complained of severe pains in the lower abdomen, especially in the right lower quadrant. This was accompanied by bleeding with large blood-clots. The bleeding still persists and is very profuse and clotted. Patient has had a leukorrheal discharge ever since marriage and has had symptoms referable to the adnexa. She thought she felt faint last night.

Examination showed the uterus lying in retroversion and drawn over to the right side. A mass extending from the right horn of the uterus, elongated to about the size of a turkey's egg, was felt. Under anesthesia, the uterus seemed larger and on the left side there was also some thickening. No culdesac fullness was felt before the operation. There was no pallor and the pulse was of good quality.

The blood count showed white blood corpuscles, 11,000; polynuclears, 76 per cent; monononuclears, 1 per cent; lymphocytes, 23 per cent. The temperature was practically normal.

At operation, by curettage, small shreds were obtained. At the laparotomy, the right tube was found swollen to four or five times the normal size and was full of pus.

COMMENT.—Neither the temperature nor the blood count pointed to an inflammatory condition. The only suggestive symptom was the profuse bleeding which, by excluding ectopic pregnancy, pointed to the inflammatory character of the lesion.

SIMPLE RETENTION CYST OF THE OVARY ASSOCIATING PROFUSE BLEEDING

R. D., aged thirty-five years, was admitted to the hospital on August 9, 1921, complaining of severe vaginal bleeding of three days' duration. Three weeks previously she had had a curettage performed for a supposedly incomplete abortion, following which she had such severe pelvic pains that the doctor was led to suspect a perforation of the uterus. Her pains subsided, however, and the bleeding stopped. Three days before her admission, she began to bleed profusely and had a slight pain on the right side of the pelvis, associated with some dysuria and polyuria.

On examination, the uterus was found to be in partial retroposition and not enlarged.   In front of the uterus and extending to the right side, was a cystic mass, moderately movable in all directions with a smooth cystic wall, not tender and somewhat elongated laterally.   On the left side, the adnexa were not palpable.   There was a partly coagulated blood discharge from the cervix.   A diagnosis of retention cyst of the right ovary was made.

At operation, a right graafian follicle retention cyst was found together with some small cysts of Morgagni.   Pathologically it was shown to be a cystadenoma simplex of the ovary.

Hemorrhagic Corpus Luteum Cyst Associated with Bleeding in a Virgin

L. F., aged twenty-three years, admitted May 13, 1919.   Her menses began at thirteen years, always regular and of four days' duration.   There was no dysmenorrhea.   One year before admission, after very hard work at a machine, she skipped a period for one week and then began to bleed profusely for two days; she fainted once. She was taken to the hospital where a curettage was done.   The patient was in the hospital eleven days and remained well for a year.   The last period was two weeks before, lasting three days; she was clean one day and then began to bleed again and has continued to time of admission.   The present attack is the same as the one a year ago.   At admission, her temperature was 101.8° Fahrenheit.

On attempted vaginal examination, it was impossible to examine the patient owing to her abdominal rigidity.

Under anesthesia, the corpus luteum cyst was palpable in front of the uterus.   At operation a right-sided hemorrhagic corpus luteum cyst was found.   The uterus was slightly enlarged and in good position; the left adnexa were normal.   A moderate amount of serosanguineous fluid bathed the pelvic organs.   The cyst content was gelatinous and appeared like coagulated blood.

Delayed Menses with One Cystic Ovary and one Ovary with a Corpus Luteum Cyst

D. L., single and twenty-eight years of age, was admitted November, 1920.   Her menses began at sixteen years and occurred every six weeks. For a few years the interval between the periods increased to two and three months.   The patient had a prolapse of the rectum since childhood.   The last period was three months before.   The chief complaint was alternating constipation with diarrhea and occasionally bloody stools.

Examination showed the rectum protruding six to seven inches.   The uterus was twice as large as normal.

The Moschcowitz operation was done.   The left ovary was found large and cystic and the right ovary had a corpus luteum cyst.

Adnexitis; Irregular Periods; Delay Alternating with Anticipation

M. V., aged twenty-six years, admitted January 3, 1922. Patient had been married nine years and had two children, the older seven years, and the younger five years old. There had been one miscarriage, about four and a half years before, at seven weeks. Menses began at thirteen years and were regular every twenty-eight days with no pain. Last menstrual period was December 29 to January 2; the period before that was December 8 to 11; the one before that was November 3 to 6 and the one before that was regular. The patient had measles, mumps, scarlet fever, chicken-pox and diphtheria in childhood; pneumonia at twelve and influenza at twenty-two. Tonsils and adenoids were removed at fifteen and nasal septum was removed at eighteen.

The present illness began November 6, when she was seized with severe pains in the lower abdomen which radiated up into her axilla. Temperature of 103, associated with chills and sweats. She was at another hospital for two and a half weeks being treated with ice bags and douches. The pains gradually became less. *Period at this time was delayed.* Patient rested for two more weeks and then returned to work, although still suffering pain. On January 2, she was again seized with severe stabbing pains in both lower quadrants; vomited again and again on the day of admission and had a chill and sweat. She denied intercourse and instrumentation during the past four years during which time she was separated from husband.

General Condition.—Patient looked well nourished and not very ill.

Examination on January 5 showed perineum firm and the bladder well supported; uterus anterior, normal in size, moderately movable, no tenderness; the right adnexa, as well as the left, were enlarged, tender and slightly fixed.

On January 14, the right adnexa were found to be considerably larger, irregular in outline, firm with a smooth surface, about the size of a tangerine, intimately adherent with the uterus. The left adnexa were less thickened and appeared almost free.

January 24, the mass was considerably enlarged, extending into the culdesac.

February 1, the right exudate had almost entirely disappeared, still some thickening behind and to the right of uterus.

Inflammatory Adnexa; Disease of the Parametrium with Profuse Menorrhagia; Conservative Treatment

L. C., twenty-seven years old, was admitted January 28, 1922. The patient was married three years and had no pregnancy or operations. Her menses began at eleven years and were always regular, every month, of five to six days' duration. She had been separated from her husband during the past year and denied intercourse. The last menstrual period was January 5 to 19.

One year before, the patient suddenly began to complain of a sharp sticking

pain in the right lower quadrant. She vomited several times, remained in bed for five weeks and was ill altogether seven weeks. The trouble began with taking a bath during the fourth day of her menses. A physician told her that the right tube was inflamed. Five tampon treatments relieved her. *That period lasted for seven weeks.* Her periods after that became regular until January 5 to 19, 1922. She then started to menstruate with no pains but, four days later, had pain in the lower right quadrant severe enough to confine her to bed. Ice bags were applied to the region of pain. This lasted for ten days when the bleeding stopped. The patient was in and out of bed for a week. There was no vomiting or chills. Following this she took a two-mile walk; the pains returned with slight bleeding the next morning. The next day her physician found an "abscess" on the right side. There were no chills but slight fever.

Blood examination showed 21,600 white blood corpuscles, 78 per cent polynuclears, 22 per cent lymphocytes. Vaginal examination on January 29 showed a nulliparous cervix, profuse clotting and free bleeding. The uterine fundus was not defined on account of the rigidity of the lower rectus; the uterus was fixed by an exudate in which both adnexa were involved and occupied the lower half of the pelvis, dipping down into the rectovaginal septum.

January 30, the uterus was embedded in exudate, filling the entire pelvis and including both broad ligaments; the adnexa were not to be felt. The upper limit of the uterus was not definable.

February 6, the uterus was slightly movable, forward, and appreciably enlarged; the left side was free but, to the right and behind the uterus, there was still a somewhat fixed and slightly elastic mass.

February 13, the uterus was freely movable, only slight thickening of the adnexa remaining. *She menstruated from January 29 until February 10 with no pains.* The urine examination was negative.

February 14, the patient felt well with only a sense of weakness on the right side of the abdomen.

BLEEDING IN THE FIFTH DECADE OF LIFE; SUBSEQUENTLY CURETTAGE FOR IRREGULAR BLEEDING; CORPUS LUTEUM CYST OF ONE OVARY (RESECTED) AND NUMEROUS SMALL CYSTS OF THE OTHER OVARY; THE PREOPERATIVE DIAGNOSIS WAS SMALL INTRAMURAL FIBROID NOT FOUND AT OPERATION

S. F., aged forty-two years, was admitted August 10, 1921. Her menses began at sixteen, were always regular every twenty-eight days, of from five to six days' duration up to two years before examination. There was no dysmenorrhea or previous leukorrhea. The patient had been a widow for twenty years. She had three children living and well. After the birth of her first child, her menses became prolonged to eight days, until two years before when she began to bleed every two to three weeks, for two days, with severe pain and occasional spotting between periods. There had been marked leukorrhea for the past two years, also headache and spells of weakness. The

patient had noticed marked abdominal distention which at times disappeared spontaneously.

General Condition.—The patient appeared well nourished and not acutely ill. The abdomen was negative for tenderness. The vaginal examination showed the introitus relaxed, a slight cystorectocele, the uterus anterior somewhat to the right and freely movable; the adnexal region was normal but there was marked tenderness in the right lower quadrant. The uterus was somewhat enlarged, especially at the right horn. The *diagnosis* was possible small intramural fibroid.

August 13, an exploratory laparotomy was done with the partial resection of the right ovary and removal of the appendix. The findings were as follows: a small cyst of the right ovary the size of a hazelnut (corpus luteum cyst), the uterus slightly enlarged and no fibroids. The left ovary also showed numerous small cysts. The pancreas, spleen, gall-bladder, liver, stomach and mesentery were negative.

The patient was readmitted February 1, 1922, with the following interval history. She had some discharge and dull pain in the right lower quadrant. The pain was continuous and worse during the menstrual periods. The menses had occurred irregularly about every two weeks, of two days' duration. The patient was bleeding at the time of examination. The bowels had been regular and there had been no urinary or cardiorespiratory symptoms. Heart-burn was complained of. The examination on February 2 showed slight rectocele, moderate cystocele, the cervix well preserved; the uterus forward, regular in outline, hard and slightly enlarged. The general physical condition was normal and the urine negative.

February 2, the curettage was done. The curettings showed a few shreds of normal endometrium.

CHAPTER VII

SYSTEMIC EFFECTS OF SEPTIC GENITAL AFFECTIONS

Symptoms secondary to Sepsis Arising in Some Remote Site.—
Hematogenous infection of the uterus is most liable to take place during
the puerperium. The involuting uterine mucosa and musculature are then
in a condition of least resistance. Necrosis of decidua and an open wound
in the uterine cavity make this organ specially liable to bacterial invasion
from the genital tract as well as from the blood stream. Similarly the
ovaries, on account of their cyclical vascular changes and monthly rupture
of graafian follicle, are prone to take up bacteria from their surroundings
and are also subject to hematogenous infection. Experimentally, it has
been shown that the streptococcus and pneumococcus may invade the uterus
and incite a septic endometritis when injected into the vein of a guinea pig.
Clinically the same has been observed in instances of angina complicating
the puerperium. Von Rosthorn was the first to point out the seriousness
in some cases of tonsillar infection as a cause of hematogenous localization
in the genital organs.

Other lesions alleged to be the primary cause of blood stream infection
of the genitals are furunculosis, mastitis, middle ear disease, pneumonia,
hematogenous peritonitis and intestinal wall abscess. Diphtheria has also
been said to induce uterine infection. Although the vast majority of post-
partum sepses owe their origin to contact infection introduced from without,
whether by the hand, by coitus, by instruments or other agents, spontaneous
auto-infection must be accorded a definite clinical place. If bacteria are
always present in the genital tract, spontaneous invasion at a susceptible time,
without outside mechanical factors entering into it, may admittedly occur.
On the other hand, when there has been no examination and no outside inter-
ference, we may seek for an explanation of the sepsis in some other organ
or in some general blood infection. Such systemic infection may occur in
typhoid, pneumonia or bacterial endocarditis.

Septic bacteria may gain access to the genitals by way of the lymph
channels and along the mucosa. Thus, renal suppuration, especially pyelitis,
cystitis and intestinal inflammations, such as appendicitis, sigmoiditis and
enterocolitis, may cause secondary infection of the uterus and appendages.
Right-sided tubal and ovarian disease secondary to appendicitis is a not
uncommon occurrence. The proximity of these organs makes for direct
extension of the process. Involvement of the left adnexa occurs less fre-
quently, but may be due to an occasional long appendix dislocated to the
left side of the pelvis, particularly when associated with a mobile cecum.

When pelvic abscess results from suppurative appendicitis, both adnexa are implicated without the appendix necessarily being in close contact with them. Suppuration of ovarian tumors and also uterine wall abscesses have been reported as due to appendicitis.

Effects on General Organism and Various Organs.—Sepsis originating in the genitals may spread to the extragenital organs and become generalized. On the other hand, without such spreading sepsis, disturbance in function of the sexual organs has its effects upon the rest of the organism.

Fever in gynecology always betokens some inflammatory process in the pelvis. Whether or not tumors are known to be present or are suspected, it must be assumed either that they are undergoing suppuration of some degree or that they are simply associated with an inflammation in the genital organs. The rise of temperature and the character of the curve varies considerably, sometimes simulating malaria; in the postpartum state, fever may be present for several weeks without any accompanying pain. At other times, it is more sustained, as in pneumonia. Again, it may be remittent and suggest some infection such as typhoid. The fever course varies to such an extent in gynecological sepsis that distinct clinical types may not be distinguished. Perhaps one condition, lochiometra, gives a clinical fever picture. In the second week postpartum, as a rule, there is a sudden rise of temperature to 102°, even to 104°, without a corresponding increase in the pulse rate, and other prostrating symptoms. The fever is sustained for several days and then sharply falls, when the uterine retention is relieved spontaneously or by cervical dilatation.

The time occurrence in puerperal sepsis is also more significant of the nature of the infection than is the character of the temperature curve. Thus septic endometritis and peritonitis give rise to fever within three to four days postpartum. Fever coming on within the first twenty-four hours after labor suggests some other cause. This may be located in the tonsils (angina), to an attack of influenza, to a bronchitis or, in many instances, to a pyelitis. The diagnosis of pyelitis can readily be made by examining a catheterized specimen for pus cells, the finding of colon bacilli in pure culture, and by the prompt relief, in most instances, which follows adequate therapy. The other conditions may be diagnosed by their peculiar physical signs. Parametritis, on the other hand, may cause fever at a much later date, even after two weeks. Peritonitis at such a late time would occur only in the rare instances of rupture of an ovarian abscess, appendicular abscess or pyosalpinx. Even these accidents are more apt to occur at the time of, or shortly after, labor, since the strong uterine contractions with their incidental pulling apart of adhesions predispose to the rupture. As to the significance of the duration of the temperature, it may be said, in general, that long fever courses end favorably. In this instance, the absence of chills is also a good omen, but the presence of rigors may not altogether indicate a fatal prognosis. Cases have been reported in which dozens of chills were present in the course of the fever and yet complete cure resulted. When they do occur, they usually mean blood-vessel involvement, periphlebitis, periarteritis or blood-stream invasion, thrombophlebitis and

thrombo-arteritis. The chills associated with rapidly spreading lymphangitis are apt to recur more than once or twice, but peritonitis may rapidly cause death without chills or marked fever; the temperature in the most desperate cases need not arise above 101° F. The organism may be overwhelmed so rapidly with toxins that there may not have been sufficient time to produce the frank, anatomical signs of a peritonitis.

In the course of genital sepsis, as, for example, that which follows the puerperal state or abortion, scarcely an organ or tissue in the body escapes attack.

The heart and blood-vessels show perhaps the most serious and present the most important symptoms for, while the results of secondary infection in other organs may be treated surgically and offer a tolerably favorable prognosis, such lesions as infective endocarditis, due to genital sepsis, or arteritis with thrombophlebitis, prove fatal in most cases. Less grave conditions and symptoms are myocarditis and general weakness with its associated pallor, arhythmia and soft compressible pulse. The blood-pressure, when low in genital sepsis, betokens an unfavorable outcome, as it does in general sepsis of whatever primary origin. In peritoneal sepsis, it is well known that the blood-pressure begins to drop and falls rapidly when the splanchnic nerves are involved with vasomotor failure. The general toxemia may have a direct paralyzing effect upon the surface vessels themselves.

Relation between Septic Genital Infection and Respiratory Tract.— Apart from the increased breathing that characterizes all febrile states, the respiratory excursions may be augmented by toxic irritation of the center in the medulla. The meteorism attending genital sepsis may disturb the diaphragm and interfere with breathing, while the sensation of pain evoked by deep breathing (peritoneal friction) may also cause the patient to "catch her breath," restricting the motions to the costal areas. Cough and pain in the chest suggest bronchitis, pleurisy or even pneumonia, secondary to the genital sepsis. Either bacterial invasion or the dislodgment of thrombi or emboli are responsible for these pulmonary processes. Sudden respiratory embarrassment, cough and blood sputum, nearly always indicate pulmonary infarcts. When the embolus is of the infective type, septic pneumonia inevitably follows. When a large branch of the pulmonary artery becomes blocked or when several of its larger branches are blocked, sudden death invariably results.

Effect on the Urinary Apparatus.—A sense of pressure in the bladder area, urgency, tenesmus and frequency usually suggest a pericystitis. The bladder, in such cases, is hemmed in by the exudate and does not yield to distention. The edema of its muscle and serosa causes contractions to be painful. Complete emptying is inhibited, hence the increased frequency. There is very often bullous edema of the trigon and especially of the sphincter margin, causing tenesmus. Occasionally rupture of the pelvic abscess or pyosalpinx into the bladder leads to pyuria.

Anuria with coma and death may occur in extreme cases of pelvic exudates where the ureters are so compromised as to cause suppression. In other cases, pain is experienced in the region of the kidney or in the dia-

phragmatic area, suggesting a subphrenic suppuration which ascended along the retroperitoneal plains from a pelvic connective tissue phlegmon. The pyuria may result from rupture into the kidney calices of a perinephritic abscess whose origin could be traced from an ascending pelvic infection. Contractions of the thigh due to secondary psoas abscess, and perirenal swellings may be the result of a similar ascent of the septic process. Albuminuria, casts, red and pus cells, all indicate serious kidney involvement, from an acute parenchymatous nephritis to kidney infarcts and multiple kidney abscesses. Symptoms of renal insufficiency may, however, be entirely lacking in cases of genital sepsis, owing to the relatively short duration of the disease. As a rule, kidney involvement occurs later in the disease, but it may, exceptionally, occur early, and symptoms referable to the renal disorder may dominate the clinical picture.

Effect on the Adrenals.—When marked prostration, asthenia and reduced blood-pressure are present, they are suggestive of the severity of the sepsis and also of adrenal involvement. Lesions, such as cloudy swelling of the adrenals (the chromaffin elements), are demonstrable.

Effect on the Spleen.—Swelling of the spleen is almost a constant finding in sepsis. Occasionally sudden pain in the course of a septic attack will point to splenic infarct. A peritoneal friction rub may be present in the splenic area when perisplenitis follows the splenic infarct.

Effect on the Digestive Tract.—The furred tongue of sepsis is well known. It is due to lack of salivary secretion, absence of solid food and swallowing of fluids; increased dryness may also be due to mouth-breathing and to increased respiration. Stomatitis is common owing to the absence of protective secretions. The appetite is incidentally lost, since deglutition is often painful and the sense of smell and taste, upon which this sense is so largely dependent, are dulled. Swelling of the parotid gland is a not uncommon symptom in genital sepsis. It is due to increased sepsis in the mouth, lack of normal secretions which clear Stenson's ducts and to the lowered resistance of the individual in general. Metastatic abscess of the parotid is an extremely rare occurrence.

Diminished hydrochloric acid secretion is the rule in fever. On account of the recumbent posture and general abdominal wall weakness, obstipation is also practically always present. Diarrhea of severe type signifies severe sepsis. If loose bowels mean an attempt on the part of the organism to throw off infection, they, at the same time, cause great depression and weakness. Hemorrhage from the bowels arises in sepsis from septic infarcts, from septic ulcers and capillary thrombosis. Severe intestinal hemorrhage due to mesenteric thrombosis may be the forerunner of rapid intestinal gangrene, peritonitis and death.

Severe pelvic pain, whether at first unilateral or bilateral, in the course of sepsis of genital cause, usually signifies tubal colic in which an attempt is made on the part of the tube to expel its contents. Pelvic peritonitis results first in the majority of the cases. If the patient is operated on or if the capsule is broken through, as by careless examination, the sepsis spreads to the general peritoneal cavity. In this case, increasing meteorism

and constant increase of tenderness are pathognomonic of the spreading peritonitis. The meteorism is due to loss of muscle tone in the intestinal wall, owing to toxic injury. Disturbed secretion favors gas production which, combined with that retained by diminished peristalsis, causes still greater bowel distention.

Influence of Menstruation on Genital Affections.—Old inflammations of the adnexa are very apt to be lighted up during the menses. In addition to the hyperemia, the general resistance appears to be reduced, thus permitting renewed bacterial activity. Indiscretion during menses, whether by plunging into cold water, taking a cold douche or indulging in sexual intercourse, rarely may be responsible for the so-called idiopathic peritonitis to which Nothnagel has called attention. Not only are the secretions of the vagina altered by the menstrual flow (the acid vaginal secretion being changed to alkaline), but the cervical canal is patulous, hence facilitating the ascent of bacteria to the tubes and the peritoneal cavity. The protective surface epithelium being cast off at many points during menstruation, bacteria gain access to the deeper lying structures rich in lymph vessels and blood and thence reach the peritoneal cavity.

Lesions elsewhere in the body have been known for a long time to become aggravated during the menses. The fever of pulmonary tuberculosis, for instance, exhibits striking exacerbations during menstruation. In the same way, fever due to local genital disease shows the tendency to rise during the menses. This is especially noticeable after operations, when the usual postoperative rise is apt to be higher if menstruation supervenes within twenty-four hours. If menstruation occurs several days after, a rise in temperature may be noted when the condition is one of an inflammatory nature.

A number of nonvenereal infections of the pelvis in young women may be traced to bacterial invasion during the menses. Not only do bacteria gain access by the vaginal route, but rupture of graafian follicle offers a portal of entry and a favorable site for their propagation. The bacteria may, in this latter case, be transported by the blood stream or via the rectum, sigmoid, etc.

Effect on the Liver and Pancreas.—Swelling of the liver is rather common in sepsis of genital origin. The sepsis itself, and not the origin, is responsible for the liver enlargement. Icterus is not infrequent under these circumstances and is due to stasis in the liver occasioned by degenerative swelling of the cells. Bacteria are abundant in the liver substance, where they are said to be destroyed in large numbers. When overwhelmingly present, they may cause multiple metastatic abscesses which, however, are very rare. These conditions also favor gall-bladder infection and, thus, cholecystitis, complicating the puerperal period, is not infrequently met.

Cloudy swelling of the pancreas cells occurs in septic infections. Embolic processes may obtain here as elsewhere in the body, leaving the pancreas damaged structurally and functionally. Thus, a preëxisting glycosuria, accompanying some suppurations, may be explained by disturbed pancreatic function. It must be stated, however, that alimentary glycosuria or that

associating adrenal disturbance must be distinguished from that due to pancreatic disease.

Effect upon the Skin.—The skin suffers from the results of the fever itself as well as through the sepsis, for the sweating which may be excessive predisposes it to other changes. The excretion through it of the various inorganic salts and elements in a disturbed proportion also occasion dermatological changes. Prolonged sweating, on the other hand, causes prostration through loss of warmth and water elements. Sudamina are common in septic infections. Red and white forms may be distinguished. Miliaria is fairly common in septic conditions followng genital infection and is due to the retention of sweat. The occurrence of icterus is a sign of the ravages of the sepsis upon the liver and the blood.

Abnormal redness of the skin may appear overlying metastatic inflammations, such as muscle abscesses, periarticular swelling and subcutaneous infiltrations. A roseolous eruption may be present and simulate the rash characteristic of typhoid fever or typhus. When associated with joint pains and intermittent fever, polyarticular rheumatism may be strongly confused with it. Pure urticarial eruptions are rare and occur after antitoxic serum injection. Herpes is not as common in sepsis as in pneumonia; when occurring, it usually ushers in a marked elevation of temperature. An erythema resembling that of measles is apt to occur in staphylococcic infection. When present, it is of bad omen.

A scarlatinal eruption is fairly common in sepsis; in fact, it was formerly so common as to cause great confusion between genuine scarlet fever and puerperal sepsis. Even when there are apparently no genital findings suggestive of puerperal fever, the diagnosis of scarlet fever should not yet be made, because a septic thrombophlebitis in the early stages may escape all detection by the physical examination. The absence of angina and the atypical distribution of the rash distinguish it from scarlet fever.

Hemorrhages into the skin are very common. They are due to "apoplectic" processes in the capillaries and give rise to the punctate forms and those as large as a lima bean. They may be pale or dark red papules. Their predilection is at the points exposed to pressure. They occur mostly in association with infective endocarditis. Cocci have been demonstrated, "stuffed" in the capillaries and in the small arteries. The tendency to cutaneous hemorrhage may be and often is associated with hemorrhage into other organs and, hence, leads to the term "septic hemorrhagic diathesis." In the streptococcic infections, there may be hemorrhage under the skin, giving rise to bluish red nodules like erythema nodosum. Streptococci have been found in these nodules.

A pustular eruption, reminding one of pemphigus, occurs in some cases. When scanty and discrete, the infection may come from outside, but, as a rule, they are more plentiful, being discrete or more diffuse, small or large, and may, when undergoing hemorrhage, resemble the hemorrhagic type of small-pox. In other cases, the eruption is but a subcutaneous infiltration, palpable in the depth, and tending to appear near the surface of the skin, when it causes redness. Suppuration occasionally occurs.

Erysipelatous and phlegmonous processes are likely to be seen associated with the external genital infections.

Desiccation and falling out of the hair usually occur in the convalescent period.

Decubitus ulcers, which are so troublesome to manage even while the patient is convalescing, arise especially in cases exhibiting marked emaciation. But their occurrence over the bony parts, especially where pressure occurs, is a factor that may be noted early in the sepsis. Necrosis follows infection from without or within, while the skin breaks and separates inordinately. The ulcerative process, as a rule, develops upon rupture of a vesicle and in spite of the most vigilant care.

Effect on Muscles, Joints and Bones.—The muscles undergo fatty degeneration and atrophy chiefly because of the inanition which attends prolonged fever. But embolic processes may start the formation of abscesses in them. As a rule, suppurations in muscles are secondary to connective tissue phlegmons, joint, tendon-sheath or peri-articular abscesses. Massive edema of fat and muscle are not uncommon. Joint pains, analogous to those of rheumatism, may occur and be referable to peri-articular processes. In other cases, the joints become filled with exudate, serous or purulent. The sacro-iliac joints and the symphisis are more liable to purulent involvement, owing to the trauma to which they are more frequently subjected during forceps application. Severe pain in the limbs in the course of septic infection may be traced to an osteomyelitis, periostitis and bone necrosis of metastatic nature. But it may be present in the absence of evidence of such gross processes. Nevertheless, it is always a foreboding symptom of thrombosis of the large venous branches.

Effect on Brain and Nervous System.—Brain symptoms due to the toxemia itself consist of headache, dizziness, delirium and increased irritability. Coma resembling that of eclampsia may occur in severe sepsis. Even convulsions of one side of the body or of half the body and other evidences of so-called meningismus may occur, without local disease. Some forms of meningitis, the pneumococcic especially, may simulate eclampsia so closely as to make differential diagnosis very difficult. In the absence of pus in the spinal fluid obtained by puncture, the diagnosis becomes well nigh impossible.

Brain abscesses or hemorrhagic infarcts, depending upon whether the emboli are infected or not, may result in the course of sepsis of genital origin. While not as apt to arise as from a suppurative middle-ear condition, they nevertheless result through the agency of the septic endocarditis. Hemiplegia is not infrequent in septic abortion or puerperal sepsis with cardiac involvement. Functional brain disturbances are common. Thus, various psychoses may follow an attack of sepsis. Paraplegias and sphincter paralyses indicate spinal cord involvement. This may have arisen by continuity from the pelvic septic process or by metastasis in the meninges. Sciatica, intercostal neuralgia, etc., are expressions of toxic neuritis of the peripheral nerves. Yet, in some cases, a direct extension from the septic inflammation may be traced to the nerves as in parametritis.

Ocular Symptoms in Sepsis.—These are due to embolic processes and to hemorrhages of septic origin. While nonpuerperal gynecological conditions may incite ophthalmic changes, they are rare by comparison with the lesions induced in the component parts of the eyes by septic pelvic infections. Suppuration may involve the orbit, sclera, cornea, iris, chorioid, vitreous, crystalline lens, and even the optic nerve. Blindness, gradual, or sudden and complete, nearly always signifies retinal hemorrhage, whether this be embolic or merely toxic. Panophthalmia of one or both eyes accompanies, as a rule, bacterial endocarditis.

Otological Symptoms.—Earache in sepsis is usually due to embolic hemorrhage or to metastatic middle-ear suppuration. Reduced hearing may be associated with parametritis, endometritis and adnexal disease, while loss of hearing may become progressive with each pregnancy. The explanation for this is not clear.

Functional disturbances secondary to, and consequent upon, septic genital infection consist of menstrual anomalies, amenorrhea, menorrhagia and metrorrhagia, dysmenorrhea, sterility, abortion, and disturbances in the mechanism of labor or of the placental expulsion stage. These have been discussed in detail under their appropriate headings.

Genital Symptoms Secondary to Extragenital Sepsis.—Genital symptoms due to sepsis of extragenital cause are due to the reduced vitality, the anemias, emaciation, general circulatory disturbance and changed blood composition. Fluor albus is associated with a severe reduction in weight and severe anemia, the improvement of which is followed by cure of the white vaginal discharge.

The involvement of the genitals may, however, be more direct; by continuation of a neighboring septic process, such as that of the bladder, kidney, appendix, intestine and stomach. Pregnancy predisposes especially to secondary genital infection. Thus wounds of whatever sort during the pregnant state are to be regarded seriously for, by careless handling, pathogenic bacteria may be deposited upon the genitals and lead to septic infection. In the same way, hematogenous infection from some remote cause, such as angina, may take place at the placental site or in the ovary. Fetal death is very common in septic conditions of whatever origin, whether the uterus is locally affected or not, for the lethal effect is transmitted by the blood stream.

Nonseptic conditions may predispose to the development of genital sepsis. Such are the anemias, nephritis, diabetes, hypoplastic vascular conditions and the constitutional anomalies.

Symptoms Due to Metastasis of Carcinoma of Genitals.—When metastasis is at all extensive, well-marked general symptoms are almost always present. The loss of weight may be the chief complaint; more often it is associated with an increasing pallor and general weakness. The complexion becomes sallow, lemon-tinged; the cheeks and eyes sunken; the facies assumes a chronic anxious appearance and the picture is one of cachexia. Fever is not infrequent, since the metastasis renders the organ which it attacks more susceptible to bacterial invasion. Necrosis, hemorrhage and

mechanical interference with the normal function of the viscus are the processes by which infection is facilitated.

Schottlaender has divided symptoms due to metastasis into direct focal symptoms and indirect focal symptoms. The direct focal symptoms may manifest themselves in enlargement of the organ without apparent functional disturbance. The liver is conspicuously an organ which permits of extensive metastasis, as evidenced merely by enlargement without icterus necessarily being present. As a rule, however, some functional disturbance does occur. The most constant symptom of metastasis, as of the original tumor, is bleeding, whether this occurs in the lungs, in the kidney or in the gastro-intestinal tract. If not always detectable in the sputum, urine or feces, hemorrhage may be suspected when the tumor becomes unusually large within a short period of time, when pain is acute and the pallor is increased. Tenderness is also augmented by local hemorrhage. Inflammation and suppuration superimposed upon hemorrhage contribute their special symptoms. In the absence of these complications, the affected organ may exhibit symptoms of suppressed or augmented function. Indirect focal symptoms are those produced by interference with the normal function of neighboring organs.

Symptoms Referable to Hematopoietic Organs and Circulatory System.—Glandular enlargement in the region of the affected organ is a most common finding, and yet Virchow's glands in the supraclavicular fossa may be the seat of metastasis far removed from the primary focus. The inguinal, bicipital, elbow and cervical lymph-nodes are the more commonly involved. In rare cases, the thoracic duct and the large veins, especially of the lungs, become involved, leading to rapid death by hemorrhage or by dislocation of a large embolus. Edema, due to blocking of the large iliac veins by massive involvement of the iliac and hypogastric lymph-nodes, is not uncommon in advanced cases of cervical carcinoma.

The heart itself gives few symptoms when it is the seat of metastasis. Perhaps the most that may be elicited with reference to the heart is an irregularity in the pulse rate and a basal murmur. Swelling of the spleen is occasionally met with in carcinoma of the genitals.

Symptoms Referable to Digestive Trace.—When the liver is the seat of metastasis, whether this is derived from the uterus or the ovaries, general enlargement, rather than nodular formations, is palpable. The same may be said of metastasis from a chorio-epithelioma. Icterus is likely to be present when the metastasis is sarcomatous. In rare cases, there may be evidence of portal vein involvement.

Belching, nausea, vomiting, pains, diarrhea, constipation and meteorism are symptoms which may be present in carcinoma genitalis without actual metastasis. As a rule, they suggest metastasis by contiguity or by blood stream transportation. Metastasis in the rectum and sigmoid is the most common, while the small intestine is also liable to involvement, but more especially in instances of ovarian papillary carcinoma. Ileus is occasionally encountered, but, as a rule, the patient succumbs before this can take place. Strictures and stenosis of the gut are more common, while perforation with its consequences is not so rare. The strictures are most often located at the

flexures of the large gut, although pyloric stenosis has also been reported. Abdominal pains, tenderness, vomiting, fecal impaction and ascites occur when the peritoneum is involved. Ascites occurs in from 50 to 75 per cent of the ovarian carcinomata.

Symptoms Referable to Respiratory Tract.—Chest pains and dyspnea suggest hemathorax or hydrothorax. In rare cases, these may be the first symptoms in a malignant lesion. The fluid drawn off may show evidences of carcinomatous elements in the centrifuged specimen (F. S. Mandelbaum). Hemoptysis is common in metastasis from ovarian carcinoma (one out of five cases). Embarrassed breathing and cough, occurring in the presence of uterine carcinoma, should at once point to the possibility of a lung metastasis. Hemoptysis is more common in chorio-epithelioma. Great difficulty in breathing, sudden in onset, and cyanosis are characteristic of pulmonary hemorrhage.

Symptoms Referable to Urinary Organs.—Hematuria and renal enlargement follow chorio-epithelioma and also melanosarcoma of the ovaries. The diagnosis is aided by cysto-ureteral catheterism. Compression of the ureters occurs in 25 per cent of cases of uterine carcinoma. Hydronephrosis is said to occur in about 15 per cent. In ovarian carcinoma, this is less frequent. Bladder involvement, however, occurs in a great many cases. Hematuria, urgency, difficult urination and frequency are symptoms strongly suggestive of vesical metastasis.

Symptoms Referable to Brain and Its Membranes.—Although metastasis in the dura is not infrequent, symptoms occur only when the brain is involved. Severe headaches, expulsive vomiting and other signs of cerebral compression call our attention to metastasis of the brain. Since this lesion occurs late in the disease, symptoms may be entirely missed. Cerebral apoplexy may occur insidiously or may manifest itself suddenly, as when an embolus reaches the artery of the sylvian fossa. Symptoms of leptomeningitis have been known to follow ovarian sarcoma. Repeated attacks of fainting, headaches, twitchings, paralysis of the cranial nerves, together resembling the picture of eclampsia, have also been observed.

Chorio-epithelioma is more apt to give rise to brain metastasis than uterine carcinoma. Here, too, severe headache and vomiting are the prominent symptoms. When, in addition, there is aphasia and facial paralysis, very little doubt need be entertained as to the diagnosis. Ocular symptoms may be the first to suggest brain involvement; ptosis of the lids, sluggish pupillary reaction, paresis of the eye muscles and the changed eye-grounds may be in evidence. Paralysis of the extremities, and especially hemiplegia, indicate an apoplectic embolic metastasis.

Symptoms Referable to Osseous System.—Fracture of a bone may be the first symptom of bone metastasis. On the other hand, swelling, local tenderness and pain, with difficulty in locomotion, may be present. Paralysis, following a period in which backache was a prominent symptom, is suggestive of spinal metastasis, while "neuritic" pains may antedate by months the discovery of the bone lesions. Muscle symptoms due to metastatic carcinoma may be latent for a long time.

Skin metastasis appears in the form of isolated nodules which may be, and frequently are, associated with local pain. Sometimes it takes the form of an extensive "brawny" infiltration resembling the lymphangitis of erysipelas. The thigh is a favorite site for this form of metastasis. It is associated with extensive vaginal and vulval carcinoma.

Nodular swelling of the thyroid is occasionally seen as a complication of uterine or ovarian carcinoma. Aside from the tumor, there appears to be no functional disturbance. The same appears to be the case with *adrenal metastasis,* although morbus addisonii has been ascribed to metastatic involvement in some cases.

CHAPTER VIII

INTERNAL SECRETORY DISEASES OF THE OVARY

PRECOCIOUS PUBERTY

Hypergenitalism.—Cases of premature sex development have been described by the ancients. An increasingly larger number has been added in the past two decades. These individuals attain full sex maturity long before the average, and exhibit an abnormal tendency to body growth which, however, ceases at a certain period, more often leaving them undersized than oversized. The psychic side runs parallel with the general physical development and is noticeable especially in those traits which bear upon sex relations, such as coquetry and inclination toward the opposite sex.

Precocious Menstruation.—In most of these cases, menstruation begins in the second year of life and is associated with growth of pubic and axillary hair and swelling and hypertrophy of the breasts. Moreover, as evidence of premature ripeness, the epiphyses have been observed by Tandler to become joined. The alteration in the appearance of the teeth is also a much earlier process.

These cases fall into several groups: (1) those in which there are associated tumors of the adrenal cortex. The adrenal cortex and the gonads arise from the same embryonal source and have, later in life, related inner secretory effects upon each other. The hypertrichiasis common in these cases is supposed to be due to the adrenal cortex tumors. A heterologous behavior of the secondary sex characters, such as enlargement of the clitoris, growth of hair on the chin, etc., give the appearance of secondary or pseudo-hermaphrodism described by Halban.

Another group is formed by cases in which tumors of the pineal gland are present. Here there is obesity and also evidences of intracranial pressure, such as strabismus, etc. Whether the pineal gland acts by inhibiting sex development, or whether there is a specific effect manifesting itself in activating the gonads, is not settled. Some authors maintain that the teratomatous tumors of the pineal gland may contain those embryonal elements, which have a stimulating effect upon the gonads, in the same way as chorionic cells in newborn children may be the cause of uterine bleeding and of breast swelling. The latter is a theory advanced by Halban and appears to have the support of others. Aschner believes that, in the tumors of the pineal gland, the trophic interbrain centers are probably secondarily affected either chemically or mechanically, and that this is responsible in a measure for the premature development. For he calls attention to the fact that the literature contains reports of cases of precocious puberty following hydrocephalus, serous meningitis, poliomyelitis and other forms of paralysis.

This notion enters into the third group in which tumors of the hypophysis are found. Here the connection between hypophysis and gonads appears to be a more direct and intimate one. Nevertheless the interbrain with its trophic centers, which control the organs and the metabolism, comes into play.

A fourth group is presented by ovarian tumors. Cases of sarcoma of the ovary (for example, in Riedel) have been described in which menstruation, established at six years of age, was terminated by removal of the tumor. The uterus in Riedel's case was the size of that of a girl of seventeen years. Halber's case of precocious menstruation at two years, pregnancy at eight years and cessation of body growth soon after, shows that the premature development does not depend solely upon the inner secretion of the ovaries. This same individual lived to be seventy-five years of age. It is noteworthy that some individuals are abnormally large at birth, appearing to have the development of children several months old. These individuals may menstruate as early as the first or second year.

The external genitals are better developed than the internal genitals. The same changes are noted in young boys suffering from tumors of the gonads. A remarkable result is that which obtains after removal of the ovarian sarcoma, namely, a cessation of the heterosexual symptoms and other abnormal traits, such as the deep voice, with a return to the infantile configuration. There can be no doubt in such cases of the etiological importance of the excessive gonadal function. Sexual precocity is also encountered in other constitutional diseases, such as chondrodystrophy, rachitis, cretinism, chlorois and gigantism (infantile and acromegalic).

Hypogenitalism.—The ovaries are rarely congenitally absent. This is difficult to determine because, unlike the male, one cannot determine the presence or absence of the ovaries. In the castrated male, also, there are definite conditions such as eunuchoidism and cryptorchidism. There are no available cases of early castrates in the female such as occurs in eunuchs or "Skopzen." So far there have been no authentic reported cases of absence or aplasia of the ovaries.

A girl of twenty-two has never had menstrual periods, complains of indefinite pains in the chest, headaches, constipation and hot flushes, has lost forty pounds in weight in the last three years, feels strong and is able to do her work without any sense of fatigue. The hair distribution is typically that of a female, the breasts are moderately large, consisting mostly of fat; the general appearance is feminine, all the secondary characteristics being present. The urethral meatus is somewhat dilated, a depression below it permits the introduction of the finger tip to the depth of a centimeter where it ends blindly. Per rectum, a strand is felt transversely across the pelvis; no uterus or structures resembling ovaries are palpable. The case is one of total amenorrhea due to gynaplasia. Whether or not the ovaries were present was not ascertained. H. N. Vineberg has made the interesting observation that when the ovaries are not seen in the pelvis they may sometimes be found high up in the abdominal cavity from which place they failed to descend. In one case he was able to identify the right ovary under the liver.

In marked contrast to this case is that of a girl of twenty-two whose periods began at sixteen, were of a week's duration and regular every twenty-eight days until her seventeenth year since which time—an interval of five years—there has been amenorrhea. At the beginning of this amenorrhea, the patient states she was ill for three months being confined to her bed for the most of that time. The chief complaint then was abdominal swelling. Examination reveals normal external genitalia; the hymen is intact. Per rectum, the uterus is in retroversion; both adnexa are palpable, enlarged, tender and somewhat fixed; the breasts are small, resembling the development of a girl of twelve or under. It is clear that this patient had a peritoneal tuberculosis which involved her adnexa and destroyed the function of the ovaries. There is no evidence of pulmonary tuberculosis. The patient's general condition and weight are satisfactory.

CASTRATION

Early.—In the male there has been ample opportunity to observe the effects of early castration—in religious sects, the Skopzen, Mohammedan eunuchs and in individuals where castration was done for therapeutic purposes. In the female, because of the inaccessibility of the ovaries, extirpation of the breasts and removal of the external genitals, especially the clitoris, are performed in place of the castration.

According to Tandler and Gross, Miklucho Macley described the case of a young girl who was castrated at an early age. The breasts were slightly developed with scant fat development; the nates were thin and the chin showed some hair growth. The sexual inclinations of this girl were entirely absent. In India, according to R. Roberts, there are female "professional" castrates who at fifteen years of age are tall, exhibit a strong muscular development, appear to be perfectly well and have an abundant fat deposit all over the body with the exception of the nates and the external genitals. The general configuration is that of the male.

From these meager and perhaps unreliable reports, it may be concluded that girls with early castration attain a tall stature, which is perhaps due to a delayed union of the epiphyses, a process common to both sexes. But, in contrast to the male castrates, the female castrates do not accumulate fat. The work of Tandler and Gross on castrated cows, that of Sellheim on bitches and of K. Franz on sheep, all tend to show the inhibitory action of the ovary upon the growth of bone. For, in all these animals following castration, there was an undue lengthening of the long bones beyond the normal average size. The pelvis appeared to be narrower and shallower than in the normal female.

Both male and female castrates approximate a neutral, asexual form. The genitals not only remain stationary in the development attained previous to the time of castration, but moreover undergo a decided regression. Uterus, vagina and the breast glands become very atrophic in musculature as well as in glandular elements (parenchyma).

Aschner points out the importance of the cerebellum in all these experi-

ments, maintaining that with the loss of the inner secretory action of the gonads there are found, to a marked degree, reflex nervous influences emanating from the small brain. He further calls attention to the reciprocal action upon the central nervous system from the peripheral nerve apparatus; in case this is destroyed, there must follow an atrophy of the corresponding centers in the central nervous system.

Maturity of the early castrated individual is considerably delayed so that a hypovarism is accompanied by postponed ripeness.

Late.—This is quite common as compared to that in the male because of the greater frequency with which gynecological operations are performed. Perhaps conservative surgery on the one hand and X-ray and opotherapy on the other will tend to lessen the incidence of castration. Removal of the ovaries in the mature woman is followed by a more or less high grade atrophy of the uterus. In rarer cases, the vagina atrophies, and very rarely the external genitals also become atrophic. These changes appear to depend upon individual and constitutional factors. Menstruation and the cyclic changes in the uterine mucosa fail to occur. The sex impulse in female animals following castration disappears. In woman, this is diminished in intensity in most cases—perhaps in 70 per cent. Occasionally, however, the libido appears to be augmented, temporarily at least. Cerebral influences apparently play an important rôle.

The effect upon the breasts, especially upon lactation, in late castrates, is in striking contrast to the results in very young animals. Lactation in animals is considerably prolonged; the blood appears to be better able to store up fatty substances. These changes, according to Hegar and Alter, occur in women. Even in nongravid castrated women the breasts may increase in size and even secrete colostrum. A similar thing is noticed in male castrates. In cases of gravidity, the hypertrophied breasts do not recede following castration, but these women go on having milk secretion as in normal lactation.

The same phenomena follow castration as after gravidity. There is lactation atrophy of the uterus, accumulation of lipoids in the blood, increase in fat, etc. This occurs in more than half of the cases. An increase in the fatty substances of the blood in late castrates, as well as in climacteric women, was found by Neumann and Hermann. In animals, the same observation was made after castration and after X-ray application, that is, a certain degree of lipoidism.

This increase in fat is naturally thought to be due to a reduction in the oxidation processes in the body. Löwy and Richter found a reduction of 20 per cent in the respiratory metabolism of female animal castrates. L. Zuntz found a similar result in one out of four castrated women, none of whom, however, happened to have exhibited the tendency to increase in fat.

As Aschner suggests, it would be well worth while to determine the respiratory metabolism exchange in animals before and after X-ray castration, because then we should be in a position to say whether the follicle apparatus and its derivatives (corpus luteum and the interstitial gland) or

the disturbed ovarian stroma has an influence upon the metabolism. It is noteworthy that the administration of ovarian extracts appears to restore the metabolism to normal, although it has been reduced by 20 per cent after the castration.

Cristofoletti was able to show that in castrated animals the injection of adrenalin is followed by a more marked glycosuria than in normal control animals. The alimentary glycosuria of pregnancy may be accounted for in part by a reduced function of the ovary. Stolper also showed in castrated rabbits that the ingestion of twenty-five grams of grape sugar, without any other additional nutriment, caused a decided alimentary glycosuria. In normal animals this glycosuria was not produced by the intake of the same amount of sugar.

Stolper also observed this sugar intolerance in castrated women.

The ovary was found by Adler and Cristofoletti to have an inhibitory influence over the chromaffin system; therefore, castration is followed by a stimulation of the chromaffin system. This would explain the deprivation symptoms of the climacteric period. The symptoms, according to Aschner, are due to irritation of the sympathetic rather than to vagotonia, as maintained by Eppinger and Hess. Bucura, Adler and others have demonstrated the presence of sympathetic ganglion cells or chromaffin cells in the ovary as well as in its immediate vicinity, and, therefore, have assumed that the ovary acts as an irritant to the sympathetic. But more recent studies have shown the reverse.

Adler as well as Cristofoletti has demonstrated the extent of the sympathetic irritation symptoms by injecting 0.2 to 0.3 c.cm. of 1 per cent adrenalin solution subcutaneously in women castrated for genital disease some years before. This was first proposed by Aschner as a functional test of the vegetative nervous system. In normal women, there followed no glycosuria, polyuria nor any subjective symptoms. In the majority of the patients after castration, there was an increased sensitiveness toward small doses of adrenalin which must indicate an increased sympathetic tonus. The same results were obtained in women during the menopause. The pulse frequency was increased to 120, the temperature rose to 38° C. and polyuria and glycosuria resulted. The instillation of three drops of 1 per cent adrenalin solution in the conjunctiva caused, in the majority of the castrates, a stronger or milder mydriasis within fifteen to thirty minutes—a reaction not obtained in control cases.

This increased irritability of the sympathetic nervous system after castration or in cases of hypoplasia of the ovaries is attributed by Adler to a reduced calcium content of the blood. For, as Chiari and Fröhlich have shown, calcium deprivation causes an increased sensitiveness toward adrenalin on the part of the blood-vessel nerve endings, and the whole vegetative nervous system becomes more irritable. Subcutaneous injections of calcium chlorid should counteract the effect of the adrenalin, and, hence, inhibit or even prevent the adrenalin glycosuria (Schrank). These are added proofs of the great importance to the organism of calcium lactate when it is administered therapeutically to prevent sweats and heat flushes. These results

were obtained by me in several instances, but my impression was that they are merely helpful additions to organic extracts of the ovary.

Inasmuch as the deprivation symptoms may last for a longer or shorter time following castration or in the climacterium, we must assume that there are individual differences in respect to the compensatory influence of the other endocrine glands. So one may assume that vagotonic individuals in general react very slightly, if at all, while those with the sympatheticotonic tendency react very strongly after castration.

The increased blood-pressure, which reaches 150 mm. Hg (Riva-Rocci), the rushing of blood to the head, alternating redness and pallor of the face and extremities, appear to arise as a result of irritation of the peripheral vessels which are supplied by sympathetic nerves. The headache and dizziness and the faintness (cerebral anemia) following adrenalin injection resemble very strongly these phenomena, both in the castrates and the climacteric individuals. Obstipation is another common symptom in the climacteric and is said by Adler to be due to an increased irritability of the sympathetic system. Naturally enteroptosis and pendulous abdomen predispose to this.

Mononucleosis and eosinophilia are expressions of increased vagotonia and are found in cases of hyperfunction or dysfunction of the ovary, as, for example, in osteomalacia or bleeding caused by ovarian disease. In the same way, hypofunction of the ovary may manifest itself in the blood picture. Adler found in women what von Breuer and von Seiller had demonstrated in animals, namely, that the red cells are diminshed after castration, and return to the normal number only after some months. The eosinophils, according to Adler, are appreciably diminished in castrates, climacteric individuals or those with hypoplastic ovaries. The reduction in eosinophils has been noted in cases of increased tonicity of the sympathetic nervous system by Neusser, Falta and others. This would agree with the finding of von Rosthorn that the number of eosinophils during pregnancy is strikingly small, indicating an irritability of the sympathetic nervous system. Adler points out that the ovary occupies an antagonistic position toward the chromaffin system and in its effects is analogous to the behavior of the pancreas and the epithelial bodies.

The male type of eunuchoidism is readily recognized. It is, however, another matter to diagnose the female eunuchoid type. Tandler and Gross maintain that the true male eunuch must resemble in all respects the characteristics of the early male castrate. In women there have been so few authentic reports of early castrates that it is more difficult to describe the genuine female eunuch. Following the description of Roberts and Miklucho Macley, we must accept the tall, slender girls with scant fat development, poorly developed breasts, infantile genitals, meager buttocks and scattered hair upon the chin as approximating the genuine type of female eunuchs.

In male eunuchs, according to Tandler and Gross, there are two types: those with the abnormal increase in height and those with an abnormal growth of fat. In both types, the pelvis increases in girth and the knees assume the valgus deformity. It is noteworthy that the female eunuch does

not present a type which approximates that of the male eunuch. Some of the characteristics are typical of the infantile status while others are hetero-sexual. In the female eunuch, the appearance and other manifestations are characteristic of infantilism. Only one thing, perhaps, is pathognomonic for the female eunuch and that is the greater length of the lower portion of the body. Tandler and Gross describe a sixteen-year old eunuchoid female whose lower body portion (below the umbilicus) was 100 cm. while the upper portion was 79 cm.

Von Noorden and Tandler made the observation that, in a family in which the male members exhibited various degrees of eunuchoidism, the female members were subject to chlorosis. Aschner ascribes this to hypo-plasia of the ovaries and maintains that it is equivalent in females to the prepuberty eunuchoidism of males; further, that struma, myoma, rachitis and ovarian tumors are apt to occur in families where eunuchoidism and chlorosis have been observed and are but links in that great chain of consti-tutional endocrine disease in which the one may merge into the other.

There appear to be no reliable data by which one can obtain a criterion or definition for female eunuchoidism. According to Novak, the women who begin to bleed late and irregularly at long intervals with very scanty flow, who exhibit and retain the tendency to fat accumulation before puberty, who are apt to be sterile or bear one child and lose their menses permanently at an early age must be regarded as eunuchoids. Pre-cocious climacterium may follow the only puerperium these women experi-ence. Adler thought the two types of feminine eunuchoidism corresponding to those in the male were but expressions of the two main types of hypo-plastic individuals. The one was the slender, tall, more infantile type cor-responding to the eunuchoid tall growth of the male; the other was the fat type with the heterosexual hair growth corresponding to the eunuchoid fat growth of the male.

Mixed and transitional types are not uncommon. A proper classification of these individuals awaits future research.

A girl of eighteen believed she had a menstrual period when she was seventeen years old and again two months later. On careful questioning, it was discovered that she had noticed a dark concentrated urine. She was four feet nine inches tall, had practically no breast development, sparse hair over the pubes, masculine hips and agglutinated vulva. By rectal examination, a small nodule in the usual situation of the uterus was pal-pable. From this a transverse band extended across the pelvis. It was impossible to identify ovaries. The voice was deep and masculine.

HYPOPLASIA OVARII (STATUS HYPOPLASTICUS AND INFANTILISMUS)

G. Anton first described the two main types of infantilism: the general and the partial. Under general infantilism he included: (1) infantilism with myxodema and cretinism; (2) mongolism; (3) infantilism with absence or destruction of the genitals; (4) those in whom the visceral glands were

primarily affected, especially the adrenals, the thymus, the pancreas, the hypophysis, pineal and brain itself; (5) the dystrophic type of infantilism which was produced by vascular aplasia, primary unilateral or bilateral cerebral disease, inherited syphilis, alcoholism or other intoxications of the parents (lead, mercury, phosphorus, etc.), early acquired disease, such as tuberculosis, cardiac disease and chlorosis, and, finally, those degenerative processes in children due to bad hygienic conditions and inadequate nutrition.

Of the partial type of infantilism, that which is concerned with defective development of the genital organs is of chief interest to the gynecologist. Bartel and Herrmann have described the female genitals associated with status hypoplasticus and state that the characteristic features of such ovaries are the very rich connective tissue content, the smooth surface and poverty of follicles. Virchow described the same picture in chlorotic girls. This condition may obtain, however, in hypoplastic girls in whom the ovaries reveal small cysts and who bleed excessively. The hypoplastic ovaries need not always be small and lacking in ripening follicles. For very large ovaries, enlarged by hyperplasia of the connective tissue or by small cystic degeneration, are also found. The smooth surface which these ovaries present appears to be a constant finding. Besides these changes in the ovaries, the genitals show the defective underdevelopment. The pelvis is apt to be of the simple flat variety, it may be infantile, cretinoid or masculine, or these types may merge into each other as they do in the majority of the cases. The anteroposterior and transverse diameters are apt to be narrow and the outlet funnel-shaped.

Functionally these individuals may suffer from dysmenorrhea, fluor albus, vaginismus and chlorosis. Adler found that, in cases of amenorrhea and even in oligomenorrhea, the blood coagulability was reduced, a condition which obtained in castrates as well as in the climacterium, and he considers it as an objective sign of hypofunction of the ovaries. The sympathetic nervous system is also more irritable as demonstrated by the adrenalin test. Adler also showed that, in women with amenorrhea, there is a decrease in the eosinophils, a fact which accords with the reduced vagotonia caused by deficient (hypo) or absent ovarian function. Such women appear, therefore, to belong to the sympathicotonic individuals, just as profuse genital bleeding (of ovarian causation) is commonly found in vagotonic individuals.

In amenorrhea, the corpus luteum has been found to persist. Halban, Latzko, Adler, Kohler, Thaler, Wener and Rubin have described persistent corpus luteum cysts in women with delayed menses. Tandler described a similar finding in cows in whom the absent heat was restored when a corpus luteum cyst was ruptured manually through the vagina.

A woman, thirty-five years old, married eight years, one child six years of age. After an amenorrhea of six and a half weeks, during which time she considered herself pregnant, patient began to stain. The vaginal discharge was dark brown. On examination, the uterus was found in good position but enlarged to the size of a six to seven weeks' gravidity. There was some thickening and enlargement on the left side of the uterus. Bleed-

ing soon set in and lasted for seven days, being very profuse in spite of the patient resting in bed. After a brief interval, bleeding began and continued for two weeks. The uterus was then found to be small, a cystic tumor was present on the right side of the uterus and was tender. The patient complained of pain in the right side of the abdomen. A tentative diagnosis of right-sided ectopic gestation was made. Very little material was obtained by curettage. An exploratory postvaginal section resulted in the escape of old, thin blood under tension from the pelvis. At the laparotomy, the pelvis was found to contain thin, dark blood; the right ovary was the seat of a ruptured retention cyst; there was no evidence of ectopic pregnancy.

During such a period of amenorrhea, ovulation is rare or entirely absent. When it does occur and pregnancy follows, it simply means that ovulation was finally successful. In other instances, ovulation can take place at long intervals without the full cyclical, menstrual changes taking place; while, in others, it is a rather rudimentary type in which only a fluor albus is present at regular intervals. Ogorek described this occurrence as "cyclical leukorrhea" in which the uterine mucosa undergoes a certain degree of change without, however, culminating in actual bleeding. This author and others have demonstrated the presence of corpora lutea in women who never menstruated or in those who have not menstruated for a long time.

Aschner and Grigoriu had shown that in virgin animals it was possible to cause a regularly recurring hyperemia and hemorrhage in the uterus by injecting them with placental and ovarian extracts and that, furthermore, there occurred a premenstrual change in the uterine mucosa. Adler was able to substantiate these results in two virgins who had amenorrhea, by injection with ovarian extract. He found that, while the curettage before injections resulted in finding a quiet mucosa of the interval stage, after six injections a typical premenstrual mucosa was formed.

A woman of twenty-eight, married ten years, never pregnant; menses began at thirteen, were irregular from the start. She was very stout during puberty. After marriage, the menses became delayed for three or four months, occasionally for as long as seven, eight or nine months. Five years ago, following an operation upon the cervix, she had four regular periods. For the past two years there has been complete amenorrhea, although almost monthly the patient feels menstrual molimena. On examination, the uterus is fairly well developed, the cervix shows evidence of a tracheloplasty; uterine sound enters for a distance of two and a quarter inches; the right ovary is enlarged about twice the normal size, is very hard, slightly tender and prolapsed. Marked hirsute growth is present over the thighs, abdomen, breasts and face. Patient was given opotherapy and returned a week later to report that her menstrual period began two days after the examination and had lasted for four days. There was no pain associated with this period, in striking contrast to the dysmenorrhea which she had always suffered before. The following month the patient bled for seven days after a delay of one week. There was then again an amenorrhea of two and a half months and a period of five days' duration. Amenorrhea of six weeks followed that, and again menstrual molimena without bleed-

ing. After an amenorrhea of two and a half months, during which time she received opotherapy by hypodermic administration, patient stated that she had a menstrual period lasting five days. On reviewing this patient's history, however, and the notes reported, it became evident that bleeding followed every time the uterus was sounded and that it was not the result of the so-called endocrine therapy. We were dealing here possibly with hypofunctioning ovaries, but the amenorrhea was in reality due mostly to a cervical stenosis.

It appears that those women yield to opotherapy in whom there is an increased lipoidemia, a condition which was first demonstrated by Neumann and Herrmann. When there is no associated lipoidemia, these individuals do not yield to ovarian extract therapy and the prognosis is not favorable. The same applies to certain cases of sterility with reduced lipoid content of the blood.

As a therapeutic measure, ovarian extract is of value in the thin type of woman with amenhorrea or sterility. In the fat type, thyroid alone, or in conjunction with ovarian extracts, is to be used. In the chlorotic form of amenorrhea and sterility, Aschner gave Lienin (spleen extract), with good results. Iron, arsenic and other antichlorotic measures are naturally useful in chlorosis associated with amenorrhea or excessive bleeding of ovarian origin.

A girl, thirteen years old, five feet ten inches in height, weight one hundred and fifty pounds. Her menses began at twelve, when she bled for a week. After an amenorrhea of seven weeks, menses recurred, flow moderate. The third menstrual flow lasted a month, then followed by amenorrhea of seven weeks and menses which again lasted for a month. After an amenorrhea of nine weeks, bleeding began and has continued for three months. Patient was well developed, except for a masculine skeletal frame and a large head; the type was otherwise feminine. By rectal examination, the uterus appeared small in size, in good position, the adnexa not palpable. Bleeding was present and appeared like menstrual blood. The last bleeding continued for seven and a half months, being profuse at times and at times more scanty. Rest in bed, the administration of styptics; of opotherapy by oral and hypodermic method proved futile. At the insistent request of the patient to be restored to normality, so that she might exercise like "other girls," I operated upon her June 5, 1922. The curettage resulted in the removal of very little endometrium, although bleeding was very brisk. At the laparotomy, uterus and tubes were normal, the ovaries were prolapsed and enlarged equally to about the size of a hen's egg, the surface was smooth and studded by many small follicle cysts; no corpora lutea were seen. Bilateral subtotal oöphorectomy was done. Bleeding stopped, returned June 21 and lasted for six days; there have been continued regular periods at intervals of three and a half to four weeks since the operation.

Pituitary extracts and pituitrin, according to Hofstätter and Peham, are useful in certain cases of sterility and amenorrhea. Why this substance, acting as it does like mammin and adrenalin by vasoconstriction, should accomplish cures in some cases is not altogether clear. To explain its action

by way of the hypophysis is somewhat far-fetched as there are not sufficient facts to support it. Aschner suggests that it is probably through some vasomotor influence that pituitrin accomplishes the relief of the amenorrhea or sterility. Organic extracts of the other endocrins appear to have no effect upon amenorrhea and sterility.

Hermaphrodism.—True hermaphrodites should possess a functioning ovary and testis. In man, such true hermaphrodites have not been described. A condition of ovotestis, consisting of ovary and testis in varying proportions, has been described in perhaps a half dozen cases and is the only form of hermaphrodism occurring in man. The occurrence of a corpus luteum or of an interstitial ovarian gland has so far not been noted.

Pseudohermaphrodism.—This condition is much more common than genuine hermaphrodism. Besides the gonads of the one sex, the primary and secondary sex characteristics are either partly or wholly duplicated. There are three varieties of pseudohermaphrodism: (1) the internal genital organs of the opposite sex; (2) the external genital organs of the opposite sex; and (3) when both internal and external genitals of the other sex are present. Where an ovary is found, we are dealing with a feminine pseudohermaphrodism. Cases rarely occur exhibiting, both in the secondary sex characteristics as well as the psychic, traces of heterosexual tendencies to a greater or lesser degree; for these cases, Halban used the term secondary pseudohermaphrodism. These are individuals who have normally developed unisexual gonads with more or less normal inner and outer genitals; but, in regard to skeletal structure, type of hair growth, distribution of fat, breasts, voice and character they approximate the opposite sex. In women, the bones are coarse, the hips are narrow, the shoulders are wide; they are muscular women with hard facial lines, deep voices, bearded chins which vary between a few scattered hairs and well-developed beards, poor development of the breast glands and abnormally luxuriant growth of hair over the body; in other words, feminine eunuchoid individuals. Here again we must think of the profound importance of a well-developed and vigorously functioning gonad influencing the sexual peculiarities of the individual in a homologous direction. When this gonadal development is inadequate, there comes into play, to a greater or lesser degree, those latent or indifferent heterosexual characteristics. Aschner maintains that, in such instances, it is a matter of personal taste whether one speaks of a secondary pseudohermaphrodism or a mild grade eunuchoidism. The importance of the gonads, not only in embryo but also after birth, in the control of the sex characters, has been demonstrated by the transplantation experiments of Steinach. This author succeeded in producing a feminization of male rats by implanting ovaries of the same species of rats. In these transplanted ovaries he was able to demonstrate follicles as well as interstitial cells, a result which has not been substantiated by Marshall and Jolly and Louise McIlroy, who found only interstitial cells. Bucura and Adler, however, found a retention of the follicles and a degeneration of the interstitial cells with a fibrous change of the stroma, but, as Aschner observes, fertility and other sex characteristics are not to be attributed to the inter-

stitial cells. The relationship between these cells and the interstitial cells of Leydig in the testicle is different. It is possible that the remains of the wolffian body, that is, epoöphoron and parovarium, although nonfunctionating in both sexes, nevertheless bear a certain close relationship to the male gonad anlage, for it has been repeatedly observed that the adrenal cortex, when diseased (for example, tumors) may, in female individuals, lead to precocious puberty and in adult life produce hirsutism, hypertrichiasis and other male sex characteristics. The gonadal gland of a pseudohermaphrodite, according to L. Pick, displays a tendency to malformations. Teratomatous formations, such as ovarian dermoid cysts, appear to indicate embryogonadal disturbance. According to Zacharius, there were 3.5 per cent of neoplasms of the genitals in the cases of pseudohermaphrodism collected in medical literature up to 1909. The entire conversion of the sexual character may take place after the development of large cysts of the ovary. Friedrich Gravitz and Albertin have described a case of a girl of twenty who presented all the features of a well-developed female up to the age of seventeen, after which, with a cessation of menses, there was a gradual conversion into the male type. The body fat disappeared and, in its place, there was a profuse growth of hair. The breasts, which had been voluptuous, became soft; the cephalic hair became short and thin; the voice became deep; and a very coarse growth of hair occurred upon the cheeks and upper lip.

Clinical Significance of Parovarian Cysts.—Hegar reported six cases of mental disease in parous women who, with cessation of menses, began to exhibit masculine traits such as a deep voice, and a strong growth of beard. In two cases, parovarian cysts were found. The mental disorders which included dementia precox, melancholia, catatonia, imbecility, periodic manic exaltation, anxiety psychoses and congenital weak-mindedness indicate an inherited psychopathic tendency which forms a part of a deeper lying disturbance of predisposition. In one, a very pronounced adiposity set in, indicating an alteration in the endocrine apparatus or, as Aschner believes, in the central nervous system.

In certain cases of acromegaly in women, there appear heterologous sex characteristics, as, for example, growth of beard and deep voice. These changes are said to be due to a hypofunction or complete absence of ovarian activity. It is not settled, however, whether these changes occur in the central nervous system and, in particular, in the "trophic center" situated between the pineal gland and hypophysis in the interbrain. It appears, therefore, that at least one gonadal gland is essential for the appearance of a true beard growth and other analogous sex characteristics, for example, one masculine gonadal gland or a diseased female gonadal gland. In agenitalism, it follows that the beard growth must be absent; in female dysgenitalism, it may be stimulated; in male dysgenitalism, however, it is inhibited in growth (A. Kohn).

Defective or diseased ovarian function, anomalies of the adrenal gland, the hypophysis, the pineal and the interbrain may set free heterosexual sex characteristics in woman and thus produce the symptoms of pseudohermaphrodism of primary or secondary type.

ILLUSTRATIVE CASES

Irregular Bleeding; Sterility; Parovarian Cyst in a Short Woman (Four Feet Nine Inches)

S. S. was admitted September 2, 1921. She had been married two years and had had no children. Her menses began at fifteen years, irregular every three to four weeks, of five to six days' duration and very painful. The patient had never had any operations. She had a period two weeks previous to examination lasting four days which was quite profuse; bleeding resumed four days previous, very profuse and continuing to date. The patient also compained of lower abdominal pains on the left side which had been constant for four days, without vomiting.

The finding at operation was a left parovarian cyst, the size of an orange.

Right Parovarian Cyst as Large as Grapefruit Deep Down in Pelvis, Pedicle Twisted Twice, Intermenstrual Pain

E. S., admitted December 31, 1919. In January, 1917, she had a ventrosuspension and vaginal operation. Four months previous to examination, at another hospital, she gave birth to a dead fetus at full term. There have been no menstrual disturbances. The patient's chief complaint is intermenstrual pain in the right lower quadrant for seven or eight months and occasional incontinence of urine.

At operation, on January 2, a right parovarian cyst, as large as a grapefruit and twisted twice, was found deep down in the pelvis. There was no strangulation and no free fluid in the peritoneum. It was diagnosed before the operation by one examiner as peritoneal inflammatory cyst, and by another as an intraligamental cyst. At operation, the right round ligament was attached close to the abdominal wall. The left was somewhat stretched.

The gross pathology was as follows: At the pedicle there was an edematous nodule as thick as the small finger tip. Its surface was covered by ecchymotic spots; the cyst was single and was lined by thick membrane which was covered over by peritoneum that could be easily stripped off the inner lining. The tube was stretched over it.

Late Eunuchoidism (Multiple Endocrine Sclerosis).—The term "pluriglandular insufficiency" is intended to cover functional changes such as sclerodermia, adipositos dolorosa, Recklinghausen's and Raynaud's disease, degeneratio genitosclerodermica, pedatrophia, nanism, progeria, etc. Falta calls it "multiple endocrine sclerosis" and Niesel "connective tissue diathesis" of several "blood glands." Aschner maintains that the cause of the pluriglandular insufficiency is to be found in a disturbance of the common nervous center for all these glands, namely, in the brain or interbrain.

Falta tried to separate from this group cases of late eunuchoidism. By this term, he meant a disease entity, characterized by regression, in an individual who had exhibited all the secondary traits proper to his sex, including complete gonadal function of the genital auxiliary apparatus (in

man, atrophy of the penis, scrotum and prostate; in women, atrophy of the labia majora and uterus) and, finally, a retrogression of the secondary sex characteristics, especially the hair of the pudenda, the axilla, the face and the trunk and extremities. Furthermore, there is an accumulation of tissue, to a greater or lesser extent, in the breasts, mons veneris, and upon the hips, in conjunction with certain changes in the psyche. Typical eunuchoid skeletal changes are naturally not to be encountered in adult, ripe individuals. In these, there is uniformly a high grade disease of the gonads which appears to Falta to be the cause of these symptoms.

These changes, as described in sixteen cases collected by Falta from the literature, were exclusively in men. By the term "multiple endocrine sclerosis," Falta describes that disease in which, through some obscure infectious agent, several endocrine glands are simultaneously affected, leading to sclerotic atrophy of a high grade and, therefore, to deprivation symptoms. As a rule, the thyroid, gonads, hypophysis and adrenals are attacked. Thus, there occur frank symptoms of hypothyroidism, of late eunuchoidism and hypophyseal insufficiency combined with an Addisonian sort of syndrome (hypotonia) pigmentation, etc., especially an uncontrollable and severe cachexia.

Falta pointed out the common factors of a late eunuchoidism in the eight cases he reported. In all there was a progressive cachexia and anemia, premature senility and frequently the appearance of old age with emaciation. In contrast, an adiposity of the eunuchoid type was never noticed. Instead, myxedematous appearance, fragility of the teeth, skin atrophy, disturbances in pigmentation, hypotony, hyperleukocytosis, mononucleosis and hypereosinophilia were present. Occasionally tetanic spasms were evident.

In most of these cases, there were asthenia, prostration, intellectual torpor, headaches, forgetfulness, sleeplessness, fleeting rheumatoid pains in the joints and very often a troublesome polyuria. These, according to Aschner, are all frank signs of cerebral disturbance. Falta, however, ascribes them to the hypophysis, while other observers explain them as evidences of hypotonia due to adrenal insufficiency.

Alcoholism, tuberculosis, syphilis and other systemic infections may, through local inflammation or general toxic processes, so injure the various trophic brain centers as to be responsible for the symptoms ascribed to a multiple endocrine sclerosis. These infections may have a selective action on the endocrine system and produce the disturbances commonly ascribed to endocrine sclerosis. Aschner calls attention to the importance played by the disturbed cerebral centers in the causation of general symptoms. Inasmuch as we do not see these disturbances set in after a castration in the adult woman, we are led to the belief that the central nervous apparatus is more likely to have been injured by the infection because the trophic control of the body in general and the endocrine glands in particular are found in these structures.

A noteworthy fact in instances of dystrophia adipositas genitalis (hypo-

physeal disease in the adult) is the absence of advanced regression of the genitals as it occurs in the late eunuchoid individuals. In the latter, there is an extreme degree of atrophy of the gonadal glands and a disappearance of the secondary sex characteristics. Both late eunuchoidism and multiple endocrine sclerosis appear to be related, if not identical, conditions, and are due, in all likelihood, to acquired or more often to constitutionally inherited injury of the trophic brain centers. All these diseases bear a certain relationship to a neuropathic predisposition. Basedow's disease, either latent or fully developed, is common as a forerunner of these conditions.

Therapeutically these conditions may be improved by ovarian therapy. Dalche describes favorable results from its use. Camot recommends pluriglandular extracts which contain a predominant proportion of thyroid. In sclerodermia, W. Kölle and Aschner have employed what they believe to be a specific remedy, namely, Celiacin (Merck) which consists of an extract of the celiac ganglion of the cow. A similar result was obtained in cases of adipositas dolorosa, lymphadenia dolorosa, and certain types of pseudoleukemia described by Aschner.

PREMATURE OVARIAN AND UTERINE ATROPHY

In these are included climacterium precox, kraurosis vulvae, normal and pathological lactation, atrophy of the ovaries and the uterus, lactation amenorrhea.

Only recently was the fact established that uterine atrophy follows ovarian disease. Foges and Novak definitely pointed out the etiological connection between the two. Very rarely both organs may simultaneously undergo atrophy as a result of a common cause. A primary atrophy of the uterus, without at least an associated ovarian disturbance, is almost unthinkable.

Lactation atrophy, the commonest form of uterine atrophy, was shown by Foges to be due not to the act of nursing but to the absence or abeyance of ovarian function. Novak modified this viewpoint by saying that the atrophic condition of the uterus during lactation is due to a temporary change in ovarian function. That there is a diminution in ovarian activity is highly probable because of the fact that there is a relative amenorrhea and relative sterility during lactation. At the same time, we cannot lose sight of the occurrence of nervous reflex connections between the breasts and the uterus. Thorn described the breast-uterus reflex, in which the uterus is felt to contract through irritation from the breast glands, and concludes that the atrophy during lactation is due to this fact. It is well known that nursing women show a more rapid involution during the puerperium than non-nursing women. Through the frequently repeated breast reflexes, contractions of the uterus and increased circulation are produced, causing increased metabolism in the uterus whereby the fatty involution products become more rapidly absorbed.

But it is plausible that there are chemical and nervous correlations between the breast glands and the ovaries. The occurrence of lactation

atrophy is so common, according to Thorn, that he considers it almost physiological and, in contrast to other gynecologists, regards it as a good prognostic sign. L. Frankel maintains that the lactation atrophy begins in the third month postpartum and begins to return to normal in the seventh month in spite of protracted lactation.

When the amenorrhea lasts longer than nine months, he claims there is an intervening pregnancy to account for it. In the event of menstruation occurring during lactation, uterine atrophy is not encountered. But, in spite of long standing amenorrhea and lactation atrophy over a period of years, there may be a restitutio ad integrum and conception may take place. This, however, does not occur when the organism has been injured through severe infection or trauma, or perhaps most commonly through disturbance of the endocrine glands. In such cases of lactation atrophy or lactation amenorrhea, the ovaries are affected even to the point of atrophy. And, in these cases, there is not only uterine atrophy, but also a regression of the external genitals and shrinking in the same way as we observe after castration or in the climacteric.

Another form of physiological gonadal atrophy occurs in the senile involution of the uterus; but premature atrophy of the ovaries and uterus can occur through pathological causes, such as acute or chronic pelvic inflammation, mechanical factors, such as pressure of tumors (myomata, cysts, hematomata, exudates, etc.), or through dislocation by cicatricial scars. As a general rule, the ovaries are resistant to all sorts of injurious influences, particularly mechanical. In the majority of cases, there are or have been serious injuries to the general condition of the patient, caused by toxic, infectious or endogenous constitutional factors. So, for example, ovarian atrophy may follow typhus, scarlet fever and acute articular rheumatism; in like manner, by poisoning through phosphorus which leads to fatty degeneration of the ovaries. Aschner demonstrated this experimentally upon dogs fed with phosphorus. The ovaries in these animals showed a marked fatty degeneration of the follicles and an increased follicle atresia with an apparent increase in the interstitial gland which always follows upon this atresia; at a later stage, there was shrinking of the ovaries which, however, still showed follicle rests after several weeks. Anemias produce similar results as the intoxicants.

Of the endocrine gland diseases which may lead to atrophy of the uterus, myxedema and Basedow's disease were already known to the older literature. More recently it has been demonstrated that Addison's disease, sclerodermia, multiple endocrine disease, especially hypophyseal disease (acromegaly and dysplasia adiposogenitalis), can produce the same genital effect. Certain disturbances in the vegetative system, as gigantism and dwarfism, may also be added as causes of ovarian atrophy because they can directly influence the interbrain center which is the *regulator* of the gonadal glands.

Diabetes mellitus and insipidus may influence ovarian atrophy chiefly through the agency of the central nervous system (Aschner). The cerebral control lies at least as often, if not oftener, in the neighborhood of the third ventricle as in the hitherto supposed fourth ventricle. Severest disturbances

from the sphere of the genitals occur in diabetes insipidus (Hoppe-Seyler, Bab, Falta, Schiff and others).

The local symptoms of early uterine atrophy may be very marked. There may be an extreme degree of uterine atrophy, exceeding even that following castration. The vagina and external genitals are associated in the atrophic process so that kraurosis vulvae may result and simultaneously a very distressing pruritus, such as we rarely see following castration. Concerning kraurosis vulvae, Aschner feels that there must be some constitutional factor in addition to the deprivation of the gonadal function to account for it, because it is a condition not frequently encountered after castration. Perhaps some change in the central nervous system results, to which the pruritus may be attributed. Schickele succeeded in producing relief of this symptom in three patients by giving twenty drops of concentrated alcoholic corpus luteum extract.

Amenorrhea and sterility follow ovarian atrophy. While they follow severe injury to the ovarian parenchyma, they may undoubtedly be due to disturbance of the nervous system of longer or shorter duration. The suppression of menses due to fright is well known.

Fluor albus, which is due to a disturbed function of the uterine glands which in turn depends upon the ovary, occasionally occurs in instances of ovarian atrophy. This is not untenable. Other local symptoms, such as pain in the back and the feeling of bearing down, are more difficult to explain. But it may be recalled that the muscles of the pelvic floor and of the smooth muscle fibers in the pelvic connective tissue become atrophic as a result of the atrophy of the ovaries; hence the sensation of lack of support, etc.

The general symptoms of ovarian atrophy are the same as those following castration. Not only are there disturbances of the viscera and of the circulatory apparatus, but the central nervous system is especially upset as the numerous psychic symptoms which manifest themselves in this condition will indicate. On the other hand, there are cases with well-marked uterine atrophy in which the deprivation symptoms are absent. This is due to the fact, as Novak pointed out, that the ovarian stroma, which is a specific type of connective tissue, carries on ovarian activity without the aid of the follicle apparatus and thus prevents the occurrence of the deprivation symptoms.

In the climacterium, the ovaries lose their function gradually in contrast to the sudden deprivation which takes place at castration. But while during this period an increasing hypofunction takes place, there may occur a flaring up, as it were, of ovarian activity which may last for a longer or a shorter time. The very apt simile of the flaring up of the flickering candle flame before its final extinction has been used to throw some light upon the behavior of the ovaries at their functional and structural decline. The setting in, or failure to set in, of senility changes locally and, in the general organism, varies in different individuals. It depends upon the rapidity with which, on the one hand, ovarian function is extinguished and, on the other, to the readiness with which the rest of the endocrine glands respond to the needs

of the body. In half the cases at least, according to Jaschke, Novak and others, this compensatory effort upon the extragenital ductless glands takes up the work of the ovaries. In the other half, there appear more or less severe deprivation symptoms. In the worst type, there can be no question of the disturbance in equilibrium of the organs of internal secretion and of the vegetative nervous system.

Another factor in the variability of symptoms during the "change of life" lies in the previous status of the other ductless glands; for any one, or any group of these, may have already shown evidence of disturbance and, with the deprivation on the part of the ovary, they are increasingly disturbed. The effect of this disturbance may occur directly or through the medium of the other glands. Women with a so-called labile nervous system are particularly prone to endocrine upsets during this period of their sexual life.

Recent studies have shown that the deprivation symptoms of the climacterium are not due to hyperthyroidism alone, but also, and to a much greater extent, to disturbances and reactions on the part of the autonomic and sympathetic nervous system. Indeed most of the symptoms have been proved by numerous clinical and experimental data to be due to irritation of the sympathetic. Cristofoletti, Adler, Schickele, Novak and Aschner emphasized the rôle played by the general metabolism, but it has so far presented the greatest difficulty because of imperfect technic in its study.

The Changes in the Ovary Itself.—At the menopause, the ovaries become smaller, the follicles disappear. Occasionally, however, isolated follicles and even primordial follicles may persist to advanced old age. As a rule, the corpora fibrosa or albicantia dominate the picture and remain as evidences of ovarian activity. Occasionally fibromata and retention cysts are present and appear to be influenced by the sclerosis and hyaline degeneration of the prevailing connective tissue. The interstitial gland is inconspicuous at this stage, being present only in traces; but this has no great significance, because, as Aschner points out, in the adult woman (except in gravidity) it is poorly if at all developed.

The typical ovary of the menopause consists of corpora albicantia and is free of practically any theca lutein cells. The sclerotic process has been demonstrated by Gertrude Bien to give rise to the gyrate form of the ovary, the so-called "ovarium gyratum."

The parovarian gland in woman (wolffian body) appears to contain the heterosexual gonadal rests which Biedl first pointed out exists in both sexes and which can, with the decline of the primary gonadal function, take on fresh activity in the direction of the opposite sex. As the parovarian gland persists in the menopause and, as has been demonstrated by Bucura, it bears some relation to sex function, it is not unthinkable that it may play a delayed rôle in the menopause. Thus, the growth of the beard in climacteric women and the masculine type of hair growth which also sets in at this period may be traced to pathological changes of the parovarian. The deep basso voice and the hard facial lines suggestive of reversion to the masculine type are other features which A. Hegar described in three cases, in two of which parovarian cysts were present.

Uterine and external genital atrophy may pursue a rapid course in much the same way as after castration. In many cases, this may proceed unnoticed over a long period of years until the general evidences of senility make themselves manifest. The uterus of rabbits after castration is said to be the seat of a very fine nuclear fatty degeneration. It would be interesting to know whether the same change takes place regularly in the human individual following castration or during the natural course of the climacterium. Evidence is also lacking concerning the changes the heart muscle undergoes during this period.

Concerning pruritus, which so frequently is associated with diabetes mellitus, Aschner reminds us that it is not alone the excretion of sugar but factors in the central nervous system which may be responsible for this symptom. The urinary apparatus also undergoes simultaneous senile changes, hence the incontinence, burning on urination and special urgency. Cystitis colli and desquamative catarrhal processes in the bladder mucosa have been held accountable for these symptoms. Fatty degeneration of the bladder musculature are said to occur in the climacterium. Cicatricial displacements of the bladder through shrinkage of the pelvic connective tissue and of the pelvic floor, especially in cases where there is an enteroptosis, lead to leakage of urine and often to very distressing urinary tenesmus.

Pollakiuria, a symptom common in male neurasthenics, is met with as part of the symptom complex of the climacterium, in which there already exists evidence of nervous disturbance in the bladder to account for its occurrence. Patients suffering from this symptom are often needlessly examined and subjected locally to cystoscopy, and are often, also, erroneously designated as having cystitis colli.

In the climacterium the menses should become more infrequent and more scanty, but, in many cases, instead of gradual diminution, there sets in more profuse bleeding of such severity as to lead to serious secondary anemia. When we can exclude carcinoma, myoma and the relatively rare, but genuine, inflammatory polypous endometritis, we find that in most cases the climacteric bleeding is due to pathological ovaries.

The sympatheticotonia is increased in the climacterium as demonstrated by Cristofoletti; he also found sympatheticotonia in the course of his studies upon osteomalacia and castration. This is manifest by an increased reaction to adrenalin and in a diminution of the carbohydrate tolerance. Adler found that there was considerable delay in the blood coagulation time during the climacterium as after castration, also a reduction in the eosinophile cells and diminished reaction to vagotropic measures.

The reaction to adrenalin consisted of a sense of warmth, alternating pallor with redness, a feeling of anxiety, marked trembling, sweats, chilliness, pulse retardation, rise in temperature, polyuria, glycosuria and occasionally mydriasis. These are the same symptoms as those met with in the spontaneous evolution of the climacteric symptoms. Hypertension is another symptom of the climacterium, which Schickele believes is due to the failure of the ovaries to function; for these glands produce, during the period of

sexual ripeness, a substance which causes dilatation of the blood-vessels and another which lowers blood-pressure. In the climacterium, the antagonistic ductless glands and nervous system predominate and produce a characteristic form of hypertension. The blood-pressure rises often to 200 mm. Hg as against 120 mm. Hg.

In view of the fact that the vegetative nervous system is in a condition of augmented irritability and the sympathetic especially so, the numerous climacteric symptoms due to the heart and blood-vessel apparatus acquire a new and increased interest. Mild grade vasomotor symptoms (Opitz, Jaschke and others) are practically never missed. In the same case, the symptoms may vary to such an extent as to make the distinction between the physiological and the pathological difficult. Added to this, we must take into consideration the fact that vasomotor excitability in woman is greater than in man (Jaschke).

The most frequent symptom, that is, flashes of heat in the head is the same as that of the falling asleep of the upper and lower extremities, a vasomotor neurotic symptom which resembles that obtained after adrenalin injection. L. Fränkel produced similar results by injections of corpus luteum.

Sweat outbreaks, blood-vessel spasms in hands and feet, intermittent claudication, rush of blood and itching in the perineum, bladder and genital region also belong to this picture.

A form of angina pectoris was described by M. Herz and substantiated by Aschner as occurring in the climacteric period, and is supposed to be based upon functional nervous disturbances of the heart muscle. As ulcer of the stomach may follow upon continued functional nervous hypersecretion and hyperacidity of the stomach, so an early arteriosclerosis of the heart follows frequent nervous irritability. This symptom is more apt to occur in women who are nervous, and in whom there is a greater tendency for the heart and blood-vessels to undergo degenerative processes (Aschner recommends phlebotomy in these cases).

The respiratory apparatus appears to be unaffected by the climacterium.

The skin is subject to many disturbances similar to those manifest during the period of puberty. Disturbances of the sebaceous glands are exhibited in the shape of acne and seborrhoic eczema; the sweat glands become hyperactive, resulting in hyperhidrosis. In addition, urticaria, pemphigus, herpes zoster, edema, pruritus, anomalies of pigmentation, etc., are very common. These disturbances are partly explainable on the basis of vasomotor influences, partly on disturbances of function of the ductless glands and partly by nervous trophic influences. The tendency to diffuse or circumscribed fat accumulation is also recognized. Sclerodermia and adiposis dolorosa are not infrequent after the climacterium. The appearance of the so-called "old granny's" beard, that is, scattered long hair on the upper lip and the chin, as a result of the decline of the gonads, is also quite common.

The digestive system is subject to many disturbances during the climacterium, for example, obstipation, diarrhea, hyperacidity, belching, vomiting,

etc. Obstipation is the most distressing. These symptoms are mostly due to augmented irritability of the vegetative nervous system.

The increased lipoid content of the tissues in the climacterium, as in gravidity, predisposes the patient to the formation of gall-stones. Of the general metabolism disturbances, diabetes and obesity are very common; diabetes is traceable to the disturbance of one of the ductless glands. Banting's recent discovery of the specific action of *"insulin"* establishes beyond doubt the correctness of this belief and, further, locates the seat of disturbance precisely in the islands of Langerhans. Endocrinology has been vastly enriched by this new contribution and thus step by step the foundation for a rational opotherapy is being laid. Aschner claims the actual existence of a center of metabolism residing in the brain, which, when disturbed, may lead to diabetes, etc. Obesity is due (probably in at least half the women of the climacteric age) to an endogenous rather than an exogenous fat accumulation (such as increased diet or laziness).

Disturbed metabolism of the inorganic mineral substances is best seen in the Heberden's nodes so common in women in the climacteric period and in arthritis deformans. Most likely the deposits consist of uric acid and, in some cases, oxalic acids. Of the organotherapeutic extracts, thyroidin, as recommended by Huzuisky, appears to be efficacious. Measures that promote metabolism, such as muscular exertion, drink cures, laxatives, sweat baths and especially phlebotomy, appear, however, to be of greater value than opotherapy.

Neuralgias (trigeminal, cephalic, intercostal, sciatic), muscular rheumatism, backache and spinal pains (climacteric pseudogout of Pineles) are common in the climacterium.

Of the special sensory organs, smell and hearing are particularly increased in sensitiveness. The increased susceptibility to cataract formation and to glaucoma is also worthy of mention. Aschner calls attention to the glandula choroidalis which lodges in the ciliary muscle and which, in fish, functions as a gland of internal secretion. He believes, with M. Ruttin, that it may play a rôle, especially in women, with the gouty diathesis, in causing glaucoma.

Psychic disturbances in the climacterium vary from temporary changes in mood, depressed or stimulated states, to genuine psychoses. Existing neuroses or psychoses and even hysteria are aggravated during this period of life under the influence of the disturbed equilibrium in metabolism, endocrine and nervous system (Anton). Vagotonic individuals are less apt to be affected by the climacterium than sympathicotonic individuals (Adler, Schickele, Jaschke and others).

RÉSUMÉ OF THE INTERNAL SECRETORY DISEASES OF THE OVARY

Puberty, menstruation and climacterium, both in their physiological as well as in their pathological relationship, are dominated by the function of the ovaries. The ova and follicle apparatus appear to have the most important internal secretory function. The corpus luteum and interstitial gland of the ovary, from the pathogenetic point of view, play a secondary rôle.

During these three periods of woman's sexual life, as well as in that occupied by pregnancy, certain abnormalities in the general constitution and in the ductless glands and the ovaries, in particular, may play a conspicuous part. On the other hand, whenever there already exists a predisposition to disease, it is apt to manifest itself especially, at puberty, during the climacterium and during pregnancy. Thus, chlorosis, which is apt to occur during the period of puberty, shows the tendency to improve or to be cured during a pregnancy.

As regards functional disturbances of the ovary, we may speak of hyperfunction, hypofunction and also of a dysfunction, because in some diseases, especially those of the ductless glands, there are transitions between the three.

As a positive sign of hyperfunction of the ovary, the bleeding due to ovarian cause may be cited as the best example. In this category, we may include the bleeding of the puberty period, the bleeding due to ovarian cause in the adult woman, climacteric bleeding and the bleeding due to inflammation of the adnexa as well as to neoplasms of the ovaries. The myomata indicate hyperfunction on the part of the ovaries, since they are associated with marked bleeding, because the climacterium is prolonged and, furthermore, because of the increased uterine growth. Stigmata of hypofunction of the ovary associated with myomata are manifested by sterility and by a hypoplastic development of the rest of the genitals.

As an ovarian dysfunction, we have the abnormal tendency to overgrowth on the part of the uterus (myomatous nodule formation) and of the injurious influence of myoma upon the general organism, such as struma, heart and metabolism disturbances.

In osteomalacia, we have another example of marked hyperfunction of the ovaries because castration is followed by cure of this condition. Here, however, there is most likely associated a certain degree of dysfunction.

Temporary hyperfunction of the ovary is seen in precocious puberty with its excessive ripeness of the sexual organs. This is soon followed by exhaustion or the return to normal condition. Even here there are evidences of a simultaneous dysfunction, for example, ovarian tumors, hypertrichlasis, etc.

In dysmenorrhea, there occur symptoms of overfunction and underfunction of the ovary; also in chlorosis. In dysmenorrhea, the local chemistry of the uterine elimination is completely changed, while, on the other hand, the remoter effects of the menstrual secretion upon the organism expresses itself in the form of a toxin.

Ovarian dysfunction in chlorosis is surmised because the ovarian secretion has an unfavorable effect upon the composition of the blood. Hypofunction of the ovaries may be seen in hypoplasia of the genitals, scantiness and delayed onset of the menses. Occasionally, however, there may occur premature ripeness and profuse bleeding in hypoplastic individuals. Complete congenital absence of the ovaries need not, for practical purposes, be considered.

The early castration of woman is so rare an occurrence that the effects of pure ovarian hypofunction cannot be described with any accuracy. A great variety of conditions have been grouped under the general category of hypoplastic conditions referable to ovarian hypofunction.

In this group may be mentioned eunuchoidism, pseudohermaphrodism and the various types of infantilism, status hypoplasticus, status thymicus, status thymicolymphaticus and other similar "vegetative disturbances."

In all instances of hypofunction of the ovaries, the most important symptoms are amenorrhea and sterility. Later, hypofunction of the ovaries is met with after castration in the climacterium, in premature ovarian atrophy and in late eunuchoidism. The last two conditions are associated with diseases of the general constitution, of the ductless glands, or of the nervous system. In all these affections, whether it is hypofunction, hyperfunction or dysfunction of the ovaries, there are associated disturbances of the other ductless glands as well as the vegetative nervous system. Furthermore, these diseases do not, as a rule, arise from the genitals; but, in the majority of instances, they are rather a product of disturbances in the general organism.

While exogenous injuries may cause this disease, the endogenous disease-producing factor lies for the major part in the pathological constitution itself. Disease of the ductless glands may be said to occupy a rôle in the make-up of the constitution. Indeed, Aschner would place the disease of the ductless glands among the list of constitutional diseases in which were formerly included such disease entities as obesity, gout, diabetes, hemophilia and chlorosis; in other words, conditions concerning the etiology of which little is known. Aschner therefore regards diseases of the internal secretory organs, in general, and that of the ovary, in particular, as constitutional diseases.

Bleeding of ovarian causation, myoma formation, dysmenorrhea, chlorosis, osteomalacia, precocious puberty, eunuchoidism, hypoplasia ovarii, pseudohermaphrodism, late eunuchoidism and premature ovarian atrophy may be regarded as constitutional diseases. In these, the endogenous, congenital and inherited pathological factor is of vastly greater importance than the provocative exogenous trauma or injury. With the inner secretory diseases, there is, linked in the larger group of constitutional diseases, disturbance of metabolism as well as that of the vegetative (peripheral and central) nervous system.

CHAPTER IX

DISEASES OF THE PLACENTA

THEORETICAL CONSIDERATIONS IN THE DOCTRINE OF THE INNER SECRETION OF THE PLACENTA

From the very histological nature of the placenta, its Langhans' and syncytial cells being intimately connected through direct contact with the maternal and infantile blood-vessels, we should be led to consider this organ as belonging to the ductless glands. Perhaps few other internal secretory glands present the picture of the placenta, with its epithelial secretory cells discharging their products directly into the blood stream, without the agency of an excretory duct. The appearance of the cells themselves and their vascular and granular content of the most varied type makes the analogy with the other ductless glands close. The markedly abundant content of lipoids possessed by the trophoblast cells, especially in the first third of pregnancy, makes this hypothesis all the more likely.

It had been thought formerly that the syncytial cells possessed ameboid motility and behaved as assimilators or dissimilators and resorbents. Some thought that substances with a high molecular content, such as albumens and fats, were incapable of passing into the fetal organism and being utilized by it without first being split up in the placental cells in the same way that the intestine splits up substances and then synthetizes them (Bonnet, Strahl, Abderhalden and Oppenheimer, P. Zweifel). It has further been shown that water, sodium chlorid and sugar pass through the placenta for fetal nutrition, and that the placenta contains a rich supply of proteolytic ferments which have the function of not only preparing the nutritive substances for proper assimilation, etc., but also exerts an invasive effect upon the maternal vessels and ultimately upon the maternal organism itself. Albumoses were demonstrated in the placenta by Zuntz, Fischel, Mathes and Hofbauer, and were regarded as derivatives, assimilable to the fetus (Raineri, Ascoli, Merletti, Leipmann, Basso and others).

J. Veit was the first to suggest that these albumoses may also represent byproducts originating from the fetus; hence arose the notion of the excretory function of the placenta. Besides the albumen-splitting ferment, there were also found an oxydase, a diastase, a tyrosinase, a glycolytic ferment and one which dissolves the blood corpuscles. A fat-splitting ferment is probably also to be found in the placenta, because the chorionic epithelium of the first months of pregnancy contains lipoids, particularly cholesterin, which must have come from digested nutritive substances elaborated from the local maternal tissues and not from the maternal blood.

The only normal product of excretion of placental metabolism is carbonic acid. Zweifel demonstrated this when he found that the blood which left the body of the embryo contained a greater amount of CO_2 than that which it received. Kreidl and Mandl showed that alkaloidol poisons introduced into the embryo found their way into the maternal organism. The same was shown for hemolysins. But these experiments are uncertain and have not been corroborated. In general, these represented the sum of our knowledge concerning the secretory activity of the placenta until Halban and J. Veit formulated their theories of the inner secretion of the placenta and of the remote effects of the chorionic villi upon the maternal organism.

The Veit and the Halban Theories.—Halban was the first to maintain that the placenta, through its inner secretory activity, controls the growth and hyperemia in mother and child and hemorrhages from the uterus; that it is responsible for the development and secretion of the breast glands; and, finally, that it stimulates skeletal growth, hypertrichiasis and acromegalous changes in the maternal organism. J. Veit, on the other hand, was the first to postulate the principles of the doctrine of placental immunity. This idea helped to explain a great number of physiological as well as pathological processes that take place in the placenta.

Veit's hypothesis is based upon two processes that take place in the placenta. The one is biomechanical and consists of the chorionic invasion and chorionic dislocation; the other is a biochemical process and consists of syncytiolysis. Through these processes, the well-known changes in the blood, in the internal secretory glands and in all the other organs of the mother, including her metabolism during pregnancy, are explainable. By this hypothesis we may also understand the numerous toxicoses or symptoms resulting from a form of intoxication in a case of pathological pregnancy. Opinions may differ upon the question as to what extent these changes are due to the chemical action of the villi in remote areas and those which depend upon the mechanical effects of the chorionic invasion into the maternal blood-vessels in near and remote parts.

Veit at first thought that the premature separation of the placenta and of tubal rupture in extra-uterine pregnancy was due to a blockade of the efferent veins by chorionic villi. The majority of other authors, however (Winter, Seitz, Kehrer and others) believe rather that the placenta releases a toxic substance from its epithelial elements. This substance may be secreted within physiological limits as in the case of any ductless gland, or it may have pathological properties. These may be in the shape of macroscopic and microscopic morphological elements or be purely chemical in their action, their effect upon the maternal blood stream being to set up certain reactions.

Halban carried the idea, first advanced by Johannes Müller and by French authors (Bouchacourt, de Sinety, Keiffer) and von Hildebrandt, of an inner secretion of the placenta to a definite clinical and experimental conclusion. He was thus able to establish, as for the ovary, that the placenta produces substances which stimulate the growth, hyperemia and, under certain circumstances, also hemorrhages from the uterus. Moreover, it was also capable of inducing growth and secretion from the breasts. His

conclusions were corroborated upon experimental lines by Basch, Aschner and Grigoriu, Miklas and others. Aschner and Grigoriu showed that the injection of placental extracts varied according to whether the subject was an animal that had been pregnant or a virgin animal. In the parous animals, an injection of human placental débris under the skin of the back produced, on the third or fourth day, a secretion of colostrum which at the end of a week was converted into abundant milk. The same result was obtained by injection with aqueous filtered extract of placenta. Alcoholic extracts were found to produce the same results in the case of parous animals. Boiling the extract for one hour did not seem to affect its efficacy.

But inasmuch as nucleic acids and peptone are capable of stimulating milk secretion, Aschner and Grigoriu concluded that the action of the placental extract cannot be a specific one, but that all that is required is the presence of a strong leukostimulant or lymphagogue to bring back the milk in an animal in whom this is temporarily suppressed. In virginal animals (guinea pigs), however, Aschner and Grigoriu succeeded in stimulating abundant milk secretion by injecting placental débris. In these animals, without preliminary injection of ovarian substances, no one had succeeded in producing milk by nonspecific agencies. It was remarkable that, within fourteen days after daily injections of five to ten c.cm. of placental débris, the breasts in virgin animals became conspicuously larger as compared to those of the control animals. Three days after the injection, colostrum appeared and after ten days there was distinct milk secretion which at the end of the second week streamed out when pressure was made upon them. Histological section showed the same hypertrophy as in pregnancy. Similar effects were produced in other animals.

The injection of filtered aqueous extract of placenta produced the same results though in a much slower way. With all other placental extracts, for example, alcoholic, or those subjected to heat, a mild grade swelling and hyperemia appeared and sometimes a watery or slightly cloudy secretion; but at no time was a frank growth of the gland noticed or milk secretion produced. Boiled extracts were also without effect. Fetal extracts, when injected, produced similar effects upon the breast gland as placental extracts. This corroborates the results reported by Starling, Biedl and Königstein.

Injection with ovarian or placental extracts were shown to induce well-marked hyperemia and growth development upon the whole genital tract. For example, the uterine musculature increased in thickness, especially the mucosa, which exhibited hyperemia, hemorrhages, succulence and hyperplasia of the glands comparable to that of the premenstrual state. Other organ extracts failed to produce this selective action. In what manner the effects are obtained by injection of chorionic epithelium has not been made clear either by Halban or by Veit. The latter assumes that a syncytiolysis takes place in the sense of Abderhalden's theory, because the syncytial elements present a type of foreign "blood" material which becomes split up in the maternal blood stream with the peculiar reactions resulting.

Aschner states that similar characteristics were observed in the thyroid,

hypophysis and adrenals, the ovary, liver, spleen and kidney after placental extract was injected. Schickele explains the hyperemia on the ground that placental as well as ovarian extracts contain a substance which reduces blood-pressure while dilating the blood-vessels. Certain instances of prolonged postpartum bleeding may be further accounted for by the fact that placental rests of small size, almost microscopic, are retained, which act like the premenstrual uterine glands to reduce the coagulability of the blood. This bleeding ceases after curettage and is to be distinguished from bleeding due to ovarian disease.

The placenta appears to be the activating gland during pregnancy, being responsible for the metamorphosis of the ductless glands and the changes expressed in an increased activity or in an increase in the detoxicating function directed against the placental toxins.

CHAPTER X

SEX FUNCTION AS AFFECTED BY DISEASES OF THE GLANDS OF INTERNAL SECRETION

Owing to the accessibility of the thyroid gland, its relation to the sexual organs has been subject to more direct study than the other ductless glands; and our knowledge in this respect dates from an earlier period. Of the more recent writers on this subject, Novak and von Graff, Rübsamen, Mosbacher and Engelhorn have presented comprehensive historical, physiological and clinical data. It appears from their publication that the rôle of the thyroid gland was much overestimated before the function of the other ductless glands was better understood.

The influence of the thyroid gland upon genital development has not been clearly established. Through the work of Hofmeister, von Eiselsberg, Richon and Jeandelize, and others, it became known that extirpation of the thyroid in young animals leads to well-marked infantilism of the genitals. Hofmeister made microscopical studies upon the gentials and found degenerative processes in the nature of follicle atrophy. Aschner studied this question experimentally in greater detail upon dogs and rabbits and found that the genitals show an arrested development resembling the infantile state. Primordial follicles persist over an abnormally long period and only very occasionally are graafian follicles developed. In no instance was there any follicle hypertrophy or cystic dilatation. But these findings were noticeable after extirpation of the hypophysis, the adrenals or the thymus. The interstitial ovarian gland was reduced the first few weeks after thyroid extirpation, but soon approached the normal development. This occurred alike in younger and older animals.

In adult animals no notable changes in the genitals follow after thyroid extirpation. Sexual maturity, however, is delayed or does not develop at all, the corpus luteum formation being less organized than normal. The reproductive power of the thyroidectomized animals is naturally decreased; where it persists, it is probably due to a sufficient residue of thyroid substance.

In man, thyroid extirpation causes the well-known cachexia strumipriva with retarded sexual development. In the ovaries it is a striking fact that, instead of a general reduction in functional activity, there frequently occurs increased bleeding (Kocher) and small cystic degeneration of the ovaries as shown by Langhans. This may, however, be due to the fact that the hypophysis undergoes a well-marked hypertrophy.

Inasmuch as every important stage in the development of the gonads reflects its influence upon the equilibrium of the other ductless glands, it will

be obvious first at puberty.   In this respect the female sex is subject to greater influence than the male sex.   The swelling of the thyroid at the time of puberty has been explained on the ground that the organism becomes overwhelmed with ovarium products.   This explanation given by Seitz, Engelhorn and others has been supported by experimental proof.   Incidental to the breast hypertrophy, which results from injection of ovarian extracts, a decidedly noticeable swelling of the thyroid also takes place and colloid production is increased.   Typical struma may result from this primary swelling and even a Basedow goiter may develop.   At the same time, the other glands of internal secretion display a special susceptibility to pathological alteration to such a degree that acromegaly, chlorosis, dysplasia adiposis-genitalis and other conditions have their origin at this period.

The regularly recurring swelling of the thyroid at the time of menses has been observed by many authors.   The influence of the ovarian secretion upon the thyroid may cause hyperemia of that gland in the same way that other glands display menstrual hyperemia, as, for example, the liver and spleen. Engelhorn showed that in animals, at the time of heat, the thyroid contained larger follicles and was distinctly hypertrophic.   In women with Basedow's disease, the symptoms due to the thyroid changes are aggravated at the time of menses.   Diminished activity on the part of the thyroid may under certain circumstances cause increased menstrual flow, the so-called "metrorrhagia thyroprivia" of Kocher which is favorably influenced by the administration of thyroid tablets.   On the other hand, certain cases of amenorrhea are cured by thyroid extracts.

Menstrual disorders are frequently related to disturbed thyroid function, because the latter influences ovarian function in the most varied ways. Fränkel, for instance, has shown that the X-ray treatment of the thyroid can result favorably upon irregular bleeding.   After castration, the thyroid shares the same hypertrophy as do all the ductless glands.   In this case it is not a reaction to ovarian secretion, but rather a compensatory change.   The increase in size of the thyroid gland during the climacterium is, perhaps, to be explained in the same way.   Like the period of puberty, the climacterium appears to be a critical time for thyroid change.   The tendency to acquire Basedow's disease at this time has been mentioned by Novak and von Graff. On the other hand, atrophy of the thyroid has frequently been met with following the climacterium (von Eiselsberg, Fischer and others).

During pregnancy, thyroid enlargement may be viewed as a physiological symptom.   To Engelhorn belongs the credit for having definitely demonstrated that the thyroid undegoes both a hypertrophy and a hyperplasia with increased colloid formation during pregnancy.   Seitz published, in 1913, pictures of these changes which leave no doubt as to their genuineness.   But the changes in pregnancy occurring in the thyroid gland are but part and parcel of the general metamorphosis which the other ductless glands undergo and which issue from the same source, namely, the growing ovum or rather the placenta.   Certain abnormal symptoms during pregnancy may well be explained by the changes incidental to pregnancy occurring in the thyroid.   Such symptoms are glycosuria, hyperemesis, abnormal sweat secre-

tions, etc. But these symptoms may also be engendered by the other duct-less glands, since their connection with the vegetative nervous system is a similar one. This holds alike for the most severe of all the toxemias of pregnancy, namely eclampsia. In this condition and in the albuminuria of pregnancy, the thyroid appears to be less apt to show enlargement and indicates a reduced ability on the part of the ductless glands to neutralize the foreign placental toxins. Seitz estimates that the thyroid becomes hypertrophied in three quarters of all cases of pregnancy.

The frequent coexistence of struma and myomata is to be considered rather a coincidence, because, as Fränkel has shown, a cessation of bleeding follows radiation of the thyroid gland and, vice versa, radiation of the ovaries is followed by a diminution of the struma. An improvement of Basedow's disease occasionally follows myomectomy. Wettergreen reported one case and Birnbaum two cases of improvement of Basedow's disease after myomectomy. On the other hand von Graff warns against X-raying the ovaries in cases where disease of the thyroid gland is suspected, because he saw in two cases the onset of Basedow's disease as a result of the X-ray treatment. That there may be an essential relationship between ovarian activity and Basedow's disease may be seen in the fact that Basedow's occurs with far greater frequency in women than in men. Furthermore, the occurrence of this malady also coincides with the three important epochs in the sex life of women, namely puberty, pregnancy and the climacterium.

Mild degrees of hyperthyroidism and dysthyroidism are especially frequent in connection with chlorosis and occasionally are confused with this condition (pseudochlorosis of Fr. von Müller). Among these conditions may be mentioned all stages of neurasthenic-hysterical types accompanied by scattered symptoms referable to the thyroid and ovary. Thus certain hitherto unaccounted-for cases of dysmenorrhea, metrorrhagia, amenorrhea or sterility may be but a manifestation of Basedowoid disease. A persistent thymus in these cases is also common and is not only to be regarded as a sign of infantilism but also as bearing a peculiar etiologic relationship.

According to von Graff and J. Novak, Basedow's disease may be divided into the primary thyrogenous, the primary neurogenous, and the primary ovariogenous; so that therapy may be directed against the ovaries, the thyroid or the nervous system. For the latter, there is as yet no successful specific measure. X-raying of the ovaries or the thymus or opotherapy may be followed by success in some cases.

The simple struma becomes larger in pregnancy as a rule. It may be distinguished from the struma of Basedow's disease by the fact that relatively often the former is accompanied by increased menstruation and that the climacteric period is long delayed. The ovaries of these women are, as a rule, enlarged and contain many small cystic dilated follicles which remind one of the colloid cysts of the accompanying struma. The uteri of strumous women are frequently enlarged and are what was formerly known as "metritic" or, what is now better termed, "ovarial uterine hypertrophy."

In the event of pregnancy taking place in hypothyroidism (myxedema, cretinism, etc.), the symptoms of thyroid insufficiency are aggravated and

there is the tendency to premature labor and anomalous development of the offspring. When the thyroid deficiency is congenital, the general infantile structure of the individual, which may approximate dwarfism, is also manifest in infantilism of the genitals; so that a hypoplastic thyroid may be the cause of an infantile pelvis. Myxedema is more common in women than in men, showing a proportion of 80 per cent for women. This is in accord with the relative sex incidence of Basedow's disease. Pregnancy appears to mimic Basedow's disease or, when Basedow's disease is already present, pregnancy tends to aggravate it. When Basedow's disease occurs early in life, it causes genital infantilism. Myxedema predisposes the patient to an attack of eclampsia in the same way that sclerodermia, osteomalacia, tetany and other diseases of the ductless glands do. Thyroid therapy is valuable in myxedema as well as in cretinism. In spite of all therapy, cretinism becomes worse through pregnancy—so much so that interruption of pregnancy must be done. The symptoms are said to abate in the puerperium.

Von Graff claimed, on the basis of statistical studies, that the thyroid acts as a neutralizer of placental toxins. Thus, out of 24 cases of pregnancy with enlarged thyroid, there was albuminuria in 16 per cent, while in 26 cases of pregnancy without thyroid enlargement there was albuminuria in 22 per cent. For this reason, thyroid therapy has been recommended for the treatment of hyperemesis gravidarum, albuminuria of pregnancy and even eclampsia. In 33 cases of eclampsia, 23 failed to show thyroid enlargement (69 per cent). In von Graff's and J. Novak's statistics, 51 per cent of pregnant women show thyroid swelling, so that failure of this gland to enlarge during pregnancy would predispose the patient to the toxicoses of pregnancy. To increase the detoxicating action of the thyroid against the placental toxins, it would be desirable to administer thyroid.

On the other hand, an overdose of thyroid leads to premature interruption of pregnancy, as recent interesting animal experiments have shown. Whether the thyroid undergoes enlargement because of repressed ovarian function has not been definitely settled. Engelhorn, for example, claimed to have seen the swelling diminish after the administration of ovarian tablets. This, however, has not been confirmed in the work of von Graff in a small series of cases.

Protein and fat consumption are alike stimulated by the thyroid and ovary, so that cases of sterility in fat women may be cured by feeding of thyroid substance. Successful cases of cured sterility in the obese have been reported. In the case of carbohydrate metabolism, thyroid and ovary have opposite effects. Thyroid gland favors the mobilization of grape sugar, while the ovary inhibits it to a certain extent. It is not far-fetched to think, therefore, that the thyroid plays some part in the production of glycosuria of various types during pregnancy and that the patient may be considered, in such instance, to be in a condition of hyperthyroidism.

In view of the fact that skeletal growth is stimulated by the thyroid to practically the same extent that the hypophysis and the thymus are, it may be assumed to take part in the accelerated growth of the pelvis in young gravid women. At least the growth of individuals who are undersized, accord-

ing to Hertoghe and others, has been known to respond to the use of thyroid tablets. An interesting effect of thyroid therapy lies in its value in cases of secondary and tertiary lues which are refractory to the ordinary iodid treatment. B. Wagner-Jauregg maintains that the organically combined iodin contained in thyroid is very valuable in these cases because the organism will utilize this iodin when it apparently fails to assimilate inorganic iodin.

The Parathyroids.—The influence of the epithelial bodies upon the gonads is a matter concerning which we have scant knowledge. The main reason lies in the fact that extirpation of all four parathyroids leads to rapid death. Partial resection of the parathyroids may not interfere much with ovarian function, because pregnancy has been known to take place in spite of it.

The trophic disturbances resulting from partial parathyroidectomy appear in the teeth, hair, nails, and upon the skeleton in the form of calcium deprivation. This is noticeable, clinically, in man. Very rarely tetany occurs during pregnancy as a result of parathyroid damage. A diagnostic sign of parathyroid disturbance is increased galvanic irritability as demonstrated by Seitz and Kehrer in the pregnant state. Normal pregnancy appears to increase the predisposition to bring forth latent tetany. This fact was established on an experimental basis by Adler and Thaler. Morphological data concerning the changes of the parathyroids during pregnancy are still lacking.

Seitz inclines to the belief that certain symptoms of pregnancy, such as asthenias, paresthesias of the extremities, etc., are expressions of parathyroid toxicosis. Albuminuria and fatty degeneration of the liver have been noted in animals with total extirpation of the thyroid and parathyroids. Precise knowledge of the relationship of these two glands awaits further research. But it is known that thyroid medication has a favorable influence upon tetanic conditions.

Adrenalin injection may cause a latent tetany to break out, showing the relationship between the parathyroids and the chromaffin system (Falta and Rudinger), while exclusion of the adrenals in parathyroprivoid animals causes the tetanic attacks to disappear (Gulecke). The administration of parathyroidin, however, is followed by variable success in the treatment of tetany of pregnancy, so that symptomatic cures are possible. Of these, calcium lactate and acetate are the best, partly because calcium has a controlling effect upon contractions and partly because in tetany the organism suffers from a lime deficiency in the blood. Parathyroid transplantation has so far been followed by uncertain success. In animals with damage to the parathyroids, tetany may recur with each pregnancy (Vassale, Puieles, Erdheim, Frommer, Gross, Adler and Thaler). In women who were subjected to thyroidectomy, the tendency to tetany with each pregnancy is frequently marked, while in the nongravid state they are free from symptoms. Frommer showed that the insufficient parathyroids become further damaged in pregnancy by placental toxins, because he was able to induce tetany in partially parathyroidectomized animals by injecting placental extracts. Spontaneous or artificially induced labor has a favorable influence on tetany. At the same time, according to Seitz, 7 per cent of all cases occurring in

the puerperium terminate fatally. In severe cases with respiratory muscle embarrassment and disturbed consciousness, Aschner recommends interruption of pregnancy. Eclampsia, claimed by some to be dependent upon disturbed parathyroid function, has been shown by Seitz not to be so, because the increased galvanic and reflex irritability was missing.

The Thymus.—The thymus belongs to that group known as puberty glands, which includes the pineal and the interstitial gland of the ovary. It is called a "puberty" gland because it recedes both morphologically and functionally at the time of sex maturity. It has been established that extirpation of the thymus in young animals leads to infantilismus and to defective development of the primary and secondary sex characteristics. Castration or X-ray treatment of the ovaries leads to enlargement of the thymus to an extent unsurpassed by any other treatment; so that it may be assumed that the gonads exert a powerful influence over the thymus gland. In this hypertrophy, it undergoes the same change that the other ductless glands do under the same circumstance.

Many cases of amenorrhea and sterility are explainable on the basis of a thymus persistence associated with other hypoplastic and infantile stigmata, such as heterosexual hair distribution, changes in the skeletal structure of the pelvis and infantile evidences in the genitals. Hypertrophy of the lymphatic apparatus and protracted persistence of the epiphyseal cartilage are other coexistent signs of thymus persistence. The marked susceptibility of individuals with status thymicus to injury and infection, and especially to narcosis, is well known. The chromaffin system shows a hypoplasia, according to von Wiesel; and, on the basis of this finding, Novak recommends the use of adrenalin, injected intracardially, in case of cessation of the heart beat.

The symptom complexes of Basedow's disease are favorably influenced by roentgenization of the thymus or by thymus feeding; simple strumata are also observed to recede under this method. A certain vicarious relationship in function appears to exist between the thymus and the thyroid. A similar relationship exists between the thymus and the spleen, for in chlorosis good results have been obtained by thymus feeding (Blonsel, Marcolongo). Moreover, after extirpation of the spleen, the thymus hypertrophies and vice versa. Splenic substance feeding accomplishes the same favorable results in chlorosis that feeding thymus substance does. In view of the fact that, after thymus extirpation in young animals, serious disturbances in ossification occur, attempts have been made to treat rachitis and osteomalacia upon this principle but without much success.

Aschner ventures the opinion that certain cases of idiocy (idiotia thymica) with cerebral hypertrophy and infantilism are probably traceable to thymic disease and not to hypoplasia of the genitals. Because of the inhibitory action of the ovaries upon thymus enlargement, Aschner recommends the use of ovarian tablets. Perhaps certain cases of improvement in symptoms of Basedow's disease may be traceable to that fact.

The Hypophysis.—The constant occurrence of the hypophysis in the entire series of vertebrates points to the fact that this structure must have

some important function. Since the clinical observations of Pierre Marie in 1886, a large mass of facts have accumulated, especially on the experimental side. In not all instances have the experiments reproduced clinical phenomena. Aschner believes that the *pars intermedia* belongs to the posterior lobe of the gland and that it has none of the special significance that has been ascribed to it. Pituitrin, that is an extract of the neurohypophysis, is undoubtedly an important agent, but perhaps too much emphasis has been laid upon it as a part of the inner secretory mechanism of the pituitary.

It is noteworthy that, in 1839, the anatomist J. Engel, a pupil of Rokitansky, called attention to the pathological correlation between diseases of the hypophysis, of the thyroid and the genital organs. No systemic observations, however, were made until Pierre Marie's demonstration of the etiological connection between hypophyseal tumor and acromegaly and the observation of A. Fröhlich on the relationship between the hypophysis and dystrophia adiposis genitalis.

Total extirpation of the anterior lobe of the hypophysis in young dogs leads to genital infantilism. The uterus remains thin and slender, the mucosa undeveloped; the ovaries do not show large follicles or, if they do, only sparingly. The interstitial ovarian gland disappears rapidly, following the total extirpation of the hypophysis; but it returns later, probably as a result of inhibited follicle maturation, and hence follicle atresia. Corpora lutea are only occasionally found and only singly, whereas, in normal animals at the time of heat or gravidity, there are several corpora lutea, from three to seven in direct proportion to the number of progeny. Pregnancy never occurs in hypophysiprivous dogs, although Aschner states that he made many attempts at mating these animals. In pregnant dogs, extirpation of the hypophysis, no matter how gently done, leads regularly to an abortion within three days, after which milk appears in the breasts. The puerperal involution takes a much longer time than is normally the case.

In adult animals, total extirpation of the hypophysis does not lead to such marked systemic changes. A moderate corpulence, diminished protein metabolism, adrenalin glycosuria and augmentation of the carbohydrate tolerance follow. In the genitals, there is slight anatomical and histologic regression.

After castration, hypertrophy of the hypophysis has been observed in practically all species of animals. A distinct increase in the eosinophile cells is invariably noted. A similar picture is seen during pregnancy of women (Erdheim, Stumme, Kolde). The increase in volume of the gland in this instance is due to an increase in the "Hauptcellen" and indicates a reduced ovarian activity during pregnancy. Just in what manner the hypertrophy of the hypophysis is essential for pregnancy to continue is not clear. Aschner's experiments point to the important rôle this gland plays in the maintenance of pregnancy. He conducted his experiments in two stages so as to avoid injuring vital parts. Yet he is not certain whether the interruption of the pregnancy may not be due to irritation of the vegetative nerve centers in the floor of the third ventricle.

The posterior lobe of the hypophysis does not show any morphological

changes during pregnancy. Its extract, pituitrin, which has proved such an excellent oxytocic agent, has been found by Schlimpert and others not to be increased even in gravid animals. In labor, pituitrin can induce uterine contractions; but, outside of parturition, it does not exert any such influence over the uterus and does not cause interruption of the pregnancy. Aschner points out that irritation effects issuing from the hypophysis are, in reality, partly or mostly due to irritation of the floor of the third ventricle, which may cause contraction of the pregnant uterus, of the bladder and of the rectum. Pituitrin, moreover, causes contraction of these organs as well as an increase in blood-pressure. An analysis of the hypophyseal diseases of man, such as acromegalia, dysplasia adiposogenitalis, gigantism and dwarfism, is a complicated one because the symptoms may in some measure be due to injury or disturbance of the interbrain as well as to the several lobes of the hypophysis. Most of the symptoms of hypophyseal disease in man, however, may be traced to injury or underfunction of the anterior lobe. In relation to the genitals, the hypophysis has the same rôle as the thyroid, thymus and the adrenals, both for development and functional activity.

The hypertrophy of the hypophysis which occurs in pregnancy leads to changes resembling those of acromegalia. For example, the enlargement of the face and of the extremities of pregnant women is not an uncommon occurrence. Seitz even suggests that the growth of the uterus is induced by the pregnancy cells in the hypophysis. Marek reported an interesting case of acromegalia developing in the eighth month of pregnancy, which disappeared spontaneously seven weeks postpartum.

A young woman of twenty-nine, gravid for the first time after one year of married life. Increasing melancholy since the onset of gravidity was the chief complaint. It had been noticed, by herself, her family physician and friends, that her face, hands and feet had become inordinately large and distorted in the brief period of three months of gravidity. The face rapidly assumed the leonine type. The mental depression was marked until the sense of quickening was experienced by her, when it gradually abated toward the end of pregnancy. The acromegalia increased but slightly in the latter half of pregnancy and rapidly receded after childbirth. It was interesting to note the difficult labor, although the pelvic measurements were ample, the female child weighing eight pounds. The soft parts of the pelvic outlet were very rigid and friable.

Cerebral Symptoms.—In the nonpregnant state, acromegalia often causes amenorrhea. Degenerative changes in the genitals, particularly in the follicles of the ovary, and diminution of the interstitial cells have been found. In the hypophysis itself, adenomata or adenocarcinomata have been found, which indicated a hyperactivity or dysfunction of the gland. But pregnancy, taking place in acromegalia, appears not to be disturbed.

Dysplasia adiposogenitalis depends upon a hypofunction of the hypophysis; the sexual function is considerably affected in this disorder and the seat of the disturbance is in the anterior lobe of the pituitary. Inhibited bony growth, persistence of the epiphyseal lines, obesity and infantilism, especially of the genital tract, are the chief characteristics. The etiological

cause is found, as a rule, to consist of a tumor involving the anterior lobe, or the pedicle of the hypophysis with the neighboring floor of the third ventricle which are compressed. Inasmuch as the anterior lobe may often be histologically intact, we are led to believe that either the pituitary secretion through the infundibulum is obstructed or that the vegetative center in the interbrain is damaged by the tumor and, hence, is followed by trophic disturbance (Erdheim, Aschner). The hypoplasia of the genitals is secondary and not primary, as claimed by some authors, because the condition can exist without genital hypoplasia. Animal experimentation has shown, however, that the condition may be induced by a primary lesion of the interbrain which leaves the hypophysis unaltered. The same may follow meningitis, hydrocephalus, etc. And the therapeutic result which follows partial extirpation of pituitary tumors may be explained by a release of pressure upon the hypophysis or the tuber cinereum.

Anterior lobe pituitary extract occasionally may improve the obesity, the glycosuria and the genital symptoms. The same is true of dwarfism. Deficient hair growth appears to be benefited by its use. Cushing improved the fertility of rats by feeding them with hypophyseal tablets.

Functions of the Interlobe (Pars Intermedia) of the Hypophysis.—In dogs it has been shown that no symptoms follow the extirpation of the pars intermedia with the posterior lobe.

Pituitrin acts upon the smooth muscle of the body and not specifically upon the uterus; it raises the general blood-pressure and causes contractions of the uterus and the bladder. In diabetes insipidus, pituitrin appears to exercise an inhibitory influence. It is said to act as a galactogogue in lactating women, but Aschner remarks that, in this respect, it has no more elective effect than other organic extracts, such as albuminoids and peptones. Pituitrin has been given with good effect in genital bleeding, in ineffectual labor pains, as a measure to promote diuresis and bowel and bladder function, and in osteomalacia and rachitis as well as Basedow's disease. The active principle of pituitrin resembles strongly the β-imidazolylethylamin which belongs to the group of histamins which, in turn, are related to the oxytocic drugs derived from the vegetable kingdom. Of all these animal histamins, pituitrin and adrenalin have so far been the most active, especially with respect to the genital tract.

The Pineal Gland.—Aschner, in studying one hundred human pineal glands, found that they take on in weight till the end of the second decennium of life, that is, as long as the long bones continue to grow. The gland is oval in shape, its free end being somewhat pointed. After this age, the form changes so that it becomes broader, shorter and more rounded. A deposit of lime and magnesium concretions replaces the lost pineal substance and is a characteristic sign of adult life. During gravidity, the pineal exhibits a more round form in animals; the gland becomes thicker, shorter and broader. After castration in young animals, the pineal approaches more closely in form that of the gravid state. No observations have been made on men who have been castrated in early life. In late female castrates, Aschner was unable to notice any marked changes. During gravidity, how-

ever, he had occasion to observe the pineal gland in a few cases of death by suicide, sepsis, eclampsia, etc. The gland showed a distinctly rounded appearance, and contained more lipoid substance during gravidity and had, also, more lime deposits.

It is not, however, to be regarded as a puberty gland entirely, because evidences of glandular activity are still to be found in advanced age. Its functions appear to be analogous to those of the hypophysis with respect to obesity, growth of bones and genital development. Yet, unlike the hypophysis, it is said to have an inhibitory influence over the genitals; for example, in cases of teratoma of the pineal region, where the gland is more or less destroyed, precocious sex development is noted.

According to Aschner, however, these effects may be brought about by lesions affecting at the same time the third ventricle or the interbrain structures, which not only contain the same original embryonal epithelial elements but which also lodge the centers of trophic control of the organs and of metabolism in general.

Hofstätter is practically alone in recommending the pineal extract therapeutically in cases of tetanic spasm of the uterus with threatened rupture. He claims for it a sedative effect. The excitability following castration and symptoms of dysmenorrhea are said to be relieved by pineal gland therapy. Hofstätter recommends its use in cases of excessive contraction of Bandl's ring, in retained placenta, unbearable labor pains, vesical and intestinal tenesmus, priapism and ovarian hyperfunction.

The Adrenals.—Congenital disturbances in development of the adrenals, such as hypertrophy, tumors and aplasia, are frequently combined with high-grade malformations of the genitals. These may be hermaphrodism, pubertas praecox, hirsutism and all stages of genital hypoplasia with their associated heterosexual stigmata. Moreover, the adrenals play an important rôle in the body economy later in life through structural changes that they undergo. In the period of heat in animals and during menstruation in women, the adrenals become larger.

Hypertrophy of the adrenal cortex as well as of the parenchyma (but to a lesser degree) follows upon castration. During pregnancy the adrenal hypertrophy, especially of the cortex, is most striking (Guiesse, Stoerk and von Haberer, Kolmer, Aschner, Kolde, Aschoff, Wiesel). This hypertrophy, as in other endocrine glands during pregnancy, is assumed to act as a detoxicant. It is also responsible for the increase in lipoids of the pregnant woman; the placenta, corpus luteum, liver and, in Aschner's opinion, perhaps the intestinal canal, being the other organs which aid in the increased storage of lipoid substances.

The glycosuria of pregnancy in its various forms indicates an increased irritability of the sympathetic nervous system; the increased adrenalin output in gravidity may aid in the readily produced glycosuria. The pigmentation of pregnancy may also be traced to changes in the adrenals in a way similar to that which takes place in Addison's disease. Adrenalin, a histamin produced from the adrenal parenchyma, is the most powerful stimulant of smooth muscle fibers that we have. Its use as a uterine stimulant has

been abandoned because pituitrin is preferable and because its very marked contractile effect is followed by an undesirable atony. The neutralizing effect of the adrenals upon toxins of all sorts has been assumed because of a well-marked hypertrophy of the cortex in pregnancy. Hence, some have sought to ascribe to the adrenal the rôle of a detoxicant in the toxemias of pregnancy. Aschner, however, found at autopsy that there was a deficiency in lipoids in the adrenal cortex and an atrophy of the adrenal parenchyma in eclampsia. The observation is in accord with the insufficiency of the other endocrine glands incident to eclampsia, for example, the thyroid.

J. Novak showed that bilateral extirpation of the adrenals in young rats was followed by hypoplasia of the genitals. The ovaries showed very sparing follicle ripening and poor development of the interstitial cells. Corpora lutea were, as a rule, absent altogether. On the other hand, Christofoletti showed that the adrenals are not essential to conception, gravidity and the normal termination of labor, because adrenalectomized animals give birth to living young. It is interesting to note that the injection of pituitrin renders the organism more sensitive to the effect of adrenalin.

Amenorrhea is common in Addison's disease, showing a suppression of ovarian function. Conception in this disease is rare. When it does occur it is usually terminated prematurely. Occasionally, however, a pregnancy goes to term and labor sets in normally, showing that the adrenal status has no bearing upon the labor. The disease itself as a rule becomes fatal through an intervening pregnancy which aggravates the adrenal tuberculosis.

Adrenalin has been used with good results in Addison's disease in recent years; it also appears to exercise a specific therapeutic influence in osteomalacia. The patients suffering from osteomalacia tolerate large doses of adrenalin well, and symptoms are very frequently improved by it. Adrenalin has been found to be useful as an antineuralgic measure. Carlton, R. Schmidt, and others gave it internally and subcutaneously for neuralgias in different anatomical regions with success. The good effect is probably brought about through a vasomotor regulating mechanism. Its addition to a local anesthetic increases the duration of the anesthesia and neutralizes the toxic effect of the narcotic by producing local anemia and, finally, renders the operative field bloodless.

Stoltzner found the adrenals in rachitic children smaller than normal; hence he used adrenalin therapeutically in rickets with good result. As a hemostatic, adrenalin has been used locally with best effect in the urogenital tract. Dysmenorrhea has been benefited by its use; also menorrhagias of young individuals and vesical and uterine atony. In hemorrhoidal bleeding, a favorable effect is easily obtained. Finally, pruritus vulvae is said to yield to the use of adrenalin (Cramer, Peters).

The therapeutic effect of adrenalin upon ovarian activity still awaits trial.

The Pancreas.—It is well known that a premature suppression of genital function is common in diabetes. Menstruation is sometimes increased, sometimes quite regular, but more often it is scant and infrequent or there is complete amenorrhea. Hofmeier observed a case of uterine atrophy. Unfortunately the condition of the ovaries has not been described. Seitz found

that less than 5 per cent of diabetic women become pregnant. This suggests a suppressed ovarian activity. In about 25 per cent of such cases, the diabetes may be traced to a pregnancy. Repeated pregnancy aggravates it. The prognosis of diabetes complicating pregnancy is, however, grave, since, in cases where pregnancy ensues upon an existing diabetes, the patients die in 30 per cent of the cases from coma during the labor or soon after it. Offergeld also claims that 50 per cent of all the children born of diabetic mothers die before birth. When this occurs, it indicates a serious toxicosis. Hydramnion is rather common. In living children born of diabetic mothers, a number show polyuria, congenital diabetes, hydrocephalus, etc. This indicates, according to Aschner, a central predisposition lodging in the third ventricle of the brain.

Antidiabetic measures should be instituted during pregnancy and, in the event of failure to relieve, pregnancy should be terminated. The alimentary glycosuria in pregnancy may be due to pancreatic or ovarian influence. The pancreas and ovaries act in this case in a synergistic way. But a great deal of further clinical and experimental work remains to be done.

The Spleen.—Until recently the spleen was not considered an endocrine organ. Limert and Aschner demonstrated in rabbits and guinea pigs an increase in the spleen of one third of its volume during pregnancy. In dogs a similar change has been observed; also there was an enlargement of the malpighian bodies as well as an increase in fat deposits. The reticular endothelial cells appear to resorb lipoids from the blood in the same manner that the Kupfer star-shaped cells of the liver do in conditions of increased lipoidemia (lipemia). In pregnant women, an enlargement of the spleen occurs frequently. Experimentally, following castration a similar result is noted.

Aschner found that splenectomy in young dogs was followed by earlier sex function than in control animals of the same age. The genitals in the former were better developed and heat manifestations were earlier. In this connection, Bayer reported a very striking degree of development of the breasts in a woman six months after splenectomy. In chlorosis, there is frequently a precocious sex maturity with manifestations of ovarian hyperfunction, such as profuse menstruation.

Hormonal, lienin (Poehl) and stagnin (Bändan) have been used in chlorosis to increase peristalsis in obstipation and as uterine oxytocic (not as strong as pituitrin) for amenorrhea and excessive bleeding.

The Liver.—The best known reaction between the liver and the genitals is seen in the hypertrophy of the liver during menstruation and in the changes that it undergoes during pregnancy. The liver swelling may sometimes be accompanied with slight icterus (Senator, Miemayer and Frerichs), or associated with severe pains, as in the case observed by Frerichs. Chvostek explained this swelling during menses by the circulation in the organism of menstrual ovarian products which also affect the thyroid, spleen and other organs. In individuals with increased excitability of the vegetative nervous system, the liver hyperemia is more apt to be advanced. These individuals are particularly liable to icterus and biliary colic. Stones may

first manifest themselves at this time and recur during menses (Metzger, Kehrer, Fellner, Schickele, Rissmann).

Pregnancy makes particular demands upon the liver. When the liver has already been incapacitated by other injuries, it is especially liable to suffer through the overwhelming effect of the placental toxins. Thus we have catarrhal icterus, cholelithiasis, icterus gravis and acute yellow atrophy of the liver (E. Kehrer, Schickele, A. Mayer, Rissmann, Fellner and Hofbauer have published the best reports). In eclampsia, the anatomical liver changes are of a severe grade. It is possible that the various ferments and immune bodies which are elaborated during pregnancy are produced in the liver. Their disturbance under certain conditions may be expressed by an attack of eclampsia which indicates a toxicosis due to the splitting up of protein substances.

Glycogen is most probably stored up in the liver to a greater degree during pregnancy than normally; the lactosuria and glycosuria, especially of the latter part of pregnancy, would indicate this. The thyroid, hypophysis and chromaffin system act as stimulants to the mobilization of sugar and influence the liver during pregnancy as in the nonpregnant state. The liver stores up lipoids as do other organs during the gravid state and it appears even to influence the metabolism of mineral substances. Osteoporosis has been observed in animals with chronic biliary fistula, showing that the loss of lime is traceable to the bile deprivation.

PART II
ANALYTIC CONSIDERATION OF SYMPTOMS

THE CAUSES OF GENITAL BLEEDING AND OF AMENORRHEA

Genital bleeding in the female may be divided into two types: (1) oöphogenic, by far the most important and the most frequent; (2) non-oöphogenic, which comprises: (a) degeneration and necrosis of tumors situated anywhere along the genital canal, (b) erosions and ulcerations and inflammation of the mucous membrane, (c) traumatic, (d) malpositional, (e) general constitutional.

Oöphogenic.—As normal menstruation depends upon the physiological influence of normal ovaries, it follows that, when the latter are diseased, the menstrual function will be disturbed. Whether the ovaries are hyperfunctionating, as in hypertrophy and follicle cyst hyperplasia, or hypofunctionating, as in passive congestion (circulatory disturbance), or destroyed by benign or malignant new growths, the menses are necessarily disturbed. The functional and organic (structural) changes of the ovary induce reflex or secondary disturbances in the uterus. These are then expressed by variation in the type, periodicity, intensity and duration of the menstrual bleeding (Fig. 12).

In the case of hyperfunction of the ovaries, whether due to actual parenchymal increase or nutritional hypertrophy from hyperemia, the menses will be prolonged and excessive, and the interval will be diminished (Fig. 13). The interval might even be obliterated by the continuous flow and the periodicity wiped out by prolonged and persistent bleeding for several months. Such bleeding is seen chiefly at puberty. Aside from the bleeding noticed at the vaginal orifice, physical examination may fail to reveal any obvious cause. Even in cases where the vaginal, cervical, uterine exploration is made under anesthesia with fingers and curet, there may be no gross abnormality to account for it. In cases of puberty-bleeding personally observed, enlarged ovaries could not even be palpated. The law of cause and effect operates so uniformly in this type of bleeding that unless extra-ovarian causes can definitely be established, such as necrotic inflamed cervico-uterine polypi, uterine tuberculosis, etc., one may safely ascribe the bleeding to the ovaries.

It is conceivable that following hematocolpos, hematometra and hematosalpinx, there would be an escape of blood from the tube over a prolonged period. Actually no such cases have been observed. Except for this possibility, the tubes may be eliminated in the young girl as a cause of genital bleeding.

That the ovarian disease is responsible for the bleeding of puberty is amply demonstrated by the prompt relief and restoration to normal function when the diseased portions of the ovaries are removed (Fig. 14).
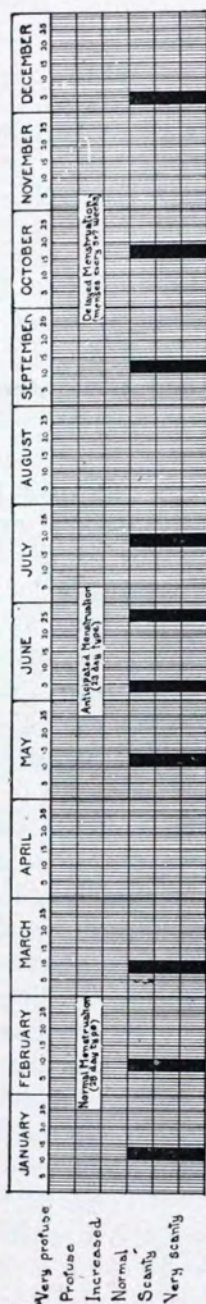
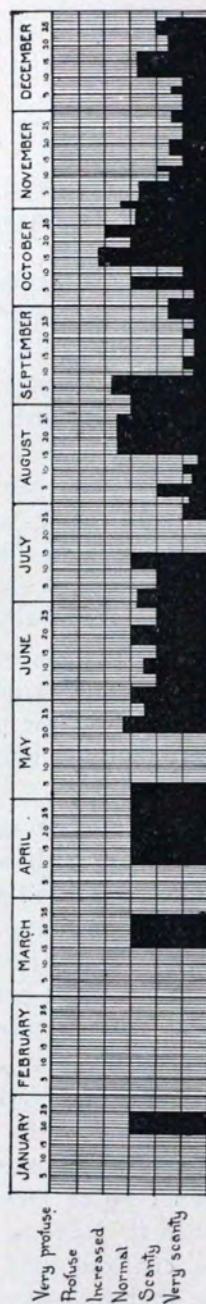

FIG. 12.—TYPES OF MENSTRUATION.

FIG. 13.—OÖPHOGENIC PUBERTY BLEEDING (base E. R.).

The nature of the primary cause in the ovary is not as yet demonstrable. By analogy one may call to mind the changes in goiter and the secondary nervous symptoms which result from that cause. Whether or not the thyroid

changes are induced by pathological influences orginating in that organ, or whether they are secondary to some disease of one or other endocrine organs is not clear. In the same way that the nervous symptoms tend to clear up after a subtotal thyroidectomy (the nervous system and thyroid being closely linked), so the menstrual irregularity is corrected by subtotal bilateral oöphorectomy.

Non-oöphogenic.—It is particularly in that large group of cases where

FIG. 14.—MICROSCOPIC SECTION OF AN OVARY FROM A CASE OF OÖPHOGENIC UTERINE BLEEDING SHOWING THE CONTIGUOUS FOLLICLE CYSTS.

no obvious disease is demonstrable (essential uterine bleeding) that the cause must be sought for in the ovaries. This applies to girls at puberty and in adolescence, as well as to young adults and those even in the fourth decade of life.

While age is a factor the history of prolonged or excessive bleeding at the normal menstrual period suggests at once inflammatory disease of the adnexa or uterine fibromyomata If the latter are appreciably enlarged,
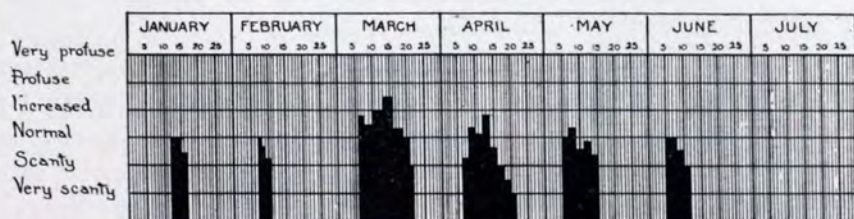
FIG. 15.—PROLONGED PROFUSE BLEEDING FOLLOWING A RECENT ADNEXITIS PERHAPS DATING FROM THE ONSET OF THE PRESENT MENSES. After three or more periods the menses may be restored to the normal type for that individual.

they would cause no difficulty in the diagnosis. This would only arise in distinguishing fibroids from diseased adnexa or when a combination existed. It has been my impression that, apart from other distinguishing features pointing to an inflammation (history, palpatory tenderness), bleeding is more prolonged in inflammatory cases and there is very apt to be bleeding at irregular intervals, the menstrual cycle becoming altered so that the interval is shortened (Fig. 15). An uncomplicated fibromyoma may be associated with

only slight change in the menses. An exception to this is gonorrheal endometritis.

Fibroids are subservient to ovarian function and will, therefore, affect uterine function only secondarily. It is generally conceded that bleeding is most profuse in the submucous variety and more profuse in the intramural than in the subserous fibroids. Practically all submucous varieties arise in the uterine musculature as interstitial fibroids, so that the distinction is not an important one except, when the tumor protrudes into the uterine cavity owing to the greater tendency to sloughing and inflammation, bleeding is liable to be more profuse.

The Type of Bleeding.—It is remarkable how often the statements of the patient are inaccurate with reference to the type of the bleeding. Only exceptionally does one encounter a patient who conscientiously keeps track of her periods, noting the dates of onset, duration and recurrence. The matter of the duration becomes an uncertain quantity, patients, as a rule, trusting to an untrained memory. Unless she presents herself for an explanation of the first irregular period, the patient's answers to detailed questions will be only haphazard. A practical guide as to the amount bled daily may be obtained by the number and saturation of napkins. But in this respect account must also be taken of the temperament of the patient; whether she is fastidious and neat or slovenly and careless.

When a patient states that she bleeds every two weeks, one should be clear as to whether she means that she bleeds twice a lunar month, each period lasting about a week with a free interval of two weeks. It is desirable, therefore, to inquire not only how often and how long the menses are but also as to the interval. In this way the patient's statement can be checked up and thus one can be certain as to whether one is dealing with menorrhagia or metrorrhagia. When the bleeding is very irregular, it is well to plot out a curve showing the date, duration and intensity of the bleeding. Kaltenbach's or Winter's curves may serve as a model. It can thus be seen at a glance in what the abnormality manifests itself.

Metrorrhagia must be distinguished from the frequently recurring bleeding which is due to hyperfunction of the ovaries. Here the interval may be one or two weeks, the graafian follicles ripening immaturely and forming abortive types of corpora lutea. If the ovaries in such cases be examined, there will be seen many ill-developed yellow bodies much smaller than the normal structure. A true metrorrhagia will be caused by an ulcerating carcinoma, or polypus or, exceptionally, by acute uterine and adnexal inflammation. The bleeding following amenorrhea of shorter or longer duration will, in the preclimacteric age, as a rule, be attributed to the pathological changes in the gravid state. When molimena occur, they favor the true menstrual type, as they may occur just before the bleeding that corresponds closest to the normal. Thus, if a patient begins to bleed irregularly so that the normal periodicity is no longer maintained, the pathological menses will be differentiated from the normal by the occurrence of the well-known molimena.

Occasionally menorrhagia can be traced to overexertion prior to and

during the onset or course of the period. Great mental strain, sexual excitement and exceptionally marked asthenia may be responsible for the excessive menstrual flow. These factors may act by increasing pelvic hyperemia, by altering the qualitative function of the ovaries or, as in the asthenic conditions, by sharing the weakness that is probably ascribable to the other endocrine organs. Perhaps a greater friability of blood-vessels in the latter condition and weakened musculature, both of the uterus and of the vessels (hyaline degeneration), coöperate to bring about the increased bleeding.

Direct trauma may cause bleeding outside the menstrual period. Unless the trauma is severe, bleeding only occurs when some condition exists which predisposes the patient to bleed. Thus, for example, when bleeding is due to coitus, to vaginal douching, or to digital examination, there is present, as a rule, some ulceration or some erosion in the genital canal. In coitus, there is the added factor of increased congestion. Particularly is this the case in the presence of carcinoma. For this reason, bleeding following cohabitation is of pathognomonic significance in carcinoma of the uterus or vagina. Winter and Neumann estimated that, in at least 60 per cent of cases, carcinoma is present when bleeding follows intercourse.

Similarly bleeding following vaginal examination is suggestive of carcinoma. When the lesion is not apparent in the vagina or on the cervix, it is not difficult to substantiate this surmise by inspection with the aid of the speculum and the passing of a sound into the uterine cavity. Brisk bleeding following the introduction of the sound, particularly when irregularities, stenoses and grating are elicited, make the diagnosis of carcinoma very probable. While well-developed carcinoma of the portio vaginalis may almost always be diagnosed without resort to the microscope, corporeal carcinoma and many cervical carcinomata may only be diagnosticated by histological examination of curettings.

Indirect trauma may also cause increased uterine bleeding, for example, lifting heavy objects. Similarly, long hours at work and lack of rest or fatigue cause pelvic vascular stasis in cases where there has previously existed a congested mucous membrane, an erosion or ulceration or in the presence of the delicate blood-vessels of a young ovum. As to the last-named condition, it has been my impression that the injury may be primarily in the ovary, the increased congestion causing hemorrhage into the corpus luteum of pregnancy or its actual dislodgment. It is this hypothesis which perhaps best explains the bleeding incident to early gravidity and in which coitus plays the traumatic rôle. Habitual abortions in newly married women with no evidence of luetic or other constitutional disease are, perhaps in the majority of cases, traceable to excessive coitus with its attendant hyperemia and mechanical dislodgment of the corpus luteum verum. Since the yellow body contains a substance that enhances blood coagulation, the corpus luteum of pregnancy inhibits bleeding. When, therefore, it becomes destroyed, bleeding sets in from the delicate vessels of the decidua. In all probability also, ferment substances form in the decidua which are lytic to the young blood capillaries.

But indirect trauma can cause bleeding only in tissues which are predis-

posed by ulceration, erosion or inflammation. Very occasionally uterine hemorrhage or increased uterine bleeding follows nervous shock or fright. If these occur soon after the period is ended or just at its close, it may take on renewed activity, sometimes appearing profusely enough to be called a hemorrhage. The explanation probably is that this takes place through sympathetic shock or irritation causing increased vasodilatation. The parts that are most predisposed exhibit the brunt of this disturbance. The same may be said, for example, when epistaxis or hemoptysis occurs. In either case, there is some underlying condition predisposing to the hemorrhage consequent upon increased blood tension or vasodilatation of the local blood-vessels. Depressions of a psychic type, while associated with uterine hemorrhage, may be due to the same alteration, in an endocrine sense, as the bleeding itself.

Bleeding after the menopause is established always denotes the presence of some disease in the uterus or vagina. The ovaries no longer exert a trophic influence and their genetic importance may no longer be considered after the menopause. This, however, may only be considered as having set in when the constitutional changes and symptoms characteristic of this period have manifested themselves, and periods must have ceased for at least six months. For, in many individuals, the climacterium is preceded by periods of amenorrhea varying in duration from six weeks to three months. During such time, a tardy graafian follicle still ripens and the menses set in upon the failure of pregnancy to take place. It need only be recalled here that, as long as the menses occur, even late in life (for example, the fifth or sixth decade), pregnancy is still possible, proving that the ovarian function and, hence, corpus luteum formation also occur.

Another cause of bleeding in the menopause is a necrotic ulcerating uterine polypus—the adenomatous or the fibromyomatous (submucous) type. Hematometra of senility is another cause. Here the blood is not discharged, due to senile synechia of the cervical canal. The last normal menses may have been retained by a synechia partly involutional and partly inflammatory. Increased intra-uterine tension causes dilatation of the stricture and the bleeding becomes apparent. As a rule, there is an obtruding polypus with necrosis and bleeding. In many cases of pyometra, the bleeding is due to an inflammatory process of the corporeal endometrium.

In a few cases of individuals with arteriosclerosis, hemorrhage from the uterus takes place in the postmenopause state, without any of the other conditions being demonstrable. It is only when this is the case that one may ascribe the bleeding to the arteriosclerosis, that is, apoplexia uteri.

Chorio-epithelioma, although usually occurring in the childbearing period, may not infrequently be encountered after the menopause. It is characterized by most intense hemorrhages, to which Vineberg has called attention. A previous history of abortion or hydatid mole is pathognomonic of this type of growth. While the time of the menses is always unfavorable for an examination to be made, it may offer the best and perhaps the only opportunity to detect a cervical or fundal polypus as the cause of abnormal bleeding.

During the menstrual period, the polypus may be seen protruding from the external os, or it may be palpable to the finger.

A dilated external os with thin cervix lips should suggest the presence of a cervical polypus or a polypus that arises from the corpus, one that is making its way down through the dilated internal os. Uterine colic is often experienced by these patients and clots are passed at the same time. The appearance of the portio vaginalis, with its dilated external os and a dark shadow in its depth, presents a picture distinctive of this condition. An endophytic cervical cancer may balloon out the cervix, but the irregularity of the cervix lips and their infiltration will readily distinguish the malignant from the benign new growth. The polypus may readily be grasped with the ring clamp (ovarian forceps) and brought down far enough so that its pedicle and even its attachment may be seen. The carcinoma cannot be seized with forceps because it is friable, the infiltration is broad and it has no pedicle.

Bleeding from erosions of the cervix is not so common; the papillary variety may ooze, if rubbed. The douche tip, when awkwardly introduced, may also cause slight bleeding. Wounds made by pessaries, particularly after these are removed, bleed for several days, depending upon the depth and extent of the ulceration.

Bleeding from the vagina is due, in the vast majority of cases, to injury. Coitus is a rare cause of vaginal injury; the tears occasioned are readily recognized. Other causes are carcinoma, sarcoma, gummata and decubitus ulcers. Senile macular colpitis predisposes to bleeding on contact with finger or instrument or after coitus.

In the vast majority of cases, irregular bleeding is properly identified by the patient as issuing from the vagina. Occasionally when the bleeding from bladder or rectum is sporadic and perhaps slight, she may confuse it with genital bleeding. The reverse is also true; the urine may be thought to be bloody although, in reality, it was due to contamination with blood in the vagina. How frequently this actually happens during menses is readily appreciated by any one examining the urine of a patient during her menses. These occurrences will not give rise to difficulty in the mind of the physician, since careful anamnestic questions will serve to locate the bleeding. The use of the catheter in cases of doubt and the examination of the rectum (proctoscopy) or the inspection of the stools will surely clear up the diagnosis.

Bleeding from the portio vaginalis arises from the presence of carcinoma, sarcoma and ulcerations (tubercular, syphilitic, corrosive and decubitus). Occasionally a mucous polypus, arising from the portio vaginalis, causes bleeding. In the presence of such a polypus, however, one should make certain that there is no cause deeper in the cervix or in the uterus, because the polypus may be entirely innocent. It may be well to mention here that, where one polypus is visible protruding from the cervical canal, there are probably others higher up. The endometrium in such cases is the seat of a well-marked hyperplasia, throwing the mucosa into polypoid folds, a process formerly called "endometritis fungosa," and by some still referred to as "uterine adenoids." It will not surprise one to observe recurrence of the

bleeding in spite of the removal of a polypus of the cervix or portio vaginalis. This should lead to close observation of the patient for malignant uterine growth.

Bleeding from the external genitals follows some sort of trauma as a rule. The patient herself can recognize the bleeding point. She usually states that there has been some injury, by a sharp object or as a result of a fall. Coitus causes laceration of the hymen which, being very vascular, may bleed profusely. Brutal coitus or awkwardness may cause bleeding from the urethral orifice and even the perineum. For this, however, marked disproportion of the organs and severe manipulation are required. In the gravid state, varices of the vulva may undergo rupture and cause both external bleeding as well as hematomata. This may occur spontaneously. Malignant lesions of the vulva with ulcerations, tubercular or luetic, very infrequently cause bleeding. These are at once recognized by inspection. An edematous urethral caruncle may give rise at times to oozing whether it is injured or not.

In examining the patient, the physician notes with one glance the site of the bleeding from without inwards. If this fails to discover bleeding points, it may be assumed that the bleeding comes from the body of the uterus. A point made by Winter, that the intact cervical mucosa does not bleed, since it does not partake of the cyclical hyperemia to which the corporeal mucosa is subjected monthly, is to be borne in mind. He also pointed out that, for the same reason, a diseased condition of the cervical mucosa (endocervicitis) is not apt to cause bleeding as frequently as a diseased endometrium.

When we come to consider the uterus as the seat of the abnormal bleeding, we arrive at perhaps the most radical departure in modern gynecological interpretation. A score or more years ago we were taught to regard every change in size, consistency and position of the uterus as responsible for abnormal bleeding; for changes in size were supposed to be due to diseased conditions of the uterine wall or of its mucosa, for example, myomata, sarcomata, carcinomata, polypi, chronic metritis, and chronic endometritis. Nor was a small submucous myoma or an early carcinoma to be excluded in the absence of notable uterine enlargement (Figs. 16, 17, 18, 19, 20, 21).

The association of a submucous myoma with an early carcinoma of the uterus is occasionally encountered and the bleeding associated with this combination may, therefore, have a double cause. Such was the case of a woman forty-two years of age who had been bleeding for a number of months. She had been curetted several times. Still hemorrhage continued. On examination the uterus was enlarged and soft; there seemed to be a hard nodule near the fundus, which could be made out on bimanual examination. The sound caused bleeding from the enlarged uterine cavity. Owing to the history, a preliminary curettage was made for diagnostic purposes.

On examination of the curettings, it was found that there was a typical malignant adenoma with early adenocarcinoma. The glands were enormously enlarged and increased in number. This hyperplasia was so marked that
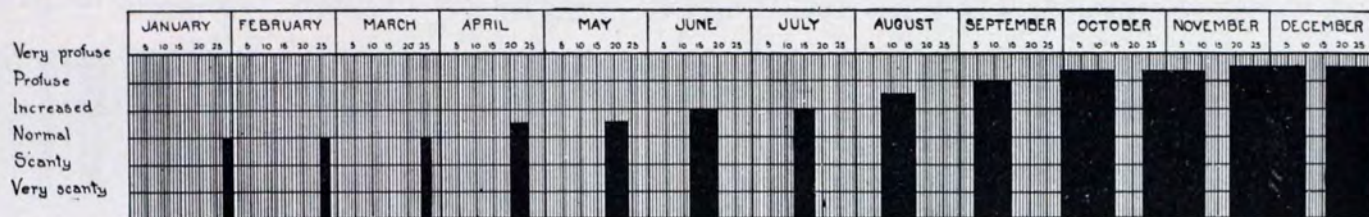
FIG. 16.—MULTIPLE FIBROMYOMATA WITH MENORRHAGIA.
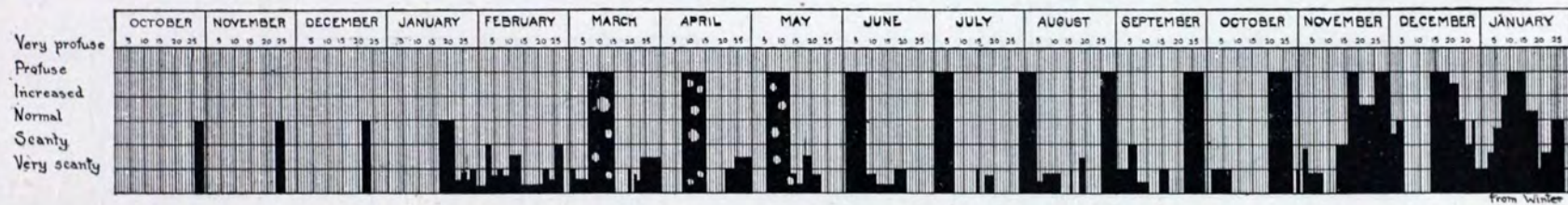
FIG. 17.—SUBMUCOUS MYOMA WITH MENORRHAGIA AND METRORRHAGIA.
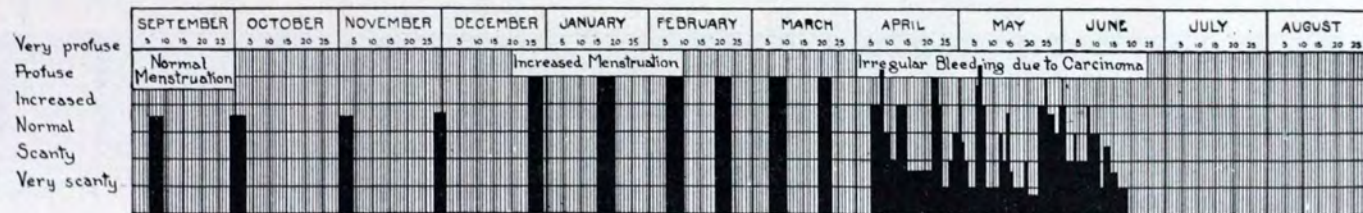
FIG. 18.—CORPOREAL CARCINOMA OF THE UTERUS WITH MENORRHAGIA AND IRREGULAR BLEEDING.
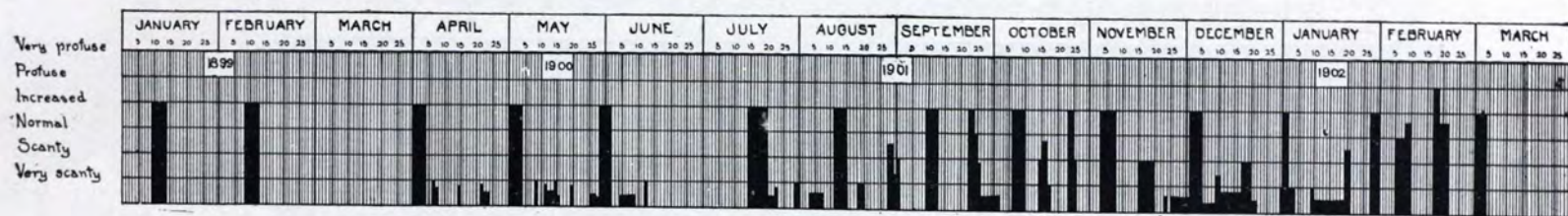
FIG. 19.—MULTIPLE FIBROMYOMATA WITH CARCINOMA OF THE FUNDUS UTERI AS A SECONDARY COMPLICATION. Menorrhagia followed by Metrorrhagia of Carcinoma.
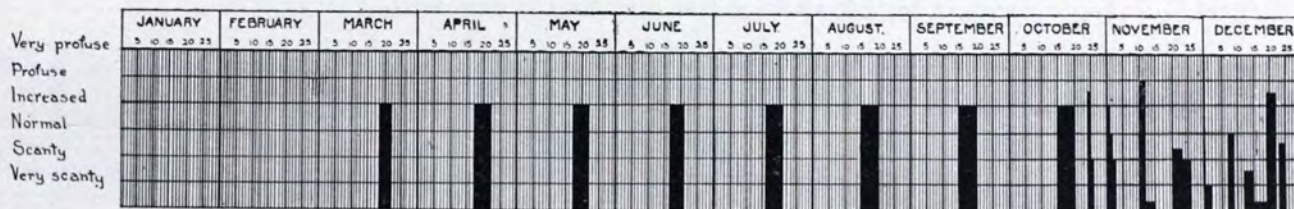
FIG. 20.—MULTIPLE FIBROMYOMATA WITH SECONDARY SARCOMATOUS DEGENERATION. Menorrhagia followed by combination with Menorrhagia.
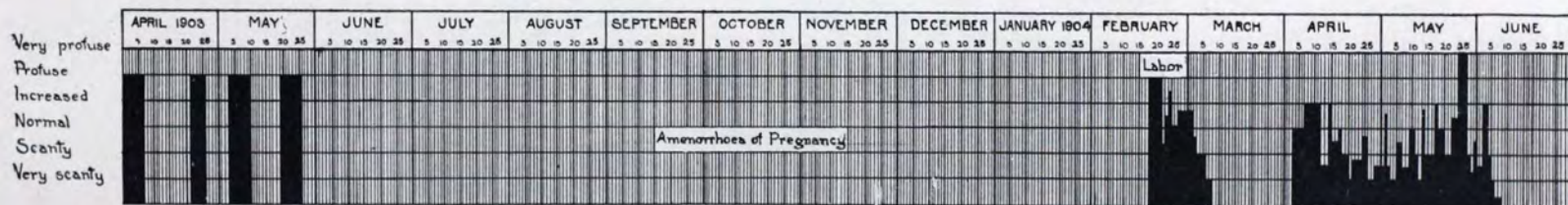
FIG. 21.—INTERSTITIAL FIBROID WITH NECROSIS FOLLOWING LABOR. Menorrhagia followed by amenorrhea of pregnancy. Postpartum bleeding due to necrosis of the fibroid.

the glands lay "dos-a-dos," very little, if any, stroma intervening. There was papillary proliferation of the epithelium within the lumena and also an actual increase in the layers of cells, which were atypical in appearance and showed mitosis. On this finding, a panhysterectomy, modified after Wertheim, was done. The uterus, on section, showed an elongated polypus, about the size of a hickory nut, with its base at the fundus. It showed evidences of curettage. Microscopic examination of this polypus and of the uterine mucosa showed, however, *no area of carcinoma*. It was evident that *all the lesion had been removed by the curet.*

The bleeding, in this case, was in all probability due to the submucous polypus in addition to the very small area of carcinomatous conversion of this polypus.

When, in addition to increase in size, the uterus is also softened, disturbances of pregnancy at once come to mind. Such are deciduitis, placenta prævia, traumatic bleeding and that following incomplete abortion. Subinvolution after abortion and labor, hydatid mole and chorio-epithelioma are other conditions that must be thought of. Retroflexion of the uterus, when acute, as in the puerperium, is said to be the cause of metrorrhagias; and chronic retroflexion is attended by menorrhagia in consequence of disturbances and weakening of the uterus and of its blood-vessels.

Should these three changes in the uterus not be elicited, it is then recommended to probe the uterine cavity by the uterine sound. When no irregularity on the surface mucosa is found, the uterus is said to be healthy. Distortion of the uterine cavity, particularly when it is definitely ascertained to be narrowed, points to a submucous myoma or some malignant neoplasm. In the latter event, the sound is supplemented by a diagnostic curettage.

It is remarkable that, although these conditions were emphasized as the chief causes of abnormal uterine bleeding, it was nevertheless recognized by Winter and others that, in the absence of any such abnormality in position, size or consistency, the cause of the bleeding was then to be sought for in the neighboring structure, that is, in the adnexa, peritoneum and parametrium.

Chief among the causes of secondary uterine bleeding, Winter mentions acute (fresh) and large pyosalpinx which should cause profuse menses, the onset of which antedates the normal period. The same occurs when the tubal inflammation spreads. Chronic tubal disease and chronic "adnexal tumors" were not regarded as causes of secondary uterine bleeding, but as being associated with endometritis.

Irregular uterine bleeding is also associated with tubal pregnancy. This is not observed when the fetus remains alive. As a rule, the bleeding is very slight. However, when the tubal pregnancy is terminated, when tubal mole formation is present, when there is a peritubal hematocele, or retro-uterine hematocele, then persistent bleeding may set in. The blood does not escape from the tube; this would only theoretically be the case were the blood to remain fluid and the uterine ostium very wide. Winter explains this bleeding from the uterus as due to stasis and subinvolution.

In spite of the appreciation of the dependence of the uterus upon ovarian function, changes in the ovaries were not until recently held to be the cause of

uterine bleeding except in rare cases. Ovarian tumors, when bilateral, espe-
cially if they are carcinomata, may cause uterine bleeding in the menopause.
This, however, may be due to a metastasis in the uterus. When the ovarian
tumor is unilateral, it will only very rarely cause secondary uterine bleeding.
Inflammatory ovarian disease may cause uterine bleeding. In acute conditions
of the ovaries, irregular bleeding occasionally appears, while, in chronic
oöphoritis, irregular and prolonged and excessive menses are not infrequent.
Winter, however, ventures the suggestion that whether these are secondary
to the ovarian condition or whether they may be due to an associated endo-
metritis is a matter not so easily settled.

Pelveoperitonitis, acute or chronic, may cause irregular and prolonged
uterine bleeding. This was supposed to be purely "symptomatic." Frequently
bleeding appears in this disease as an initial symptom. When adhesions and
exudates are present, Winter thought that the bleeding was more probably
due to a combination of the peritonitic process with an endometritis. Almost
uniformly in cases of extensive blood accumulation in the peritoneal cavity,
there is associated uterine bleeding which may be present for several weeks
without conforming to any type.

Parametrial disease is very rarely a cause of uterine bleeding. Here,
again, a complicating endometritis was thought to be the primary cause, par-
ticularly when it conformed to the type of menstruation.

In the event that the adnexa may be ruled out as a cause of the bleeding,
and when all else is apparently normal, the case becomes very difficult to
interpret. Here Winter warns against loose hypotheses but seeks to present
only those causes which are plausible and approved by common consensus
of opinion.

In this class of cases are patients who state that they have one severe
hemorrhage without recurrence, and those who describe repeated menorrhagia
with each succeeding period. As Winter remarks, such cases are most com-
monly seen after pregnancy at term or after an abortion. When appearing
after a prolonged amenorrhea, it may also be looked upon as a profuse
menstrual flow. The explanation for a profuse first menses after labor or
abortion is not easily adduced, except that retained fetal membranes and
even placental tissue are thus first discharged. The uterine contents may
thus be expelled without leaving a trace. Neither by sound or finger can
any abnormality then be detected. Here, however, as in most other condi-
tions, the condition of the ovaries must not be lost sight of. It must be
remembered that the corpus luteum is retained until well toward the end
of pregnancy to undergo complete regression in the second month post-
partum. With fetal parts retained in the uterus, the regression of the corpus
luteum may be retarded or hastened. It may undergo cystic or hemorrhagic
change, as it very frequently does in abortion, especially when artificially
induced, and cause at first delayed menses, followed by prolonged or exces-
sive menstruation. The proteolytic effect of the placental rests upon the blood
vessels of the endometrium has been referred to in Chapter VI.

Physical and mental overexertion and strain, for example, fright, expo-
sure to cold, excessive bathing before and during the period, dancing, gym-

nastics, bicycle riding, sexual excitement, hard physical labor, etc., may cause the menses to be profuse. But here, too, it must be recalled that the ovary shares in the disturbed blood supply and would react in its special way, reflexly affecting the bleeding. Following parturition or abortion, the uterine musculature may be insufficient from failure of involution, but a true insufficiency, except in the most marked universal asthenia, is not to be considered except when there has been a true metro-endometritis.

In these cases there may be repeated profuse menses. It would be difficult to conceive of a genuine metritis without the broad ligaments and appendages being also involved. Atony, as seen in and after the third stage of labor, and even in abortion, is not always due to insufficient, pathologically altered uterine musculature. The suddenness with which the uterine cavity becomes dilated bespeaks also for this mechanism a sudden inhibition of its sympathetic innervation. Nor is it conclusive to say that the reason multiparae bleed more profusely at the time of menses than primiparae or nulliparae is because of an associated endometritis or a metritis.

Hyperemia of the uterus may lead to menorrhagia. Here there is an increased filling of the blood-vessels through active or passive congestion. This, in turn, is not infrequently aroused by sexual excitement (in the engaged, premarital, period), cohabitation without complete satisfaction (as in impotence of the male), or in coitus interruptus, coitus condomatus and masturbation. Continual sex thoughts, the reading of suggestive books, hard study and great physical effort, all tend to cause active hyperemia. Passive hyperemia is said to be due to imperfect emptying of the venous blood in the pelvis, due to tight corseting or constipation, pelvic tumors and cardiac and hepatic disease. It need only be recalled that this hyperemia affects the ovaries as well as the uterine lining. This, too, may influence uterine bleeding through qualitative and quantitative alteration in the ovarian secretions.

As was mentioned above, the appearance of the vagina and cervix is evidence of active or passive congestion in the pelvis. Hemorrhoids, when present, indicate more directly the presence of pelvic venous stasis. Menorrhagia, as a result purely of catarrhal vaginitis or cervicitis, can hardly be maintained.

In the absence of all local evidence to account for the bleeding, it is well to examine the more remote causes such as will be found in constitutional or organic diseases. Thus it is well known that the acute infectious diseases may cause menorrhagia as well as metrorrhagia.

1. In influenza, typhoid, cholera, scarlatina, variola, articular rheumatism and malaria, irregular bleeding or excessive menstrual flow will be not infrequently encountered. The cause of the bleeding is direct toxic hemorrhage from the endometrium or indirectly through nutritional and vascular changes in the ovaries.

2. In disease with a universal tendency to bleeding, such as morbus maculosus, hemophilia and scurvy.

3. In stasis of the pelvic veins, as in decompensated heart disease, liver diseases and emphysema of the lungs.

4. In asthenia; whether the bleeding is excessive or prolonged because

of disturbed vasomotor phenomena, or because of a greater friability of the vessels, or both, is not known.

Whether bleeding is excessive or exaggerated by the patient may sometimes be best settled by actual observation. But, in general, clots denote profuse bleeding, and are due to a ruptured vessel from the surface of a polypus or a submucous fibroid or carcinoma. Retention of decidua and fetal parts may cause bleeding and clots. Menstrual blood is a rather thin fluid and most often mixed with mucus. It has a somewhat moldy, slightly offensive odor and is dark red or black. Clot formation is prevented by the uterine secretion. When the bleeding is acute or excessive, it means that a fairly large bleeding point has been laid open because the uterine alkaline secretion is not sufficient to inhibit coagulation. On the contrary, prolonged but slight bleeding, as it occurs in hematocele, is seldom associated with clotting. Muddy brown-red blood from the uterus indicates that it has been retained for a fairly long time and has undergone chemical change. Such is the character of the bleeding associated with ectopic pregnancy and gravidity. A copious admixture of mucus with the blood as a rule denotes an origin from the cervix mucosa, although it may arise from the corpus uteri in association with a hypersecreting endocervix. This is particularly the case in pregnancy. A thickened blood (inspissated) resembling syrup occurs in hematocolpos and hematometra. In this case, clotting is also absent. Tissue particles mixed with the blood speak for disintegrating neoplasms but may also come from degenerating decidua.

CAUSES OF AMENORRHEA

The causes of amenorrhea are often exceedingly obscure. Apart from pregnancy, lactation or castration, the menses may become delayed for several days or weeks at a time without apparent cause. There is very little change in the genital organs in such cases. Inasmuch as every pregnancy in the beginning may theoretically be extra-uterine as well as intra-uterine, one is naturally anxious to establish, if possible, some other cause for the delayed menses. With a history of exposure to cold, wetting the feet, taking a very cold bath shortly before the onset of the menses, one may await the arrival of the menses without necessarily considering pregnancy. Pregnancy cannot be absolutely excluded in such an event, because not every cold exposure leads to suppressed menses. The latter may simply be a coincidence.

It is fanciful to dilate upon the manner in which psychic, emotional influence affects an objective phenomenon, such as menstrual discharge. Two avenues by which this influence must be conducted are open to speculation. The one is the sympathetic nervous system and the other is the effect of the endocrins upon the ovaries and endometrium. Fear may be said to be linked with hyperadrenalism and hyperthyroidism. Increased temporary activity of the adrenals and thyroid is apparently aroused by fear. As these two glands act by inhibiting ovarian, that is, lutein, function, they may produce a delay in the onset of the menses. The lytic ferments which are normally released in the menstrual phase of the endometrium are apparently inhibited

under these circumstances. The absence of ferments in turn precludes bleeding because ordinarily it is through their action that the delicate blood-vessels in the uterine mucosa are opened up. On the other hand, through sympathetic irritation, there may result a vasoconstriction of a marked degree which may further contribute a factor in the delayed menses. Fear may then be assumed to cause transitory amenorrhea which it produces by inhibiting ovarian function, indirectly by way of the sympathetic nervous system, and by stimulating the adrenals and thyroid gland, the normal antagonists of the ovary. In the present state of our knowledge, we may be permitted to submit this explanation for suppressed menses as a result of *fear*. The secretion of the ovaries is held by Aschner and others to be essentially vagotonic, increasing the secretion; hence, this hypothesis would fit in well with the explanation offered, since the sympathetic is its chief antagonist, acting by inhibiting ovarian secretion.

Another factor in the effect of fear upon the phenomenon of menses is perhaps the altered metabolism (Langdon Brown).

An altered condition of the circulation in the pelvis resulting from wetting the feet cannot satisfactorily explain suppressed menses because, if the pelvis is the seat of congestion, bleeding ought to be fostered and even be excessive. Either this does not actually take place as a result of exposure to cold and wet, or there results instead a secondary vasodilatation of the extremities and a vasoconstriction of the pelvis. Through stimulation of the sympathetic, such vasoconstriction of the pelvic vessels occurs together with vasodilatation of the peripheral vessels of the head and the extremities.

While the menses may be temporarily suppressed by some profound shock to the nervous system, not infrequently it happens that irregular or even excessive bleeding is inaugurated by a psychic trauma. The divergence of these effects can best be explained by assuming a different predisposition in patients, on the one hand, and the profoundness of the shock on the other. For example, as has been demonstrated in the paralyzing action of atropin upon the vagus, not only is the inhibitory effect of the vagus upon the heart exerted, but the action of the sympathetic, its normal antagonist, is made more manifest. In a vagotonic individual, however, the vagus may primarily be stimulated by the shock. The sacral autonomic (pelvic visceral parasympathetic) nerve which supplies the ovaries causes greater secretion. Consequently, sudden, unexpected hemorrhage may occur—a phenomenon noticed in some women under extraordinary psychic agitation.

Scanty menses (oligomenorrhea) is but another expression of this same nervous and endocrine action. Quite frequently it alternates with amenorrhea and is a sign of an attempt of the economy to adjust the endocrine balance. Very often an amenorrhea of weeks or months sets in after the initial onset of the menses. In a limited number of women, the menstrual onset is delayed until well on to the eighteenth or even twentieth year.

In this country where the general average would be somewhere from about thirteen and one half to fourteen years, any case in which the menses is delayed till the eighteenth or nineteenth year must be regarded as abnormal. A young woman, eighteen and one half years of age, weighing one

hundred and sixty-five pounds, although only five feet three inches in height, complained of severe headaches, occasional abdominal pains and the total absence of menses. Her face was flushed, the abdomen was very adipose and pendulous, hanging over the upper portion of the thighs. On examination, evidences of masturbation were present, the vagina admitting two fingers. The uterus was definitely palpable and appeared to be somewhat small. On the right side of it was a globular mass as large as a fetal head, having a wide range of mobility which permitted its displacement into the upper half of the abdominal cavity. The tumor was firm in consistence, gave the impression of being heavy and was semicystic. The diagnosis of dermoid cyst of the right ovary in a subject suffering from Fröhlich's syndrome was made. This patient under observation proved to have a well-marked glycosuria and developed widespread furunculosis.

Similarly the cessation of menses may set in prematurely. An amenorrhea may first be observed in the thirty-fifth or thirty-sixth year and lead the patient to ask whether she has entered upon the "change of life," a question not easily answered. While amenorrhea at the average age for the onset of menses is to be accounted for by some ascertainable abnormality, this cannot be said of the premature climacterium. A very important factor is fear of impregnation. The loss of the menses, to them a natural landmark which guides them in this respect, and the fear of premature senility with its attendant changes, perhaps act indirectly further to delay the menses.

When a period of amenorrhea of several months occurs during the reproductive period, the patient has uppermost in her thoughts the possibility of pregnancy. After two months, there should be no difficulty in the diagnosis. The presence of climacteric symptoms, for example "flushes," are suggestive of the impending climacterium. Yet women of any age may complain of this symptom during periods of amenorrhea and miss them when the periods are temporarily restored. In cases of doubt, particularly when no such symptoms are present, time is the best and perhaps the only guide as to the proper interpretation. In very young women amenorrhea may set in, as after pelvic tuberculosis and in chronic pulmonary tuberculosis. When the menses are absent in early adolescence, the amenorrhea may be absolutely without associated disturbance. Young girls may feel perfectly well; psychically they may even be stimulated from a sense of relief at not being annoyed by repeated menstrual periods. Were it not for their parents, chiefly the mother, who regards this symptom as an omen of some abnormality, these patients would pay no attention to this abnormality. But, as a rule, there are other symptoms such as headaches, frequently noticed in the morning and lasting well into the day; or the headache may manifest itself periodically one or two weeks before the expected time. Very commonly these patients put on weight. Frequently, too, there may be molimena, flashes of heat, lassitude, sleepiness, enlargement of the thyroid, growth of hair over the upper abdomen and on the breasts, thighs and over the lumbosacral region. Pigmentation of the skin is a common sign in these cases. Acne vulgaris and eczema are other accompaniments. The farther away from the age of adolescence, the more marked will the gonadal deprivation symptoms

be, so that in the worst cases the picture will approximate that of the pre-climacteric and climacteric stages. Sterility almost always attends this type of amenorrhea.

Failure of menstruation in the last analysis means failure of combined ovarian function and endometrial function. Whatever agency inhibits or destroys the efficacy of these two organs will result in some form of menstrual disturbance. It will at once be seen that conditions of the tubes may be left out of consideration at this point, because their chief and perhaps sole function is that of an oviduct. Menstruation in the tube is said to occur, but, if it does, it cannot be distinguished from the physiological uterine bleeding. A true decidua or decidua-resembling tissue in the tube has not been observed except in ectopic pregnancy. In several thousand tubes, I have not seen a true decidual reaction of the endosalpinx. But, apart from local causes, there are more remote causes not so easily identified. The amenorrhea may be merely the most prominent symptom, perhaps the earliest, of some systemic disease not yet fully manifested

Primary uterine atrophy is met with in the fetal and infantile type of uterus. No doubt the ovaries are concomitantly atrophic and poorly developed. It is not conceivable that well-developed ovaries exist in connection with a fetal type of uterus or with one whose development has been retarded. The writer has never observed this. When the uterus is but rudimentary, the ovaries may be present, but they will always be atrophic. A mechanical cause of amenorrhea residing in the uterus is complete stenosis. This occasionally follows severe puerperal endometritis and metritis, the application of caustics, trauma induced by too vigorous and careless curettage, with or without attendant infection. Synechia of the cervix not infrequently results from rude handling of the cervix with the sharp curet and as a result of a cervix amputation. When this mechanical cause is responsible for the amenorrhea, three things are practically always ascertainable: (1) the uterus is larger than normal; (2) the sound cannot be introduced into the uterine cavity; (3) molimena are nearly always present. These of course depend upon and betoken the presence of the ovaries. The symptoms consist of drawing pains and even cramps in the hypogastric regions and in the back, which last several days to return every four weeks or perhaps irregularly. The history of previous operative treatment or of postpartum or abortive infection is suggestive. These are the cases that are most gratifying from the therapeutic and prognostic point of view, because the obstruction may be overcome and prompt return of the menses assured.

A woman thirty-eight years old. Fourteen months previous to examination she was curetted for an incomplete abortion. Since then there have been no periods, although, at the usual time of her menses, there were decided molimena. On examination, the uterus was found to be enlarged to about the size of six to seven weeks' gravidity; it was anterior and tense. The external os appeared normal except for scars on either side. The uterine sound met with an obstruction midway between the external and internal os. The patient happened to be suffering from menstrual molimena at the time of the examination. When the obstruction was relieved, immediately there was noticed a

discharge of dark, old, fluid blood, and the sense of bearing down and "drawing" pains in the thighs disappeared.

OÖPHOGENIC AMENORRHEA

Local Ovarian Causes of Amenorrhea.—When there is no local mechanical obstruction to the normal menstrual outflow as is met with in cicatricial stenosis of the cervix, or when there is no atresia of the hymen or the vagina, the true cause of the amenorrhea must be sought in the ovaries (Fig. 22). Not always, however, is this possible to attain. For these organs, though normal, may escape detection by the palpating fingers. On the other hand, small ovaries may be definitely examined in a thin person. Unless decidedly diminished in size, they may not be held as the cause of the amenorrhea, but, when they are distinctly enlarged and the seat of bilateral tumors, they are more apt to cause it. Bilateral dermoids and malignant growths replacing the ovarian parenchyma result also in functional destruction. The same may be said of destructive processes (pyogenic), occasionally due to the gonococcus but more frequently to the streptococcus hemolyticus, arising
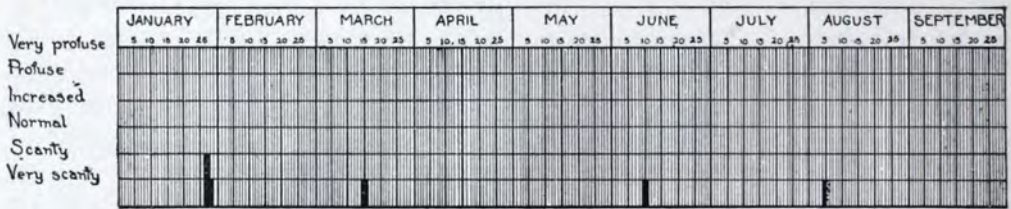
FIG. 22.—AMENORRHEA (FUNCTIONAL) 5 TO 6 OR 7 MONTHS AND SCANTY BLEEDING.

in puerperal sepsis and extensive pelvic exudates. Perhaps the most dismal cases of total amenorrhea are those resulting from pelvic tuberculosis in young women. Occurring most frequently in adolescence and toward the end of the second decade, these young women will give the history of abdominal pains and swelling, fever lasting for weeks and months, general emaciation, then disappearance of the menses—in other words, peritoneal tuberculosis.

The author has observed a patient whose total amenorrhea was due to a destructive process involving the ovaries, which occurs, in some cases, in peritoneal tuberculosis. These symptoms may be preceded by a history of cough, pleurisy, emaciation, and then amenorrhea from secondary extension (hematogenous) into the pelvis. In the early stage of the disease, examination may reveal the change by palpation. If the patient, however, is examined several years after the onset of the amenorrhea, no marked physical change may be elicited because the inflammatory products may be absorbed; only cicatrices and atrophy are found. The uterus in these cases may approximate the normal because, once the secondary sex characters have been developed, the uterus may retain its pre-amenorrhea size. It must not be forgotten, however, that such a uterus may be enlarged through the presence of tubercular endometritis.

When no abnormality is to be found in the pelvis, attention is naturally directed toward more remote causes. But whether these consist of general infections, organic and constitutional disease, including deranged metabolism, poisons or psychic factors, they must act indirectly by causing ovarian atrophy first and uterine atrophy second. When uterine atrophy is thus elicited, it must lead to a search for the etiology elsewhere than in the pelvis.

Among the acute infections, typhoid is most frequently the cause of amenorrhea. In severe cases, destruction of the follicle apparatus by the toxin of the bacillus typhosus may result. In one case, ovarian abscess contained this organism in pure culture for years after the attack of typhoid. The profound toxemia with wasting attendant upon this infection is also a factor that enters into the causation of the amenorrhea. In this connection, it may be well to point out that mumps, which is not an infrequent complication, may be a most important cause. Acute infectious parotitis *per se* is now generally accepted as a cause of ovarian atrophy similar in its action upon the testes. Other infections, such as scarlet fever, cholera morbus, etc., may be the cause of an amenorrhea of varying duration.

Ovular maturation may also be impeded by wasting diseases, for example, chronic pulmonary tuberculosis, severe luetic infection, cachexia incident to carcinoma, leukemia and nephritis. The same may result from diseases of metabolism in which other endocrins play a part; such are myxedema, Basedow's disease, acromegalia, Addison's disease, chlorosis and diabetes. Chronic poisons, such as morphin, opium, mercury, arsenic, phosphorus, alcohol and, in some cases, phenacetin and other coal-tar products, act upon the general nutrition and locally upon the ovaries. Reynolds and others have shown that, in conditions of nutritional deprivation, follicle maturation and corpus luteum formation do not take place. Starvation in the war-stricken zones was a prominent cause of amenorrhea. Lack of proteins, fats and calcium is especially injurious. This may also follow severe hemorrhages as, for example, from the uterus during labor.

Severe psychic influences may be associated with amenorrhea. In these instances, noteworthy associated symptoms are loss of appetite, poor digestion and elimination, faulty metabolism and general bodily starvation. Melancholia or dementia praecox may be the result of some toxic process or perhaps it is based upon a derangement of the endocrine organs in which the thyroid and pituitary play an important rôle.

An interesting cause of amenorrhea is prolonged lactation. This is perhaps best explained by drainage of the albumens and inorganic matter, with a relative state of impoverishment of the tissues, chiefly in calcium content. The lactation atrophy noticed in the uterus is to be observed in the ovaries as well. Yet uterine atrophy may be explained partly on the basis of a continuation of the contractions stimulated by the act of nursing, so noticeable in the first few days postpartum, for it is probably this act which speeds uterine involution. It is well known that women who wean their offspring one or two months postpartum rapidly see a return of the menses. Is it possible that the breast secretion contains in it a hormone which inhibits ovarian function? According to Halban, the secretion of milk sets in only

after the placenta is expelled, although in that gland he recognizes the hormone which stimulates breast activity. During the early weeks of pregnancy, it is the corpus luteum which exercises this influence to be taken over at the end of the second month or at the beginning of the third month by the placenta, which acts as a gland of internal secretion. Is mammin a true hormone which pharmacologically acts as a uterine oxytocic and, at the same time, is inhibitory to the ovaries? On the other hand, gestation and lactation have been shown to affect the pituitary, resulting in a hypertrophy. If this is kept up by prolonged lactation, we have another factor that inhibits ovarian activity and hence causes amenorrhea. For the pituitary and the ovaries are antagonists in the same way that the sympathetic and the vagus counteract each other.

In this way, perhaps, may also be explained the amenorrhea of Fröhlich's syndrome. If the primary lesion is in the pituitary, the hypoplasia of the ovaries is then secondary. The adiposity may be secondary to ovarian activity. On the other hand, obesity of other causes may also result in amenorrhea. Here the thyroid is probably at fault, for the administration of thyroid substance succeeds in reëstablishing the periods. The same result may occasionally be obtained by reduction through modified diet. Here the calcium metabolism, or perhaps iodin metabolism, may be at fault. Possibly, too, the vagus under this altered metabolism may be depressed, leading to depressed ovarian activity.

Amenorrhea associated with urinary fistulae may be explained by the presence of a destructive process resulting from injury and infection which occasioned the fistula formation. A simple traumatic fistula resulting from an operation upon the genitals without a concomitant infection is very difficult otherwise to explain. Many of the fistulae result from operations designed to remove the uterus. The mere fistula with leakage of urine cannot cause amenorrhea by itself.

Perhaps improved methods of studies on metabolism will bring to light blood changes which may explain many cases of obscure amenorrhea.

CHAPTER XII

DYSMENORRHEA AND ITS CAUSES

Dysmenorrhea was formerly confined to the pain occurring at the onset or during the menstrual period. This pain alone is, however, seldom a manifestation of disturbed menstrual function. There are very frequently associated symptoms which reflect a disturbance in the function of the whole constitution. For example, there may be nausea or vomiting, headache, sometimes of migrainous character, salivation, diarrhea, painful swelling of the breasts, the thyroid gland, the liver, the spleen, etc. Indeed, scarcely any organ in the whole body escapes at the time of the menstruation.

The older "mechanical" theory is obviously inadequate to account for the constitutional manifestations. The theory of nervous reflexes would seem to explain the occurrence of the associated symptoms in part, but not entirely. In inner secretory chemical reaction, we find a mechanism that explains a great number of the symptoms. As Aschner well remarks, the two latter ideas will probably serve to enable us to understand why those symptoms occur, particularly in individuals who exhibit the stigmata of constitutional inferiority.

The purely mechanical hypothesis has been abandoned because, on the one hand, dysmenorrhea occurs in cases where there is absolutely no anatomical obstruction to be found, while, on the other, in some very extreme stenoses of the cervix, dysmenorrhea is absent. In certain other instances with faint, scanty bleeding, the dysmenorrhea may be intense, while again, in the same individual, dysmenorrhea may alternate with a normal painless period. In other cases of infantilism of the genitals, there may be associated inflammatory conditions of the adnexa, of the uterine mucosa and of the parametrium. Increased hyperemia at the time of menstruation, and just preceding it, may cause pain. Moreover, there may result, through inflammation, a pathological reduction of the coagulability of the menstrual blood leading to uterine colic.

The nervous theory of dysmenorrhea is held to account for a number of symptoms which are supposed to reflect a form of hysteria. These are individuals who are either infantile and asthenic, according to Mathes, or are wanting in constitutional organization. Such failure in constitutional development may be expressed by chlorosis, status hypoplasticus, obesity, Basedow's disease, etc. Mathes lays great stress upon the asthenic nature of dysmenorrhea. He described certain sensitive spots in the abdomen, associated with all forms of dysmenorrhea, which he ascribes to a hyperesthesia of the sympathetic nervous system. Be this as it may, this theory cannot account for the swelling of the spleen and liver, for the disturbances in met-

abolism, blood changes and skin exanthemata which indicate a sort of menstrual toxemia.

According to Aschner, the vagus, particularly its pelvic branch, is in a state of irritability at the time of menstruation, for it has been demonstrated that small doses of atropin excite, while larger doses paralyze uterine con-
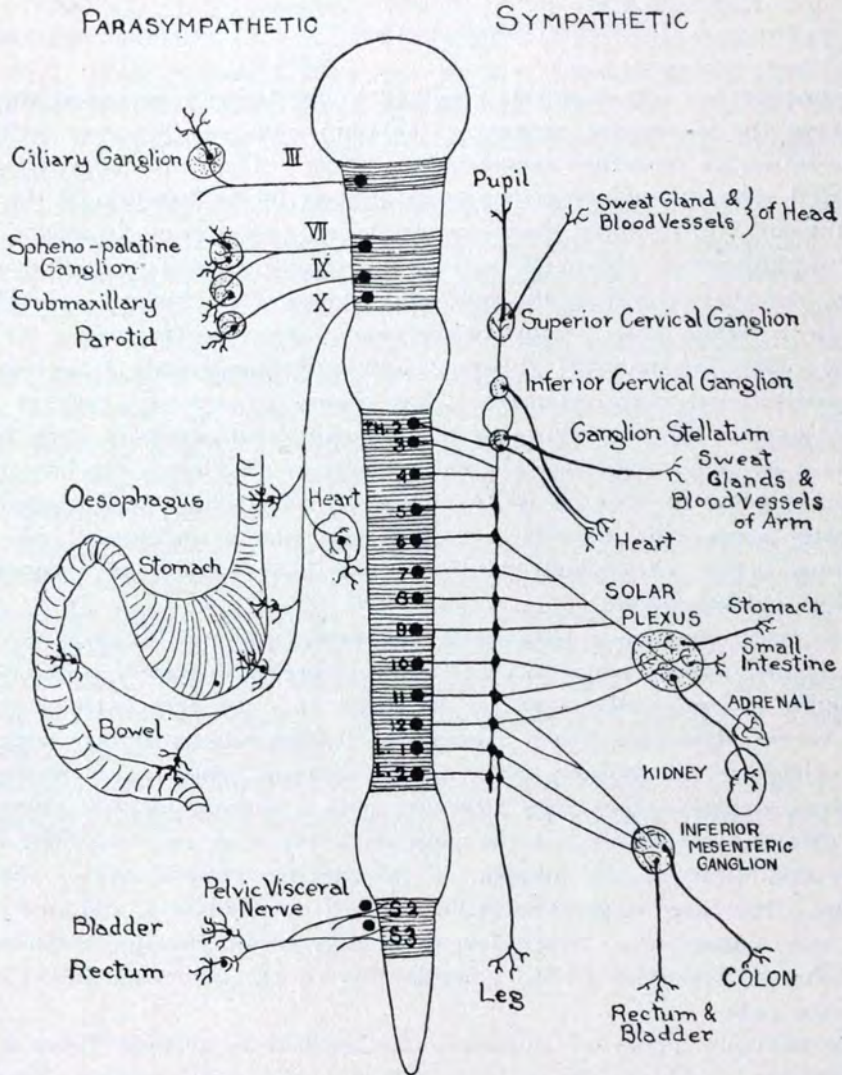
FIG. 23.—SCHEME OF THE AUTONOMIC NERVOUS SYSTEM (Langley).

tractions (Fig. 23). This finding of Kehrer's was applied therapeutically by Drenckhahn who recommended the use of atropin to quiet the uterine contractions. Novak arrived at the same conclusion by observing the bradycardia and arhythmia in the puerperium. These patients were precisely the ones who had suffered from dysmenorrhea prior to their pregnancy. Hence Novak deduced that dysmenorrhea was associated with an increased excitability of the autonomic nervous system which would, therefore, yield to atropin

treatment. The atropin may be applied locally to the cervical canal, as recommended by Drenckhahn, or by internal administration or suppository, as recommended by Novak. In women who vomited during the period, Adler treated the dysmenorrhea by the subcutaneous injections of atropin. This, however, is helpful in cases in which there are no inflammatory processes. Adler pointed out that with this treatment one can achieve success only in individuals with vagotonia. In women with increased sympatheticotonia, atropin fails.

But, as Aschner states, neither Novak nor Drenckhahn hit upon the point that these symptoms at the time of menstruation must, like all menstrual symptoms, depend upon normal or pathological function of the ovaries.

Does the reduced coagulability of the menstrual blood depend upon the secretory substances emanating from the ovary? Where dysmenorrheal membranes are formed, there is not only a faulty ovarian secretion inhibiting the coagulability of the menstrual blood, but the tryptic ferments are also missing in the uterine mucosa so that the normal decidua, instead of being "dissolved" into microscopic particles, is cast off in the form of membranous shreds. *Both these functions, namely, (1) the production of substances which reduce the coagulability of the blood, and (2) tryptic ferments in the uterine mucosa, are dependent upon ovarian activity, and hence they may play a rôle in the origin of the dysmenorrhea.*

Whether this disturbance in ovarian function is one of hypofunction, hyperfunction or dysfunction is not yet settled. Should it be possible to bring about an improvement in the symptoms of dysmenorrhea through the use of ovarian extracts, as has been reported in a number of cases, it would point to hypofunction. It is possible that, in many cases of dysmenorrhea, the individuals are hypoplastic; therefore, one may speak of hypofunction because of underdeveloped ovaries which they may be assumed to have. In other cases in which there is profuse bleeding, one may assume that there is a hyperfunction and, as the ovarian secretion is vagotonic in its effect, the increased irritability of the autonomic nervous system in dysmenorrhea is due to an overfunction of the ovaries. In these cases atropin would be valuable. In hypofunction of the ovaries, there should be increased sympathetic irritation; hence atropin would be of no avail.

The difference in the coagulability of the menstrual blood as well as that in the general circulation obtains as it does in other organ systems, under many conditions of irritation, so that now one may speak of an overfunction and again of an underfunction. There is also said to be an antagonism in the various components of the ovarian substance, particularly between the follicles and the corpus luteum. French authors believe that the symptoms of dysmenorrhea, as well as the "menstrual toxemia," are produced by the corpus luteum (Bouin, Ancel, Villemin). These views, however, have not been substantiated by anatomical evidence nor by organotherapeutic measures.

There does appear to be a sort of menstrual intoxication in the same sense as there is a pregnancy toxicosis, because of the systemic symptoms that are often associated with normal as well as pathological menstruation. It

is better perhaps for practical purposes, therefore, to speak of a dysfunction of the ovary associated with dysmenorrhea.

The very common occurrence of associated symptoms, even in normal menstruation (M. Tobler states that only 16 per cent of women are free of symptoms before or during the menstrual flow), leads us to assume that there occurs a flooding of the organism with "toxic" substances which not only stimulate the internal secretory organs but also affect the whole organism. Thus, these women complain of headache and neuralgia, pains or cramps in the abdomen, drawing pains in the back and lower abdomen which radiate down the thighs. When these symptoms are intense, they may assume the type in which there is nausea and vomiting and lassitude which cause the patient to keep to bed; while in women with lessened resistance, these symptoms naturally assume graver proportions. The chief local genital symptom is colic, which is due to spasmodic uterine contraction and occurs especially in individuals with increased hypersensitiveness. For the uterus which is normally insensitive may, under pathological circumstances, become very tender through vagotonia, in the same way as has been observed in intestinal and heart diseases.

A factor in dysmenorrhea is the change in the coagulability of menstrual blood. The calcium content of the blood has been declared by Blair Bell to be increased during menses, while Adler, Hartmann and Grigoriu deny that there is any alteration in the coagulation time of the blood. The alkalinity of the blood has been maintained by some to be reduced during the menstrual period, and before the menses by others. The acidosis thus produced may account for some of the symptoms. According to some, the cellular elements of the blood show certain changes, from an increase in the erythrocytes before the menses to a reduction by 1,000,000 per c.mm. on the fourth or fifth menstrual day. Hyperleukocytosis and eosinophilia are said to occur in the premenstrual state. The lymphocytes are also increased, a fact which corroborates Heinmann's finding of a mononucleosis in ovarian disturbances. But it is obvious that these changes in the blood picture may not be explained by the loss in blood during the menstrual period, because this amounts to only 100 or 200 grams distributed over three to five days.

It is possible that pain in the "pit" of the stomach may be accounted for by the swelling of the spleen during the menstrual period, partly also by the swelling of the liver which has been described by Niemeyer, Frerichs, Senator and Quincke. Chvostek was able to demonstrate this by percussion and palpation and stated that it was due to the products of the internal secretions of the ovary. The occurrence of menstrual icterus is to be accounted for in some cases by the swelling of the liver. It is in these cases that the tendency to biliary colic is increased when gall-stones are known to be present.

The well-known thyroid swelling is due to the reaction of that gland to the ovarian hormones which circulate in the blood (Freund, Halban, Klein and others). The other internal secretory glands appear also to be affected by the menstruation. The lipoid content of the blood, according to Neumann and Hermann, is somewhat reduced during menstruation. In the general

metabolism, the changes noted are nitrogen retention, greater urinary excretion, increased oxygen need, etc. Furthermore, increased blood-pressure is noted in the premenstrual period, while the general muscular strength is reduced. The temperature is inclined to rise during this period. Individuals ill from other diseases, as for example tuberculosis, are more liable to suffer exacerbation at this time.

The breast reacts markedly to the ovarian secretions. Halban speaks of it as a growth impulse directed from the ovaries. There is frequent swelling and tenderness of the breasts before or during the menses, and increased erectility of the nipples and colostrum secretion during menses, even in virgins. In place of the menstruation, there may be periodic milk secretion or vicarious bleeding from the breasts.

The toxicity of the blood during menses is suggested by the disturbances noted in nursing infants during the menstrual period. In addition, bleeding from the gums, anginas, herpes, swelling of the parotids, colitis membranacea, appendicitis or biliary colic are prone to occur. Diarrheas may occur periodically but, when already present, become worse during the period.

There is a tendency to epistaxis and increased secretion because of hyperemia of the nasal mucosa. The vocal cords become swollen (as in pregnancy) and give rise to asthmatic attacks (sexual asthma). The rise in temperature during the premenstruum and the menses is both diagnostic as well as prognostic in tuberculosis. In general it means a reduction in the tuberculin opsonins (Turban, Murland).

As in gestation toxicosis, there appears to be a tendency toward skin eruptions. Mathes, Friedeberg and others speak of this as "dermatitis symmetrica dysmenorrhoica." Thus the herpetiform eruption has a symmetrical distribution, indicating that the ovarian toxins attack the peripheral nerves or the vasomotors or perhaps the blood-vessels themselves.

Anomalous blood distribution, of turgor, of sebaceous and sweat secretions, of pigmentation, etc., must in all certainty depend upon the reactions of the inner secretory glands upon the vegetative nervous system and especially of the gonads upon the latter. Menstrual edema (toxic and nervous—vasomotor) herpes, urticaria, erythema, eczema, even cutaneous hemorrhages through the action of the "menstrual toxins" are naturally to be expected in individuals with inferior constitutions.

Even bones and joints (intermittent joint swelling) may result through "menstrual toxins." Bone marrow reacts by a marked hyperemia to these same toxins with a "washing out" of its cellular elements. The general blood picture during menses makes this fact probable.

The eyes may show inflammatory changes, even hemorrhages, as well as functional disturbances of all their parts, as a result of pathological menstruation or as a vicarious manifestation. In certain cases of menorrhagia in young women who have scant pigment of the iris, there is a strong tendency to cataract formation. Aschner calls attention to this combination and reminds us of the lens cloudiness obtained experimentally by extirpating the parathyroids. So far the ovarian cause of this lesion has not been stressed so that no therapeutic results have been obtained.

The same holds for the sense of hearing to a lesser extent. Here there are also periodically recurring inflammatory processes, nerve affections, and also vicarious bleeding.

Menstruation psychoses cannot better be explained than upon the basis of toxic symptoms. Epileptic, hysterical, manic and melancholic conditions return at these periods as a rule in neuropathic individuals; or, where psychoses already exist, they are apt to be aggravated during menstruation. On the other hand, the menses are often absent in mental disorders, to return when improvement takes place. The peripheral nervous system is also liable to suffer because neuralgias are not uncommon.

The relationship between the nasal mucosa and the genitals was emphasized by Fliess. There appears to be a more intimate connection between these organs than the reflex action of certain affections of the genitals upon other organs and vice versa. For example, cough and asthma, salivation, disturbances of the sense of smell, spasm of the glottis, etc., have long since been described. In none of these instances is the reflex action so frequent or so intense. From comparative anatomy and embryology there appears to be sufficient evidence to point to a rational basis for the relief obtained by Fliess treatment, in the more intimate relationship between the nasal mucosa and the genitals. For the innervation of the nose (trigeminus, olfactory and perhaps part of the vagus branches) arises from that part of the original brain, that is, the anterior portion of the brain stem, which recent research has established as important for the function of the gonads.

In the lower animals there is a very noticeable hyperemia of the face and swelling of the nasal mucosa at time of heat. In women there is not infrequently nasal bleeding at the time of menstruation or, instead of it, vicarious menstruation. Whether this reflex action is accomplished via the nervous system, or, what is more plausible, via some chemical action issuing from ovarian activity, has so far not been settled. Koblanck and Roder succeeded in producing a condition of infantilism of the genitals in young dogs in whom they removed the lower nasal turbinates. These results, if substantiated, would prove of practical value.

Meanwhile, there do seem to be undoubted cases of dysmenorrhea which have been benefited by cocainization or cauterization of the nasal mucosa (Brettauer and Mayer). Amann is said to have noticed that the uterus gets paler after applying cocain to the nasal mucosa. Kermauner explains this on the basis of a reflex process in the autonomic nervous system which brings the nose and the genitals into some relationship. Painful menstruation is apt to occur in women who appear to have an abnormal irritability (increased tonicity) of the vegetative nervous system. Modern research has pointed more and more to the close interrelation between inner secretory processes and the avenue of interchange, between augmented or pathological ovarian secretion and augmented irritability, sensitiveness and abnormal secretory conditions in the genital "sphere." This relation can be disturbed especially in individuals who are constitutionally inferior, in women who display hysteria, vagotonia or who show the asthenic-enteroptotic habitus, status hypoplasticus, chlorosis, infantilism, etc. The disturbed effects upon all the organs

of the body, due to a pathological change (heightening) of the reciprocal reactions between the ovaries and the nervous system, may be numerous.

Not only does this explanation hold for the general symptoms that accompany dysmenorrhea, but it also accounts for the local symptoms. It should not be difficult to imagine that the disturbances in blood coagulation, in mucosal separation and desiccation, as well as the colics and pains, should emanate from a disturbed chemical state in the ovary and through it a disturbed innervation be brought about. This disturbance is sufficient to arouse abnormal peristalsis in smooth muscle of hollow organs elsewhere in the body; therefore, we need not seek for complicated explanations for the uterine colic.

The psychic disturbances of dysmenorrhea affect individuals of neuropathic tendency. It has long been observed that marriage and pregnancy often tend to relieve the condition.

The therapy of dysmenorrhea should, therefore, be directed along two lines: (1) measures that will influence the vegetative nervous system; and (2) those that will affect the inner secretory processes. French authors have employed lutein and ovarian extracts, also thyroid tablets, the latter with the view of neutralizing the "menstrual toxemia." These substances were said to be followed by favorable results. On the other hand, pituitrin was given by Hofstätter on the ground that the dysmenorrhea is occasioned by a too mild ovarian activity and muscular insufficiency of the uterus. In none of the eleven cases in which this was used did he see any undisputed results. G. Klein employed adrenalin on the theory that where the uterine mucosa is hypertrophic, especially in young women, he would produce an anemia and therefore relief. In cases of atrophic mucosa, he obtained good results with pituitrin. Franz Lehmann saw good results from the use of pituitrin in cases of pruritus and menstrual herpes and claims his results prove that this substance stimulates ovarian hormones. Ovarian extracts are said to be followed by favorable results in cases of dysmenorrhea. The associated symptoms, such as drawing pains in the thighs and pains in the lower abdomen, are said to be relieved by the use of this ovarian extract. Kalledey, who used it subcutaneously in twenty-one cases with uniformly good effect, maintains that the ovarian extract diminishes the coagulability of the blood, dilates the blood-vessels of the genital organs as well as increases their hyperemia and succulence at the time of menstruation. He also reports that the use of the subcutaneous injection of the ovarian extracts in his twenty-one cases was followed by pregnancy in all. This remarkable result is one which ought to be confirmed.

Further Analytic Consideration of the Causes of Dysmenorrhea.— Normal menstruation in a healthy woman takes place without evoking painful subjective symptoms. Except for the menstrual flow, the individual would not be aware of the physical changes involved in the process of menstruation. For the premenstrual changes in the uterus, the maturation of the follicle with its rupture and replacement by the formation of the corpus luteum are all physiological processes which arouse no conscious sensations any more than does normal digestion, respiration, the heart action, kidney function, etc.

Perhaps more comparable to normal menstrual flow is normal urination. When the normal processes are disturbed by factors that affect the ovaries, tubes, uterus, nerves and blood-vessels, the menses will be attended by painful sensations varying from pelvic discomfort to excruciating pain which is in turn associated with reflex phenomena on the part of other organs. We then have dysmenorrhea.

The central nervous system, the autonomic nervous system and the blood stream are the avenues of transmission of the impulses from the affected parts whether these arise from mechanical or obstructive causes or from an altered chemical agency produced just before and during the menstrual process. The whole organism may thus be affected and the term dysmenor-rhea may refer to the symptoms complex in which, however, pelvic pain is the chief element. While a great many patients will complain only of pain, others will also lay stress upon associated symptoms, chiefly headache and vomiting. The latter need not be ascribed to the pain occurring reflexly through the parasympathetic system, for the vomiting of early pregnancy occurs without any sensation of pain even in the worst cases of pernicious vomiting. Nor does headache result from pain produced elsewhere in the body than in the head itself. Pains and swelling of the breasts cannot be described as reflexes. We must therefore assume that absorption of some toxic product takes place in the abnormal type of menstruation. What the nature of this toxic product may be, whether it arises in the endometrium primarily or in the corpus luteum or in both, or whether some other endo-crine gland undergoes dysfunction, remains to be determined. The analogy is patent between the qualitatively and quantitatively different thyrotoxin from the normal thyroid secretion. Increased hormonal secretion from other organs, such as the adrenal, have been definitely demonstrated under certain conditions. The results from such excessive output of hormones into the blood stream manifest themselves in various ways. Similarly a dysfunction of the endometrium in the decidual phase or of the corpus luteum in its flowering state (stage of efflorescence), may produce systemic effects which, if they occur at the time of the menstrual period, may be grouped under the term of dysmenorrhea.

Inasmuch as these matters await further study, we are obliged to confine ourselves to an analysis of the causes which produce the chief complaint of the patient—pain. It goes without saying that, being a subjective symp-tom, pain naturally varies in intensity with the disposition or temperament of the patient. While some women may bear pain with but slight, if any, com-plaint, although the physical processes underlying it warrant real suffering, others may appeal for the relief of severe pain when physical examination fails to reveal the slightest alteration in the pelvis that might act as a cause. It is in this latter class of cases that an explanation elsewhere than in the genital organs alone must be sought for.

In considering the ways in which pain of dysmenorrhea may be produced and the time at which it may occur, it is well to recall briefly the stages at which trouble may arise; thus, in the ovary, the approach to the surface and rupture of the graafian follicle. This occurs practically between the

periods, fourteen to sixteen days from the first day of the last preceding period. The ripening of the corpus luteum precedes the menstrual flow by a period extending from at least a week to ten days. Therefore, conditions affecting the ovarian parenchyma or more especially its surface as, for example, when through displacement and circulatory disturbance or through perioöphoritis the process will be interfered with and pain in some degree may be produced.

The endometrium undergoes premenstrual changes from about twelve days to one week before the onset of menses. Increased vascularization in the mucosa—its greater thickening, takes place at this phase. The whole organ is increased in size from hyperemia and decidual reaction in the mucosa. This enlargement may be definitely elicited when one has had the opportunity to compare its size in the resting stage. The swelling of the mucosa begins to disappear with the onset of the menstrual discharge, which is under the influence of the ovaries. Normally all this transpires without noticeable symptoms. Perhaps a sense of fullness in the lower abdomen or a mild bearing-down sensation, a sense of uneasiness in the back or drawing pains in the thighs may be experienced. These are normally borne by the patient without complaint. The patient regards them as normal signs and goes on with her usual activities. This presupposes, however, that her organs are in a healthy condition. There is in this case no inflammatory infiltration in the mucosa, myometrium or perimetrium, and the uterus is normally developed, its size and position are normal, the cervico-uterine angle is not exaggerated, and its cavity is ample. In addition, the chemical composition and behavior of the decidua and its digestive ferments, and the composition, physical characters and quantity of the blood extravasated through the mucosa are normal. Finally, the nervous system must be in a state of normal irritability, the psyche placid and equable. Perhaps of the least importance and yet one not to be neglected is tubal congestion and swelling, particularly when the tubes are the seat of torsions and kinks due to perisalpingitis.

Though the peritoneum and parametrium share in the menstrual congestion, frequently, perhaps normally in many cases, an imperfect decidual reaction takes place on the pelvic peritoneum, upon the omentum and even the appendical serosa, showing the "sympathetic" reaction of these tissues. These processes, however, may be without symptoms and only the peritoneal coat of the organs themselves when affected by pelvic peritonitis will be responsible for pain.

Division of dysmenorrhea into several types, according to whether the pain arises from the ovary, the tubes, the uterus or, in case no pathological evidence is advanced, from the nerves, cannot, strictly speaking, be adhered to, because in many cases all or several of these factors are combined.

By careful bimanual examination, the condition of the genital organs may be ascertained and thus the cause of the dysmenorrhea be made known.

Ovarian causes are chronic oöphoritis, perioöphoritis or ovarian cysts, especially those undergoing torsion or hemorrhage into their capsule. The pain is distinctly lateral—unilateral or bilateral, depending on whether one or both ovaries are affected. The right side is the most frequently involved

and, if occurring for the first time, this fact renders necessary a differential diagnosis from an attack of appendicitis. This difficulty arises particularly in young girls who may not be examined by the vaginal route. The pain may be described as a drawing, sticking, nagging, boring sensation in the side, radiating often to the hips or down the thighs. It may, however, be stationary. True ovarian dysmenorrhea occurs several days before the menses and is the type most liable to be associated with breast swelling, breast pains and tenderness. In the case of ovarian hematoma (follicle hematoma) or hemorrhage into a corpus luteum with possibly cyst formation, the character of the menstrual flow will in most cases be disturbed, that is, they will be delayed or anticipated and the flow is more profuse and prolonged. Removal of the corpus luteum cyst or the twisted pedicle cyst results in relief.

Such was the case of a girl fifteen and one half years of age whose menstruation was always irregular, beginning at thirteen. She had always had severe pains which lasted for two days at the onset of menses, the duration of the flow varying from four to six days. The delay of the menses was frequently as long as three weeks but for the few months previous to examination it was only a week. Patient complained of pain on the right side of the abdomen, dating from the appearance of the last period which was terminated four days previous to examination. On examination by recto-abdominal palpation, an ovarian cyst the size of a tangerine was located on the right side. This proved at the laparotomy to be a corpus luteum cyst. The appendix was normal. It is interesting to note that when the patient was seen three years after her operation she reported that her menses were regular and that there was no longer any dysmenorrhea. Incidentally, her last period was delayed six weeks and this time she proved to be gravid.

Tubal Causes of Dysmenorrhea.—The tubes are capable of contractions, vermicular in character, similar to those of the intestine. Theoretically, the discharged ovum migrates through the tube assisted by the ciliary action and the current of pelvic fluid. It is conceivable that mild contractions of the tubal musculature may assist. This need not be perceptible any more than normal peristalsis is. Only when the contractions become violent, as when attempting to overcome an obstruction and when surrounded by inflammation, will the contractions be recognized as colic. If this actually takes place in the tubes, we should have another explanation of the intermenstrual pain which must otherwise be ascribed to a pathological process involving the rupture of the graafian follicle.

The pain due to tubal disease is also situated on the side. It is less apt to radiate than ovarian pain. When colic is experienced, it is very apt to be a reflex contraction of the uterus. When the tubes are thickened and their lumen obliterated by inspissated mucus or agglutination of the endosalpingium, they become so fixed as to be unable to undergo contractions. In this case the uterus reacts in the same way that the pylorus does, through appendicular, biliary or other reflex irritation.

Pain resulting from tubal distention is admirably witnessed when insufflating the tubes with gas for determining tubal patency. As the tube

distends and contracts similar in manner to other hollow viscera, a sharp pain ending in cramps is felt in the side above Poupart's ligament until the gas is allowed to escape. When one tube alone is present and it is closed at the fimbria extremity, pain attends the insufflation. If the right tube is residual, the pain is on the right side; if the left tube alone remains and is closed, the pain will be felt on the left side. When stricture or incomplete stenosis is present, the same type of pain is felt. It scarcely ever radiates when produced in this way; therefore, we may assume that when caused by contractions, as in dysmenorrhea, the pain is indicative of the point of origin.

The chief cause of pain in dysmenorrhea is produced in the uterus itself. It need only be recalled how powerfully this organ contracts after parturition or abortion, to understand how the contractions that are already perceived by the patient in the latter months of pregnancy as mild pains become the severest cramps which woman experiences during parturition. As soon as the child is born and after expulsion of the placenta, the uterus becomes contracted down to one fourth its previous size. During labor the contractions, starting at first mildly, become increasingly more severe till the product of conception is expelled.

In dysmenorrhea the pains may be so severe as to be compared with labor pains. Not infrequently they appear in rhythmic attacks reminiscent of labor pains. They may, however, only take the form of severe pressure in the middle and depth of the pelvis. Frequently pains extend into the groins. These are due to pulling on the round ligaments, a symptom strikingly present in the latter half of pregnancy.

What are the conditions that predispose to uterine colic or pain during the menses? (1) Faulty development of the uterus. (2) Intra-uterine growths, acting as obstruction, and foreign bodies. (3) Marked angulation and displacements. (4) Changes in the blood coagulability and fluidity. (5) Traumatic and inflammatory cicatrices. (6) Infiltrations of the myometrium and perimetritis.

1. *Faulty Development of the Uterus.*—Small hypoplastic uteri do not yield to the distention incident to menstruation. The uterine cavity is narrow, the blood is usually not fluid, bleeding is scanty and not free. The organ becomes hyperemic without having an adequate avenue of escape for the blood. Dysmenorrhea in these cases is present with the first appearing menses or shortly after the initial onset, that is, during the first year. Pregnancy and labor, if eventually passed through, appear to cure the symptom.

2. *Intra-uterine Growths.*—Submucous myomata may fill the uterine cavity, obstruct the internal os, distend the uterus by increasing bleeding and stimulate it to greater contraction by inducing attempts to expel it and by causing blood-clotting through excessive bleeding. Thus, given a case of multiple "fibroids" with a definite history of dysmenorrhea of a severe grade, it is safe to assume that at least one of the growths is submucous.

3. *Angulations and Displacements.*—Angulations such as acute anteflexion and retroflexion come under the third group. The angulation must be established as real by the failure to pass a sound with a diameter of 2 mm. through

the internal os. The condition is as a rule congenital, but may be the result of inflammatory dislocation. The pain occurs just before the onset of the menses, at the onset or during the first or second day when clots are apt to be passed. These are the cases, however, in which one must be sure one is dealing with otherwise healthy and normal patients without nervous and hysterical tendencies. It is perhaps the most infrequent cause of dysmenorrhea. Operations intended to correct the deformity result only successfully as a relief from the dysmenorrhea in one quarter to one third of the cases, indicating that other factors are present that are responsible for the pain. In the smaller number of successes it is justifiable to conclude that the mechanical obstruction which caused the dysmenorrhea was overcome.

4. *Changes in the Blood Coagulability and Its Fluidity.*—Causes bringing this change about in the uterine mucosa are not local but originate in some constitutional metabolic or endocrine condition. Normally the blood-vessels in the decidua are ruptured by digestive ferments. Clotting is signally inhibited. It is conceivable that perverted corpus luteum action will result in an inhibition of these digestive and tryptic ferments and of the substance which delays coagulation. If an adrenalemia can be demonstrated in such patients, we will have another explanation for increased coagulability since adrenalin not only raises blood-pressure (spasm of the blood-vessels) but also increases blood coagulability. The sympathetic nervous system in these individuals may then be regarded as being in a state of increased irritability (sympatheticotonia) which is heightened at the premenstrual and menstrual phase.

5. *Traumatic and Inflammatory Cicatrices.*—A severe form of dysmenorrhea results from failure of the uterus to expel the menstrual blood through a stenosis more or less complete which has formed as a result of an endocervicitis. Usually there is a history of previous local treatment with caustics or astringents. Cauterization with the Paquelin cautery of the cervical mucosa may also be followed by a synechia. And the same may result after a cervix amputation. This cause is readily elicited by passing the uterine sound and noting its failure to enter the uterine cavity. When the obstruction is overcome, there follows almost immediately an escape of dark, sometimes inspissated blood with prompt relief from the dysmenorrhea, which returns if the stenosis is not permanently overcome.

6. *Myometritis and Perimetritis.*—These may act as a cause of pain during menses because the organ is chronically tender and any condition which increases hyperemia, so well marked in menstruation, will increase the pain. Besides uterine contractions, pull on the perimetritic adhesions may cause reflex viscerosensory pain. Too much importance has been attached to endometritis as a cause of dysmenorrhea. We have learned that its occurrence is relatively rare. An exfoliative endometritis, however, may be associated with intense pain during menses while the decidual membrane is cast off. Here the tryptic ferments, normally present in sufficient amount to cause decidual lysis, are absent and the blood coagulability is increased.

Is there a hyperesthesia of the endometrium without associated pathological change? This does not seem likely. Rather let us presuppose a gen-

eral hyperesthesia of the central and sympathetic nervous systems in which the hypersensitive uterine mucosa also shares.

The introduction of the sound is met with painful response in most cases, but not in all. The pain is appreciated as sticking and sharp and radiates upwards toward the umbilicus from a point immediately above the symphisis pubis. The mucosa at the internal os and of the fundus are the more sensitive areas. Grasping superficially the upper aspect of the anterior cervical lip with a tenaculum forceps will not be appreciatively painful to the patient. If the forceps is closed tightly, pain will be felt momentarily, but not severely enough to cause her to wince. If the outside and the inside of the cervical lip are so grasped, pain is at once felt, showing that the sensory nerve supply is especially abundant at this point. The cervix, however, may be relatively insensitive in cases where the external os is surrounded by eroded, edematous tissue, the result of trauma (laceration). Thus, in one case, I was able to perform an amputation of the cervix without a general anesthetic or a local analgesic. Stretching of the external os is accompanied by pain but not nearly as acute as when the internal os is dilated instrumentally. The gradual dilatation occurring in the first stage of labor gives rise to the bearing down pains and backache; for the uterine contractions cause severe, sharp, sticking pains to radiate across the abdomen, resembling the severe cramps common to intestinal distention from which they may be differentiated by the marked periodicity and the more palpable objective signs elicited from the enlarged uterus.

For there are not infrequently women who, though quite conscious of their pregnant condition in the advanced weeks, nevertheless mistake the onset of labor at term or occurring prematurely for intestinal "gas" cramps.

When no abnormality in the uterus, tubes, ovaries and adjacent structures is found, one seeks the cause of the dysmenorrhea in the nervous system. For physical strain and psychic depression with poor nutrition are frequent causes of dysmenorrhea. Thus, girls or women of the domestic servant type who are confined to the house with long hours of work, very little fresh air and relaxation, factory girls under similar conditions, school or college girls who cram their lessons, or those who are particularly delicate, are particularly liable to suffer from dysmenorrhea. Unrelieved pain may inaugurate a train of associated symptoms which are but an expression of increased nervous irritability from lowered resistance. Naturally, those who have a hereditary predisposition will break down in this respect sooner than normal women and particularly if the family marital relations are unhappy.

ILLUSTRATIVE CASES

Dysmenorrhea and Menorrhagia as a Result of Fibroids; Postoperative Peritonitis with Adhesions

M. S., twenty-seven years old, was admitted May 18, 1921. She had been married one year and had had no pregnancies. Her menses had begun at thirteen years, had been regular every twenty-six days of six days' duration, without much pain until three years before examination, since which

time the pain had been considerable. The patient was operated seven months before at another hospital for a uterine tumor. She had no serious illness. The periods were more profuse the following year; she complained of weakness and of feeling tired. The last period was two weeks before examination.

May 19, 1921. Examination showd the uterus in retroposition, but movable. Behind the uterus and filling the culdesac was a hard, tender, irregular mass which, on recto-abdominal examination, was found to be quite freely movable. The tumor could be pushed up from the pelvis and moved with the uterus. *Diagnosis.*—Pelvic tumor and left-sided diseased adnexa with marked induration. A transuterine insufflation before the operation established the fact of normal tubal patency. In view of this finding, inflammatory disease of the adnexa was ruled out and the diagnosis favored a subserous fibroid.

At operation, May 20, the findings were: intestines adherent to the fundus of the uterus, bladder obscuring the uterus completely until the adhesions were freed, omentum adherent, uterus down in the pelvis with a large fibroid the size of an orange springing from its posterior upper angle; both adnexa free and practically normal.

PREMENSTRUAL DYSMENORRHEA; CLOSED RIGHT TUBE AND STRICTURE OF LEFT TUBE WITH ADHESIONS BETWEEN TUBES AND OVARIES, FOLLOWING HISTORY OF ACUTE APPENDICITIS WITH PELVIC ABCESS TWO YEARS PREVIOUS TO EXAMINATION; DIAGNOSIS OF TUBAL STRICTURES MADE BY TRANSUTERINE INSUFFLATION WITH OXYGEN

S. H. was admitted January 18, 1922. Her menses began at thirteen years, somewhat irregular, occurring five days earlier or later than normal periods, and lasting seven days. Two years previous to examination she had an operation for acute appendicitis with abscess, complicated later by a pelvic abscess. Since then she has complained of pain in the right and left lower quadrant of the abdomen. Recently, dull and intermittent pain became localized in the right lower quadrant. There has been no fever, chills or vomiting. The pain becomes worse for about a week before the menses.

Examination showed the cervix small, the uterus forward, movable and slightly enlarged. On the right side there is an elastic, somewhat fluctuating mass about the size of an orange, which is movable and slightly tender. The left adnexa are slightly thickened and tender. *Diagnosis.*—Diseased adnexa.

A transuterine insufflation test was done previous to the laparotomy; the pressure rose to 160 mm. Hg and fell sharply to 40 mm. Hg, suggesting strictured fallopian tubes.

At laparotomy, the left ovary was found slightly enlarged and there were a few small cysts adherent to the pelvic wall by fine cobweb adhesions. The left tube was closed and constricted at its fimbriated end which, when squeezed, became open and permitted a fine probe to go through to the uterine end. The right ovary was enlarged to about the size of an orange and was cystic. The tube was a hydrosalpinx, the size of a finger and adherent to the pelvic wall. The omentum in the right pelvis was also adherent.

DYSMENORRHEA MEMBRANACEA

M. S., aged thirty years, was admitted November 8, 1920. She had been married ten years and had one child eight years old but no other pregnancies. Her menses had begun at twelve years; they occurred every twenty-eight days, occasionally skipping a period when she suffered from a cold. The last period was October 28. There had been severe dysmenorrhea with each period and especially during the last eight. The patient has always passed a definite membrane on the first day of her period, following which the bleeding becomes very profuse. There has been constant pain in the lumbar region for the past eight years. Two specimens of the decidual cast were examined in the dispensary and at the pathological laboratory.

At operation, November 9, the curettage obtained very small fragments. At laparotomy, the right ovary was found to be one half the size of the left, but denser. The left had a cystic portion occupying two thirds of the ovary. The appendix was distended and adherent by its tip to the cecum.

CHAPTER XIII

STERILITY AND ITS CAUSES

Winter emphasized the clinical importance of considering the sterile marriage itself, since the male element is as important as the female. For the complete study of sterility, therefore, those conditions which bring about this condition in the male partner must be investigated just as thoroughly as in the female. Huhner has enabled us to investigate the adequacy of the sex function of the male in the most direct way. The gynecologist obtains the most direct evidence of the husband's potency by studying the character of the semen deposited in the vagina after coitus. As Huhner has pointed out, the male's part is completely fulfilled when he is able to inseminate the depth of the vagina. Further evidence of his potency is demonstrated when living, motile, well-formed spermatozoa can be seen in the vaginal or cervical secretions or both.

Thus, at one stroke, the male is acquitted of blame for the sterile marriage. He is proved impotent, however, when after several trials there is failure of the seminal evidence in the genital secretions of the female. In this case he may be azoöspermatic, or simply mechanically impotent. This difference may indicate a hopeless or a favorable prognosis as the case may be and further test may be made to determine this fact, but it establishes at once that he is at least partly responsible for the sterility. The establishment of this fact, however, does not justify the exoneration of his mate, because she may be equally at fault. While the investigation of the male may be easily conducted, that of the female is comparatively more difficult and must be more subtle.

It may be worth while to mention that coitus condomatus may be advised to determine the presence of the biological elements in the male sperm. When spermatozoa are abundant in the condom specimen, even though they are repeatedly absent in the vaginal secretions, it is safe to assume that the male is relatively impotent due to some defect in the mechanism of the sex act. This is a matter about which we will not concern ourselves; it should be left to the genito-urinary specialist, who should coöperate with the gynecologist. It is remarkable, however, how little importance can be attached to the wife's estimate of her husband's ability in a sex sense. Most frequently she asserts that the male is very strong and physically fit. The logical conclusion is to exclude him from consideration, but too often the surgeon regrets his reliance on this hearsay evidence when, after performing an operation upon the woman, he finds that her husband has been at fault.

Sterility in the female is considered absolute when there are physical evidences to prove that the patient never could conceive. In the absence of such

evidence, the history of habitual abortions, if these are bona fide and proved by microscopic examination or by first-hand evidence by a competent witness of the passage of an embryo, should cause the woman to be considered *relatively* sterile. It is not often possible to be sure on this point, particularly as the abortion may have taken place at an early period of gestation. But, with the history of a skipped period in an individual otherwise regular in her menses, with subjective symptoms presumptive of pregnancy and the passage of clots with "organized" material, it may be assumed that conception has taken place at least once or twice and that the impregnated ovum has failed to maintain its foothold. In other words, the embedding process is defective and results in early abortion.

Sterility may be further designated as primary when it is absolute; secondary or acquired when it results from infection, operative extirpation or severe trauma. In the last-named instance, the patient, having had one or two children, is prevented from conceiving or carrying through to term by the subsequently acquired, artificial conditions.

An interesting question is the time limit which should be set as marking a sterile marriage. The matter of having children has always been governed by various circumstances not the least of which are extrasexual. Economic stress or economic ease and comfort dictate to a large degree not only the time at which offspring is desired, but also the number of children a married couple feel they can afford to have. Other factors, such as convenience, infelicity in the choice of the mate, incompatibility, ill health, such as cardiac disease or tuberculosis, the prospects of difficult labor, etc., are conditions that may play a most important part in sterility. So that, in gathering general statistics on sterility, if one wishes to set a time limit from a prognostic point of view, it is necessary to go into these marital circumstances.

Perhaps the truest statistics in this respect could be derived from a study of a group, unfortunately not large, in which no attempt at prevention had been practiced from the beginning. For artificial precautions exercise an important influence in many cases upon the mechanism of conception, as may be seen in women who practice contraception after the birth of one child. It comes as a great surprise and even disappointment to many of these women who, having had their first child, after a year or more of precautions, fail to become impregnated a second time. We will consider this class later.

The female genitals not only serve for impregnation, they must also provide for the maintenance of embryonic nutrition and for the birth of the mature fetus. Each part of the genital tract has an essential rôle in one or more of these three functions. When any one of them proves inadequate, sterility may result. The inadequacy may represent no disease in itself but merely a symptom of a variety of diseases involving, perhaps, more remote organs. The task of the physician is to analyze such diseases and evaluate them as causes of the sterility.

GENERAL CONSIDERATIONS CONCERNING THE NORMAL MECHANISM OF CONCEPTION

Normally during coitus the semen is deposited in the deeper part of the vagina. In a complete orgasm, on the part of the female, spermatozoa most probably are ejaculated directly into the external os of the cervix. When disproportion of the sex organs is not appreciable, the vaginal musculature contracts about the penis, the external os and urethral meatus being more or less in apposition. This direct injection of spermatozoa into the cervical canal is, however, not necessary for impregnation as evidenced by countless cases of incomplete cohabitation, cases in which the uterus is so dislocated as to preclude this perfect mechanical coaptation of the parts, and instances of wide-gaping vulva with large cystocele and rectocele where the levators and vaginal sphincters have been crippled.

During normal cohabitation, too, the uterus is probably brought more into the axis of the vagina by voluntary muscular effort on the part of the abdominal muscles and reflex involuntary and voluntary effort on the part of muscles of the pelvic floor. The uterus may be said to be lowered and to approximate the introitus, facilitating insemination. The matter of direct aspiration of the semen into the cervical canal has not been settled. For obvious reasons it must remain open to conjecture. From observations, however, during the ordinary examination, the impression has been gained that the external os can dilate under psychic or physical stimulus. The edge of the lips of the cervix becomes softer, the external os wider, more gaping and, as further evidence of sympathetic stimulation, there is a noticeable increase in cervical secretion. In the healthy state this is viscous, resembling the white of an egg, or saliva. While a true sphincter of the cervix at the external os has not been anatomically and histologically demonstrated, it may, nevertheless, be accepted as occurring physiologically. This is best seen in the first stage of labor when, particularly in certain instances of rigidity, the external os is dilated only partially and is palpated as a tense, sphincterlike ring when in spasm, which yields to antispasmodic measures or to artificial dilatation and trauma. Whether or not the cervix becomes turgid from active hyperemia incident to coitus or only more succulent, the area about the external os appears to be softer. This may be due to edema or relaxation of fine muscle fibers, for it must be remembered that the cervix contains relatively more fibrous tissue than the uterus itself.

Theoretically, then, the most ideal circumstance for fruitful coitus, so far as the reception of spermatozoa is concerned, is direct injection into the cervical canal. The spermatozoa then rapidly make their way upwards into the uterine cavity and also into the tubes, where they meet the ovum. It is difficult to say whether ovular discharge, that is, graafian follicle rupture, takes place in woman at the time of intercourse in a manner similar to its occurrence in lower animals. Were it not a fact that both spermatozoa and ova are known to live for days after being discharged, this matter would be simpler to determine because a single cohabitation would be sufficient from

which to reckon conception. In recent studies on the question of the duration of pregnancy and the favorable time for fruitful coitus to take place, reliance has been placed on well-established instances of a single coitus practiced during the soldier's leave from duty. It has, moreover, been fairly well established that ovulation takes place practically in the middle between two periods. The most favorable time for conception to take place would be at that time. Since it is known that spermatozoa can survive in the uterus and tubes for several days, impregnation may result soon after the ovum is discharged from its follicle. On the other hand, the ovum may survive but a short time in the tube, and become rapidly absorbed if thrown into the peritoneal cavity. In this way can be explained the relatively great infrequency for a fruitful coitus to occur when practiced a short time before the menses.

Practically all observers are agreed that spermatozoön and ovum meet in the fallopian tube. It is doubtful whether any appreciable length of time elapses under normal circumstances between this union and the migration of the impregnated ovum into the uterus where it rapidly becomes embedded. Segmentation probably does not take place except perhaps in the most rudimentary degree in the tube, because if this were the case the incidence of ectopic pregnancy would be greatly increased. The interstitial, intramural portion of the tube is so narrow, being no more than 1 or 2 mm. at most, that an advancing segmented ovum would find it impossible to pass through. From theoretical considerations only, it would seem that the uterine end of the tube lumen with its simple folds of mucosa and lack of a labyrinthian endosalpinx would be the ideal site for impregnation. Surely the uterine cavity itself presents too wide a surface and does not adapt itself as admirably as the tube at its uterine insertion.

Volition on the part of the female, in other words, coöperation on her part, is not altogether essential for conception to take place. Instances of rape, particularly during war time, speak against the importance of psychic or nervous influences, while there are numerous women who have had one or several children without having once experienced libido or orgasm. Nevertheless it must be admitted that there are cases in which conception follows only that particular intercourse which has been attended by the conscious gratification of the sex act. Whether this is because the reception of the spermatozoa is made more easy or complete or because in these individuals the increased amount of secretions overcome an abnormally existing secretion otherwise antagonistic, thereby favoring the activity of the spermatozoa, are matters that may be assumed but must await further proof before definitely stated as fact. How else can one explain pregnancy following one coitus with a second husband, although she may have lived for years with the first husband who may also have given every evidence of potency? Unfortunately this thought leads us into the further speculation of bioserological incompatibility which must be entertained but offers still smaller prospect of explanation. It would certainly be interesting and instructive to know whether libido, all other things being equal, may not play an important part in the sterility or fertility. Perhaps the most trying situation in sterility is

encountered in a married couple, both of whom upon the most careful examination by all the tests so far devised prove to be normal.

It is not difficult to determine the cause when a mechanical barrier exists which militates against physiological conjugation of the sex organs. Thus, when atresia of the external genitals is found, when large tumors obstruct the introitus, when abnormalities exist suggesting hermaphrodism, when atresia of the hymen or extreme vaginismus is present, an obvious cause of sterility is established. To these may be added certain cases of urethral caruncles, which are extremely sensitive, and kraurosis vulvae in women who have married late. Acute or subacute catarrhal processes of the vulva or vagina, or both, which do not permit sexual contact to be completed are other obvious causes.

Of these causes, vaginismus deserves special consideration. There are two types: one favorable, the other less favorable. The first is purely psychic in origin, being based upon fear of injury, particularly when the male is very strong and large and the female more or less delicate. Antenuptial education also plays a part. The spasm in this class of cases can be overcome by reëducation, by encouragement, operative or nonoperative. The less favorable cases of vaginismus are due to increased irritability of the vaginal sphincter as a defense against contact with a vagina which has been rendered tender by a catarrhal process. The altered secretions, moreover, serve to destroy the spermatozoa if partial penetration is eventually achieved.

Relative sterility may be due to extreme lacerations of the perineum and to a gaping vulva, particularly when the bladder comes well down. Possibly the sperm secretion in these cases may not come in any contact with the cervix, either because it is almost immediately discharged, or because the secretions are very apt to be inimical, being altered by exposure. One must not be too willing to lay the blame upon the female genitalia in such a case, because, even in the presence of the most severe deformity resulting from lacerations, pregnancy may ultimately take place. Even in these cases, the husband must be examined for responsibility. Several cases of third degree prolapse have come under my observation where pregnancy was repeatedly carried to term, although shortly after labor the cervix and both vaginal walls were completely prolapsed. The occurrence of such cases makes one think that certain individuals must possess power of fertility to such a remarkable degree as to defy all analysis or speculation. Nevertheless, even in these cases, the favorable factor is probably the absence of catarrhal processes. This absence may be purely accidental or may be based upon the presence of a singular degree of immunity from infection. Conditions of the vagina which cause absolute sterility are: complete absence or atresia and complete stenosis at some point in its canal. Septum of the vagina is a hindrance when cohabitation takes place in the vaginal compartment leading to the blind alley; otherwise it is merely an obstruction at the time of labor. Tumors and cysts of the vagina, if of large size, also hinder the penetration of the penis and hence the proper deposition of the semen.

Conditions of the vagina which act as contributing causes are: too great shortening, thus permitting seminal reflux; too great widening and atony

allowing for faulty insemination; and incomplete stenosis. The latter is not an absolute hindrance to conception but often forms an obstruction to the normal progress of labor. In some cases of short conical vagina, there are other evidences of faulty genital function and development. Let us repeat that probably the most important contributing cause is chronic vaginitis. This condition not only favors the external discharge of the spermatozoa but brings about their destruction by a pathological secretion.

Other conditions contributing to sterility in the female are: marked deformity, such as, great elongation of the vaginal portion of the cervix or large nabothian follicles, the result of trauma and infection. Stenosis of the external os is only a cause of sterility when there is an associated catarrhal process which completes it. Normal spermatozoa require but a very
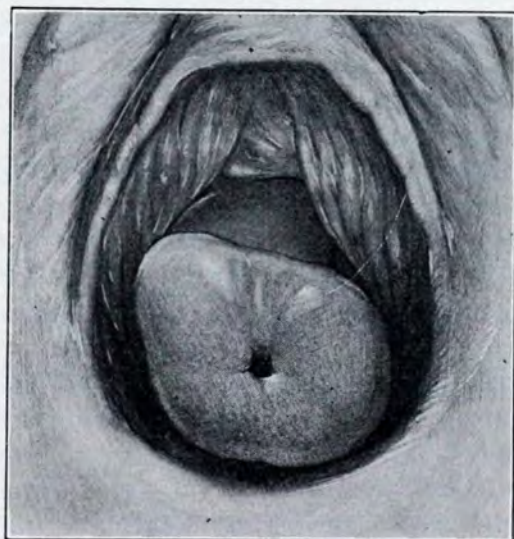

FIG. 24.—A TRUE INFANTILE TYPE OF CERVIX. It is short, lobulated and more or less quadrangular rather than conical. The lateral fornices are particularly shallow and the anterior and posterior fornices relatively shallow.

narrow passage to make their way through to the uterus. One need only recall the narrow lumen of the tube at the uterine ostium to realize this point. It may also be pointed out that the so-called infantile cervix is part only of a general infantilism of the genitals which together militate against conception.

The rôle of the conical cervix has been overestimated (Fig. 24). Formerly, attention was focused upon it as a factor of prime importance in the cause of sterility, and numerous operations were devised to overcome the difficulty, in the belief that it was due to an inadequate portio vaginalis. That the real obstruction might be higher up in the genital canal or that this retarded development also characterized the uterus, tubes, ovaries, etc., was disregarded. As a consequence, the operation which was intended to correct the anatomical anomaly was followed by failure to relieve sterility in most of the cases, and, furthermore, pregnancy has been known repeatedly to ensue when no so-called corrective surgical measures were undertaken.

What has been said of the portio vaginalis applies equally well to the mechanical conditions of the cervix. Apart from stricture or synechia, which may produce absolute obstruction to conception, the patency of the cervical canal can at once be determined by the successful passage of the uterine sound. When the cervical canal permits the introduction of a sound having the thickness of from 2 to 4 mm., it is conclusive proof that no possible obstruction to the entrance of the spermatozoa into the uterine cavity is present. While anteflexions and retroflexions may increase the angulation formed by the junction of cervix with the body of the uterus, it is inconceivable that it should at any time act as a total hindrance, except in the presence of some other associated pathological process, such as an endocervicitis with altered secretions, producing an inspissated plug of mucus or mucopus. In this mucous plug lies not only a mechnical factor but also a chemically antagonistic element which paralyzes the motility of the spermatozoa. It is this process also which is responsible for the apparently successful artificial sterility produced by the use of occlusive uterine pessaries. For the foreign body, thus used, sets up endocervicitis in the vast majority of cases. Tumors of the cervix, the large cervical fibromyomata, occlusion of the canal by carcinomata, cervical polypi, all act as deterrents to conception for longer or shorter periods. An interesting case of nine years' sterility, under my observation, was relieved by the removal of a uterine polypus which occluded the internal os and was discovered accidentally during a tracheloplastic operation, which was intended, by itself, to cure the condition. Pregnancy followed shortly after the removal of this polypus. Undoubtedly, in this case, there was no associated disease, the mechanical ball-valve obstruction being sufficient to prevent conception.

The matter of cervical secretions, emphasized particularly by Reynolds, has come to be accepted as a most important factor in promoting or inhibiting conception. While the vaginal secretions, according to Reynolds, are normally acid, their function being to destroy pathogenic bacteria which are introduced not only by routine contact but more especially by coitus, the cervix and uterus are relatively free from bacteria unless infected by sexual intercourse, during labor or by instrumental trauma. Normally the secretion of the cervix is markedly alkaline, favoring the activity and survival of the spermatozoa. Under pathological conditions, this alkalinity is neutralized or destroyed, thus removing the most favorable condition for spermatozoön motility and promoting sterility. In the investigation of cases by Huhner's method, one very frequently finds dead spermatozoa in the cervical canal and secretions, while a sponge placed in the vagina immediately after intercourse, or a specimen brought in a condom, may show numerous living, motile spermatozoa. If repeated examinations reveal this finding, it is safe to assume that the cervical secretions are unfavorable and alone responsible for the sterility. What the factors are in the altered secretion that destroy the life of the spermatozoa, besides the change in alkalinity, are not known. It is not the bacterial toxins alone which are responsible, because in many cases there is no gross evidence of inflammation nor can pathogenic bacteria be demonstrated in the smear. On the other hand, clinical experience abounds

in cases of pregnancy in spite of apparently abnormal cervical discharge. There is accumulating proof to show that the secretion of the cervix may be altered chemically by disturbed ovarian function. This alteration of the endocervical secretion by ovarian activity is probably purely chemical and not nearly as marked as its influence upon the endometrium. In the latter, a marked, visible change in the cells takes place as well as an invisible accumulation of chemical substances. This endocrine relationship awaits further study. At present it is sufficient to say that the favorable results in curing sterility by the administration of ovarian extracts may be due in some instances to their favorable influence upon the cervical secretions.

Erosions of the cervix, especially in nulliparous women, have their etiology in perverted ovarian function (dysfunction). So-called congenital erosions are not infrequent in cases of primary sterility, where the menses are also known to be disturbed; they are chiefly protracted and very infrequent. The secretions from eroded glands may be assumed, a priori to be pathological, although multiparae are often met with who have eroded cervices. These are more the result of laceration and eversion of the cervical mucosa than true erosions. It would be of interest to study sterility based upon the association of lacerated cervices where no other factors could be held responsible. Early abortion due to this condition has been frequently observed. The corpus uteri subserves two functions from the viewpoint of conception. One is purely mechanical, permitting in the normal state the traversing of the spermatozoa to their initial destination in the fallopian tubes. The other is nutritional. Not only does the impregnated ovum lodge in the specially prepared soil offered by the decidua, but the uterus must be so constituted as to adapt itself to the increasing demands and growth of the fetus. Whatever condition in the uterus interferes with these two functions will naturally prevent conception or its successful termination—the birth of a full-term child.

It goes without saying that a rudimentary uterus fails in these two essentials; in the same way a truly fetal uterus, whose cervix is larger than its body, will prevent conception. In the infantile type of uterus and in the presence of a marked degree of hypoplasia which exists normally in the prepuberty stage, pregnancy is not likely to occur. One has to think only of the infrequency of pregnancy occurring in girls of the prepuberty age, although the opportunity for observation is not lacking in cases exposed to assault. Whenever pregnancy does occur, it is safe to assume that the young individual is precocious in her sex development and that ovulation and possibly also menstruation must have manifested itself at least once. Precocious menses have been observed in girls of nine years and under. The writer has had two cases, occurring in sisters, in which the menstrual onset antedated the ninth year of life. Since menstruation is an expression of sexual maturity, its general behavior in any given case of sterility may be taken as a guide to the degree of development of the uterus and the ovaries. By its character and periodicity, one obtains an idea of the harmonious working of the ovaries and uterus alike. When the menses appear normally, one may assume that the uterus is adequate for the function of pregnancy. In atrophic uteri and hypo-

plastic states, they will deviate both quantitatively and qualitatively. A notable exception is pregnancy occurring during the amenorrhea of lactation. This is not readily explained, although it is well known that, during the period of lactation, women are not as susceptible to impregnation as in the nonlactating condition. It must also be borne in mind that, in advanced cases of lactation atrophy, pregnancy is extremely rare and the menses are, as a rule, missing. This may be accounted for by the atrophic, unresponsive endometrium and the ovarian deficiency, which doubtless also exists, need not be considered. When pregnancy occurs during the amenorrhea of lactation, it probably is because the corpus luteum of pregnancy, persisting into the postpartum period, has just regressed completely, allowing for graafian follicle maturation and ovulation. The ovum thus discharged becomes impregnated, thereby precluding the onset of the menses and one may assume that the uterus is in a condition to respond to the decidual reaction and that the involutional changes have not been extreme. It has been my impression that many cases of early abortion owe their origin to this defective, deficient, decidual change and also to the inadequate expansion of the uterus. These conditions are more apt to obtain when lactation is incomplete, that is, when the breasts are soon exhausted, lactation being supplemented by bottle feeding. It is especially in instances following vigorous and excessive breast-feeding that lactation atrophy of the ovaries is encountered. The uterine pains, sometimes requiring analgesics, indicate the reflex effect of nursing upon the uterus. The explanation of this mechanism is not so apparent. The fact that mammary extract causes uterine contractions is very suggestive, but it does not adequately explain the mechanism.

Stenoses, strictures and partitions of the uterine cavity may occur after severe postpartum infection and trauma. Hematometra follows these cases and the diagnosis is made by the passage of the uterine sound and by noting the change in size, consistence and contour of the uterus. The occurrence of this condition as a cause of relative sterility is very rare. Malformations of the uterus, such as uterus bilocularis or bicornis and didelphys, are not necessarily a hindrance to conception and full-term pregnancy, although they are more prone to accidents of pregnancy, jeopardizing the life of the fetus. On the one hand, intra-uterine obstruction interferes with the normal progress and expansion of the growing ovum, and, on the other, the malformation is liable to cause dystocia during labor.

The influence of positional changes upon the occurrence of conception have already been discussed. It may be repeated that in some cases the uncomplicated retroversion and retroflexions may be responsible for failure of conception. Apart from associated hyperemia in the ovaries, tubes and uterus, with alteration of secretions which undoubtedly play a part in the sterility attending these uterine positions, the abnormal site of the cervix with reference to the vagina and the angulation at the cervico-uterine junction are responsible. When this is the case, relief from sterility may be had by correcting the malposition, or the manner of the intercourse may be calculated to overcome the difficulty.

Anteflexion of the uterus has been held responsible for a great many cases

of sterility, not only the acute flexion of the cervical canal, but also the unfavorable position of the external os with respect to the axis of the vagina and the posterior fornix being held responsible. I shall not enter here into a discussion of the occurrence of the receptaculum seminus (seminal pool) and its predilection for the posterior fornix. Let it simply be emphasized that the seminal lake is more a rhetorical description than an actual anatomical fact and that in different individuals this must vary widely, depending upon the method of coitus, measurement of the parts, etc. In many cases where anteflexions and retroflexions are present, pregnancy follows shortly after marriage without artificial, surgical procedures being necessary. The anteflexion, according to older notions, was sufficient to account for the sterility without obvious complications being present, such as gross disease in the adnexa. When the latter were not found on physical examination, measures were then undertaken to correct the mechanical deformity and so give relief from sterility. That this did not occur in at least 75 per cent of the cases so operated must prove two things: first, that anteflexion *per se* is not the cause of sterility as commonly as supposed; and, second, the cause must lie in some other part of the genital tract. That this actually is the case has been demonstrated by investigating the tubes. These are not always palpable even though occluded, and if one were to express an opinion upon the prognosis of a given case of sterility, he first would be obliged to determine this fact concerning the tubes. Every gynecologist, on analyzing his results from operative procedures intended to cure sterility, must have been disappointed with the number of failures. Therefore, it has become necessary in recent years to explore the pelvis to exclude both tubal and ovarian pathology as causes of the sterility.

The relationship between fibroid tumors of the uterus and sterility has been referred to in a previous chapter. In general, the large submucous myomata favor infertility because they may obstruct the uterine ostia of the tubes and, when not thus obstructing the passage of the spermatozoa, they may cause abortion in a great many cases. Intramural fibroids are less frequently responsible for sterility, as only those occurring near the uterine ends of the tubes cause obstruction. The subserous myomata are practically without significance in this respect. Occasionally, when they are located in the cervix, they become impacted and interfere with the normal progress of labor. The accidents to which these tumors give rise are especially marked during the gravid state. Thus, red degeneration, common to these tumors in pregnancy, excites uterine contractions which may lead to premature interruption of gestation, or torsions of the subserous tumors may incite uterine contractions, hemorrhage and early abortion.

Endometritis as a cause of sterility is very infrequent. Formerly it was regarded as the most common cause because of the formation of abnormal secretions which destroyed spermatozoa and prevented normal decidual formation. It was, moreover, held that habitual abortion was most commonly caused by the presence of endometritis. Since the occurrence of a true endometritis is now definitely known to be very uncommon, these notions need no longer be entertained. Nevertheless, a tuberculous endometritis, an

occasional pyogenic endometritis and the rather rare exfoliative form of
endometritis may certainly be responsible for sterility and, since tuberculosis
of the uterus is usually accompanied by tuberculous salpingitis with lumen
occlusion, its importance becomes greater. Instances are known of pyometra
or lochiometra following parturition which have healed and, if unattended
by suppurative salpingitis, have permitted the subsequent bearing of healthy
children. The exfoliative endometritis is an extraordinary process, the true
etiology of which is as yet obscure. If a possible cause resides in the ovaries,
it has not so far been determined. In one case, in which the opportunity was
afforded for examining, microscopically, sections of the ovaries, I could not
determine any striking change, nor did the patient respond to the ovarian
resection.

The rôle of the tubes in sterility is definitely known to be mechanical.
Whether the endosalpinx under physiological circumstances contributes a
secretion which favors ovular nutrition is a matter awaiting research and
upon which we have as yet no available data. One may assume that a rather
luxuriantly developed tubal mucosa has been provided for a deeper purpose
than to carry cilia which should simply aid in the transportation of the
impregnated or unfertilized ovum into the uterine cavity. Observations on
this point are lacking, chiefly because our opportunities for studying tubal
function are confined to pathological conditions. Thus, whether they are
removed for inflammatory disease or for ectopic pregnancy, the tubes present
such gross alterations as to destroy any evidence of physiological changes
which may possibly occur in them; changes that might parallel, for example,
the cyclical changes exhibited by the uterine mucosa. The latter has been
clearly demonstrated through the operation of curettage at various phases
of the menstrual process. The uterus is naturally more available for this
observation. The future may, however, bring data in connection with tubal
changes and to this end advantage may be taken to examine tubes removed
incidental to hysterectomy. That the tubes, derived from the Müllerian ducts,
share the potential property for ovular nidation is amply evidenced by tubal
pregnancy. That it may share some of the other properties, as for example
decidual reaction, has also been observed. If this is not a constant occurrence
in the tubes, it only serves to emphasize the greater incidence of infantilism
of the tubes as compared to the uterus.

While this point cannot be settled at the present time, there can be no
question of the importance of the mechanical factor offered by tubal closure
in the causation of sterility. When the tube is closed at its funnel-shaped
end, at the fimbria, or along its course or at its narrow isthmic portion, the
passage of the ovum cannot be effected. In the same way, when the lumen
is constricted by kinks or adhesions, obstruction to the ovum also results.
When both tubes are thus completely closed, pregnancy cannot possibly result.

Theoretically, under normal conditions, the fimbria should be close to the
ovary, prepared to receive the discharged ovum, which is then carried along
by healthy cilia over healthy tubal folds. In the presence of an endosalpin-
gitis, the ovum fails to be thus carried along because of the paralysis of
ciliary motion and the increased pathological tubal secretion with its toxic

contents. So that, without any closure of the tube lumen, its patency still being demonstrated by the escape of serum or seropus into the peritoneal cavity, conception is incidentally prevented. In the subacute process and in those cases which may be regarded as "healed," there may be sufficient patency and sufficient physiological function left to permit an occasional uterine pregnancy or, more commonly, tubal pregnancy.

Inasmuch as the occurrence of pregnancy in a given individual may be repeatedly extra-uterine or, what is more common, the only pregnancy ever experienced by her, she may be regarded in such case as having been relatively sterile; this applies, also, to the woman whose only pregnancy has prematurely terminated in abortion or premature labor with a nonviable child as the issue. Perhaps the most frequent cause of the subsequent sterility is closure of the fallopian tubes. Usually this closure is the result of an unhappy decision to interfere with pregnancy by artificial means. Less frequently, infection follows the spontaneous miscarriage. In this connection it may be well to call attention to the fact that, while it is the exception for infection to occur incident to the spontaneous miscarriage terminated without any instrumental manipulation, it should always be suspected where the abortion has been induced. The saddest women met with in gynecological practice are those rendered sterile through indiscreet practice shortly after marriage, because of light-heartedness or through lack of courage to face their marital responsibility. Apart from the moral repression, they feel the want of a child all the more keenly in later years.

The diagnosis of tubal closure may be suspected in the presence of adnexal tumors, such as would suggest chronic pyosalpinx or hydrosalpinx. When there is considerable thickening around or near the fimbriated ends of the tubes and marked "thickening" in the neighborhood of the adenxa, tubal trouble may be suspected. But in neither case can we be certain of the actual closure. This task becomes much more difficult when we are asked to express an opinion in the absence of such gross palpatory evidence; for very frequently we are dealing with the end result of an inflammatory process of the tubes when nature has spent its effort in resolving the injury. The pus in a nonvirulent pyosalpinx may become inspissated and even absorbed; the walls of a hydrosalpinx may be thin and flaccid, so that the vagino-abdominal examination may be negative. Tubes may be constricted by fine adhesions or coarser adhesions from a pelvic peritonitis, not induced through the tubes but from some other pelvic organ. The ovaries, for example, may be the starting point of a pelvic peritonitis by the rupture of an infected ovarian cyst or a suppurating graafian follicle. The whole process may have been mild and insidious and not sufficiently pronounced to cause the patient to take to bed. Or there may have been an attack of "colitis" prior to marriage or even after it. A pericolitis of mild type results, inflammation of the appendices epiploicae to which the tubes become agglutinated, and, in the end, the process heals, leaving the tubes permanently injured.

Perhaps a cause of sterility innocently acquired and occurring in a fair percentage of the cases is that due to tubal closure following appendical suppuration. In quite a large number of absolute sterilities, the only exciting

cause may be traced to an attack of suppurative appendicitis at an early age. As a rule the attack is given as occurring shortly before marriage in early maturity. The patients will state that they had a stormy course, having required prolonged wound dressings; indeed, inspection of the abdominal scar, without an accurate history, will point to the severity of the operation. When it is recalled how frequently pelvic abscess complicates the "pus appendix," particularly when there has been a peritonitis, it will not be surprising to find the incidence of secondary tubal involvement of clinical importance.

In the series of 500 cases of sterility recently studied, appendicitis, as a cause, could be traced in 7 out of 166 cases of nonpatent tubes.

But whether sterility results from tubal closure of venereal or innocent origin, the result is the same. When the closure is effected by external causes, leaving the endosalpinx practically intact, the prognosis is more favorable, for it is possible to relieve the constriction by laparotomy. While definite knowledge of an attack of appendicitis may help us to place the blame, the problem still remains to establish the fact of tubal patency or of nonpatency.

Formerly, we were obliged to perform a laparotomy in order to answer this question. But the opportunity for exploratory laparotomy was not always forthcoming, partly because its importance was not appreciated and, more especially, because most sterilities were supposed to be due to conical cervices. It is only in the last decade that rigid criticism and analysis of the failures of operations for the relief of sterility brought about a change in viewpoint and focused our interest on the deeper parts as a cause of sterility. It is safe to say that tubal disease in all its manifestation is the most common cause of sterility. Being purely a mechanical factor, it should naturally be the one lending itself to determination by physical means.

Such means to determine the fact of tubal patency and incidentally tubal normality is now available through the use of gas insufflation into the uterus by the method described in a subsequent chapter.

In these days of abundant surgery, one removes diseased fallopian tubes *in toto* or perhaps leaves portions of one or both in the pelvis in the hope that, the active process having terminated, the residual tube portion may regain its function. This conservatism is practiced particularly in women of the childbearing period. Nevertheless a great many of these women, perhaps most of them, never become pregnant. Naturally they desire to know whether or not it is because of the "operation."

The physician is now able to determine the presence of normal tubes by the method of transuterine subphrenic pneumoperitoneum. If the tubes fail to transmit the gas insufflated into the uterus, they are closed or, what is the same, they are absent, having been removed by an operation. Whether one tube has been removed and the other is closed, whether both are removed, or whether both are subjected to a plastic operation, the result is the same to the patient. She is sterile on that account. If subphrenic pneumoperitoneum can be demonstrated, it proves one or both tubes capable of transmitting the gas and, therefore, patent. Inasmuch as one normal tube, all

other things being favorable, is sufficient for the performance of the function of an oviduct, the cause of the sterility may be sought elsewhere. Points in the technic which are helpful in diagnosing one-tube patency or two-tube patency have been mentioned in the chapter dealing with methods of examination. Here it may be stated that the test has been of decided aid in that now fairly large group of cases where operation was performed for the specific purpose of conserving reproductive function or to improve the individual's chance for pregnancy. I have in mind a number of women who still ardently hope for pregnancy to occur, although their fallopian tubes have been totally removed. Since it is not always judicious to inform a woman of the fact, she will travel from physician to physician in the hope of finding some one who will promise her fertility. On the other hand, the fact of the hopelessness of the case may be very important to certain women of determined will who, wishing to face the conditions squarely, may yet content themselves with adopting a baby and so fulfill their maternal instinct. When one can be certain of the positive resolve of such women, he is in a position to render important social service through the use of this diagnostic method.

Only a word need be mentioned concerning the needlessness and futility of operation performed upon the cervix, as the supposed seat of the cause of the sterility, when actually the tubes in the given case are sealed by an old disease process. It is now quite generally conceded that such operations are to be undertaken, if at all, only after a preliminary test for the patency of the tubes has been made.

But if this matter of tubal occlusion as a prominent cause of sterility can now be determined in almost every case, the matter is very different with the ovaries. These still offer and will continue to present difficulties, until perhaps some serological test, specific for ovarian function, is developed. For even with these organs available for inspection, we are in no position to know whether they are performing their function because the organ is so variable. We are beginning now to differentiate certain unhealthy forms of ovaries, aside from those obviously inflammatory, so that what was formerly considered anatomically normal may no longer be so considered. There is one question to be decided definitely before we can speak authoritatively of the rôle of the ovaries in sterility. This question is whether all the ova are capable of being impregnated and of sustaining the whole process of growth and development, culminating in a new individual, or whether there are only certain more highly specialized cells which possess this potential property.

There is no reliable method except laparotomy by which the size and position of the ovaries may be determined in every case. As mentioned above, when they are prolapsed and enlarged, or when sought in very thin women, it may be possible to palpate them. Unless they are found by palpation to be abnormally small, say half the size of a pigeon's egg, one should be disinclined to ascribe deficient function to them. In such case the menses would have to be scanty or absent, and, in the behavior of the menses, we have perhaps the only reliable index of ovarian physiology. When menstruation is regular and normal, at least when it corresponds with that seen in healthy

childbearing women, we may assume that the ovaries are healthy, at least as far as their trophic influence over the uterus is concerned. The fate of the product of its "external secretion" is, however, by no means so easily decided. Whether it may have attained full physiological ripeness, whether it is susceptible of fecundation, or whether it has been adequately discharged into the fimbrial opening and not into the general peritoneal cavity, are matters that challenge speculation. The ovaries may be anchored below while the abdominal end of the tubes may be fixed at some other level to which the ovum is not easily carried, constituting another cause for sterility.

Amenorrhea in young women, with or without climacteric symptoms, speaks for ovarian hypofunction and, hence, for ovarian sterility. Conditions that may interfere with the normal rupture of graafian follicles are chronic oöphoritis and perioöphoritis which, when sufficiently outspoken, may be diagnosed by palpation. Here again the symptom of bleeding offers some help because the menses under these circumstances may be disturbed, tending to elongate the periods or to produce metrorrhagia. The excessive and almost continuous bleeding noticed in some young women is due to abnormal ovaries, which make pregnancy extremely unlikely; first, because of ovular disease or immature follicles, and, second, because the bleeding from the uterus militates against ovular embedding.

Pelvic peritonitis, as a rule, leaves adhesions, binding the pelvic organs. From the standpoint of sterility, its chief damage is in the constrictions of the tubes or their complete closure and the surrounding of the ovaries by filamentous adhesions which interfere with the normal process of ovulation. But, inasmuch as the majority of instances of pelvic peritonitis arise from tubal infection, it matters very little which effect finally produces sterilization. On the other hand, there are cases with a definite history of an attack of acute pelvic infection, as for example after abortion, when it may have been necessary to open a pelvic abscess by a posterior colpotomy. Later, in such cases, in the presence or absence of palpable adhesions, it certainly becomes a question of importance whether the tubes have escaped damage. It is remarkable to find by gas insufflation that here, where one would least expect it, the tubes have remained patent. This fact is corroborated by the occurrence of normal pregnancy.

The same may be said for parametritis as a cause of sterility, although on account of its extraperitoneal situation it is less apt to be responsible for it. Only in the large exudates with dislocation of the organs and local interference with their nutrition may sterility be directly traceable. In several cases with an old history of parametritis following puerperal infection, I have been able to demonstrate the patency of the tubes. In one of these cases pregnancy ensued.

Summarizing the above, it may be said that, whenever a local organic cause exists to explain the sterility, we are now in a fair position to determine the fact by the use of improved diagnostic methods. In this respect, neither laparotomy nor anesthesia is necessary for diagnosis. The finer lesions will escape detection by bimanual examination even under anesthesia, while their one important effect, namely tubal constriction, may be satisfactorily estab-

lished by transuterine insufflation. Nevertheless, the first duty is to exclude organic disease, and, having satisfied oneself of this, one is still confronted by a large group of cases of sterility which are not so readily explained. This group may, by careful inquiry, fall into two subclasses: (1) those which owe their sterility to constitutional disturbances; and (2) those due to profound changes in the nervous system. Two cases in my personal experience, after postvaginal section for pelvic abscess, proved to have patent tubes months after the operation and one of these patients has since borne a healthy child. It is, therefore, not prudent to dismiss such a case as hopelessly sterile on the supposition that the pelvic abscess surely must have sealed off the fallopian tubes.

One of the most common symptom complexes is amenorrhea with sterility. Whatever constitutional cause may be operative to bring about the amenorrhea can also explain the sterility. These are individuals who, as young girls, menstruate but once in two or three, or more, months and then scantily; who are, as a rule, inclined to be adipose and exhibit other evidence of disturbed endocrine function. Although pregnancy does occur among them, as a rule they consult the gynecologist for sterility for years following marriage. What the processes are underlying such amenorrheas is not yet understood. It is easier to understand the deprivation of nutrition from the ovaries, particularly in such a wasting disease as tuberculosis. The amenorrhea may be purely an accidental result of emaciation or it may be a defensive, compensatory provision, as some would have us believe. But, inasmuch as the same thing occurs in instances of enforced starvation, whether from sheer lack of food, as has been experienced in the war-stricken lands, or through the physical impediment as offered by cardiospasm, or esophageal stricture, we may accept the hypothesis of nutritional organic deprivation as the cause of both the amenorrhea and sterility. The ovaries not only cease to ovulate, but the uterus undergoes rapid atrophy. While first-hand evidence has been scarce in the case of women, it has been possible to study the changes in structure induced by experimental starvation. Reynolds and MacCumber have shown, by a large series of experiments on rats, that nutrition and fertility are intimately linked. By decreasing the rations, they caused a diminution of fertility of almost 100 per cent. They were able, furthermore, to note a corresponding increase or maintenance of the normal degree of fertility by adding lime salts, protein and fat to the food. The ovaries, on histological section, showed failure of corpus luteum formation in the starved animals, while in those abundantly fed there was every evidence of functional activity.

The association of sterility with amenorrhea and obesity forms a tripod which it is almost hopeless to cure. Dysplasia adiposogenitalis with headache, or Fröhlich's syndrome, is seen in a fair proportion of cases. Whether primarily a pituitary disturbance or an ovarian atrophy, the genitals may present varying degrees of hypoplasia. It is not always easy to separate this type from the eunuchoid type. When recognized as belonging to this gonadal or pituitary disturbance, the prognosis is bad as far as conception is concerned.

Consanguinity appears to be of importance in some cases, particularly if

the relationship is a close one. In such a case under my personal care, each could be dismissed as a perfectly healthy individual and yet their married life was sterile. In what way blood relationship operates is not understood. It is not always inimical to fertility as numerous cases of healthy offspring have been known to follow such marriages. That inbreeding does have a great influence must be assumed because of the tendency to structural anomalies and to striking changes in secondary characteristics exhibited by the children born of "blood" matings.

The mode of life, particularly prolonged worry and hard work indoors without adequate hours of rest, may also militate against fertility. Probably, by reducing general metabolic activity, the gonads are depressed under these conditions. Fatigue in general cannot be held to favor physiological function. If we only consider this from the purely physical standpoint, that of the sexual act itself, we can understand how it may interfere with normal fulfillment.

An interesting and rather important cause of sterility is disclosed by the history of prolonged premarital courtship.

I have in several instances traced the cause of infertility to this factor. It produces its relatively sterilizing effect in this way. On the male side, by the frequent and excessive ejaculations, there results in time, and for a varying interval, cessation of the production of spermatozoa. One need not dwell here upon the incidental effects upon the epididymis, seminal vesicles and prostate glands with their congestions, obstruction and possibly qualitative secretory changes. In the female, ovarian congestion and cervical "catarrh" result. Either the type of ovum produced is immature and incapable of fertilization or the secretions are abnormal. When, after a long period of sexual rest, intercourse is again permitted, pregnancy may rapidly follow. In one case this happy result followed in the eighth year after marriage, although a Dudley operation had been undertaken five years before in the hope of improving the chances of fertility.

A certain degree of relative sterility is brought about in women who have borne one or two children, the interval between childbirths being intentionally prolonged and determined. Various methods are employed to prevent conception. Without going into the practices indulged in by these people, we may understand the mechanism of the relative sterility in the case of the woman to operate in two ways: by injurious effects of the prolonged use of antiseptics upon the normal vaginal flora, and by the chemical alteration in the secretions of the Bartholin gland, vagina and cervix. That this must be the case may be seen in the fruitful coitus that follows the discontinuance of the pernicious practices and by a period of sexual rest.

It is hardly believable, but nevertheless true, that awkwardness and lack of experience in the sex act are responsible for a number of sterile marriages. These anomalous cases belong chiefly to exceptionally uninformed persons of both sexes and to those who may have acquired repressions in that direction. A number of cases of dyspareunia and actual apareunia are traceable to lack of education or intelligence on sex matters or to psychic inhibitions. When the male is normal and the female abnormal in this respect, dyspareunia

is usually the result. Then, too, fear of injuring his bride with the incomplete, perhaps awkward, efforts at intercourse may produce reflex spasms in her which become increasingly worse, so that eventually he is unable, although quite willing, to effect complete penetration. While not an absolute cause of sterility, dyspareunia is a factor to be considered, and, as proof of this, cases may be cited that showed a return of fertility soon after the dyspareunia was eliminated by surgical or other measures. Other causes of dyspareunia may be seen in diseases of the genitals, particularly those associated with inflammations, since the act as a rule produces pain. The pain induces defensive muscular contractions of the sphincter ani and the levators, while the anticipation of the sex act, by women who are delicate or debilitated by local or other systemic disease, being anything but pleasant, evokes psychic inhibition.

Local causes which set up vaginismus and, hence, dyspareunia are affections of the external genitals, such as vulvitis, bartholinitis, leukoplakia and kraurosis vulvae. Urethral caruncle and inflammations of the urethra and bladder may also set up spasm, partly through coital contact and partly through coital congestion. Vaginitis, particularly gonorrheal colpitis, may be associated with the greatest tenderness. Prolapsed and inflamed ovaries in association with retroversion may act as a cause of dyspareunia, while perimetritis and salpingo-oöphoritis, particularly in the acute and subacute stages, are obvious causes of coital pain. Painful affections about the anus, such as thrombosed and inflamed hemorrhoids, may cause extreme dyspareunia, for sphincteric contraction is apt to be particularly violent in these conditions.

When these lesions are absent, one may find that the dyspareunia is based upon the presence of hypersensitive hymenal rests. These are, as a rule, found in women who have practiced onanism or in those where coitus is incomplete. A genuine neuritis of the pubic nerve is occasionally met with. It may be recognized by locating tenderness where the nerve passes alongside the ischial ramus just inside the vaginal orifice.

Where no visible lesion is found to account for the dyspareunia, an explanation may be sought in the anamnesis. Not infrequently it develops that the marriage has been an unhappy one, the wife being disappointed in her mate, and, in order to avoid distasteful intercourse, she complains of pain and physical difficulty. In contrast to those cases in which a local physical lesion is present with accompanying vaginismus, in these cases such lesions may be totally absent so that penetration is easy and complete.

In the history of each case of sterility, data may be available to suggest its etiology. Thus, when one pregnancy, which was artificially interrupted, has taken place, one may at once rule out congenital causes. Here inflammation has the chief rôle in the acquired sterility. In primary sterility, however, there may be a definite history of gonorrheal infection—one of the most common causes of sterility. Habitual abortion immediately suggests luetic infection. When a woman is married for the second time, having borne children by her first husband, she may be sterile in her second marriage. In this case, if this husband's first marriage was sterile, it is presumptive evi-

dence of his sterility. This need not necessarily be the case, however. It is necessary in each case to examine into the physical status of each partner and, on the evidence adduced, express an opinion as to the responsibility.

Summarizing the causes of sterility in women, one may say that cervical infection and tubal occlusion are the most important causes of sterility. These are determinable in almost every case. The part played by the ovaries is next in importance and is the least amenable to diagnostic scrutiny. The causes least understood are those located in perversions and disturbances of the rest of the endocrine system of glands and their effects on general metabolism. The uterus itself, with all the lesions to which it is disposed, contributes but a small percentage of the causes of sterility. The smallest percentage is due to abnormalities in development, local and constitutional, and to nervous and psychic factors. Matters still awaiting illuminating research are the blood reactions and tissue compatibility of male and female partner.

ILLUSTRATIVE CASES

Case Illustrating Defective Mechanism in the Vagina and at the Same Time Azoöspermia

A. R., twenty-eight years old, was seen on January 3, 1916. The following history was obtained: She had been married ten years; had had typhoid fever at the age of fourteen; menses began at thirteen and were always regular. Since marriage the periods have come three to four days before the expected time; the bleeding lasts about five days and there is no pain. There has been no amenorrhea at any time. The last menstrual period was two weeks previous to examination. Her weight was one hundred and seventy-six pounds; her flesh was firm. She had been heavier before marriage. The patient experiences sex libido occasionally.

Examination revealed the uterus in anteflexion, and upon *stretching the vagina with a bivalve speculum, the vaginal folds were seen to roll over the cervix and to hide it completely from view as if a septum were placed over it.*

March 27, 1916, at examination after intercourse, no spermatozoa were found, living or dead. The husband was examined and found to be sterile from an old gonorrhea and colliculitis.

Case of Sterility with Multiple Fibroids

S. W., aged forty-one years, was admitted October 18, 1920. She had been married twenty years and had never been pregnant. Her menses started at thirteen years, regular every thirty days and of three days' duration, being preceded by slight pain. The patient had a curettage ten years before and typhoid at ten years. Her chief complaints were menorrhagia and metrorrhagia and generalized abdominal pain the previous six months. During that time she had bled twice a month for five days instead of three days. The last period was three weeks previous to examination.

Examination showed a tumor which reached up to the level of the umbil-

icus and was hard, movable and inclined to move independently of the cervix. The cervix was congested and a sound entered in a forward direction for about two inches. The diagnosis of a pedunculated fibroid was made.

At laparotomy, multiple fibroids were found. There was a large fibroid the size of a large cucumber overlying a smaller tumor on the left side of the uterus and one small tumor near the cervix. There were several small tumors in the uterus and a small polypus occluding the tubal orifice on the right side. The right ovary had two fairly fresh corpora lutea and one smaller hemorrhagic follicle. The left ovary was very much congested, the surface was beefy and there were small subcortical follicles but no follicles protruding.

CHAPTER XIV

VAGINAL DISCHARGE

At one time, vaginal discharge was identified for the most part with endometritis. Endometritis was believed to be of several varieties but for all of these, bleeding being the most prominent symptom, the term "endometritis hemorrhagica" was introduced. Several advances have been made in the past two decades which change our conception of the endometrial function. (1) The establishment of the various types of so-called "endometritis" as different stages in the cyclical change which the uterine mucosa undergoes month after month (Hitschmann and Adler). (2) The discovery of the subservience of uterine function to ovarian function. (3) The histologic bacterial study, chiefly of Arthur Curtis, who demonstrated that, in the vast majority of cases, the endometrium is free of bacteria. (4) The discovery that cervical mucosa is the only portion of the lining membrane of the genital tube that secretes mucus. It also appears that, while infection of the endocervix is very common, the brunt of the bacterial invasion is borne by the cervix, the internal os forming a primary and effective barrier. A violent infection may over-ride all resistance and spread rapidly upward to the tubes, ovaries and peritoneal cavity by way of the uterine cavity. To accomplish this one must assume: (1) reduced vitality and extreme patency of the uterus—conditions favored by the puerperal or abortive state; and (2) very virulent microörganisms, the streptococcus and staphylococcus being the chief offenders.

It is difficult to conceive of any vaginal discharge without a coexisting infection, no matter how mild. Thus, proceeding from without, inwards and upwards, the mucosa of the internal surface of the large labia, of the small labia, the clitoris, vestibule, urethra, Skene's ducts, Bartholin glands and ducts and the vagina, may all be the seat of a catarrhal process in which there is a serous, serogranular or in the case of the vagina, a milky serous discharge. Primary infection of the vagina is uncommon, chiefly because the squamous epithelium resists infection. The urethra has a transitional type of epithelium, and conditions for drainage are not nearly as favorable as in the vagina. When the latter is macerated by irritative discharge from above, as in gonorrhea, it may be affected, the inflammation spreading to most of the vaginal mucosa. This widespread involvement is uncommon and is seen only in cases of acute gonorrhea, particularly in the pregnant woman. As a rule, however, the redness appears in streaks or spots (the macula) of gonorrhea, present upon the vaginal mucosa and by special predilection upon the portio vaginalis.

Whether or not signs of acute inflammation are present, the vagina may

contain a serogranular discharge consisting for the most part of the transudate from superficial capillaries mixed with copious quantities of epithelial cells desquamated from the surface. During pregnancy, a previously existing discharge may be increased, owing to the hyperemia of the pelvic organs. A condition known as colpitis emphysematosa, the vesicles containing gas, is very commonly met with during gestation.

Abundant greenish or greenish yellow purulent discharge, particularly when mixed with mucous strings, is almost pathognomonic of gonorrhea. The exception is gravidity. If in addition there is evidence of infection at the urethra, Skene's ducts, bartholinitis or acute cervical catarrh, the diagnosis is almost certain whether the gonococcus is found or not. The gonococcus is not always demonstrable, since the organism may disappear rapidly.

The most favorable time to demonstrate gonococci in the cervix is promptly after the menses, since the discharge comes from the deeper portion of the cervical glands. A provocative application of a strong solution of silver nitrate to the cervical canal or to an eroded area of the vaginal portion will help to bring out a crop of the microörganisms. Light scraping of the surface may serve the same purpose.

A probable sign of gonorrheal infection in the presence of a cervical discharge is the history of acute symptoms of vulvitis or cysto-urethritis occurring immediately after marriage. In such cases there may be still a slight amount of thin purulent secretion which may be milked out of the urethra. Adnexal inflammation, hydrosalpinx, and tubo-ovarian disease are also presumptive evidence when there is no history of postpartum trauma or trauma after abortion or infection. Condylomata acuminata indicate gonorrheal infection in the vast majority of cases.

Without gonorrhea, there may be a mucopurulent discharge from a secondary infection of an everted, eroded, lacerated cervix. Papillary proliferations on the surface of the portio vaginalis, or over the eroded area, and cystic ovula nabothii, which discharge their viscid glassy mucus, are the most frequent causes of vaginal discharge in married women, notably multiparae.

In children, vaginitis and cervicitis may keep up a discharge indefinitely, resisting treatment. Gonorrheal infection is, in reality, a rarity, although this has been universally believed to be the cause of every vaginitis of infancy and chilhood. I hold that, in the vast majority of cases, the vaginitis is the result of an infectious catarrh similar in nature and perhaps in pathogenesis to angina tonsillaris or Vincent's infection, and that they are but manifestations of infection by the micrococcus catarrhalis, a germ morphologically similar to the gonococcus and which is a secondary invader in the exanthemata of childhood. In asylums for children and hospital wards, this form of vaginitis may break out in epidemic fashion. From a careful analysis of over 500 children with vaginal discharge, I have concluded that it starts as a nongonorrheal infection, becoming complicated through faulty and too vigorous treatment which acts as trauma to the delicate mucosa, giving rise to erosions, ulcerations and secondary suppurations.

Profuse milky, purulent discharge is met with in cases where a pessary has been worn for a long time, especially when hygienic precautions have

not been taken. The pessary causes irritation by friction, erosion and even deep ulceration, when it becomes so fixed that it is removed with difficulty. These cases may even bleed. The pessary was so fixed in five cases under my observation that splitting was necessary to remove it.

The seat of the discharge is not difficult to ascertain by inspection of the external genitals, particularly the orifice of the Bartholin ducts, the urethra and Skene's ducts. The neighborhood of the clitoris and along the outer surface of the labia minora is commonly covered with smegma. This secretion arises from the sebaceous glands to which is added epithelial and bacterial débris; the smegma bacillus is the most common invader. Inspection of the vagina through the speculum enables one to locate the source of vaginal discharge. One must decide whether the discharge comes from the cervix or the vagina. Schultze's method of inserting a tampon for twenty-four hours against the cervix, to determine whether the central or lateral portions are bathed in secretion, is valuable. The latter is supposed to indicate vaginal discharge, while the former denotes cervical discharge. In practice, this method is rarely necessary because the appearance of the vagina is indicatory. The presence of an unhealthy cervix with mucus or mucopus exuding is significant. While any bland medicament (bolus alba, either on a tampon or in the form of a spray) over the vaginal mucosa may clear up the discharge produced by the mild vaginitis, the cervical catarrh is not influenced. The explanation for this becomes obvious when we call to mind the histo-anatomy of the cervical glands. Practically all are racemose, winding through the cervical parenchyma without a submucous layer and penetrating in diseased conditions almost to the surface of the portio vaginalis. In endocervicitis, the fundal portions become dilated, even separated by stricture from the ducts, forming the ovula nabothii or cystic follicles which may balloon out the cervix to an enormous size. By rupture, a chronic discharge may result. Conservative treatment fails to reach the infection confined to the deeper parts of the glands and, to even a less extent, that in the ovula nabothii. Without surgical interference, an endocervicitis may cause discharge throughout the greater part of the life of the individual. In favorable cases, the atrophy attendant upon senility may cause the process to terminate, but this rarely happens.

Of great interest is the purulent discharge of unknown cause. This discharge may be constant or periodic. Constant discharge from the vagina may be due to:

1. **Watery** leakage from the bladder, urethra or ureters.

2. **Purulent:** (*a*) *genital;* for example, rupture into the vagina of an adherent suppurating ovarian cyst, or a pyosalpinx.

(*b*) *Extragenital:* for example, the gravitation and rupture into the vagina, through the paravaginal space, of a perityphlitic, appendical abscess. A pyoureter may discharge into the vagina.

(*c*) *Serosanguineous discharge* from the cervix due to carcinoma or papilloma of the tubes.

Intermittent discharge through the cervix is due to escape of serous fluid from a huge hydrosalpinx.

If the point of leakage is visible, it is not difficult to locate the tear into the urethra or bladder. When very small, the fistula may be located by cystoscopy. By injecting colored fluid (methylene-blue) into the bladder, the escape through the point of leakage establishes the injury. If the colored fluid does not appear at the point of leakage, the injury is not in the bladder or urethra. In such a case, the intramuscular injection of indigo-carmin is of value; in from fifteen to thirty minutes, the colored fluid will trickle through the small opening seen in the vagina, if the kidney parenchyma of the affected side is functioning. In the case of the ureterovaginal fistula, the point of leakage is usually found in either lateral fornix. In the vast majority of such cases, the uterus has been removed by the abdominal or vaginal route, leaving the cervix *in situ*. Occasionally injury to the ureter occurs during an amputation of the cervix or in the opening through the vagina of a laterally placed pelvic abscess.

The following case is an example of a persistent, purulent, offensive discharge from the vagina, lasting fifteen years, causing the patient great personal distress and resulting in the desertion of her husband who claimed living with her was impossible. She was a woman of forty-five who had had four children. Fifteen years ago she was operated upon for lacerations and a vaginal discharge which followed an instrumental delivery. Leakage of urine was noticed soon afterwards. An attempt to correct the leak was without result. The patient was curetted several times for the vaginal discharge, without success. She was treated by tampons and douches at the Out-Patient Department of several hospitals, but the discharge continued. It was after her husband deserted her that she applied at the hospital for relief. It was not difficult at that time, in reviewing the history carefully, to suspect that the discharge was one of the urinary tract and, indeed, on cystoscopic examination, it became at once clear that the left ureter was injured. A very small point of leakage was identified in the left vaginal fornix and, on bimanual examination, a large tubular swelling the width of the wrist was palpated on the left side, which, on compression, caused a profuse flow of pus from the vaginal opening. We were, therefore, dealing with a pyoureter which communicated with the vagina. The condition cleared up after the extirpation of the pyonephrosis and pyoureter on the left side.

Perhaps the most direct method of determining a ureterovaginal fistula is by cystoscopy and ureteral catheterism combined with the colored fluid test and pyelography. Not only will the ureteral catheter fail to pass into the injured ureter, but no colored urine will be seen to escape from its orifice in the bladder. By passing a lead catheter up as far as the injured portion, or by filling it with bromid solution, the vesical end of the ureter will terminate at a point usually 2:5 cm. or more from the bladder, and none of the opaque fluid will be seen above. A complicated fistula with discharge issuing directly from the cervical canal arises when the fistulous tract passes along the paracervical tissue into the cervical parenchyma and thence into the cervical canal; or the tract may open on the side of the cervix or the portio vaginalis.

The diagnosis of a fistulous communication with an ovarian abscess or a pyosalpinx will be established by passing a probe through the opening and noting its direction and extent. If this leads to a large mass lateral to the uterus, and if pressure over this mass causes it to collapse gradually, while the escape of pus through the vaginal opening is noted, it will signify the rupture of a pyosalpinx or suppurating ovarian cyst. It may be impossible to distinguish between these conditions, but for practical purposes a differential diagnosis is not essential. While pressure over a pyoureter will lead to a similar reduction in size of a palpable abdominal mass, its exact nature may be determined by ureteral catheterism, etc.

Foul-smelling discharge from the vagina is caused, as a rule, by the presence of a foreign body, usually a pessary, which has been retained a long time and has not been cleansed. Gauze left in after vaginal operations for more than a few days causes a very disagreeable and offensive discharge. Iodoform gauze, if more than a 5 per cent saturation, may stay "sweet" for as long as a week. Weaker iodoform gauze becomes foul within three or four days, while white sterile gauze does so within forty-eight hours.

Occlusive pessaries inserted into the cervical canal may cause a very profuse discharge, foul-smelling and persistent. As a rule, relief follows the removal of the offending foreign body. A secondary effect of the contraceptive pessary is stricture formation which causes pyometra. The latter becomes manifest by the intermittent escape of a profuse amount of foul-smelling green or greenish yellow pus which tends to diminish gradually, to reappear again in abundant amount. Uterine contractions, as evidenced by hypogastric colic, may precede the onset of the discharge and become less as the latter increases in severity. The diagnosis is made by palpating an enlarged, almost cystic-feeling uterus, compression of which may be followed by a noticeable purulent discharge. When this does not occur, the introduction of a sound may establish the presence of a stricture or atresia of the cervix. In favorable cases, pus may escape from the external os without a necessary probing of the uterine cavity. The escape is accomplished by the increased tension within the uterus, by dilatation of the stricture and by forceful uterine contractions. When the uterus is nearly collapsed, the stricture tightens and again the pyogenic uterine mucosa starts the production of a fresh quantity of pus which is discharged in the same way. The introduction of a dressing forceps, with or without preliminary cervical dilatation, serves to empty a large quantity of the pus within a few seconds.

Perhaps the most aggravated case of pyometra coming to the author's observation was one in which a cervix amputation was done some months before, and the patient complained of "fouling" herself almost constantly, especially when her bowels moved. The diagnosis in this case was made of rectovaginal fistula, although the point of communication could not be demonstrated. Examination brought out two physical findings: (1) an enlarged cystic uterus, and (2) pus escaping from the external os. It was only necessary to introduce a dressing forceps and stretch the stenosed, shortened, cervical canal when, with a large amount of foul-smelling, dark brown pus, a strip of gauze was removed. This had been obviously left

in situ when the gauze tore in the attempt to remove it, some two or three days after the operation. The gauze had evidently not been properly seamed or had been cut irregularly, so that part of it was very narrow. Although this possibility was strongly suspected, the most common diagnosis in such a case would be a degenerating necrotic polypus, acting partly as a ball valve shutting the cervical canal and opening only when the accumulated fluid is sufficient to distend the uterus so as to allow the escape of its fluid content.

Occasionally a pyometra is encountered that results from retention and even embedding of a "wishbone" clavus which may have been introduced within the uterus months or years ago. A simple amputation of the cervix, by causing a cicatricial stenosis of the newly formed external os, may eventually lead to pyometra, particularly in the menopause. Case K. is an excellent example. The patient had a premature, artificial menopause. An amputation of the cervix was performed some fourteen years previously; ten years later, there was a partial removal of the adnexa of one side and total removal of the other; the menses rapidly diminished, while the time intervals were appreciably lengthened till finally they ceased altogether. The patient noticed a disagreeable, foul-smelling, greenish pus. After several examinations, the true nature of the trouble was recognized as pyometra.

Pyometra is most commonly observed in the climacterium. During the menstrual life of the patient with a strictured cervix, the uterus may be filled with retained menstrual fluid; a hematometra which may become infected. When pyometra is noted in the postmenopause state, suspicion is always cast upon a degenerating polypus or a malignant tumor. In rare instances, a combination of the latter two lesions may be encountered.

As an example of pyohematometra, I may cite the case of a woman of forty-six who had had a premature menopause from a cause which was determined only at the autopsy. The patient was emaciated, had a waxy appearance and a severe anemia. She developed a low-grade fever a few months before exitus. There had been an occasional discharge of a bloody purulent nature from the vagina. The diagnosis of pyohematometra was made because the uterus was found to be moderately enlarged and tense and, upon forcing a uterine sound through the cervical canal, blood-stained pus escaped. The uterus on section showed the presence of a hard mass which proved to be sarcomatous. The cause of the secondary anemia was found in a large retrocecal abscess, which was well encapsulated and had existed for a long time.

Hypersecretion of the Genital Tract.—If specific and nonspecific infection associated with all catarrhal processes is assumed in vaginal discharges, how is the latter to be explained in virgins and in young children where all positive evidence of gonorrhea is missing? Aside from vaginitis in children, a condition rarely of gonorrheal etiology, there are many children and young adults who complain of a more or less profuse, watery, almost salivary, secretion from the vagina which, in most cases, is regarded with apprehension, annoyance and in some cases leads to neurasthenic symptoms. Anemia, chlorosis, asthenia, and conditions which have been held recently to arise as

a result of endocrine dysfunction, may be incident only to the vaginal discharge. Particularly young women complain of great weakness which they ascribe to the "leukorrhea."

The term "leukorrhea" is used by patients to denote any discharge from the genitals. Originally it was confined to the milky serous discharge characteristic of a colpitis. In hypersecretion, the discharge is rather different. It consists of a thin, slightly mucous, almost salivary secretion which adheres to the cervix only lightly. As a rule, a very mild, simple erosion is present. This may be congenital, or may not be present. The secretion from the sebaceous gland at the vulva, Bartholin's secretion and that from Skene's ducts all appear to be increased and subject to psychic influence.

It will, therefore, not be surprising to find that these young women respond to sex stimulation very readily; they read books relating to sex. The hyperemia produced through the psyche, or directly by masturbation, causes, in turn, a dysfunction or hyperfunction of the secretory apparatus associated with the genital tract. If the latter is true of the Bartholin gland, which pours out an oily secretion at the height of the orgasm, it may be assumed that the cervical mucous membrane will also pour out its secretion. Structurally, it presents an admirable apparatus for producing secretion in abundance. It need only be recalled here that all are agreed, since Reynolds called attention to the fact, that the rôle of the cervical mucous secretion is especially to further the activity of spermatozoa and their entrance into the uterus. The ovaries, too, must not be forgotten. For surely they share in the stimulation through the nervous system, whether this is mechanical or psychic, and it is not improbable that the mechanism regulating the cervical secretion resides in these organs.

CHAPTER XV

PAIN: GENERAL CONSIDERATIONS, AND AS A SYMPTOM IN GYNECOLOGY

Radiation of Pain.—"When a powerful stimulus is applied to one part, pain may be felt at some distance: as a rule some characteristic spot. The reason for this is that the centers in the brain of these widely removed surface areas are nevertheless closely related in the brain. An example of this is the sensitiveness of the cheek and pain along the jaw when one tooth is affected. For the nerves supplying the teeth and the skin of the cheek meet in the center of origin of the fifth cranial nerve, and the stimulation of the fibers from the teeth affect the fibers supplying the cheek.

"In the diagnosis of symptoms," says MacKenzie, "it is of the highest importance to appreciate both the nerve supply of the part in which the pain is felt, and the relation of these nerves to others in the central nervous system. The manner in which the pain spreads and the appearance of the other phenomena, due to central stimulation, provide the clue."

Visceral Pain.—"While the viscera are normally insensitive and remain so even when stimulated by agencies that evoke reflex responses in the cerebrospinal arc, adequate stimulation may produce symptoms. The stimulus from the viscus passes by the efferent nerves to the spinal cord where it affects neighboring nerve-cells, and these nerve-cells react according to their function—a sensory cell by producing pain, a motor cell by contraction of certain muscles, a secretory nerve by increased flow of its peculiar secretion, and so forth. When such stimulation affects a sensory nerve, pain arises which is referred to the peripheral distribution of the nerve so stimulated.

"The tissues particularly sensitive to pain in the abdominal wall are: (1) the skin, (2) the flat muscle layer, and (3) the loose properitoneal connective tissue layer which is exquisitely sensitive." According to MacKenzie, the peritoneum itself, the serous covering of the viscera, is not sensitive. In peritonitis, it is the inflammation and adhesions affecting this remarkable nervous layer which cause the severe pain.

"An adequate stimulus to viscera, however, can produce pain." As MacKenzie pointed out years ago, the most violent pains of which we are conscious are associated with hollow muscular organs, and by producing violent contractions of a hollow viscus, pain can be elicited. MacKenzie illustrates this by calling to mind the action of a distending enema which causes pain produced by violent peristalsis as evidenced by the bowel contents being expelled with considerable force as the sphincter relaxes. The pain subsides immediately upon the complete evacuation. Its situation is curiously not

over the area occupied by the rectum and descending colon, but is referred by most people across the middle line immediately above the pubis."

The Mechanism by Which Pain is Produced in Visceral Disease.— "When a nerve that terminates in a sense organ is stimulated in any part of its course from the periphery to the brain, a stimulation is given to the brain of a kind similar to that which would have happened if the peripheral end-organ had been stimulated. Thus the stimulation of any part of the optic nerve or auditory nerve gives rise to the sensation of light or of sound. In the same manner, if a sensory nerve is stimulated in any part of its course through the brain, spinal cord, or trunk of the nerve, the resultant sensation is referred to the peripheral distribution of the nerve in the external body wall. As already remarked, in the normal processes of life, a succession of stimuli is continually passing by the afferent nerves to the spinal cord, and continuously playing upon the efferent nerves that run to muscles, blood-vessels, and so forth, maintaining what we call 'tone' in muscles and blood-vessels. These processes are conducted so that they give rise to no appreciable sensation. If, however, a morbid process in a viscus gives rise to an increased stimulus of the nerves passing from the viscus to the spinal cord, this increased stimulation affects neighboring centers, and so stimulates sensory and motor nerves that issue from this part of the cord. Such stimulation of a sensory nerve will result in the production of pain referred to the peripheral distribution of the nerve, whose spinal center is stimulated, so that visceral pain is really a viscerosensory reflex. If the increased stimulus affects a motor center, then a contraction of the skeletal muscle results, and thus the visceromotor reflex is produced."

Referred Pain.— "The reason why the pain is referred to portions of the body so far apart is because, in the course of development, the tissues, that in a low scale of life immediately covered the organ, had been displaced. Thus, the pain felt in the testicle in renal colic is due to the fact that, in its journey down to the scrotum, the coverings of the testicle receive a twig from the first lumbar nerve, and, when the center of this nerve in the spinal cord is stimulated, as in renal colic, the pain is experienced in the testicle. In renal colic, one never finds the skin of the scrotum hyperalgesic, but always the deep covering of the testicle, because the scrotum is supplied by the sacral nerves, while the ureter and testicle are supplied by lumbar nerves.

"This view is the one adopted by practically all, to account for what is called 'referred pain.' Ross described visceral pains as of two sorts: 'splanchnic' pain in the organ, and 'somatic' pain referred to some part of the body wall remote from the organ. But when the so-called 'splanchnic' pain is critically examined, it will be found to be of the same nature as 'somatic' pain."

Radiation of Visceral Pain.— "Perhaps the best evidence as to the true nature of visceral pain is found in the manner in which pain spreads. No attempt has been made by writers to appreciate the meaning and significance of the spreading of pain. Thus, in gall-stones, a 'hypersensitive' gall-bladder and a 'tender liver' are described, and the pain of an inflamed gall-bladder is 'diffused over a large area along and below the margin of the liver.' In what tissues was this widely diffused pain felt? If the pain were in the

gall-bladder, why was it felt in a region more extensive than that occupied by the gall-bladder?

"The diffusion of pain over a wider area than that occupied by the organ in which the stimulus producing the pain originates can be proved in many ways to be due to an extension of the irritation affecting the central ends of sensory nerves in the spinal cord, as has been described. Thus the extension of the painful area is frequently associated with hyperalgesia of the tissues of the external body wall. The pain is often found to radiate along peculiar areas, inexplicable unless we recognize the relationship in the spinal cord of the nerves supplying these areas; as for instance, when the pain of angina pectoris passes from the front of the chest into the axilla and down the arm —that is to say, into areas supplied by contiguous nerve roots (third, second and first thoracic nerves); or when pain may appear at a distance from the affected organ and gradually approach it till it is felt in the tissues covering the organ, as when, in angina pectoris, the pain may at first be confined to the arm, but with increasing severity radiates to the front of the chest.

"An excellent illustration of the referred pain is seen in cases where the lesion is in the tissues supplied by the phrenic nerve. The phrenic nerve passes out of the spinal cord with the fourth cervical nerve, receiving sometimes small branches from the third and fifth cervical nerves. It is distributed, in part, to the diaphragm, the liver, and the gall-ducts. The sensory nerves from the fourth and fifth cervical nerves are distributed to the skin, over the top of the shoulder and down the outside of the arm. In a few cases of diaphragmatic pleurisy (sometimes with basal pneumonia), the patient has felt severe pain over the top of the shoulder on the affected side. On rare occasions, I have found a patch of cutaneous hyperalgesia on the shoulder. In gall-stone disease, shoulder pain is not an infrequent complaint, and the pain may extend from the top of the shoulder and down the outside of the upper arm. It may persist here with such severity that the causal condition may be overlooked and the case looked upon as one of 'neuritis.' The expulsion of a gall-stone may be followed by instant and permanent relief. In many instances, pain of real severity may be experienced and the pain may be, in some part, near the organ causing the pain, and no hyperalgesia may be detected. Such instances cannot claim to settle the question whether the pain is direct or referred. If, however, a careful search is made in all cases, some will be found which exhibit this hyperalgesia."

Pain the Only Sensory Reflex in Visceral Disease.—"There is one peculiar and puzzling feature about the reflex stimulation set up by a visceral affection, namely, that pain is practically the only sensation evoked. I shall show later that the stimulus from the organ on reaching the spinal cord, if of an adequate strength, will pass on to neighboring nerve-cells and stimulate motor and secretory nerves as well as the sensory nerves. But it is not clear why the stimulation should not affect the nerves that subserve other forms of sensation such as touch, heat, and cold. The ingestion of cold into the stomach under certain circumstances does give rise to a sensation of cold, and I have tried to explain that by another hypothesis, but, apart from this, the stimulus from any viscus does not produce cold or any sensation but that

of pain. The only explanation I can suggest is that for other sensations, apart from pain, a special receptor organ is necessary; for we know that in the skin there are special spots which are alone susceptible to heat or cold, and, unless the stimulation reaches the central nervous system through the special organ at the periphery for receiving these sensations, the stimulation of these nerves at higher levels gives no response. On the other hand, in disease of the central nervous system, other sensations may arise, such as formication, which are supposed to be due to stimulation of particular nerve fibers.

"*Dragging pains* associated with various visceral affections, such as gallstones, renal colic or appendicitis, are always, according to MacKenzie, associated with, if not due to, muscular hyperalgesia. 'In such cases, walking induces pain, and the contraction of the muscles may compel the patient to stoop. After exercising the muscle, or after the testing for muscular hyperalgesia, the patient may suffer from aching in the muscles which may last for hours.'

"A hyperalgesic muscle is rendered more so by exercise; pain and muscle contraction are the results.[1]

"Cutaneous hyperalgesia will usually be found in an ill-defined patch occupying portions of the field of distribution of one or more spinal nerve roots. The centers of these nerves in the cord will be found to be in close association with the sympathetic nerves from the offending viscus."

Tender Vertebrae.—"In many cases of visceral disease, pressure over the spines of certain vertebrae elicits pain, sometimes of a very acute character.

"Hyperalgesic areas at some distance from the spinal column associate such tender vertebrae, and these areas are supplied by the nerves that issue from the cord at the level of the tender vertebrae."

Mechanism of Production of "Direct Pain" and "Referred Pain."—"From what has been said in regard to the production and recognition of pain, it will be realized that, from the practical and clinical point of view, pain can arise from peripheral stimulation in two ways, which may be designated as 'direct pain' and 'referred pain.' Leaving out of consideration the pain arising from direct involvement of the nervous system by disease, such as affections in nerve trunks and in the central nervous system, and considering only the pains arising from stimulation of the peripheral distribution of the cerebrospinal and of the sympathetic nerves, we recognize that pain induced in either case is always accompanied by a judgment of locality, that is, the pain is referred to some region more or less well defined. There is, however, this difference: in the case of the cerebrospinal nervous system, the region in which the pain is felt is the region in which the painful stimulation occurs; whereas, in the sympathetic system, the region in which the pain is felt is not the region in which the painful stimulus occurs.

"The mechanism of the production of direct pain (cerebrospinal) and referred pain (sympathetic), and the course of the sensory and motor cerebrospinal nerves from their centers in the spinal cord to the periphery, may be readily understood by recalling their anatomical relations. If a stimulus is

[1] Cf. Pain and soreness after labor, especially in prolonged cases.

applied to the skin, the sensation is conveyed by the sensory nerve to the spinal cord, and up to the brain. The brain becomes conscious of the stimulus and recognizes the place from which the stimulus arose. Stimuli arising from organs travel along sympathetic nerves to the spinal cord. In the cord the sympathetic nerve fibers terminate in cells which are located near the motor and sensory cells connected with the motor and sensory nerves. It is here that the exchange of stimuli occurs.

"A stimulus adequate to produce pain, arising in an organ, passes to the spinal cord, extends beyond its own nerve-cell and affects neighboring cells. These cells being thus stimulated respond according to their function so that, when the sensory cell is stimulated, pain arises and the brain, recognizing forms, at the same time, displays a judgment of locality. The locality, however, is not the region where the pain stimulus arose, but at the special point in the peripheral distribution of the sensory nerve whose center in the spinal cord had been stimulated. For this reason, visceral pain is seen to be of the nature of a viscerosensory reflex, and is 'referred' to the peripheral distribution of the sensory cerebrospinal nerves whose center in the spinal cord is in close association with the sympathetic center supplying the offending viscus."

The Visceromotor Reflex.—The stimulation of the skin may produce symptoms other than that of pain; it may, for instance, produce a reflex contraction of a muscle whose nerve center in the spinal cord is in close association with that of the sensory nerve (the superficial or skin reflex). In a like manner, the stimulation reaching the spinal cord from an organ may produce a reflex contraction of the same muscle (the visceromotor reflex). It is this reflex that causes the hard contraction of the abdominal muscles, or some portion of them, in disease of the abdominal viscera; and the mechanism of their production is shown."

The Organic Reflexes.—"There is also a close association in the spinal cord between the nerve centers for one organ and the centers receiving the stimuli from other viscera. It has already been pointed out that a stimulus reaching the spinal cord may, if of adequate strength, stimulate other nerve-cells in its neighborhood, and these respond according to the nature of their functions, producing pain and muscular contraction as we have seen. If the nerve supply of another organ is stimulated, that organ will respond according to its peculiar function, so that, in the affection of one viscus, we may get reflex stimulation of another, as evidenced by the frequent micturition from stimulation of the bladder center in appendicitis, or increased flow of urine or saliva in angina pectoris. Our knowledge of the exact relationship of nerve centers does not permit of the real mechanism being always ascertained, but the clinical facts point to a relationship, as in the production of vomiting from remote organs, like that of the testicle and uterus."

Irritable Foci in the Spinal Cord.—"If the symptoms arising in cases of visceral disease be analyzed after the manner in which focal lesions in the brain or spinal cord are analyzed, then the true nature of the symptoms present will be appreciated. This manner of looking at the subject will demonstrate that, in many cases of visceral disease, nearly all the symptoms present

are really due to a stimulation of a limited portion of the central nervous system.

"Should a particular part of the spinal cord be rendered abnormally excitable in consequence of a violent stimulation arising from a certain organ, all the adjacent centers will become abnormally sensitive to stimulation, and this fact will be made apparent by the exalted functions of organs supplied from this region (hyperalgesia, muscular contraction, and undue activity of other organs).

"The stimulus that has had so marked an effect upon the spinal cord has not only produced the characteristic reflexes just described, but has rendered the sensory center abnormally sensitive so that the area stimulated is left in a condition of excessive irritability. Thus, the hyperalgesia of skin and muscle, that is often so marked a feature in visceral disease, is due to the fact that a stimulus, which would normally produce no painful sensation on reaching the spinal cord, excites an abnormally sensitive center, with the result that the sensation of pain is felt. That this is the explanation is shown by the further fact that a stimulus, reaching this excitable area in the cord from other sources, also produces pain which is referred to the hyperalgesic tissues (skin or muscle). Thus in a case of gall-stone colic, accompanied by jaundice, there is also extreme hyperalgesia of the skin of the upper part of the abdomen, especially marked in the epigastrium. This persists for some days after the stone has passed and has been found in the stool. During the time, the hyperalgesia persists and food taken into the stomach produces severe pain referred to the epigastrium. With the disappearance of the hyperalgesia of the skin, the pain, on taking food, ceases. Here there seems little doubt that the stimulation set up by the ingestion of food, which normally passes to the spinal cord unperceived by the brain, reaches that portion of the cord which has been abnormally excited by the gall-stone colic. The irritable focus thus produced in the cord being extended to the centers of the cutaneous nerves for pain which supply the epigastric region, the brain interprets the stimulus as pain and refers it to the peripheral distribution of the nerves thus stimulated.

"I have lately observed another remarkable manner in which these abnormally sensitive foci in the cord may be stimulated. My attention was directed to this aspect of the question by the following experience: A lady, who suffered from endometritis, experienced pain across the top of the sacrum, with tenderness and stiffness of the muscles of the back in the lumbar region. She told me that if she were startled, as by the banging of a door, a pain would suddenly shoot into this tender region of the back.

"I have made inquiries of a number of other patients, and have found abundant corroboration of this experience—so much so that many people, in whom there is a hyperalgesic area (cutaneous or deeper), experience a sudden pain in that region when startled. Thus, one patient, who suffers from a gastric ulcer, was frightened on her way to consult me, by being accosted by a drunken man, and she felt a severe pain in the epigastrium at the same time. In her case, there was a great tenderness of the skin and muscles of the epigastrium on light pressure. Another patient, with a dilated heart

and great tenderness of the left side of the chest, described how she started when some one unexpectedly laid a hand upon her shoulder, and, at the same time, a severe pain struck into her left breast.

"The explanation I give for the occurrence of these pains is that, when startled, a stimulus passes down certain tracts of the spinal cord, normally affecting centers of the muscular nerve supply, as evidenced by the sudden contraction of nearly all the muscles of the body. The stimulus not being of sufficient strength to affect the sensory nerves in a healthy cord affects the excitable sensory nerve centers because there are abnormally irritable foci through which the stimulus passes. The pain, so arising, is referred to the peripheral distribution of the nerve stimulated. It may be that the pain is produced by a stronger and painful contraction of the excitable and hyper-algesic muscles.

"A somewhat similar result follows extra stimulation of motor nerves whose centers are excited by visceral stimulation. When there is an exalted visceromotor reflex, the muscles are in a more contracted condition than that which the normal tonicity maintains, as evidenced in the flat muscles of the abdomen by the greater or less hardness with which we are all familiar. This is due to their being exercised in their function as part of the protective mechanism. If now they are exercised in their other functions by assisting in the movements of the body, the combined result of these two stimuli is to produce a continuous shortening of the muscle. This was remarked in the case of appendicitis, where the psoas muscle caused the patient to stoop when she walked a short distance. In another patient who suffered from renal colic, there always persisted for a few days after an attack had passed a slight tenderness and rigidity of the lower part of the right rectus muscle. When he went about, the whole of the muscle became so contracted after a few hours that he could not straighten himself, but walked with his body slightly bent. After a short rest, the contracted muscle would slightly relax. A similar condition is found in those cases of 'lumbago' where the pain and stiffness of the muscles arise from some pelvic trouble, such as endo-metritis, hemorrhoids, etc."

Exaggerated Reflexes Due to Irritable Foci in the Cord.—"In all these hyperalgesic areas, due to focal irritation of the spinal cord, the ordinary cutaneous reflex is more easily excited and the muscular response more vigor-ous and often more prolonged than normal. I need not dwell on this point as the fact is so readily demonstrated. Every one is familiar with the hard-ening of the abdominal wall when any tender part is palpated with even very gentle pressure. This springing up of the hardened muscle serves as an efficient protection of the underlying viscera, and the purpose of the cutaneous and muscular hyperalgesia is manifestly to render the reflex mus-cular contraction rapid and powerful. In severe cases, this muscular con-traction does not at once relax, the muscle remaining contracted for long periods, even under deep anesthesia."

Relationship of Visceral Lesion to Site of Reflex.—"Recognizing the fact that the pain and other sensory pheomena are to be found in the per-ipheral distribution of some cerebrospinal sensory nerve, it is necessary for

the detection of the offending viscus to know the relationship between the distribution of the cerebrospinal nerves in the external body wall and the individual organs. In the primitive vertebrate, before the development of the limbs, each spinal nerve is distributed around the body. The sympathetic nerves supplying the viscera issue from the cord with the cerebrospinal nerve and supply the viscera at the same level, so that the nerve supply of the organ and the nerve supply to the covering external wall arise from the same region of the spinal cord.

"The heart in a primitive vertebrate affords a good example of visceral reflex. From the spinal cord, the nerves pass to be distributed around the body wall. In addition to these, a branch is given off which runs to the sympathetic ganglia to be distributed to the heart. When a stimulus of adequate strength passes from the heart through the sympathetic to the spinal cord, the result is shown in the stimulation of the sensory and motor nerves arising at that level, so that these reflex phenomena are exhibited in the immediate neighborhood of the suffering viscus.

"In the course of development, particularly with the appearance of the limbs, this relationship of the situation of the viscus to the distribution of the allied cerebrospinal nerves becomes modified, although the relationship of the spinal and sympathetic nerves remains. The viscera become displaced backward, and the nerves that were wont to run transversely round the body at the level of their exit from the cord become distributed in an apparently irregular fashion. Thus, the lower cervical and upper thoracic nerves are distributed mainly in the arm, so that the nerves supplying the skin over the clavicle, and as low as the second rib, come from the fourth cervical, while the adjacent skin lower down on the chest is supplied from the second thoracic nerve—the intervening nerves being distributed in the arm. The sympathetic fibers supplying the heart arise from the spinal cord at the level of the upper thoracic nerves, so that the pain in affection of the heart is felt in the distribution of these nerves. In the case of the primitive vertebrate, the pain would be over the heart, whereas in man the pain is felt chiefly in the arm, where the upper thoracic nerves are distributed. This accounts for the characteristic distribution of the pain in angina pectoris, a symptom which commonly misleads the patient as to the source of the trouble.

"In herpes zoster, there is an inflammation of the ganglia on the posterior roots of the spinal nerves, and when the ganglia on the upper thoracic nerves are affected, the eruption has a distribution closely resembling the hyperesthetic area in angina pectoris.

"The same diversion of nerves takes place in the lumbar region, where the lumbar plexus is distributed to the inferior extremity, and, as a consequence, the symptoms of visceral disease may appear in the leg.

"In addition to the disarrangement from the primitive plan of the limb nerve supply, the organs themselves have shifted their position—such organs as the heart and stomach being situated further back, while the testicles migrate far away from their embryonic position.

"It is in consequence of this diversion of nerves and displacement of

organs that the symptoms arising from a viscus may be exhibited at some considerable distance from the situation of the viscus."

Differential Diagnosis.—"On account of the fact that pain, originating in any part of a nerve in its course from the brain to its periphery, is referred to its peripheral distribution, there is often a difficulty in determining the source of the pain stimulus. The differential diagnosis must, therefore, depend on a knowledge of how the pain arises, the relationship of the nerve supply of different regions of the body to the central nerve supply and its connection with the visceral nerve supply. In the absence of any demonstrable cause of stimulation at the periphery, it is necessary to consider the possibility of stimulation at more central parts. The symptoms that may arise from an irritation of a nerve trunk, as from pressure, neuritis, or herpes zoster, resemble those that arise from visceral disease in a great many respects. So great, indeed, is this resemblance that even the most experienced may be led astray. Thus, the pain and hyperalgesia of a stomach affection may simulate the symptoms produced by caries of the spine, and the shoulder pain of gall-stone disease may be mistaken for a neuritis.

"It might have been supposed that pain due to the stimulation of a nerve at its periphery, or at its trunk, would have had a distribution peculiar to the peripheral distribution of the nerve branch so stimulated. If the region of the pain had been limited to the part of the periphery stimulated, or to the distribution of the nerve trunk, such a limitation of the field of pain and hyperalgesia might have given the desired indication, but, as has already been shown, the stimulation of the periphery of a sensory nerve, or of its trunk, causes a spreading of the pain by reason of a central radiation. It follows that a local irritation may produce such widespread phenomena as to simulate central irritation. It is for this reason that the various forms of "neuritis" so closely resemble the pains of visceral disease, pains due to pressure on the trunk of the nerve or herpes zoster.

"For the purpose of differential diagnosis, it is necessary to know how the pains of visceral disease arise and spread. This knowledge can only be acquired by careful study of individual cases, for, though certain general laws underlie the production of these symptoms, there are differences in individual cases. In doubtful cases, the knowledge that in visceral disease certain associated phenomena can arise may often help to clear up a doubtful case. This description is far from complete, and does not take into consideration symptoms that arise from certain viscera, such as the pancreas or spleen, because opportunity has not been afforded for the study of the symptoms in these cases with sufficient precision, and the descriptions usually given in the literature are too indeterminate to be of real value. We must content ourselves with saying that, before deciding that any given case is a neuritis or a neuralgia, the possibility of visceral disease should be carefully considered."

Pain as a Symptom.—Pain brings the patient to the gynecologist perhaps as often as all the other genital symptoms put together. Its interpretation is fraught at times with the greatest difficulty. Indeed, in a certain number of instances, after ransacking every organ and employing all available methods of

diagonsis, we are left without an explanation of its source. Its genesis is so varied, its manifestations so diverse and overlapping that the best diagnostic skill is often taxed. If no ultimate analysis of its cause is arrived at, it becomes a matter of compromise and solace to be able to exclude important organic causes, such, for example, as carcinoma of the uterus, of the rectum, etc., the mere thought of which worries the patient needlessly. Pain to the average woman connotes the presence of a "sore" or a tumor. While interested immediately in obtaining relief, she nevertheless usually seeks for an explanation of its causes. The more intelligent the patient, the more anxiously is she bent upon this inquiry. Since a proper diagnosis of the cause of the pain is closely linked with measures devised for its relief, it becomes doubly the task of the physician to endeavor to find the correct solution.

In studying the general causes of pain, it is well to bear in mind that the psychic condition of the patient has an important rôle; for while some tend to exaggerate trivial sensations into violent pain, others are less sensitive and complain only upon very adequate stimulation of the pain centers. It is well to observe the general expression of the patient as she describes her sensations of pain, especially during an attack, noting her general appearance. If the latter is that of good health, if she has suffered no loss in weight, if the facial expression is not anxious, the chances are in favor of some fleeting, transitory pain experience. If, on the other hand, the underlying cause is serious, she will show marked signs of suffering. Neurasthenic and psychasthenic individuals are very prone to exaggerate their sensations and due allowance must be made for this. On the other hand, we should not be too ready to pronounce such individuals neurasthenic without making every effort to establish an organic basis for their complaint and, even after excluding all such causes, we should find refuge in the mental reservation that it may at some future time be discovered. In the absence of detectable structural cause, treatment instituted along neurological lines may serve at the same time to be of diagnostic or corroborative value.

Pain is the most telltale symptom. It points at once to the seat of pathological change. As a rule, it localizes the trouble within the closest margin; at others, it is at some distance from the seat of origin. The latter is usually "referred" and holds true for most abdominal pain. Its location on the surface of the abdomen usually points to the underlying organ which is diseased. Thus the pain at McBurney's point signifies appendicular disease. Biliary colic and renal stone colic are referred to points overlying the gallbladder and kidney respectively. While some attacks of pain are characteristic of distinct visceral lesions, others are less definite, being located in regions where several organs may be the cause. It has been customary to divide the abdomen into certain well-known surgical or anatomical regions. The regions on the right side of the abdomen are the seat of trouble more often than the corresponding sections on the left side. The same applies to the pelvis for, while the distribution of the uterine appendages is the same on each side, the right half often comes into conflict with diseases of the appendix which enters into the differential diagnosis very frequently. At

the same time, although lesions on the right side are more numerous, they are also more typical in their clinical symptomatology so that more often correct diagnosis is established than in left-sided pain. Being simplified by a smaller number of organs, the left side has more "silent areas" and, as "dead men tell no tales," so these areas tax all our diagnostic resources when it comes to explaining pain. Something can be inferred from the intensity and character of the pain. Sharp pain is induced by trauma incident to accidents occurring to hollow viscera. Pedicle twists are accompanied by agonizing pain. Spontaneous rupture of the tube, as in the case of an ectopic pregnancy or of a thinned-out pyosalpinx, rupture of the appendix and of the gall-bladder, are all associated with sharp lancinating pain. The location, radiation and recurrence, with other associated symptoms, must be taken into account in the differentiation. The character of the pain changes, and its significance varies with the pathological process which it ushers in. Thus, general abdominal pain becoming localized in the right iliac fossa nearly always indicates appendicular inflammation. When the inflammation extends to the general peritoneal cavity through perforations, the distribution becomes wider, occupying the involved peritoneal surface.

Sharp pain usually denotes an acute process. In the absence of fever and reflex symptoms, such as rigidity and immobility of the abdominal wall on breathing, inflammatory disease may be ruled out. In these cases, the mechanical factor involved in the passage of a biliary or a renal stone or in the attempt at expulsion of intestinal gas over an obstruction partial or complete must be thought of.

The most serious cause of general abdominal pain is acute general peritonitis. Its origin may be determined occasionally by an exact report of the development and distribution of the pain. Since most cases of peritonitis arise through perforation of hollow viscera or by rupture of localized abscesses, the original site of the pain may be expected to point to the viscus which is the seat of the perforation. In nonperforative peritonitis, such as that arising from the infected uterus in puerperal sepsis, the history of the labor and the early situation of the pain in the lower abdomen will point to the pelvis as the source of infection. Abdominal wall rigidity and tenderness to pressure, with increasing pulse rate, practically always indicate a peritonitis. The temperature is usually elevated, but it need not be unduly high; it may not reach a level higher than 101° to 102° F. and yet the patient may be *in extremis*. Vomiting and abdominal distention are usually concomitants, but these may be present in other intra-abdominal conditions, notably acute intestinal obstruction. The diagnosis of general or local peritonitis may always be made by the intense pain plus muscular rigidity and tenderness of the abdominal walls. Vomiting occurs as a result of the acute constipation. Paralytic ileus, with its intense toxemia, may be distinguished from intestinal obstruction by the absence of general abdominal rigidity, by the successful results following the administration of enemata, and by the absence of spasmodic pain. Whether partial or complete, the obstruction of the intestines is usually associated with violent peristaltic contractions of the bowel above the point of stricture. These contractions are recurrent at more or less

regular intervals and may be seen as elevating waves underneath the abdominal wall. When present, this is pathognomonic of intestinal obstruction. The pulse is not apt to be very rapid in the early stages, while the vomiting is more pronounced. In the later stage, it may be impossible to distinguish acute general peritonitis from complete intestinal obstruction; the meteorism, abdominal wall immobility, increase in pulse rate and peritonitic fluid may all be present in both conditions.

The use of the enema as a therapeutic measure may also advantageously be used for diagnostic purposes. When relief comes with the bowel evacuation, it is safe to assume that the pain was due to *intestinal colic*. In the mild case, that due to constipation and fecal impaction, the frequently recurring paroxysms of pain are promptly relieved. When the enema returns clear after several injections and no relief obtains, the diagnosis of intestinal obstruction may be fairly clear. The use of castor oil by mouth is less valuable, not only because it is frequently rejected by the stomach but because it sets up worse peristalsis. When the obstruction is incomplete, the oil may be seen in the stool. When complete, it cannot be recovered in the stool.

Severe abdominal pain without signs of fever and inflammation may be due to gastric crises, but absent knee jerks and other signs of tabes dorsalis will clear the diagnosis. Lead colic is another form of pain unassociated with signs and symptoms of infection; a diagnostic sign is the blue line on the gums; the history and occupation of the individual are other helpful elements in the diagnosis. Purpura hemorrhagica and erythema nodosum are occasionally ushered in by acute abdominal pain and, before the skin manifestation appears, the patient's abdomen may be opened for an impending peritonitis. The same has been recorded in measles and scarlet fever, in typhoid fever and, not infrequently, in pneumonia. In the latter, the upper abdomen may be very rigid and exhibit tenderness. The respiratory difficulty, increased breathing, cyanosis, and higher temperature are very suggestive of a primary pneumonic process as against a peritonitis. Pneumococcic peritonitis offers great difficulty in diagnosis. By aspiration through the abdominal wall in doubtful cases, light can be thrown upon the true state of affairs. Culture of the fluid thus obtained may serve to demonstrate the offending organism.

Since the physician is called upon to diagnose the cause of abdominal pain, he will be obliged to think of all the possibilities. In general, he will be able to exclude pelvic conditions by a careful bimanual examination. Unless the rigidity and tenderness is universal, extending well down to the lower rectus muscle, it should be possible to palpate the uterus and adnexa. When these are not enlarged or fixed, or tender and are distinctly palpable, they may be ruled out as contributing causes.

Certain pains are associated with other symptoms in such characteristic fashion that they may be termed syndromes. Thus the occurrence of pains in the loins radiating downward to the groin or extending into the bladder (suprapubic region) and associated with the finding of red blood-cells in the urine (catheterized specimen) and urinary frequency and difficulty at once suggest renal or the colic from ureteral calculi. If tuberculosis or even hyper-

nephroma may simulate this symptom complex, these symptoms and signs, nevertheless, always denote kidney disease. Similarly, generalized abdominal pains, finally located at McBurney's point, with local tenderness and rigidity, may be interpreted as almost absolute evidence of appendicitis. Biliary colic is associated with pain in the right subcostal margin, radiation to the shoulders and palpation of a swollen, tender gall-bladder. The demonstration of stones in either case by the X-ray is clinching evidence, but this is not absolutely necessary as the clinical symptoms are, in the typical case, sufficient to render the diagnosis certain.

In the same way, acute pain on one side of the pelvis with rigidity and tenderness in the lowest portion of the rectus abdominus, the palpation of a thickened tube or tenderness in the fornix, slight fever and vomiting and the presence of a urethritis or cervical gonorrhea, usually spell salpingitis. Spreading of the pain to the other side of the pelvis denotes, as a rule, involvement of the other tube.

Severe pain in the pelvis, coming on after a period of amenorrhea of shorter or longer duration or even anticipating the next period and spotting, with an attack of fainting, means, in the vast majority of cases, ectopic pregnancy. The only precaution necessary, is to make sure that this particular patient is not subject to fainting attacks when seized with pain, whatever the origin. The palpation of an elongated, tender swelling to either side of the uterus, especially in the absence of frank urethritis and appreciable uterine enlargement, makes the diagnosis practically certain. Here it may be well to emphasize that *an ectopic pregnancy uncomplicated by inflammation never causes profuse bleeding.* This appears in the presence of salpingitis and oöphoritis, or pelvic peritonitis in which the tubes and ovaries are involved.

A twisted ovarian cyst is associated with very severe, sharp pain, usually unilateral and situated low down in the pelvis. The site of the pain varies somewhat with the size of the tumor and the degree of the twist, the amount of intracystic hemorrhage and cyst tension. But the radiation of the pain down the inner side of the thigh and knee not only speaks for an ovarian twist or an adnexal twist, but, in the case of the former, also points to the side involved. Thus a twisted ovarian cyst arising from the right side will cause radiation of the pain down the right thigh and knee. This holds good no matter where the ovarian tumor is palpated. For it happens occasionally that a left-sided ovarian cyst may be palpated in the midline or on the opposite side and vice versa (Fig. 62). In my experience, this sign of pain radiation has been an unfailing evidence of the origin of the tumor. Torsion of the tube, that is, twisted hematosalpinx, may simulate this condition very closely. The palpation of a sausage-shaped tumor and the escape of blood from the vagina are very suggestive of hematosalpinx.

Dull pain is due to a mild grade inflammation, to displaced viscera and to passive congestion. Thus, in general visceroptosis, the patient complains of a dull, dragging, general pain and a sense of fatigue. The kidney, liver, spleen or the stomach and intestines may be displaced downwards. Likewise the uterus and bladder may drop. Prolapse of the ovaries is associated with

a dull, dragging sensation in one side of the pelvis often reflected down the thighs. This pain, combined with a mild inflammation, causes the ache described as "chronic toothache" in the abdomen. The visceroptotic patient presents a picture of asthenia best noticed in the abdominal profile, etc.

Bearing-down pain as a symptom is peculiar to women, although affections of the rectum may cause it in either sex. It is generally associated with some pelvic impaction or some gross deformity at the pelvic outlet. Whatever the cause, whether a prolapsed uterus or large cystocele or rectocele, it acts as a foreign body which sets up efforts at its expulsion. The mechanism similar to that involved in defecation appears to be set in motion by this deformity. The most extreme bearing-down pain in the pelvis is due to an incarcerated retroflexed or retroverted, gravid uterus. The contractions engendered in the uterine musculature, and reflexly in the pelvic floor with the rectal sphincters and vaginal sphincters, combine to cause severe bearing-down pains. Fecal impaction in the rectum can also produce agonizing bearing-down pains. Relief follows promptly the evacuation which has to be aided by digital removal of the scybala.

An impacted fibroid or ovarian tumor by pressing upon the pelvic nerves may produce pain of a different character. The bearing-down pain caused by hemorrhoids, rectal ulcer or cancer and, in some cases, by bladder stones and bladder growths, should lead to special examination of these organs with the instruments specially devised for that purpose. Bimanual examination will usually suffice to determine genital causes for this sort of pain. It is very important to combine vaginal and rectal touch in the bimanual examination when pain is the chief complaint. It must not be forgotten that bearing-down pains may be the first symptom to suggest the onset of labor in a young unmarried woman, and this condition arises not infrequently among domestic servants. It may, on the other hand, also indicate the beginning of a miscarriage. Here, too, it is the effort at expulsion involved in the uterine contractions that give rise to the bearing-down pains. The same sensation is experienced by a great many women at the onset and during the menses. Apart from these conditions, this symptom is absent in the many lesions which produce so many other symptoms in gynecology.

Pain in the hypochondrium does not often enter into differential diagnosis with genital lesions. If present, it radiates down from higher up, as a rule, and therefore suggests an origin in organs in the upper abdominal quadrants. Thus ulcer or carcinoma of the stomach will cause pain in the left hypochondrium and in the epigastrium. Similarly such diseases as cholecystitis, splenic enlargement or perisplenitis, renal colic, tumors and obstruction of the splenic flexure, pleurisy, intercostal neuralgia and herpes zoster, will cause symptoms of pain in the left hypochondrium.

Pain in the right hypochondrium may be caused by lesions in the organs just mentioned, in the liver, in the head of the pancreas, in the appendix and occasionally in the uterine appendages. In the case of the last named, the uterine adnexa are situated at the pelvic brim or higher and are very apt to be adherent to the appendix. Pyelitis and perinephritic abscess are other conditions that enter into the differential diagnosis of conditions caus-

ing hypochondriac pain. *The one important distinguishing point is the finding of normal genital organs on bimanual examination.* Pelvic disease may, however, be present in combination with symptoms of upper abdominal disease and it may become an important matter to decide which requires more urgent attention. When confronted with a patient suffering acute abdominal pain, the history of the attack and its location, together with radiation and associated symptoms, usually serve to establish an ante-operative diagnosis. It becomes a matter of surgical judgment whether or not to operate and which line of procedure to adopt.

In subacute and chronic lesions, one is more reluctant to resort to surgery; one hesitates to fall back on exploratory laparotomy to establish the seat of the pain. It is much more satisfactory, as Bland Sutton says, "to hit the bull's-eye rather than be content with hitting the magpie."

Pain in the iliac fossa of a more or less chronic type is practically always due to borderline gynecological and surgical conditions. While upper abdominal lesions may enter into the discussion of the genesis of pelvic pain, lesions of the sigmoid colon, rectum, ureter, appendix, cecum, retroperitoneal tissues or kidneys may enter into the differential diagnoses. Without going into a detailed narrative of the differential points characterizing the lesion of each of these organs, it is well to emphasize the fact that, when the uterus, tubes and ovaries are definitely identified as the source of the trouble, the diagnosis becomes easier.

The principal conditions of the sigmoid colon and the rectum causing pain in the iliac fossa on the left side are carcinoma, impacted feces, spastic constipation and chronic diverticulitis. The malignant growths are associated with definite clinical symptoms referable to the disturbed alimentary function. Very occasionally the sigmoid may be palpated in the left vaginal fornix and simulate diseased left adnexa. Fecal bolus or a thickened sigmoid wall with hypertrophied appendices epipolicae may give the impression of inflammation of the tube and ovary. Two points in the differential diagnosis are of value: one is the sense of gurgling which may be elicited on squeezing the mass between the vaginal and abdominal fingers; and the other is the pitting which may sometimes be elicited in the same way. Catharsis combined with rectal irrigation will clear up the diagnosis. Rectal examination with the sigmoidoscope and the X-ray must often be employed to exclude or establish the presence of organic stricture occasioned by malignant or benign ulcers. The value of rectal touch for locating lesions situated in the rectum itself cannot be overestimated. This should be a part of the routine examination of every case in which pain in the pelvis is the cardinal symptom. Carcinoma of the lower portion of the rectum may infiltrate the vaginal wall to such an extent as to interfere with coitus and, to the uninitiated, give the impression of a vaginal growth; more commonly hemorrhoids are considered to be the cause of bleeding and pain and are not infrequently operated upon, when actually the symptoms are caused by a carcinoma two or three inches from the anus.

Chronic diverticulitis is a condition which may be mistaken for diseased adnexa, especially pyosalpinx when it has given rise to a chronic, thick-walled

abscess. The diagnosis is most often established at operation. It will prob-
ably always be a most difficult thing to distinguish these two conditions be-
cause, even at the operation, the adnexa may be found adherent and involved
in the perisigmoiditis. Perhaps a suggestive hint in the primary location of
the diseased process of the sigmoid may be had from the history of long-
continued constipation together with chronic colitis. When suspected, the
condition can be definitely established by the use of the X-rays, which will
show saculations with narrowed orifices extending from the lumen of the
gut.

Perhaps the source of greatest confusion in differential diagnosis of pain
in the right iliac fossa is the appendix. The riddle of the right-sided pain
has been partly solved in late years by the identification of two or three
lesions in the ureter. An acute ureteritis is mentioned by English writers as
a definite clinical entity. As a rule, it follows the passage of a ureteral stone,
but it may be primary. Another condition termed *coli bacilluria* may simu-
late the pain of chronic appendicitis. The finding of colon bacilli in pure
culture in the catheterized specimen, or better in the ureteral specimen, estab-
lishes the diagnosis. Still another condition to which attention has been
called by Hunner is stricture of the ureter without the presence of a stone.
The frequency with which an appendix was removed on mistaken diagnosis,
with resulting failure to relieve the pain, has led to closer examination of
neighboring structures for possible responsible lesions. Even when the X-ray
has been employed without resorting to ureteral catheterism, the nature of the
true condition of affairs is often left in doubt; while, with the use of the
ureteral catheter, not only will the cause be found, but the pain will also be
relieved.

Genital lesions causing pain in the iliac fossa have been described in detail
in another chapter. Here it may be mentioned that, besides their tendency
to be bilateral, they are more easily identified by vaginal examination. There
is very apt to be disturbed menstrual phenomena; and the history preceding
the attack may be traced to some pelvic infection or trauma. Cases occa-
sionally occur, however, in which lesions of the appendix and right-sided
uterine appendages are combined, presenting symptoms common to both
structures. A useful test of appendicular inflammation is the tenderness
which results after inflating the colon and then making pressure over
McBurney's point. Another aid is offered by palpating the appendix area
visualized in the fluoroscopy after the colon has been injected with barium
or bismuth.

Lane's kink at the ileocecal junction may cause right-sided pain simulating
appendicitis. The cause of constipation, in this case, can be cleared up by a
serial X-ray examination of the alimentary canal. The dull, grumbling pain
or sense of discomfort may thus be finally accounted for. Adhesions of the
appendix itself with fixation may now be better diagnosed by the X-rays. Ad-
hesions around the colon, as elsewhere in the peritoneal cavity, may be
demonstrated by the use of the X-ray and transperitoneal inflation with gas.
Tuberculosis of the cecum causes a sense of dull pain with occasional acute
exacerbations. The tumor in the right iliac fossa, which may simulate a

chronic appendicitis, abscess, or even carcinoma, is, therefore, of doubtful value. The finding of pulmonary phthisis with tubercle bacilli in the stool (antiformin method) is strong corroborative evidence when actual swelling is present in the iliac fossa; the diagnosis of the cause of pain is a much simpler task than is the case when no swelling is palpable. Thus, whether a rare actinomycosis is present, or carcinoma of the cecum or tubercular iliac lymphatic glands, the operative indication is clear and is usually the only way of definitely establishing the diagnosis. More difficult is the interpretation of the pain for which no gross lesion is found. In this case, the most thorough investigation must be undertaken to exclude visceral disease by all the diagnostic methods available. It is not far-fetched to say that every organ must be reviewed, not only from the aspect of physical signs, but also from the evidences of their impaired function. Although we are at present still far from having at our disposal accurate functional tests for each organ, there already exists a goodly array of methods for determining disturbances of such viscera as, for example, the kidney and pancreas. Disturbances of the hollow viscera are more amenable to interpretation, since their mechanical function can be readily tested by physical means. The kidney, ureters and bladder yield perhaps the greatest percentage of diagnostic evidence, so that it is fair to state that, in genito-urinary diseases, accurate diagnosis, at the present state of our knowledge, may be made in nearly 90 per cent of cases. In gynecological diseases, precise interpretation should rapidly approach the favorable diagnostic possibilities attained in the urological domain. In paying careful attention to disturbances of function combined with careful physical examination, true interpretation will be an increasing achievement in the future. In this, perhaps, the newer methods of gas inflation of the peritoneum by the transperitoneal or transuterine route will render decided aid.

Tumors of the iliac bone may be the cause of right-sided pain. They are distinguished by their hardness and fixation and yield definite evidence in the X-ray plate.

When there is no local evidence in the iliac fossa of the common causes of pain in that region, more remote lesions may be responsible. Such conditions are pleurisy, subdiaphragmatic exudates, perinephritis and herpes zoster. The last named may cause pain in the right iliac fossa before the eruption occurs, but, as a rule, it also radiates to the thigh and to the loin.

In excluding visceral lesions that may produce right iliac pain, one must not forget lesions in and around the posterior nerve roots. Irritation of the spinal cord nerve roots in the lower dorsal or upper lumbar vertebrae, as from early spondylitis deformans, osteo-arthritis of the spine, rheumatoid arthritis and spinal caries (with or without psoas abscess), may be responsible for the chronic pain felt in the iliac fossa. A false diagnosis has been known to have led to unsuccessful operations for the removal of the appendix. Reference has already been made to the necessity of making a careful neurological and orthopedic examination in every case of backache. It need only be added that, in analyzing the causes of pain of doubtful origin, these departments should be brought into consultation, for, frequently, on careful ques-

tioning, the pain may be situated both in the iliac fossa and in the back as well.

Having thus endeavored to locate the cause of the pain, all evidence of regional trouble may prove of negative nature. Hence, it remains to inquire into the psychic state of the patient. It is surprising how often domestic, social or occupational unhappiness may be responsible for obscure aches, and relief may be very prompt following the correction of these conditions. On the other hand, muscular rheumatism (myalgia) may be relieved by salicylates, etc., and thence clear up an obscure diagnosis. If these drugs act as general anodynes, they will not permanently or appreciably relieve the pain that is due to visceral disease. If, after a short course of treatment with anti-rheumatic measures, the pain and discomfort are permanently relieved, it may not exactly prove that the lesion was of rheumatic character, but it will prove that the pain was not based upon some serious organic change in the viscera. By trying in each case thoroughly to analyze the causes of pain, one will avoid doing unnecessary surgery and especially falling into the unfortunate hazard of operating upon what H. Kelly has called the "psychasthenic patient" or what Aschner and others refer to as the individual with an "anomalous constitution." Happy is the surgeon who can weed these patients out of the group who very properly need surgical relief, for, once he has made the mistake of operating, he will be obliged frequently to re-operate on these patients in the belief that they are suffering from post-operative adhesions. Unless he realizes the type of patient he is dealing with, he will subject her to one operation after another, chasing phantom symptoms and phantom lesions.

PAIN IN THE ABDOMEN AND PELVIS OF CHRONIC TYPE

General Considerations.—The cause of pain is irritation of the sensory nerves. This irritation may affect the nerve terminals at the surface of the skin or in any of the underlying tissues and viscera, along the nerve course or at their trunk. A nerve which anastomoses with that supplying the painful area may also convey the pain stimulus. Since the thoracic and lumbosacral spinal nerves supply branches to the skin, bones and meninges of the spinal canal, the muscles lying on the vertebral column and the viscera contained in the abdomen and pelvis, any stimulus in the distribution of these nerves may be referred to their respective segments on the skin surface. It will thus be seen that all tissues and organs associated with such skin segments will have to be reviewed in trying to determine the exact site of the irritation.

In this analysis, the matter of tenderness is of great diagnostic help. When this is present over a certain spot and is elicited by firm pressure, the diseased organ is located, in all probability, at or near the seat of the trouble. In the absence of tenderness on firm pressure, the pain is to be interpreted as "referred," the sensation having been deflected from the brain centers to the skin surface. The pain in the latter instance arises at some deeper portion of the abdomen not immediately underlying the painful spot on the skin.

Another distinction present in this "referred pain" is the relative insensitiveness of the skin to deep pressure, while superficial tenderness is exquisite.

When the area of the skin corresponding to the site of pain is anesthetic, it indicates a degenerative lesion of the trunk of the nerve involved. Perhaps the most difficult of all differential diagnoses for the gynecologist is the pain reflected in diseases of the spinal cord and its meninges and the nerve trunks. For this, special neurological training is needed and, in the consideration of all chronic abdominal pain, I deem it absolutely important to secure the report of a thorough and painstaking neurological examination. Although this is most urgently needed in cases of backache, where also orthopedic opinion is to be sought, it will serve to eliminate from, or confirm in, the diagnosis the structural changes in the spinal cord.

Whenever pelvic examination is negative and the routine abdominal examination results in failure to detect gross abnormalities, it is of particular value to pay attention to the neurological and orthopedic side. For, barring such extremely rare lesions as aneurysm or thrombosis of the celiac axis, etc., which can at best be only conjectural, the more common causes of pain in the abdomen may be determined by additional inquiry into the orthopedic and neurological status.

Hyperesthesia of the skin, as pointed out by Head, MacKenzie and others, has to do with pain referred from a viscus. There must obviously be no redness or swelling in this case, for this would at once suggest an acute or chronic inflammation involving the skin. Blushing produced over a given area by the same stimulus which fails to evoke it in another area is strongly suggestive of visceral pain and proves the presence of a disturbance in the sympathetic nerve distributed to the viscus.

In the orthopedic consideration of the cause of the obscure pain in the abdomen and referred to the lower extremities, search will be made for the following conditions: in the muscles, abscesses, trauma, acute inflammations, fatigue, asthenia; in the joints, especially the sacro-iliac synchondrosis, caries, rheumatoid arthritis and spondylitis and its accompanying radiculitis. Sacroiliac relaxation is a term describing a condition which has formerly been regarded with considerable popularity as a frequent cause of backache. It is no longer held to be responsible for the symptoms of weak back or mild lumbar arthritis. The X-ray evidence (asymmetry), recently held as explanatory for a local sacro-iliac lesion, has been found present in normal individuals, proving that the symptoms were not due to an anatomical displacement. The X-ray may be helpful in demonstrating bone changes due to caries, new growths or fractures; but, in many cases, the pictures shown as abnormal may be innocent irregularities.

In the bones, as causes of pain, one may seek for evidence of caries, aneurysm, eroding growths and trauma, and, on the neurological side, such lesions as meningeal inflammations, new growths, tumors of the cord, trauma and inflammation.

Visceral Lesions as the Cause of Pains.—Perhaps the simplest task in abdominal diagnosis is to exclude or establish pelvic abnormality. If the pain is located in the pelvis, it should not be difficult to find an explanation,

but sometimes, even in this accessible anatomical region, it will be a matter for delicate balancing of diagnostic elements. If nothing more than a retroposed uterus is found, will it be sufficient to account for the pelvic pain? On the other hand, does a prolapsed ovary always cause the dragging sensation in the pelvis? Does a moderate cystocele alone account for dysuria? Is tenderness over the right iliac fossa always indicative of appendicitis? Does tenderness over the course of the sigmoid indicate diverticulitis? Does tenderness in the course of the ureter mean ureteritis or the presence of a stone? Such evidence alone is not sufficient in chronic pain to be used as a diagnostic basis. Patients complaining of chronic pain, without apparent or obvious causes being detected by the routine physical examination, will require all the aids that laboratory methods offer.

Careful history taking is of great value in the search for the cause of chronic abdominal pain. Thus, reference to persistent constipation and pain, particularly at stools, at once points to the intestinal tract, the large gut especially and, more specifically, its lowest portion. Straining at stools, with the passage of blood, and tenesmus strongly suggest lesions near the anus. Gradual or rapid emaciation and sallow complexion all suggest malignancy.

Pain coming on in paroxysms and lasting for a few minutes to a few hours refers to colic occuring in hollow viscera. The site of the pain, its radiation, and the sense of soreness which persists for a while in the muscles overlying the organ involved are helpful signs. The soreness in the back and loins and stiffness following an attack of renal colic has been well recognized. Similarly the soreness in the subcostal margin on the right side, following an attack of biliary colic, is also frequently observed.

Soreness in the pelvic floor muscles, following coital trauma, is also significant of pelvic inflammation. An attempt to examine a patient just after having such an experience is almost useless.

PAIN IN THE LOWER EXTREMITY ASSOCIATED WITH PELVIC CONDITIONS

The nerves of the leg arise from the lower part of the cord in the dorsolumbar part of the vertebral column (Fig. 25). They course down the lumbosacral vertebral canal and the pelvic cavity, where they may be subjected to injury from pressure of new growths or inflammation. Pain extending down the thighs is fairly common and even the patient often wishes to know whether there may not be something within the pelvis to account for it.

Pain which is most severe down the back of the thigh and along the outer side of the leg suggests sciatic involvement. A malignant fixed mass in the pelvis or a large exudate may, by pressing upon the nerve, cause pain to radiate down the back of the thigh, as in genuine sciatica.

Pain down the front of the thigh as far as the knee usually means pressure on the anterior crural branch. Since this nerve arises in the substance of the psoas muscle and emerges into the thigh beneath Poupart's ligament, any growth causing pressure in its neighborhood will cause pain down the front of the thigh. Since the psoas magnus extends well above the level of

the iliac crest, the tumor would have to be situated comparatively high. This would be the case in ovarian tumors and pedunculated fibroids, especially the former. Sometimes the pain extends along the saphenous branch to the ankle, the inner aspect of the foot and the big toe.

Pain in the inner side of the thigh is more apt to be due to pressure on the obturator nerve. This nerve also arises in the substance of the psoas muscle and is placed in front of the anterior crural. The obturator nerve passes along the outer side of the internal iliac vessels and behind the common iliac. It is, therefore, more exposed to pressure from tumors in the pelvis and inflammation. Intraligamentous tumors of large size are especially prone
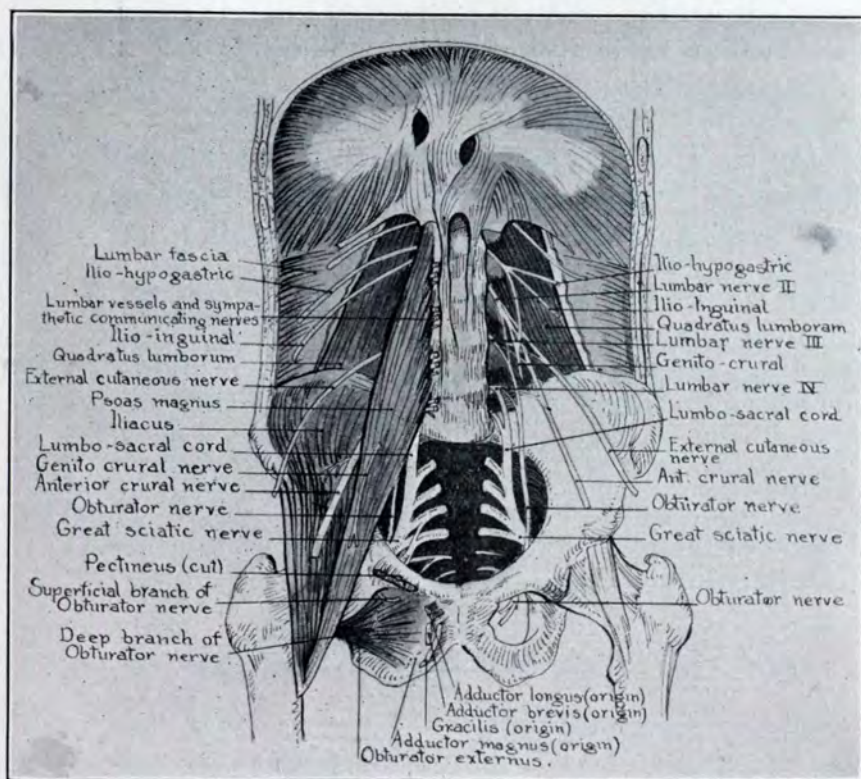
Fig. 25.—View of the Posterior Abdominal Wall Showing the Muscles and the Nerves of the Lumbosacral Plexus (Cunningham).

to press on it, since, in removing these tumors, both iliac vessels and the ureters are often exposed to view.

Since the obturator nerve arises from the anterior portions of the second, third and fourth lumbar nerves, while the anterior crural nerve is formed by the union of the larger posterior portion of the same lumbar nerves, lesions near their origin will be apt to cause more widespread distribution of the pain in the lower extremity.

Neuralgia paresthetica is referred to the course of the external cutaneous nerve of the thigh. The nerve is so situated with reference to the fascia lata and the psoas muscle that it becomes stretched or pressed upon in standing or walking, with the result that the neuralgia is intensified by the maintenance

of the erect posture, since the external cutaneous nerve passes out of the pelvis, entering the thigh beneath the outer extremity of Poupart's ligament and either over, or under, or through, the origin of the sartorius muscle.

It may be well to remember that the iliohypogastric nerve traverses obliquely across the psoas muscle and on the surface of the quadratus lumborum, whence it lies behind the kidney. It then courses through the loin, lying between the transversalis and internal oblique muscle above the crest of the ilium. About an inch in front of the anterior superior spine, it pierces the internal oblique and continues its course in the groin beneath the aponeurosis of the external oblique about an inch and a half above the external abdominal ring. By following the course of this nerve and its distribution, one may understand the radiation of the pain in renal colic.

The ilio-inguinal nerve runs practically the same course as the iliohypogastric, with which it has a common origin, but at a lower level, and emerges to become superficial through the external abdominal ring and external spermatic fascia. This explains the radiation of the pain in the vulva, since its cutaneous branches supply the mons veneris and the labium majus.

The genitocrural nerve accompanies the ureter for a short distance and reaches Poupart's ligament. Near this ligament it divides into genital and crural branches. The genital branch is very small. It crosses the terminations of the external iliac vessels and enters the inguinal canal at the internal abdominal ring. It terminates by supplying small branches to the skin of the labium majus and adjacent part of the thigh and accompanies the round ligament to its outermost termination. The pains complained of in the groins, so common during pregnancy, are due to stretching of the round ligaments and are associated with an irritation of the nerve endings of the genital branch of the genitocrural. Similar pains are complained of in large fibroids and in posterior displacement of the uterus.

BACKACHE

One of the most common symptoms for which the patient seeks relief is backache. Its mechanism is not always clear and has had many explanations. The thing uppermost in the mind of the patient is that her genital organs are not in order. The knowledge of the presence of a lacerated cervix, of a lacerated perineum, or even a slight cystocele, makes the patient blame these conditions for the backache.

When a uterine displacement exists, both patient and physician are often satisfied that the backache is due to this. It has already been pointed out that a great many movable retroversions and retroflexions of the uterus are unassociated with any backache, while the severest posterior torsion of the uterus with the most apparent rigid fixation may also be unattended by backache. The difficulty in estimating cause and effect arises when the uterus is found to be retroverted or retroflexed and the backache is acute. It need only be mentioned, in this connection, that the older theory of pressure upon the sacral plexus of nerves by the retroflexed uterus is no longer subscribed to. Instances of fibromyomata exceeding the normal uterus several times

in size and even wedged in the pelvis are encountered without any backache being present.

But an acutely retroflexed or retroverted uterus may occasion the most violent backache. It has been the experience of every one to meet cases in which the correction of the malposition is almost immediately followed by relief. There can be no doubt as to the matter of cause and effect in such cases. But the explanation will probably be different from the mere mechanical one of pressure. It has appeared to me that one or two factors during this distorted condition of the uterus are responsible for the backache: acute congestion of the uterus, the organ becoming almost twice its normal size; and detumescence following its mechanical restoration. Then the uterus rapidly shrinks, and it appears almost as if the volume diminishes by one half in a short space of time.

As an example of an acute posterior torsion (retroflexion) of the uterus, causing severe backache and prolonged menstrual flow, the following case may be cited. This patient was thirty-five years old, had been married thirteen years and had never been pregnant. Her last regular period lasted for ten days; its onset was at the regular time, but was attended by sharp pains, radiating to the back and down the thighs, being most severe on the right side. She felt chilly and had some slight fever. Her bowels were constipated and urination was increased in frequency. On examination, the uterus was found in extreme retroflexion; the cervix was displaced upwards, the external os pointed towards the symphysis. There was a profuse flow of free and clotted blood. The posterior vaginal wall was bulged by the uterus, and an attempt at restoring its position elicited extreme pain. After several futile attempts to relieve the uterine displacement, the patient was operated on. At laparotomy, the uterus was found to be incarcerated deep in the pelvis; it was enlarged to about the size of a two and a half months' gravidity; it was deeply cyanotic and, at its fundus, a fibromyoma measuring nearly three inches in diameter was found. The veins were varicose, especially in the right broad ligament.

Passive congestion in the pelvic veins, especially in the parametrium, with combined pressure upon neighboring nerves, serves to cause the disagreeable sense of fullness and weight and then backache. The distention of the uterus, with stretching of the serosa (peritoneal, sensory nerve bearing membrane), is referred to the sacrolumbar region through the pelvic sacral nerve (autonomic, vegetative) in the sense of the viscerosensory reflex of MacKenzie.

The other factor, perhaps the more important and direct, is the pull upon the sacro-uterine ligaments which contain sensory sympathetic nerve fibers.

In this connection, it is interesting to note the clinical experiment of L. Fraenkel who divided the sacro-uterine ligaments in a case of posterior parametritis and interposed a piece of fat between. He succeeded in this way in causing the disappearance of the backache. If this experience is corroborated, it points to the sacro-uterine ligaments as the nerve-carrying agency and substantiates the viscerosensory mechanism of pain originating in the uterus (MacKenzie).

That these posterior ligaments play an important part in the cause of

the backache in cases of acute retrotorsion of the uterus is shown by the fact that, when the normally situated uterus is stretched, the pain is referred to the anterior abdominal wall or to the area directly over the symphysis. I have had ample opportunity to observe this phenomenon when insufflating the uterus with gas for diagnostic purposes. The referred pain is probably carried by way of the sensory visceral reflex common to distention of other hollow abdominal viscera, for example, the intestine, gall-bladder and appendix. These tests serve as a beautiful illustration of the sensitiveness of the uterus, when acutely distended, causing colic which is localized in the suprapubic area. Similarly, distention of either tube causes pain on the corresponding side. This fact may also help in estimating the type of inflammation associated with backache. Tubal inflammation may then be excluded, unless the tube is prolapsed and adherent to the posterior parametrium. When it maintains its lateral position, the pain will probably be referred to the side.

In like manner, lateral parametritis may cause pain in the side, while the anterior parametritis will cause pain in the anterior abdominal wall. Tumors of the ovary will not cause backache unless they become incarcerated and suppurating. In the latter event, the inflammation may spread along the posterior parametrium, perhaps the nerve sheaths themselves, or even the sacro-uterine joint. Fibroid tumors of the uterus, when situated in the broad ligament and particularly when the ligament is edematous or inflamed, may cause backache.

The pain is usually described as a dull, nagging ache in the lumbosacral region or coccygeal area. The pain is usually constant, being aggravated during the day, and lessening when the patient takes to bed; it is least noticeable on rising in the morning. The latter symptom is suggestive of the more common cause of backache in women, namely an orthopedic or orthostatic condition.

In this connection, there at once arises the question of sacro-iliac strain and of muscular fatigue. It need only be recalled that the pelvic congestion incident to menses and the mechanical strain in the muscles and joints, induced by pregnancy and the labor, are factors which make women more susceptible to backache than the male. Added to these is the lack of natural support to the back, which has been removed in great measure by the use of the corset from early puberty—a factor which causes muscular atrophy so that when the orthostatic conditions are changed by the increasing girth of the abdomen, the spinal muscles do not lend support. The term "sacroiliac relaxation" is not intended to suggest a definite widening of the joint. It does, however, suggest a weakness of the muscles attached to the pelvic bones and the lumbar dorsal spine and, also, the interarticular ligaments. It is this orthopedic variety of backache which is improved by rest during the night and increases during the day. The points of attachment of the muscles of the back, as well as to the vertebral processes of the lower lumbar spine, are particularly sensitive in these cases. Women with markedly inclined pelves are especially subject to this type of backache.

Asthenic individuals are perhaps the worst sufferers of backache, a fact which is in support of the orthostatic origin. Thus Mathes has gone so far

as to deny any significance to backache as a genital symptom. He regards it entirely as an expression of muscle fatigue in the sacrococcygeal and lumbosacral joints and in the ligaments of asthenic individuals.

The character of the pain in backache, as Novak remarks, is less precisely localized than most other pains. This would appear to suggest more than one cause for the backache. Not so easily to be explained is the kind of backache which improves as the day goes on. Possibly exercise plays some part in removing products of metabolism, while, in the passive state, these accumulate and cause muscle-nerve irritation.

In many of these cases, it is possible to elicit tenderness over the sacro-iliac joints. Frequently the patients point to these areas with precision. More frequently, the flat of the hand is used by the patient to indicate the broad general area over which the backaches are present, indicating an area where the muscles are more extensively affected. Such cases are benefited by the support of a tightly fitting corset. It may readily be possible to exclude a genuine lumbago, myostitis or arthritis of the lumbosacral area. Spinal caries and carcinoma are other conditions that must be carefully ruled out.

In the vast majority of these cases, however, no hyperalgesia or tenderness of the muscles and joints or hyperesthesia of the skin can be demonstrated, so that an organic lesion of the back may be excluded. Nor are there evidences of exaggerated permanent lordosis or kyphosis.

Frequently associated with backache are chronic cystitis, chronic proctitis and hemorrhoids. Carcinoma of the rectum and carcinoma in the pouch of Douglas cause an aggravated variety of backache. It is difficult to conceive of so many causes of backache without some definite bypath for sensory transmission of the irritation, whether this is a mechanical pull, as in the case of a prolapse of the uterus, a posterior parametritis or the pressure from a neoplasm. Novak suggests that there must be some pathological alteration of the vegetative nervous system of the pelvis, especially of the plexus cervicalis (ganglion cervicalis of Frankenhauser) and of the plexus hypogastricus. The vagueness of the localization of the pain in backache and its dull character would point to disease of the vegetative nervous system. This is typical of visceral pain, no matter where the primary irritation is situated, spreading over a wider area than irritation of the central spinal nervous system where localization is sharp and definite.

The lesion in the vegetative plexus in the pelvis may be either a tearing or pulling of the fibers, due to the increase in intra-abdominal pressure consequent to lifting, or to the compression by tumors or inflammations in the neighboring tissues, to cicatricial contraction occasioned by a sclerosing parametritis, or to a combination of various destructive agencies such as phlebectasia, arteriosclerosis, etc. The rather frequent backache accompanying the climacterium, a condition designated by Pineles as pseudogout, may be explained by the degeneration which takes place in the pelvic nerves through the senile atrophy and shrinking of the pelvic connective tissue—a condition analogous to the severe pains induced in tabes by degeneration of sensory nerve paths. Novak carries his hypothesis further to include cases of sexual neurasthenia in which backache is a prominent symptom. Here, functional

disturbances of the vegetative nervous apparatus in the sexual sphere and organic changes, which are expressed in sensory and in motor and secretory disturbances, take place. In this way, pain in the genital area, so common in sexual neurasthenia, can be explained.

Perhaps the practical therapeutic test will point to the nature of the cause of the backache in many cases. Several types may thus be distinguished.

1. A first group consists of those in which pelvic examination reveals no pathological or mechanical abnormality. This group will probably fall in the larger group of asthenic, neurasthenic individuals. The pain is really a sense of fatigue. Relief is obtained by support to the back, muscular massage and exercises to strengthen the back. These are the cases which cannot get along without the corset.

2. In the second group are cases with inflammatory disease in the pelvis. Measures for support are inadequate and may even aggravate the symptom. The improvement of the inflammatory process is followed by relief.

In this group also are cases with positional changes in the uterus: (a) where prompt relief is obtained by correction of the faulty position of the uterus; (b) where this is further to be supplemented by mechanical support.

Such was the case of a young woman of thirty-one, of very tall stature and ample hips, who had had twins with hydramnion three years ago. Her abdominal wall was markedly distended and her abdominal muscles had scarcely regained their tone, there still being a diastasis at this time. The patient complained of severe backache and also stated that, although there had been no contraceptive measures employed, she was unable to conceive again. The uterus was found to be in extreme retroversion; it appeared to be enlarged and an attempt to replace it in its normal position was attended by pain. Restitution was finally accomplished and the uterus was retained in good position by a pessary. At the same time, the patient stated that her backache was relieved. This symptom, however, soon returned and on examination the uterus was found again in retroversion; with each replacement, the backache definitely improved, but at times, although the uterus remained in good position, the patient complained of severe backache. Orthopedic examination revealed the fact that her spinal muscles were weak. With the use of a corrective corset, relief was secured. Here, no doubt, both the retroversion and faulty muscle dynamics were responsible for the backache.

The two processes (1) malposition of the uterus, and (2) the associated hyperalgesia, weakness of the back muscles, may coexist; or the latter may be secondary to the former, persisting for a while longer because the sensory visceral reflex with motor irritability of the muscles may persist even after the primary irritation is removed.

PAIN IN THE SHOULDERS

Pain in the shoulders is a symptom in ruptured ectopic pregnancy, indicating extensive blood extravasation reaching the subphrenic space.

Pain in the shoulder is also associated, as a rule, by the clinician, with local disorders of the shoulder joint and the tissues in its proximity, with

intrathoracic lesions (notably: angina pectoris, pleurisy, pneumonia, new growth, etc.), and also with subdiaphragmatic lesions situated in the gall-bladder, liver and stomach. In a recent series of 14 cases, attention was called to the occurrence of pains in the shoulders in patients with ectopic pregnancy.

The first observation was made upon a patient in the gynecological service of Dr. J. Brettauer in October, 1921. The patient presented the history characteristic of tubal pregnancy. Examination revealed a fullness in the pouch of Douglas, tenderness, moderate abdominal distention and shifting dullness in the flanks. The patient stated that she had severe darting pains in the shoulders which had begun two days before her admission to the hospital and, on further questioning, this pain followed an attack of fainting. The patient had not suffered from "rheumatic" pains before and was at a loss to account for them.

At the laparotomy, a large amount of free blood was noticed in the general peritoneal cavity and clotted blood in the pelvis. The tubal rupture was found on the left side. A large amount of fluid blood poured down from both flanks, so that it was impossible to wipe the abdominal cavity dry. While the pelvis was successfully wiped clean (suction being used), the blood continued to gravitate from above.

The following morning, the patient was completely relieved of the shoulder pains. This symptom was so marked before the operation that it gave rise to some discussion as to its mechanism. Some ventured the explanation that it was due to a reflex radiation from the seat of the tubal rupture. As the spinal nerve tracts, by which such pain is produced, are too far removed from the sacral autonomic fibers, this explanation was discarded.

Observation in 500 cases, with induced subphrenic pneumoperitoneum via the uterus, revealed similar shoulder pains. The explanation for this is the stretching of the round ligament of the liver, the splenic ligament, the lifting of the diaphragm by the gas and irritation of the phrenic nerves.

Of 14 cases of tubal pregnancy, the sign was present in 4. These were all complicated by large extravasations of free blood. In 1 case, most of the fluid was accumulated in the flanks and high up in the subdiaphragmatic space. In 6 cases, without large blood effusions, shoulder pains were absent. While not being essential to the diagnosis of tubal pregnancy, the sign, nevertheless, denotes extensive hemorrhage, sufficient to reach and distend the subphrenic space. The sign itself will not serve as a differential aid in rupture of a hollow abdominal viscus, such as perforation of a duodenal or gastric ulcer, appendix or typhoid perforation. The clinical picture, the history, and other signs and symptoms will have to be called upon to establish the correct diagnosis.

ILLUSTRATIVE CASES

RUPTURED RIGHT-SIDED ECTOPIC (EARLY); ATYPICAL MENSTRUAL HISTORY; BLOOD COUNT SOON AFTER THE RUPTURE AND THE NEXT DAY; SCANTY LOCAL PHYSICAL FINDINGS; APPENDICITIS IN QUESTION ON ACCOUNT OF ABDOMINAL RIGIDITY; PAIN IN BOTH SHOULDERS

S. S., thirty-five years old, was admitted February 20, 1922. The chief complaints were abdominal pains, vaginal bleeding, vomiting and fainting; onset two hours previous to admission. The family history was irrelevant.

She had been in Mt. Sinai Hospital ten years before for pains in her left wrist and right knee. She remained there for six months, the knee remaining stiff. There was no previous surgical history. For the year previous to admission, the patient had had attacks of palpitation, with occasional fainting spells occurring once or twice a month. There was no edema, cough, night sweats or loss of weight. The gastro-intestinal history was negative. She complained of nocturia. Her menses began at fourteen years, always regular every twenty-eight days, and of from three to four days' duration up to one year ago. Since then her periods have occurred irregularly, every five to six weeks and lasted about three days. There has been no dysmenorrhea or menorrhagia, but there has been moderate leukorrhea. The last menstrual period was February 8; the one before that was December 23; the one previous to that was November 11. The patient had been married fourteen years; had had two children, twelve and a half and six years old. There was an induced abortion three years ago at about six weeks.

The onset of the present illness was very sudden about two hours before admission. This was characterized by severe, sharp pains in the right side of the abdomen, which gradually became generalized, and then slight bleeding was noticed. An hour later, the patient fainted while being examined, and fainted again one half hour after that. She vomited twice, was weak and dizzy and complained of a chilly sensation. There were no urinary or cardiorespiratory symptoms. Her bowels moved normally. The patient had had no similar attack previously. With the onset of the pains, she began to bleed. This was very scanty; there were no blood-clots or membranes.

Vaginal examination on February 21 showed the uterus forward; and the adnexal regions free, except on the right side, where there was a resistance high up. The culdesac showed an indefinite, soft fullness. The abdomen was held rigid and there was marked dullness in the flanks. The abdomen was distended and there was tenderness in the lower part. The pulse was 120 and small and there was slight cyanosis of lips and pallor of the nails. The blood count on February 20, at ten o'clock in the evening, showed hemoglobin 82 per cent, white blood-corpuscles 36,000, polynuclears 85 per cent, lymphocytes 15 per cent; at twelve midnight, hemoglobin 72 per cent; on February 21, at eight o'clock in the morning, hemoglobin 68 per cent; and at nine in the evening, hemoglobin 64 per cent. Sixteen hours after onset, there were 13,400 white blood-corpuscles, 79 per cent polynuclears and 21

per cent lymphocytes. Urine showed many hyaline and a few granular casts. Blood grouping was group three.

In view of the rather scanty vaginal findings, a curettage was done and a few shreds of tissue obtained. At postvaginal section, free blood (dark) and clotted was obtained. The finding at laparotomy was: in the right tube, at the junction of the uterine and outer third, a small dissecting ectopic pregnancy, a young villus extruded from the bloody mole which was still attached. (See Frontispiece.)

Ruptured Ectopic; Profuse Extravasation with Pain in the Shoulders

H. G., thirty-five years old, single, was admitted December 7, 1921, as an emergency case. Her menses had begun at fifteen years and had been always regular and of four days' duration; the flow was scanty and accompanied by severe cramps on the first day. The last menstrual period was a normal one, three weeks before admission. The patient was clean for a week and then began to bleed moderately with no pain until two days before her admission, when the flow became scanty. On the day of her admission, the bleeding was scanty and she passed a definite decidual cast.

On the morning of the day of her admission, the patient fainted on walking to the bathroom, picked herself up and went to her room. After that she *complained of severe pain in both sides of the abdomen, radiating to the shoulders, worse on the left side,* which continued with spasmodic attacks. Her hemoglobin was 55 per cent.

Examination showed the hymen stretched, the uterus soft and not appreciably enlarged. A decidual polypus extruded and there was a very tender, elastic mass in the left fornix. There was bogginess in the culdesac and the right fornix. Two fingers were introduced into the vagina with slight difficulty. The cervix appeared normal and there were no apparent signs of gonorrhea. There was an initial rise of temperature to 102 and then a drop to 100, then reaching normal. The pulse dropped from 112 to 100 during the first thirty hours. The diagnosis of ectopic gestation on the left side was made.

The findings at operation by Dr. I. C. R., December 7, 1921, were as follows: A left tubal gestation of the dissecting type which had ruptured. The peritoneal cavity was filled with free and clotted blood, which came down from both lumbar gutters, especially from the one on the left side. The right tube was found to be of infantile type and the ovary normal in appearance.

The blood grouping was found to be Group I. The smear and culture were negative. The uterine cast showed decidua and pregnancy was found in the tube.

The patient claimed she did not interfere for a suspected pregnancy. She admitted coitus three to four days before her awaited period, which actually came three weeks before.

PRURITUS VULVAE

A sense of itching at the vulval region may be persistent, constituting a most harrowing symptom and causing sleeplessness, debility and extreme nervous irritability. No lesion may be detectable to account for the itching, no matter how carefully the vulva is examined. The term pruritus is generally restricted to this type of itching. However, it is in such instance that some change in the circulation, expressed by abnormal metabolism, is at the bottom of the pruritus. There is not only an increased irritation of the peripheral nerve terminals in the external genitals, but there are vasomotor disturbances in the superficial capillaries of that region as well. At times, a sense of formication is felt. This type is due to circulatory disturbances and is more apt to manifest itself in the presence of pelvic varices, especially of the pudenda. In other instances, where no external lesion is seen, it is possible that the sensation is referred from deeper pelvic varicosities which, at certain times, under increased hyperemia, cause stasis in the superficial parts and affect the nerves and finer blood-vessels.

In most cases, however, there is some external lesion which causes the pruritus, although it must be admitted that it may be secondary, being caused by scratching and infection. Chief among the causes is dermatitis. This is induced by chemical or mechanical irritation; the former by the injudicious use of strong antiseptics as douches, and the latter by the rubbing of soiled or rough linen on the "bathing drawer" area, similar to that occurring in the napkin area of children. Vulvitis is not uncommon in gonorrheal infections, and the itching has been observed to stop when the vaginal discharge clears up. A prompt test of this cause may be made by tamponading the vagina with some indifferent salve on cotton, in order to prevent the discharge from escaping on the vulva. If the itching stops, it is safe to assume that its genesis is the discharge. The discharges usually arise from endocervicitis or vaginitis or both. A not uncommon source of irritating discharge is that induced by prolonged wearing of pessaries. The dermatitis may be caused by parasites. The Acarus scabiei and pediculus pubis are common offenders, while Oxyuris vermicularis and the Ascarides may wander from the anal region into the vagina and set up a violent pruritus. In the majority of instances of parasitic cause, the parasites may be seen. When search for them is attended with failure, the application of appropriate antiparasitic ointments may act not only as therapeutic agents, but also prove of diagnostic, corroborative value.

In older women, diabetes mellitus is a not uncommon cause of pruritus vulvae. The eczematous appearance of the vulva at once suggests the lesion. It is interesting to note that pruritus vulvae may be the first evidence, clinically, of an incipient diabetes. While this disease causes general pruritus, the glycosuria is perhaps more directly responsible for the local pruritus. During pregnancy, the vulvitis may be the most pronounced aspect of an otherwise general dermatitis. In other instances, lichen planus or a lichenoid eruption over the vulva may be the cause of intense itching.

Kraurosis vulvae and leukoplakia are two other lesions associated with

intense itching.   The nature of these conditions is not clear; they are both associated with trophic disturbances leading to atrophy, in which all the tissues connected with the skin are involved.   The nerves are in a process of primary or secondary degeneration.   Since atrophy of the vulva, as well as the internal genitalia, occurs in the menopause, where there is complete regression of ovarian function, it has been suggested that the ovaries may be deficient in their action.   Hence, the recommendation of opotherapy for the relief of pruritus vulvae.   An occasional favorable result has been achieved by this measure, but, so far, clinical experience is altogether too scant to permit definite deductions.   Should such therapy actually relieve a fair number of cases, it may then be accepted as proof of the endocrine origin of pruritus.

CHAPTER XVI

SYMPTOMS OF DISTURBED URINATION

Disturbances in urination in women are so frequently associated with symptoms due to gynecological affections that they are deserving of special consideration. In a study of this matter, I have found that as many as 3 out of 10 patients suffering from genital disease complain also of some urinary symptoms. Practically 1 out of 11 dispensary cases (875 out of 10,000 cases analyzed) apply for relief of some "bladder" symptoms. In private practice, the percentage is equally high. The relatively greater frequency of bladder symptoms in women is due to the greater relative incidence of pelvic affections. As a rule, any abnormal change noted in the act of urination is referred by the patient to the bladder. The correct anatomical seat, however, of this abnormal symptom, as we have learned since the introduction of the cystoscope, may be far removed from this organ. The symptoms must be interpreted in each case from the viewpoint of regional etiology and pathology.

It is curious that, in many women, urinary disturbances may exist for the longest time without exciting their suspicion. This is due partly to tradition; partly to shyness, and partly to the fact that the annoyance may become habitually tolerated. Frequency of urination may persist from an initial, mild, gonorrheal urethritis acquired almost immediately after marriage. If the symptom is at all noticeable, even to the extent of a burning sensation, it is all too readily attributed to the marital act, and this explanation is vouched for by a confidante, usually the mother, who dismisses it with the assurance that it is "natural." The menstrual period is not infrequently accompanied by increased desire to empty the bladder and even frequency of urination. These mild symptoms may subside without an appeal for adequate advice or treatment.

Whatever the nature of the pathological disturbance may be, frequency of urination is one of the most common symptoms and most often accompanies other symptoms. This, however, is sometimes limited to an increased desire to urinate, the patient controlling the act of urination often in spite of intense suffering. The next common symptom is *dysuria* or *painful urination*. This may appear at the beginning of the act of micturition, at the end, or, rarely, during the act. A "burning" sensation is experienced. It may be such a prominent symptom that it is the one for which the patient desires relief. Difficulty in starting the urinary stream is another symptom. It seldom exists alone; as a rule, it is present with the other symptoms. Not infrequently patients state that they cannot hold their water at all, that is, *complete incontinence* exists; that they lose it without being able to exercise complete control,

as, for example, while walking or exerting themselves in any way, during the act of sneezing, coughing, straining, etc., that is, *relative incontinence* exists. Sometimes there is constant flow or dribbling, and yet the patient may voluntarily pass certain quantities of urine.

Hematuria is always an alarming urinary symptom. Blood in the urine always arouses the fear of the patients that there is something wrong, and they do not wait long before consulting a physician as to its meaning. High concentrations, etc., do not alarm them so much, but they are certain to mention this fact when describing gynecological or urinary symptoms. Changes due to deposits of mucus, brick-red deposits due to urates, color changes, in general, attract their attention, and, whether or not there are functional disturbances, they are often sufficient to be brought to the notice of the physician.

Pain in the hypogastrium is usually referred to by the patient as bladder pain, perhaps as often as it is ascribed to the uterus. But, in general, it is associated with dysuria, *ardor urinae*, or difficulty in starting the stream.

The Interpretation of These Symptoms.—The conditions which may cause one or several of these symptoms are so numerous that, with few exceptions, where there are characteristic group symptoms indicatory of definite disease, it is impossible to say beforehand to what they are due. Before the era of the endoscope and the cystoscope, the cause of bladder disturbance was a matter of guesswork. Since these instruments of precision have been introduced into medicine, correct interpretation of urinary symptoms has become a matter of routine.

What should be the procedure in any given case in which proper investigation is to be carried out with the view of getting at the bottom of the urinary trouble? We will take them up in various steps.

1. The first thing is to get a careful personal history, in which the patient may emphasize certain urinary symptoms. Inquiry as to whether there are associated symptoms should also be made. Inquiries into habits of drinking, eating, exercise, etc., and the general health, with special reference to known kidney complications of previous illnesses and diabetes, are often of the greatest help in explaining bladder symptoms.

2. A physical examination is the next step. This includes inspection of the external genitals. Especial note should be made of eczema, excoriations and intertrigo, since these are often evidence of diabetes or vaginitis. Hypertrophy of the clitoris, enlarged nymphae and signs of irritation suggest the possibility of masturbation. The bladder symptoms may be due to the latter act. This should, however, be reserved as a last thought, until other causes have been exhausted. Purulent discharge at the vaginal orifice or vulval outlet is suggestive. The association of vaginitis with urethritis in the adult is a very intimate one and, therefore, should at once suggest the latter as a possibility. Pus at the urethral orifice is at once evidence of an infection. Pus at the Skene duct orifices and bartholinian swelling, as well as pus exuding from them, are other pathognomonic signs of a gonorrheal infection and give sufficient data in themselves to account for the symptoms. When no pus is observed, urethral massage should be practiced. Thus, a drop of pus, copious or scant in amount, may be squeezed out and a clew to the trouble established.

The secretion appearing at the urethral orifice should first be carefully wiped away, as it may be a contamination from leukorrheal discharge. The act of straining may be associated with visible loss of urine; a large cystocele or one of moderate size may become evident, or a gaping orifice of the urethra may be seen, indicating injury or paresis of the internal or external sphincters of the urethra. There may be a urethral prolapse or a caruncle at the urinary meatus. Where dribbling is complained of, the anterior vaginal wall, as well as the cervix wall, should be carefully inspected with the possibility of detecting a fistulous communication between the bladder or urethra, on the one hand, and the vagina or cervix on the other. Gross malformation, such as hypospadia and vesical ectopia, need only be mentioned. In the female, hypospadia is rare and is not nearly as well marked as in the male; more commonly there is urethral displacement or distortion of the urinary meatus following injuries during labor.

It is possible, by palpation, to feel for swellings of the urethra, for tenderness of the trigon and along the ureters, or for foreign bodies and tumors of the bladder. Judd has recently described a method of palpation of the ureters based upon more or less exact anatomical landmarks. While the normal ureter cannot often be located by the vaginal fingers, in the presence of pathological changes, it may become more accessible.

Further, by palpation alone, it is possible to determine the presence of associated internal gynecological lesions which might explain the bladder trouble.

The gynecological lesions that may be responsible for the bladder symptoms are numerous. The symptoms result, first, from pressure by the displaced organs of generation or by new growths; and, secondly, by inflammation which extends to the bladder and ureters by contiguity.

Pressure upon the bladder may take place in any direction. An acutely anteverted uterus which is more or less fixed will exert pressure upon the bladder. The best example of this is the position of the uterus in early pregnancy. It must be mentioned that it is not the pressure alone that disturbs bladder function; more important still is the interference with the vesical circulation; thus, passive congestion is the result and is, in turn, the cause of bladder disturbance. This further predisposes to bacterial invasion. The acute anteflexion and extreme retroflexion disturb the bladder in similar ways. The amount of bulging caused by this displacement may be determined by combined vaginal-abdominal palpation and, better, by visualization of the bladder cavity by the cystoscope. The lateral deviations are less apt to cause bladder difficulty; rather the causes that occasion this distortion, such as tumors, inflammation and scar tissue, are responsible. Tumors of the uterus, especially myomata which have a low situation, that is, the cervical variety, and those developing on the anterior surface of the uterus, similarly compromise the bladder (Fig. 26).

An exquisite example of pressure vesical symptoms is presented in the following case (Fig. 27). M. K., age forty-three, married three years, sterile. Menses began at twenty, were irregular, occurring once in two, three, five or six months for a period of ten or fifteen years. During the past decade, menses were regular, of the twenty-seven-day type, five to six days' duration. She

had had bearing-down pains which radiated downward along the thighs. Last regular menstrual period was two weeks before examination. Bowel was constipated. For ten days she had had difficulty in urinating. She had to press hard with abdominal muscles to start the urinary stream. For three days she was unable to urinate in spite of repeated attempts during an interval of fourteen hours. A hot sitz-bath relieved her slightly. Dysuria had continued since then and was practically constant, making her unfit for her household work. Frequent cramps occurred in the legs, particularly when she attempted to turn
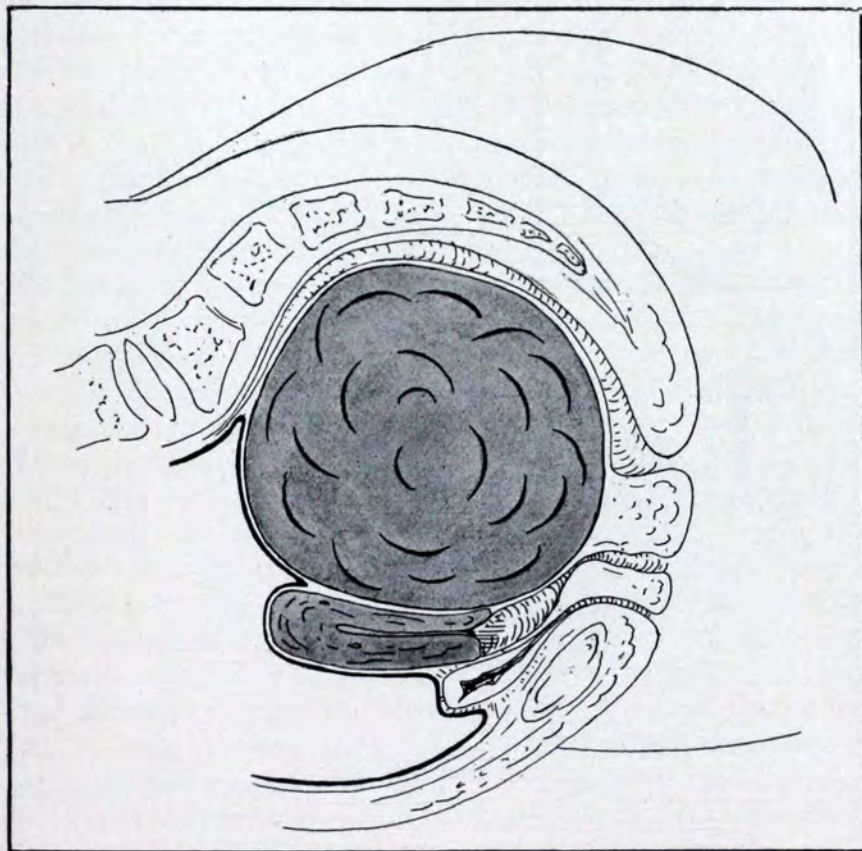
FIG. 26.—POSTERIOR INTRALIGAMENTOUS DEVELOPMENT OF A FIBROMYOMA BULGING THE POSTERIOR VAGINAL WALL AND THE ANTERIOR RECTAL WALL. The cervix uteri is displaced upward and against the symphisis.

from side to side. There was no edema of the lower extremities. Shortness of breath annoyed her also; but she had had this for some years and was traceable to chronic valvular disease. On vaginal examination, July 3, 1916, the cervix was found high up, squeezed against the upper portion of the symphysis pubis by a mass which extended downward bulging the posterior vaginal wall to a point just within the introitus vaginae. This mass was smooth, very firm and immovable, filling the whole of the small pelvis and extending to two fingers above the symphysis. It was quite as large as a child's head, but firmly incarcerated.

With the catheter, about one ounce of urine was obtained, immediately

after which the patient was instructed to void voluntarily. The cystoscope passed through the urethra with slight difficulty and appeared to go to one side, passing an obstruction. Intravesical inspection was very much limited, owing to difficulty in moving the instrument from side to side. It was impossible to view the fundus. There was an enormous bulging, more or less sym-
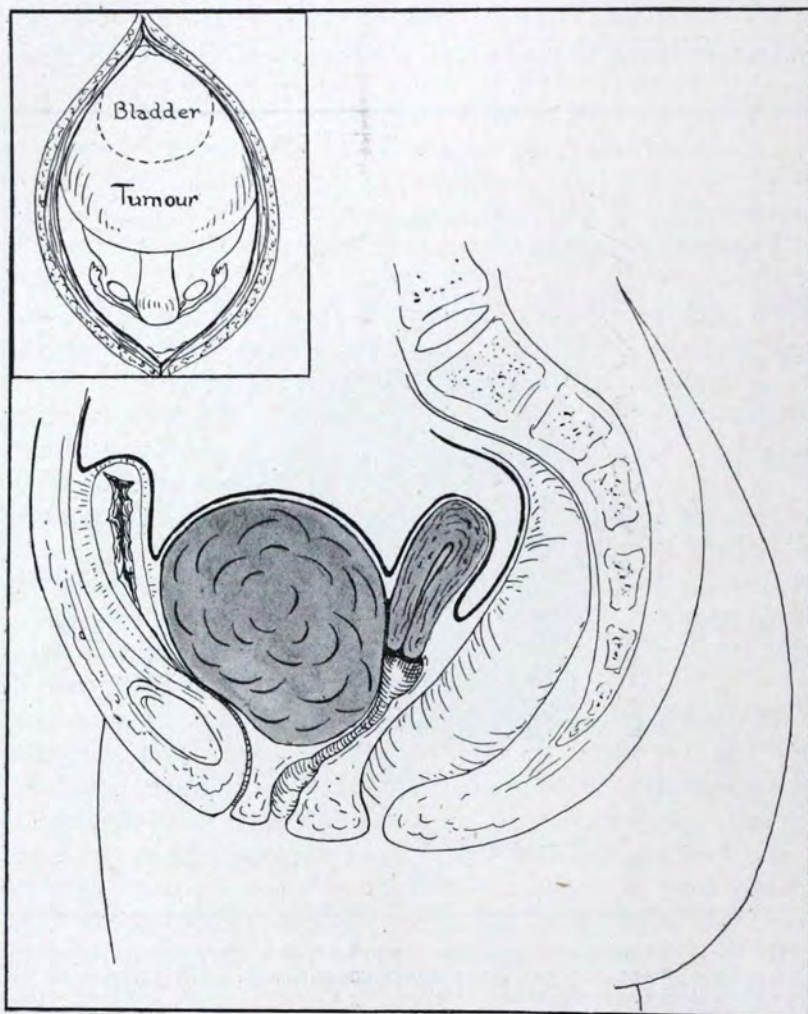
FIG. 27.—ANTERIOR-INTRALIGAMENTOUS DEVELOPMENT OF A FIBROMYOMA COMPRESSING THE BLADDER IN FRONT AND THE ANTERIOR VAGINAL WALL BEHIND. The cervix uteri is displaced upwards and toward the sacrum. The bladder was found stretched over the tumor like a fan.

metrical, into the bladder cavity, making the latter practically crescentic. The portion of mucosa seen was trabeculated and injected. The ureteral orifices were not identified. In order to get an idea of the size, capacity and conformation of the bladder in relation to the tumor, I injected thorium nitrate.

The bladder roentgenogram after injection of four ounces of thorium nitrate showed an astonishingly large shadow which led us to suspect the possibility of a large amount of residual urine having been present, which must

have diluted the thorium solution. On the supposition that this was so, the rough estimate by several laboratory workers as to the capacity of the bladder, as indicated by the shadow, was that it held at least a pint and possibly a quart. Although the bladder was previously emptied by catheter, after the injection with four ounces of thorium solution, practically the same amount was withdrawn after the roentgenograph was taken, proving that there was no dilution with residual urine. The proper explanation then was that the solution was distributed over a large surface, though to a very shallow depth. In this case when the catheter was passed it met an obstruction at a point on the right lateral bladder wall as shown by an X-ray picture. Several days afterwards, another X-ray picture, with only two ounces of solution having been employed, showed a shadow similar but not as large as the first. The catheter was seen to deviate to the left side, the point of deviation beginning practically within the urethra itself, which was also obstructed by pressure from the large cervical fibromyoma. (It should be mentioned that, in the normal bladder, the catheter usually enters in a straight line.)

In all instances of large tumors of the pelvis, vascular obstruction is as much the cause of bladder symptoms as pressure from the actual gross tumor mass. The increased size of the blood-vessels supplying these tumors is a most common finding during laparotomy and explains the blood stasis in the bladder as well as in the pelvic viscera in general. Ovarian tumors, especially those that are incarcerated in the pelvis, may operate in the same way. Carcinoma of the uterus affects the bladder and the ureters in from 10 to 30 per cent of the cases when the lesion is well advanced.[1] In early cases, the bladder is unaffected. Bladder symptoms in carcinoma of the uterus are, however, usually eclipsed by the symptoms directly referable to the uterine disease.

Of the inflammatory conditions, those involving the parametrium and other portions of the broad ligament (chiefly the mesosalpinx and mesovarium, with large exudates) frequently involve the bladder wall and extend intravesically. A large adherent pyosalpinx with adhesions extending low down to the pelvic parietes and to the bladder is a common cause of bladder disturbance. Ectopic pregnancy of the ruptured variety with hematocele formation is almost constantly associated with bladder disturbance. Infected dermoid ovarian tumors are also causes of bladder difficulty. Rupture of the contents of the bladder or of a pyosalpinx may simulate intravesical conditions by hematuria, pyuria, etc. Carcinoma of the uterus, and papillary carcinoma of the ovaries may similarly break through the bladder wall and cause symptoms. Careful vaginal palpation and inspection should be carried out in every case where bladder symptoms are the chief complaint.

There are a great number of cases in which gross lesions may be found involving the uterus and its adnexa, and yet they do not occasion bladder disturbance. There are large fibromyomata of the uterus without pressure symptoms and antedeviations and retrodeviations of extreme grade without interference of the bladder. Even with incarcerated growths of the pelvis, the

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[1] Schottlaender and Kermauner, *Carcinoma of the uterus*, 1912. In 35 out of 120 operated cases, these authors found that a part of the bladder musculature was removed with the uterus, owing to vesical extension of the carcinoma.

bladder function may not be affected. In the presence of such lesions, it is nevertheless still necessary to search for an immediate cause within the bladder itself.

Great care and discrimination must be exercised in evaluating bladder symptoms. In the presence of combined lesions, it becomes a problem of determining cause and effect. Errors in judgment are usually followed by unnecessary or meddlesome therapy. Particularly is this true when operative procedures are decided upon to correct displaced organs. It is here that the greatest chances for mistaken interference lie. In general, it is well not to blame a retroflexion or an anteflexion for bladder symptoms. Not until further investigation fails to discover any other cause should these conditions be seriously considered as etiological factors. The bladder picture in the cystoscopic examination will show how the bladder is compromised by the uterus in such case.

There are two intra-abdominal conditions which, though extravesical, are nevertheless almost certain to cause bladder difficulty: the one is a pelvic peritonitis or a general peritonitis, the other is pelvic hematocele of whatever origin. Apart from the paralyzing and toxic effect of the surrounding peritoneal exudate, the detrusor force of the bladder is robbed of assistance from the abdominal muscles which are held rigid. All the other gynecological conditions cause bladder symptoms with varying frequency. Of the intestinal tract, the appendix is a not uncommon cause of bladder symptoms. An inflamed appendix which is situated at a low point in the abdomen and pointing to the pelvis may become adherent to the bladder when it may cause pain simulating that due to a ureteral calculus. The effect of the vesical adhesion is to produce painful and frequent micturition. The diagnosis may be suspected when it is possible to demonstrate a circumscribed small area of cystitis, perhaps an ulceration, in the right lateral wall of the bladder, while the ureteral orifices and the rest of the bladder appear normal. Muscular rigidity, fever, etc., point to the appendicular cause of the symptoms.

The sigmoid and the rectum, when diseased, may be mentioned as not infrequent causes of bladder symptoms. Diverticulitis and carcinoma are the principal symptom-producing lesions. The rarer causes, such as pelvic sarcoma, teratoma, osteoma and tuberculosis originating from the bony structures and periosteum, muscle and aponeurosis, need only be mentioned for the sake of completeness.

Intravesical Lesions Including Those of Urethra and Ureters.— In the last analysis of symptoms referable to the bladder, reliance must be placed upon the cystoscope and the urethroscope. While inspection and palpation and even the use of the sound may be of help and suffice to detect superficial lesions, we must resort to cystoscopy for the diagnosis of intravesical disease. By this means alone may we accurately define the lesions which we may hold responsible for given bladder symptoms. The development of the instrument has been so highly specialized in late years that, in the hands of an expert, genito-urinary diagnosis has been reduced to a nicety.

In the urethra, we must look for evidences of varying degrees of inflammation and the results of the latter, including strictures, para-urethral abscesses

and diverticula, as well as polypi. These conditions are by no means as frequent in the female as in the male. Urethritis in the female does not exhibit the tendency to become chronic as it does in the male, nor is autoreinfection nearly so common. In spite of cervical gonorrhea, the urethra, primarily affected and healed, seldom undergoes secondary infection. In women, endoscopy *per se* is somehow not as popular as endoscopy in the male, nor is it as frequently resorted to for diagnostic purposes as cystoscopy. Whatever the reasons are for this disuse of a well-recognized aid in diagnosis is difficult to say. Perhaps the rarity of important urethral lesions, on the one hand, and the greater frequency of symptom-causing lesions within the bladder itself, make for the use of cystoscopy. The shortness of the female urethra makes urethroscopy somewhat more difficult, chiefly on account of the inability to keep the urethra free from escaping urine which obscures the urethroscopic field. However, the lesions in the urethra may be the cause of the symptoms and yet may be overlooked, if cystoscopy alone is done. Strictly speaking, urethroscopy should follow cystoscopy whenever the latter fails to disclose vesical disease. There are instances where a primary urethroscopy may detect the underlying lesions; yet it is advisable to examine the interior of the bladder as well.

The intravesical lesions may be grouped under: (1) deformities, distortions and displacements; (2) inflammation; (3) foreign bodies; (4) tumors.

1. Diverticula are not uncommon. These vary from small punched-out pockets to large chambers which may sometimes exceed the normal bladder in size. The large diverticula give rise to characteristic symptoms. The distortion of the bladder may be limited to the pressure of the uterus, some portion of it may be so compressed as to be crescentic or it may be displaced in all directions, chiefly upward, as in the terminal stages of pregnancy and during labor. Pelvic tumors may push it to one side. The displacement as such is not the cause of bladder difficulty. When the point of greatest pressure is at the sphincter vesicae, the bladder may have great difficulty in overcoming it. It is in these cases that troublesome retention takes place, and often catheterism establishes the diagnosis as well as relieves the condition. Varicosities of the bladder mucosa may be very pronounced and give rise to repeated hematuria. Trabeculation results from repeated attempts to empty the bladder against obstruction.

2. Inflammation of the bladder varies from the mild local trigonitis, the result, in a great many cases, of a gonorrheal infection, though it may arise through faulty and septic catheterism and colon bacillus infection. A fairly common lesion is bullous edema, found particularly around the vesical sphincter. Cystitis cystica is still a further stage and may involve larger areas of the bladder. The most obstinate type of cystitis and one attended with grave symptoms is tubercular cystitis.

3. Under this group are foreign bodies, chiefly stones which are not very common in females. The large stones which occur not infrequently in men are very seldom seen in women. The prostate is probably responsible for this difference. The retention experienced by aged males is seldom encountered in females. Rather is there frequency and incontinence, owing to injuries

sustained during parturition. Other foreign bodies are those which are readily introduced, such as hairpins, safety pins, catheters, etc. The introduction of these is accomplished either through accidents of surgery or by the patient herself for perverse sexual purposes. It is of importance, in certain cases, to try to elicit the circumstances antedating the symptoms that suggest the possible presence of a foreign body.

4. The new growths form an important cause of bladder symptoms. They are usually polypi or papillomata (the most common variety) and carcinomata. The great tendency for benign tumors of the bladder to degenerate into malignant growths is well known. The symptoms may be very vague and suspicion of intravesical growth may be very remote. It is impossible to make the diagnosis of a bladder growth without cystoscopy. A section removed from the tumor or a small portion of it, which, owing to necrosis and disintegration, has been passed with the urine, may lead to the exact pathological diagnosis. Whenever doubt exists as to malignancy, a section of the growth should be examined microscopically. The benign papillomata appear macroscopically as uniform villi that do not show destruction and hardly any sign of neighboring reaction. Where disintegration and well-marked inflammatory signs are present, the diagnosis should be doubtful until established by microscopic examination of the tumor particle. The high frequency current in bladder work, as introduced by Beer of New York in 1910, is both diagnostic and therapeutic. A portion of the tumor may be treated by the Oudin current, and either removed by forceps or caught in the escaped urine. Cystoscopy and microscopic section, together, make possible the diagnosis of bladder tumors. Palpation may fail to detect a soft polypus or a small soft papilloma of the bladder. With the cystoscope, not even the smallest growth or foreign body should escape detection.

CONDITIONS THAT GIVE RISE TO CHARACTERISTIC SYMPTOMS

Here may be mentioned acute urethritis, cystitis, diverticula, hernia of the bladder, urinary fistulae, bladder stones and foreign bodies, tuumors and acute vesical rupture. These will be briefly described, as the history obtained by careful questioning may lead to a presumptive diagnosis. Tuberculous cystitis will be especially discussed, as it forms a definite type of cystitis which is of the greatest importance to recognize.

Gonorrheal Urethritis.—The increased desire to urinate and the severe burning sensation during micturition occurring in a woman who has never had bladder irritability before, combined with discharge at the vulval outlet, is strongly indicatory of a gonorrheal infection. The latter is due to the associated vulvitis from the gonorrheal pus. Inspection of the urethral orifice, palpation of the urethra per vagina, and urethral massage will readily establish the diagnosis. While these are positive enough, the smear for gram negative intracellular diplococci should always be made for purposes of corroboration. In the absence of these findings, one may suspect a cystitis. The

history of exposure is, of course, of the greatest assistance in the differential diagnosis of urethritis from cystitis.

In the latter, there is likely to be the history of catheterism, of aggravation of the symptoms antedating the menstrual period and of symptoms referable to the internal genital organs. The finding of a pregnant uterus, of tumors or inflammation of the adnexa and of the uterus are suggestive of a cystitis. As Guyon pointed out, any condition predisposing to bladder retention leads to cystitis. Rovsing proved the great susceptibility of the bladder to inflammation when, for some reason, there is retention. The bacillus coli is the chief microörganism to gain access to the bladder wall and start up a cystitis. In patients with chronic valvular disease, a spontaneous cystitis is not infrequent. The acute infectious diseases, typhoid, pneumonia, influenza and even diphtheria, as well as gonorrhea, are responsible for a number of the cases of cystitis. The tubercle bacillus is the cause of the most obstinate type of cystitis.

While painful urination is present in the acute stage of the disease, and pus is present in the urine, frequency of urination is the symptom which chiefly annoys the patients. The intervals may be as short as from ten to fifteen minutes. The quantity passed is very small; often only a few drops at a time may be passed and these may be tinged with blood. When the trigonum is severely affected or when there is bullous edema and cystitis cystica, these symptoms are exaggerated. Chronic cystitis is seldom associated with dysuria. Extreme urgency may be the only symptom. In examining the urine for pus or blood in any given case of cystitis, it is important to secure a catheterized specimen. When this is not available, the genitals should be carefully cleansed and dried and a preliminary douche be given, so that the specimen may not be contaminated. No important inference should be drawn from sediments as such, because they may be due to an excessive amount of mucous or vaginal secretion or to bacteriuria; catheterism, of course, eliminates the possibility of extraneous contamination. Microscopic examination is the only precise method of determining the cellular elements of the specimen of urine obtained. Too great stress should not be laid upon the chemical reaction, because the urine of retention may occasionally be acid while, on the other hand, urine from a tuberculous bladder, instead of being acid as was formerly thought, may not infrequently be alkaline in reaction (Beer). The two-glass test, of help in distinguishing, by the character of the urine, between the anterior and posterior urethritis in males, may also be utilized in the case of females. In the latter it is of assistance in distinguishing between urethritis and cystitis. It is to be noted, however, that it is not of help in determining the source of infection or lesion as between the bladder and the kidney.

Tuberculous Cystitis.—When the proper means of diagnosis are not available, given a case of cystitis which has not yielded to ordinary treatment, one should seriously consider tuberculosis as the underlying cause. The bladder irritability is more marked than in the average case, the patient often is compelled to void several times during the night, the urine is often tinged with blood and contains, as a rule, a sediment of pus cells. Vineberg lays great stress on the nocturnal micturition in tuberculosis of the kidney as being

characteristic of that disease and also upon the imperative urgency experienced by these patients.[2] Cystoscopy often reveals, in addition to the picture of a chronic cystitis, small gray nodules, usually around one or both ureteral orifices, or, in the early stage, bullous edema about the same, or small grayish ulcers dut to the destruction of confluent nodules. In later stages, the bladder is extensively involved. It then becomes intolerant to distention with even a moderate amount of irrigating solution. It is in these cases, particularly, that Kelly's method of cystoscopy, as pointed out by Vineberg,[3] has distinct advantage over other methods. On palpation, not infrequently the bladder wall may be distinctly thickened and tender, and periureteral thickening and tenderness may also be found. Pyuria with acid reaction, but free from bacteria, should lead to suspicion of tuberculous cystitis. The diagnosis is confirmed by the finding of tubercle bacilli in the urine (the smegma bacillus is, of course, to be excluded). If this does not suffice, animal inoculation, according to the method of Bloch, will establish the diagnosis. Buerger succeeded in removing, with the cystoscopic rongeur, small particles for microscopic examination, and was able to demonstrate tuberculous tissue in suspected cases.[4]

Hernia of Bladder.—In hernia of the bladder, the symptoms depend upon the circumstance of incarceration. In such cases, urination is difficult; the patient can urinate only when she assumes a certain position and, if there is a constriction of a larger portion of the bladder, urination is completed in two stages. Ischuria paradoxa is common, as are tenesmus and colic. The diagnosis is established by cystoscopy and the finding of a hernia.

Urinary Fistulae.—These are suspected when there is a history of constant dribbling. Inspection of the bladder through the vagina readily establishes the point of leakage. The administration of methylene-blue by mouth or irrigation of the bladder with a solution of the same coloring matter will be of help in distinguishing urine from thin vaginal discharge and in identifying small apertures. Cystoscopy and ureteral catheterism are of final help in establishing leakage from an injured ureter.

In certain instances, the patient may be able to hold her urine when she assumes the recumbent position. This is accomplished by a sort of valvelike action at the fistulous opening. If the statement is made by the patient that, though there is constant dribbling, she may sometimes pass fairly large quantities of urine, the possibility of a ureterovaginal fistula should be kept in mind. This is explained by the fact that the intact ureter empties urine into the bladder, which is passed when the bladder is full, while the injured ureter constantly empties into the vagina.

Bladder Stones.—These are to be suspected under the following circumstances. There is occasional hematuria associated with pain, especially at the end of micturition. This is due to the bladder coming in close contact with the stone when it is in contraction, particularly when the stone is of large size. Sudden falling upon the buttocks may cause pain in the bladder region.

[2] Vineberg, H. N., "Tuberculosis of the Kidney in Women," *New York Medical Journal,* June 3, 1911.

[3] Vineberg, H. N., "The advantage of Kelly's method of cystoscopy in women," *Medical Record,* Aug. 14, 1915.

[4] Buerger, L., *American Journal of Surgery,* February, 1913.

The urinary stream sometimes ceases suddenly, to be followed by dribbling, due to the sudden obstruction of the urethral orifice by the stone. Cystoscopy is, of course, of the greatest importance. It is even of greater help than roentgenography because, as Beer [5] pointed out, the roentgenogram often fails to show stones in the bladder. In a series of 22 cases reported by him, the X-ray showed vesical calculus only six times, though the stones were conclusively demonstrated by cystoscopic examination. Hyman[6] published 13 additional cases of vesical calculi, making 35 cases in all; of these, 19 were not revealed by the X-ray picture.

Foreign Bodies in the Bladder.—Here the history is of great help. The symptoms are practically those of stones. Not infrequently there are symptoms and evidence of a fistula as well, as in a case of a little girl eight years old, which I reported.[7] When the bladder is empty, the pain is worse. If this symptom is definite, even without a history of foreign body introduction and trauma, the presence of a foreign body should be strongly suspected. Cystoscopy and X-ray make the diagnosis.

Tumors of the Bladder.—Hematuria is common in all advanced stages of tumor growth within the bladder. It is due to tissue destruction. In the early stages, there may be no symptoms or only irritability and frequency. Papilloma is the most common type of intravesical growth. It varies in size from a small stalk of cauliflower appearance to a tumor occupying a good portion of the bladder. Its appearance is characteristic, villous in structure, and it may be readily identified in the cystoscopic picture. In marked cases, there is an associated cystitis and, when the ureter is invaded, secondary kidney effects and symptoms are present. The larger growths and those showing degenerative changes may resemble carminoma so closely as to require microscopy to establish the diagnosis.

Rupture of the Bladder.—This forms a definite symptom-complex. There is the severest ardor urinae and dysuria without, however, the successful act of urination. When the urine is passed, it consists of a few drops, usually deeply tinged with blood. In spite of difficulty of urination, the bladder does not form a palpable tumor above the symphysis, as is the case in distention from whatever cause. While catheterism is easy, no urine is thereby withdrawn. It is easily distinguished from rupture of the kidney, because catheterism succeeds in withdrawing almost a normal amount of urine, though bloody in character. It is differentiated from rupture of the urethra by the fact that it is impossible to perform catheterism, though the bladder remains distended and there is the most violent tenesmus.

Summary.—In endeavoring to interpret bladder symptoms, it may not be at all necessary in certain cases to employ the entire routine examination. Thus the gonorrheal urethritis of very recent date is characteristic. Pus from the urethra, with the intracellular gram negative diplococci, establishes the diagnosis. On the other hand, the presence of a urethral caruncle,

[5] Beer, E., *Interstate Medical Journal*, November, 1914.
[6] Hyman, A., *Interstate Medical Journal*, August, 1916.
[7] Rubin, I. C., "Vesicovaginal fistula in a girl eight years old. Spontaneous cure following removal of hairpin." *American Journal of Obstetrics and Diseases of Women and Children*, 1914, No. 6, Vol. 69.

though so easily seen, may not, in itself, be sufficient cause for all the symptoms. Further examination into other possible causes of the symptoms should be made. Nor is a cystocele in itself enough to account for bladder difficulty. It should be remembered that very often a plastic operation for the relief of bladder symptoms fails of its purpose, although an excellent anatomical restoration may have been accomplished. The reason for this is that trigonitis may have been present, a condition for which treatment should primarily have been directed. Nor should the various displacements of the uterus *per se* be assumed to act as the cause of bladder disturbances. The proper technic in explaining symptoms should include intravesical inspection. When no lesions are discoverable in the urethra or the bladder, we must proceed to determine kidney function and disease, and ureteral patency and disease. One must proceed to apply tests which will throw light on these urinary organs. While advanced disease of these organs is scarcely ever present without secondary effect on the bladder, there are, nevertheless, cases in which this does occur. A small ureteral stone near the bladder may give rise to symptoms without any evidence of disease demonstrable in the bladder.

Ureteral strictures are said by Hunner to be very common. The symptoms are pain in the lower right iliac fossa and, at times, frequency of urination. The diagnosis is made by excluding the presence of a stone and demonstrating the "hang" to the No. 5 ureteral catheter.

The X-ray, urinalysis, chromo-ureteroscopy, blood urea examination, animal inoculation, etc., are some of the other methods in diagnosis which we have to employ in order that we may arrive at a correct diagnosis and a correct interpretation of diseases of the urinary organs.[8] In this respect, the methods employed are the same in females as in males.

[8] Hyman, A., "The application of modern urological methods in the diagnosis of surgical conditions of the urinary tract," *American Journal of Surgery,* June, 1915.

PART III
EXAMINATION AND DIAGNOSIS

CHAPTER XVII

GYNECOLOGICAL EXAMINATION

The object and aim of the examination of the patient is to locate the seat of her trouble and to apply proper and effective therapy. The latter is, of course, dependent on the former, and the indication is comparatively simple, since operative technic in this special field of surgery has been developed to a point of comparative perfection. The more we operate, says Winter, the better is our diagnosis. The more careful our diagnosis, add Forgue and Massabuan, the better we operate. There can be no doubt of the force of the truth expressed in each of those statements. Our understanding of abdominal disease has been amplified and deepened through contact with living pathology at the operating table. The facility with which laparotomy is done has enabled surgeons to see their errors in diagnosis. However, multiplicity of operations in itself does not make for greater accuracy in diagnosis. The careful surgeon seeks to establish a diagnosis, both as to the seat and the nature of the lesion, before operating. His "batting" average becomes higher and higher with increasing experience. But the man that resorts to exploratory laparotomy is not apt to profit by the exploration, and the kind of surgery he performs should not be imitated.

Good, careful preoperative diagnosis undoubtedly facilitates the operation. No time is lost in groping for the trouble to be corrected; the operation proceeds along a plan previously thought out, with chances of a happier result to the patient. There is naturally a sense of satisfaction in knowing that one's art can be perfected by faithful attention to the methods of diagnosis, as already established, and by persistent efforts in their application to each individual case. A certain percentage of error probably will always exist, since our perceptions and judgment are subject to the limitations of the mind, on the one hand, and to the complexity of disease on the other. At the same time, we can and should strive to reach an accurate diagnosis in the majority of cases.

Gynecology lends itself perhaps to greater ease of diagnosis than any other specialty, because the organs involved are more readily accessible. Possibly the genito-urinary tract is an exception, for diagnosis in this department of surgery has made rapid strides since the use of the cystoscope and roentgenography. These means have also largely been employed in the practice of gynecological diagnosis, as the urinary organs and the genital organs are very intimately related anatomically, embryologically and functionally. It would seem, therefore, that organs which are thus accessible to touch would be simple to outline and their pathological states easy to decipher. To one practiced in physical examination, it sometimes is not difficult to distinguish

the pelvic organs and tumors arising from them. But if one depends upon the sense of touch alone, he will frequently be misled. The examination includes a painstaking and thorough history of the patient's previous condition and present complaints, in conjunction with the findings obtained by other methods than palpation.

Perhaps an approach to absolute accuracy, at least in one part of gynecological diagnosis, has been achieved in the use of such physical agencies as gas in combination with the X-ray. For the knowledge gained by this newer method is at least as valuable in its own special field as that derived through the use of the cystoscope.

THE HISTORY

(Questionnaire)

The Approach.—The average patient comes to the gynecologist full of her troubles. These she may have rehearsed in her own mind on numerous occasions or confided them to her husband and friends. It is often with reluctance and after long deliberation that she decides to consult the specialist. As the things about which she must speak are always a matter of delicacy, it is necessary to encourage confidence and to reassure her, not in words so much, perhaps, as by general demeanor. One disarms her mistrust and inspires confidence by methodically asking questions concerning her general health and then those relating to her genital trouble, or vice versa, which is more direct and perhaps better. She sees at once that you mean to get to the bottom of her complaints and she is encouraged by the prospect of instant or speedy relief. One has to exercise patience with the nervous woman, steering her gradually, when she digresses by reciting irrelevant matters, into the groove of the questionnaire. Occasionally it becomes necessary, in dealing with very nervous patients, to submit to a long and tiresome account, which may not have a direct bearing upon her malady, in order to win her confidence. Having gained her confidence, it may be possible to make up for lost time by giving effective advice in a few words which have the weight of final authority. It is sometimes possible to dismiss all the complaints by an assuring phrase, not only to shorten the consultation, but as a therapeutic measure as well. Nevertheless, everything that she says or does may have a bearing on her condition. Whether she is garrulous or reserved, emotional or phlegmatic, scattered or collected, in her history, may or may not reflect symptoms of gynecological disease, but such points are to be reckoned with in the physical diagnosis as well as in outlining treatment.

There is a class of patients with imaginary troubles and another class with real troubles, in both of which the symptoms are too obscure to permit a diagnosis. These wander from office to office seeking relief, and it behooves us to take them seriously. There is no class of patients more worthy or more grateful for the honest and conscientious attempt to help them solve their problems, even if this is not attended with success. The remarks of an intelligent patient, particularly, should be borne in mind, since at times they lead to a correct diagnosis. We shall consider some of these later. Less intelligent patients

will have to be dealt with more objectively; in such cases greater dependence must be placed on the physical examination.

During the questioning, one should take note of the facies. Attention to this feature of the interview will lead often to better evaluation of the findings. Does the patient look old or young for her years? Does she appear to be suffering? Does she look pale, yellow, thin, anxious? Is her eye bright or listless? These reflect the ravages of septic conditions or malignancy or the loss of blood by frequent hemorrhages. On the other hand, if a patient has a good nutrition and a good color, one may conclude that she is not as ill as she believes. Uterine and ovarian facies spoken of and described by older authors are terms the significance of which modern methods of diagnosis have rendered obsolete. Occurrence of very large ovarian cysts is practically a thing of the past, since diagnosis of these tumors is almost universally made at an earlier stage of their development. The term "uterine facies" was used to denote cachexia, now known to result from malignancy of any primary source.

One may begin with the question, "What brings you here?" or, "What are your chief complaints?" or, "What troubles you?" It is surprising how often this simple question cannot be met by a straightforward answer. Unless the patient has been drilled in the questionnaire in the consulting room of other physicians, she is at a loss. At times, it is fright or confusion; at times, she cannot decide what is chiefly responsible for her making the visit to the physician's office. In such cases, it is well to go through the routine and gradually obtain the chief complaints by developing the history.

The points of chief importance in the history of the gynecological patient are naturally those that relate to her genital function. Nevertheless, a complete history should be taken in each case. For the complete consideration of the patient and her complaints, we should inquire systematically into the facts of importance respecting the other organs.

The history should include the following data: The age of the patient. Is she married, single or widowed? Were there any pregnancies? If so, how many were at term? How many abortions, if any? Were the labors normal, instrumental or induced? Were the postpartum periods uneventful? Was there fever, hemorrhage or any other abnormal symptoms? Age of oldest child and youngest? How long confined to bed? Were any of the abortions induced? If so, by what method? Were there any spontaneous abortions? Any complications? Were there any operations, when and for what conditions? Menses—onset—periodicity—amenorrhea the first year?—duration—character with regard to pain and time of pain in relation to menses; before, during or afterwards—how severe—confinement to bed—intermenstrual pain —the use of anodynes, etc.? Are clots passed or not? Are associated symptoms, such as headache, breast swelling, hoarseness, nausea, and vomiting present? When was the last period and type? If curetted or a miscarriage, how soon and in what way were periods reëstablished? Was there lactation or not? If lactation is present, when did periods return? How have menses varied since being sick? How affected since marriage? Vaginal discharge? Condition of bowels—bladder irritability? Digestion—strength—sleep— weight? Pains elsewhere than in pelvis?

Vaginal Discharge—*Nonbloody.*—Onset—amount—increasing or decreasing following puberty—pregnancy or abortion—character? Composition —does it resemble the white of egg—is it thin, watery or purulent—what is its color—does it stain the clothes—is it irritant—odorous? How affected by periods?

Bloody.—Normal or abnormal in quantity? Duration and character during periods—or in intervals? If irregular, how often and what duration— amount in relation to number of napkins used—fluid, clotted, or both? Is it aggravated by coitus or vaginal douche?

Pain—*Onset.*—Where located—deep or superficial—generalized or localized—median or lateral, unilateral or bilateral—lumbar, pelvic, iliac, inguinal, sacrococcygeal—radiating toward the ribs, thighs, loins, or back— spontaneous or provoked? Does *pressure* influence it or not? Is it affected by walking or riding, work, coitus—by vaginal touch? *Maximum points* of tenderness on pressure; in culdesacs lateral, anterior or posterior? Mobilization of the uterus? Does rest in bed relieve it? How do menses affect it?

Duration.—Continued—intermittent or periodic? What appears to have a bearing upon their paroxysms? Type—sharp—acute, lancinating—sudden, with diffuse radiation—gradual—insidious—sense of weight or discomfort? Colic—Is there vesical or rectal tenesmus?

General Symptoms.—Nervous—emotional—sad—depressed—tired— hysterical.

Digestive.—Flatulence—fermentation—nausea—vomiting— constipation. Are there mucous shreds, etc.?

Circulatory.—Palpitation—dyspnea (shortness of breath)—edema, and where—strength—weakness.

Pulmonary.—Cough—emphysema or bronchitis.

Urinary.—Frequency—pain—difficulty—quantity passed, etc.

Emaciation.

Fever.

Antecedent History.—Parents, with especial reference to cancer, tuberculosis, etc.; infancy, with especial reference to scrofula—rickets—nervous troubles—vaginal discharge—chlorosis before puberty—articular pains— urinary difficulty.

Is it necessary to go into all these details in each case? Probably not. The complete collation of these facts may have a general scientific value for the future when one comes to analyze group cases. It may have some bearing upon the future of the patient, if it is deemed necessary to operate. But there are and always will be conditions so obviously simple, without any associated local or general symptoms, as to require no lengthy analysis of her physical status. For example, a uterine prolapse due to prolonged and difficult labor with instrumental delivery may be present, without giving the patient backache, bearing-down sensations or even discharge or menstrual disturbance. It appears on standing and disappears on lying down, and is almost a cosmetic disadvantage of which the patient wishes to be rid. Theoretically one may inquire into the reason of the difficult labor and its mechanism, but, for practical purposes, it is enough to verify the patient's statement that her womb

"appears between her thighs" in order to proceed to correct the deformity.

On the other hand, there will be a group of cases which will demand a thorough inquiry into all the facts obtainable in the personal history. This is particularly so, where pain is the only symptom and no obvious cause is found to account adequately for it.

In the vast majority of cases, especially where the statements are intelligent, one may get the main points from the patient herself. One may then fit them into the general scheme, adding a point here and there by appropriate questioning. The chief complaint should be dwelt upon particularly and analyzed. Thus, if bleeding is the sole complaint, it should be investigated fully and as many of the special points concerning it adduced as the patient's intelligence and responsiveness will permit.

Touch.—By touch we are able directly to determine certain lesions in the pelvis. Vaginal touch should always be combined with abdominal palpation (bimanual examination). By palpation, we determine the presence of, the size, and the length of the vagina; the temperature, the condition, presence of constrictions or irregularities in its surface, new growths, etc.; the position, size and consistence of the cervix—conformation (tears) of the external os— presence of irregularities (polypi, tabs, tumors)—further, the direction, mobility and its relation to the body of the uterus; of the latter, the size, shape, position, mobility, consistence and sensitiveness, also conformation (atrophy, hypertrophy, inflammation, new growths and anomalies). The culdesacs, posterior, anterior and lateral, are next explored. Here we note the condition of the adnexa laterally, the exudates and tumors posteriorly and in front, and any abnormality of the bladder. The ureters may sometimes be palpated along the lateral pelvic walls (Judd), just before they enter the bladder. By recto-abdominal palpation, where it is impossible to examine by the vagina as in the virgin, we may elicit almost as many facts. It requires more practice, and errors can sometimes be made, such as confusing the cervix and the body of the uterus, thus leading to false conclusions as to its position. The chief service of the rectal examination is first to exclude tumors of the rectum, to exclude the presence of hard fecal masses in the pouch of the rectum and, by combining rectal and vaginal palpation, to palpate the rectovaginal septum for tumors and exudates and, in cases of carcinoma, induration and infiltration of the parametrium. In cases of tumors of the vagina, the rectal examination helps to determine primary or secondary involvement of the rectum or the vagina, etc. It is also sometimes possible to arrive at the condition of the adnexa by this route better than by the vagino-abdominal method.

To make satisfactory palpation, it is necessary to have the bladder and the rectum empty. The first is easily accomplished by the patient voluntarily voiding; the second, by catharsis, or the administration of an enema. Where retention in the bladder is present, the catheter is used. Tumors and retroversions and retroflexions have been diagnosed erroneously because of a large, filled bladder. In the same way when the sigmoid is loaded with hard, scybalous masses, they may be mistaken for tumors of the uterus or of the adnexa.

It has been my experience that the main difficulty in obtaining relaxation

is an overfilled bladder or a loaded rectum. Fear of embarrassment of passing flatus or of bowels moving during the examination causes the patient to hold her abdominal and pelvic floor muscles in a defensive tension. The muscles are apparently held in involuntary spasm when pressure is applied over the abdomen, and reflexly through pressure upon the rectum by the vaginal fingers. Catheterism removes the mechanical impediment at the same time that the spasticity is reduced or even disappears. In the absence of these two encumbrances, and if the patient is still unable to relax her abdominal muscles, I have found it useful to resort to the following procedure. Ask the patient to make her abdomen large, then flat, then to relax. The contrast between the girth of the abdomen, as increased by voluntary pressure and decreased by "sucking in," enables the patient to understand what is wanted when we say "hold yourself lax," etc. Occasionally a thick spastic rectus can simulate an underlying tumor and the mistake has been made by the most expert on palpation. Inasmuch as spasticity or rigidity is one of the physical signs of peritonitis or abdominal visceral inflammation, it is necessary to exclude reflex spasticity as stimulated by the transient irritation of the palpation.

Another fact to be borne in mind is the importance of gentleness in touch. It goes without saying that the gentler the palpation, the less irritation to inflamed parts, the less spasticity and the better interpretation through the tactile sense. Fine shades of differences in consistence or density or rigidity, induration and surface outline can lead to the proper differentiation between a hematocele, an ovarian dermoid cyst or a fibromyoma. The simple retention cyst of the ovary with its very thin cyst wall has a characteristic sensation. With increasing practice by gentle vaginal and abdominal palpation, one learns to gauge the depth of the various layers of the abdominal wall, making due allowance for the tissues intervening between the culdesacs and the skin of the abdomen as palpated by the external hand. The tactile sense can be cultivated to a very remarkable degree so that any abnormality is at once registered through that sense. The use of rubber gloves modifies the touch, but with increasing practice one acquires an appreciation of relative values in spite of the dulling effect of the rubber, etc. In thin women, one can sometimes feel prolapsed intestines in the culdesac, especially in the lateral fornices. The characteristic gurgle, as when the gut is squeezed, may be elicited. This may be confused with one thing only, and that is the rupture of a fine-walled cyst— inflammatory pelvic or retention cyst of the ovary. As the latter is accompanied by slight pain and is followed sometimes by mild peritoneal irritation, mistakes occasioned by it will not be frequent.

Certain lesions defy tactile differentiation in the most skilled hands. Soft, edematous, perhaps partially cystic tumors of the uterus may simulate ovarian tumors or pregnancy. They are properties inherent in the very pathological states themselves and will always cause confusion. Their proper differentiation may be arrived at by the other methods of physical examination with the aid of the history. But at least the personal factors, such as the posture and attitude of the patient, the skill and approach of the examiner, are matters which should offer very slight or no difficulty. These are obstacles to the successful examination which ought, in most cases, to be under proper control

Besides rendering the physical examination difficult, brusque examinations may cause dangerous complications, such as (1) rupture of an encapsulated abscess, (2) rupture of an inflammatory cyst, or (3) rupture of an ectopic gestation.

Palpation of the Normal Uterus, Tubes, and Ovaries.—The uterus is readily identified by bimanual examination. The cervix, palpable to the vaginal fingers, is felt to merge into the hard, smooth-surfaced body as felt by the abdominal fingers. The pear-shaped structure with its bulky end in the abdomen is felt to move as one mass in all the directions; it is possible to displace it upward, downward, laterally and anteroposteriorly. The broader or fundal portion may be pushed into extreme anteversion and retroversion, but it is slightly more difficult to induce flexion by combined palpation. Mo-
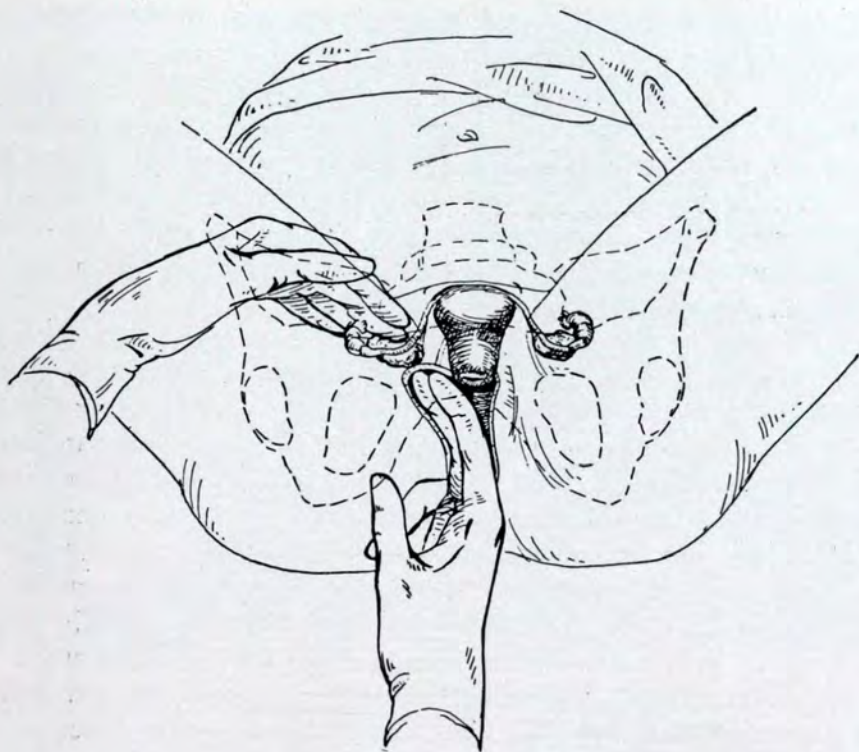
FIG. 28.—METHOD OF PALPATING THE RIGHT ADNEXA (modified after Weibel).

bility in the normal state is unaccompanied by pain or tenderness. Its position may vary from the obtuse angle with the vagina well supported by the ligaments which suspend it. When the suspension and supporting apparatus is defective, it may be in extreme anteversion (very rare), or in the axis of the vagina (not uncommon), or in retroversion of mild or severe degree (not uncommon). In addition, the angle of the cervix and the body may be exaggerated anteriorly or posteriorly, when we have the anteflexion and retroflexion. The whole uterus may be dislocated to the right or left side (dextro-deviation and sinistrodeviation), or it may sink toward the vulva and even appear between the thighs (prolapsus, descensus uteri). Except in complicated pathological conditions, the uterine body is perhaps the easiest one of the internal genitalia to identify.

In the normal case, the ovaries are felt by the examining fingers at either side of the uterus, at varying distances, from very close to the fundus to two or three inches away (Fig. 28). They are rounded, firm structures, varying in size from a large Brazilian nut to a walnut, and give rise, on pressure between the fingers, to a characteristic pain. It is possible to elicit this in many instances by pressing the ovaries against the lateral pelvic wall. As opposed to the uterus, which is insensitive to pressure, the ovary is tender, owing to its richer nerve supply. Palpation of the ovaries is possible nearly always in thin women; in stout women, only when they are prolapsed or enlarged. In the latter case, the vaginal fingers detect them when the abdominal fingers fail to reach them. In some cases the ovaries appear in the culdesac, where they may be adherent.

The tubes are not to be palpated in the normal state in stout subjects. In thin individuals, they may be traced from the uterine horns, but it is not possible in such cases to differentiate them from well-developed round ligaments. In the absence of tenderness, such tubes may be assumed to be normal. On the other hand, failure to feel enlarged tubes does not preclude actual disease.

The bladder is not palpable except when distended, when containing a foreign body, for example a stone or a hairpin, or when its walls are very thick. The vaginal fingers may palpate it against the symphysis with the aid of the fingers over the hypogastrium.

In the presence of abnormal masses, it is necessary to locate their origin, size and possible pathological, or histological, structure. Tumors of the uterus will, in general, move with the cervix. Pushing the cervix upward will cause simultaneous motion of the tumor and, vice versa, pressure over the tumor will be transmitted to the cervix. While this holds good in submucous and intramural tumors, those with a long pedicle may not be so easy to identify. Particularly is this true when subperitoneal fibroids spring from either horn or from the lateral wall of the uterus. Despite our best efforts, it may be impossible to make the diagnosis. One method proposed by Hegar will be helpful in these instances. While an assistant brings down the cervix, grasped by the tenaculum, the examiner palpates by the recto-abdominal method and elicits whether the pedicle is attached to the body of the uterus by direct continuity and, at the same time, whether it moves with the uterus. Another method is to fix the uterus in the same way and then, by abdominal palpation, note whether there is any motion of the cervix when the tumor is displaced in various directions. By fixing the uterus, or what appears to be the uterus, bimanually, and then having an assistant displace the tumor, the question of its uterine origin may also be settled.

The different types of tumors, according to their histology, will also require differentiation. These will be taken up in the interpretation of symptoms, along with the differentiation between uterine and ovarian or perhaps tubal tumefactions.

Inflammatory masses, in general, are fixed and more or less tender. This constitutes the chief feature distinguishing them from pelvic tumors. On the other hand, tumors and inflammations are not infrequently associated. This association complicates the diagnosis, but in the symptomatology combined

with the physical findings we may get a clue to the exact condition. Here, however, it may be mentioned that an incarcerated, retroflexed uterus may simulate both tumor and inflammation without either being present. This will be described later.

Collections of blood and pus or serum without encapsulation sometimes yield to proper interpretation by palpation. Blood often gives a boggy sensation, because of the admixture of clots and fibrin with the free fluid. Chiefly felt in the posterior culdesac, it may also be palpated in the lateral fornices and around the fundus of the uterus, in the adnexal regions and about the bladder (suprasymphyseal). Serous collections are elicited in the posterior culdesac by palpation and in the flanks by percussion and shifting dullness.
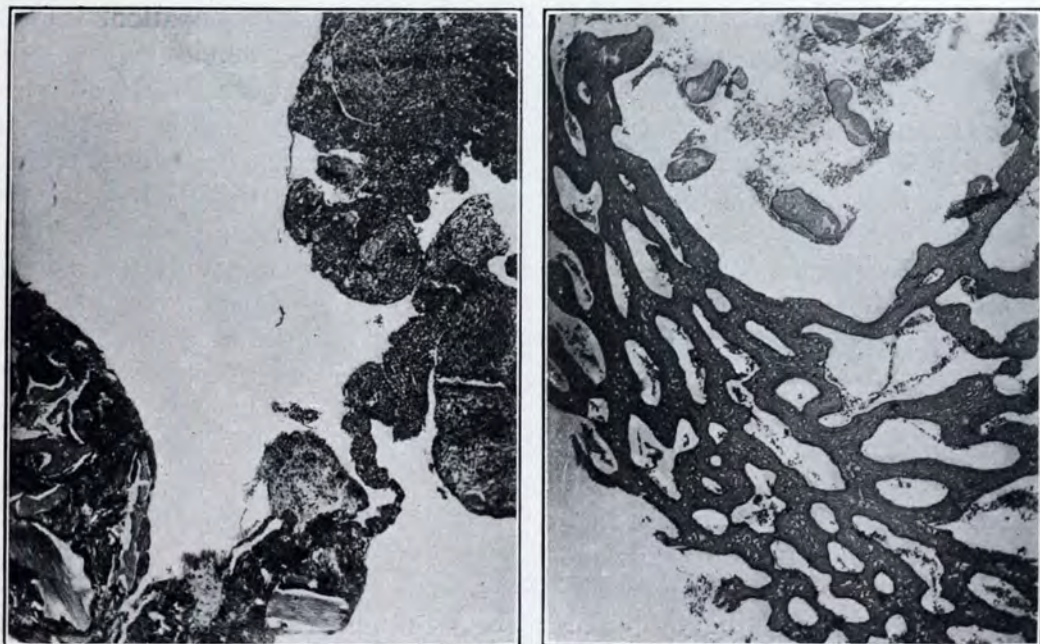
FIG. 29.—MICROSCOPIC PHOTOGRAPHS OF YOUNG BONE FROM THE ENDOMETRIUM OBTAINED BY CURETTAGE. Several fragments of long bone from a fetus of three to four months were removed from the uterus along with microscopic fragments. A distinct crepitus was elicited by bimanual examination of the uterus and a sense of grating was elicited by introducing the uterine sound. The X-ray findings were negative.

The uterus and adnexa seem to "float"; their range of mobility is increased. Pus, as a rule, is palpable in the posterior culdesac and occupies the rectovaginal septum which it infiltrates; it is not necessarily associated with induration of the parametrium. The uterus and the adnexa are most often limited in mobility. This obtains also in those rare cases of rupture of large pyosalpinx with empyema of the peritoneum. In all these instances, the clinical findings are of great value. A distinct crepitus was elicited by the author in a rare case of retained small fetal bones (Fig. 29).

Percussion and Auscultation in the Gynecological Examination.—The chief value of percussion of the abdomen is to determine the presence of free fluid in the peritoneal cavity. The method is too well known to need description. The limitation of tumors may also be further defined; whether they are

retroperitoneal or intraperitoneal may sometimes be established by combining palpation with percussion. Tympany over a tumor which does not move, or which moves but slightly by pressure, is very significant of a retroperitoneal origin.

Auscultation has its chief value in cases where the tumor is so large as to suggest pregnancy. Also in certain ovarian tumors, such as hydatid cysts of the ovary, the characteristic thrill may be made out. In certain very vascular fibroids, the uterine *bruit de souffle* may be heard. While serving to complement the other senses, the findings through percussion and auscultation have in themselves a limited sphere of usefulness.

The position of the patient and the method of palpation in the gynecological examination need not be described. One precaution considered of great importance in the pre-antiseptic era, namely, cleanliness in palpation, it is no longer necessary to dwell on. The use of sterile gloves excludes adding sepsis to parts already inflamed. The fingers entering the vagina should not enter the rectum without first changing the glove or at least thoroughly washing and dipping it into an antiseptic solution. The abdominovaginal should always precede the abdominorectal examination, where it is possible to enter the vagina at all.

The Use of the Vaginal Speculum.—The bivalve speculum of Brewer, Graves or Sims, and vaginal spades (Brettauer) are used in this country. The trivalve speculum and cylindrical speculum are no longer used for diagnostic purposes, and a description of the method of their introduction can be dispensed with.

The data that may be obtained through the use of the speculum is given herewith:

1. The appearance of the vagina, including secretions.

2. The appearance of the cervix in the physiological state. The virginal cervix, as well as that of the nulliparous woman, is apt to be conical, its surface mucosa, smooth and reddish, contrasting with the somewhat rugose and pale vaginal mucosa. Its anterior lip is slightly shorter than the posterior lip. The external os is most often punctiform in the virgin, while in the nulliparous married woman it is more patulous and broader.

3. In the parous woman, the cervix is apt to be plumper, larger and paler; the external os is more apt to be transversely elliptical and present scars of obstetric trauma.

4. In old women, the cervix is atrophic, of grayish pallor and the fornices are shallow or absent.

Pathological alterations visible by means of the vaginal speculum are the following:

Hypertrophy or atrophy of the cervix, tears, eversions, simple erosions, retention cysts and papillary erosions, ectropium, cysts, polypoid tabs, abnormal secretions—from the thin serous to the frank purulent; the tenacious mucus plug just protruding from the external os to the broad mucopurulent wick which can be removed with difficulty. The discharge may be bloody. Ulcerations, specific and neoplastic, are also at once apparent on inspection.

By means of the speculum and the tenaculum forceps, we are able to determine the mobility of the uterus.

The intra-uterine sound is of the greatest aid in gynecological diagnosis. It enables us to determine the permeability of the cervical canal (important in dysmenorrhea and sterility), to measure the length of the uterine cavity and its axis, to detect irregularities within the uterine cavity and cervical canal (submucous myoma and carcinoma) and, finally, to determine the sensitiveness
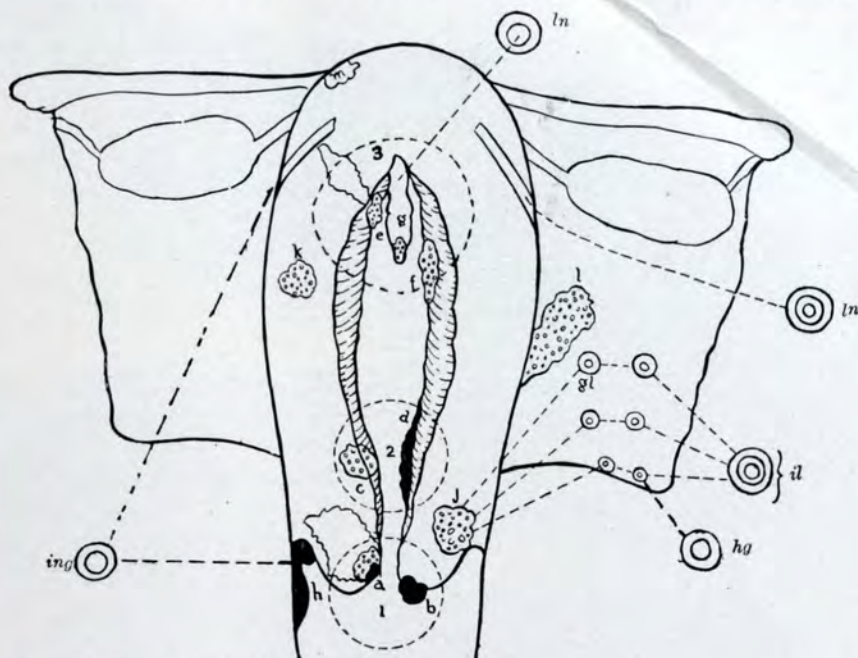
FIG. 30.—DIAGRAM ILLUSTRATING ANATOMICAL SITES OF ORIGIN AND MODE OF PROPAGATION OF CARCINOMA OF THE UTERUS. I, Areacircumscribing external os, primary seat of carcinoma; II, area circumscribing internal os, primary seat of carcinoma; a, small carcinoma of one lip of cervix, endophytic tendency; b, small carcinoma of one lip of cervix, exophytic tendency; c, small carcinoma of cervix at internal os, endo- and exophytic tendency; d, young carcinoma cervix, tendency to spread along surface mucosa; e, young carcinoma of body, tendency to endophytic propagation; f, young carcinoma of body, tendency to exophytic propagation; g, young carcinoma grafted upon a submucous polyp or myoma (so-called carcinomatous degeneration); h, young carcinoma of vagina at formix with propagation downward; i, a large tumor (endophytic propagation) developing from j, a distant nodule in cervix parenchyma, via lymphatic transportation k, carcinoma developing in Gartner's duct; l, large nodule in broad ligament (parametrial involvement); m, implantation metastasis from neighboring carcinoma of intestine or as in Krukenberg tumors from carcinoma of stomach; ln, lumbar lymph node; gl, small glands in broad ligament; il ank hg iliac and hypogastric lymph nodes; ing, inguinal lymph nodes.

and abnormal vascularity of the endometrium (tumors, inflammations). While enabling us to get an idea of the thickness of the uterine wall when combined with abdominal rectovaginal examination, its usefulness in this respect is very limited and requires very careful maneuvering. Although it cannot successfully be employed in the presence of atresias and stenosis of the cervical canal or the external os and certain extreme types of uterine flexion and deviation, these conditions are often discovered only by its use.

The digital exploration of the uterus is possible, as a rule, in the post-abortive or postpartum state. Here the external os and the cervical canal is

patent to the finger and, by it, retained parts can be detected as well as removed. Occasionally in submucous myomata, which are in the process of

Amer. Jour. of Obstet., October, 1910.

FIG. 31.—SEGMENT OF A GLAND SHOWING MANY LAYERS OF EPITHELIAL CELLS WITH GIANT NUCLEI AND DISORDERED ARRANGEMENT INDICATING AN EARLY STAGE OF CARCINOMA.

extrusion, the cervix may admit a finger. In the vast majority of nonpregnant uteri, it will require considerable dilatation to open the cervix sufficiently to permit a digital exploration; hence it is not commonly employed. The use of
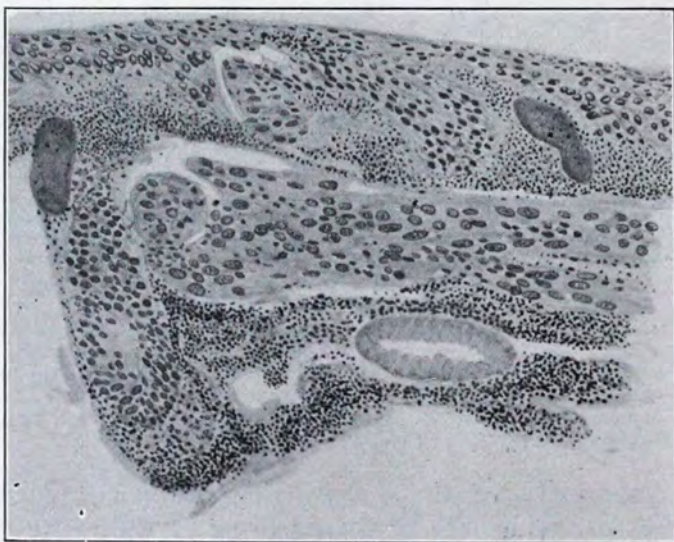
Amer. Jour. of Obstet., October, 1910.

FIG. 32.—LYMPHATIC PROPAGATION OF THE CARCINOMA. Note the normal endometrial gland immediately underneath and the atypical solid cell nests above it.

the sound and of the curet in cases where the cavity of the uterus is to be explored enables us to elicit practically all the data necessary to make a diagnosis of intra-uterine lesions.

Uterine endoscopy, when feasible, is certainly a help in diagnosis. Of all the instruments devised for this purpose, that of Heineberg may be mentioned as the best. He carried the David idea of an endoscope with internal illumination to a practical point. By means of it, polypi, tumors, etc., may be detected. Its chief disadvantage is its caliber, which requires the administration of an anesthetic and wide dilatation for its introduction within the uterus.

Exploratory Excision and Diagnostic Curettage.—Exploratory excision refers to the cervix and, in rarer instances, to the vagina, the vulva and the inguinal glands. A history of irregular or inordinate bleeding with the finding of an irregular formation of the cervix which bleeds to the touch, in a woman of middle life or above thirty, should indicate a diagnostic excision. The material should be examined carefully by a competent pathologist. In
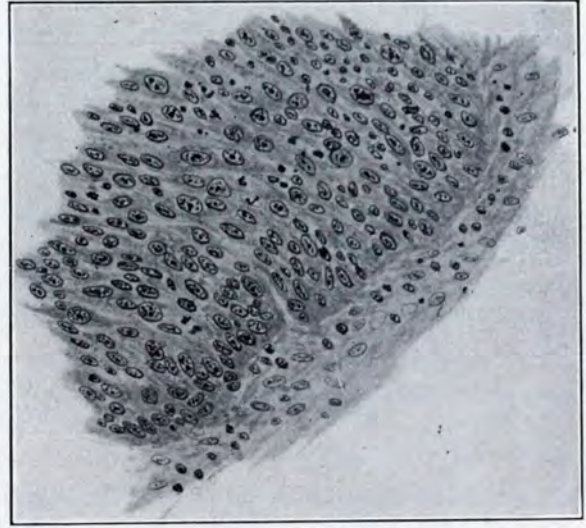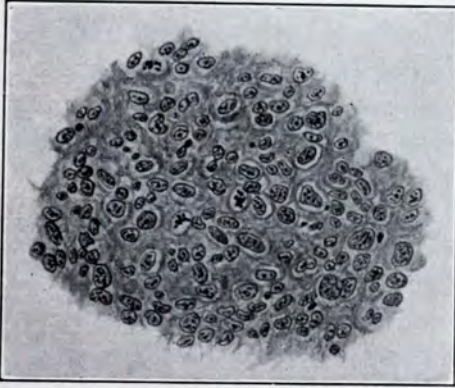
Amer. Jour. of Obstet., October, 1910.

FIG. 33.—CELLS OF TWO CASES OF INCIPIENT CARCINOMA. The atypical arrangement, the irregularity in size and staining of the nuclei and atypical mitosis are diagnostic of malignant proliferation.

the absence of a suggestive history, the finding of such a formation should lead one to make a diagnostic section also.

A lesion of the vagina, vulva or indurated inguinal glands may require similar handling for diagnosis (Figs. 30, 31, 32 and 33).

Diagnostic curettage is employed in all cases of irregular bleeding. Indeed a therapeutic curettage should, at the same time, be regarded as a diagnostic curettage. The curettings should in all instances be examined microscopically. This statement will include those cases in which radiotherapy is contemplated and those where obvious lesions, such as multiple fibroids, are present and for which a hysterectomy is planned. In the latter event, a preliminary curettage, if done as a routine, would help to locate an associated carcinoma. Sometimes the main lesion is the carcinoma where fibroids are clinically diagnosed. The routine use of diagnostic curettage and examination of the curettings by the microscope cannot be overemphasized.

Inspection.—The history of the patient can be checked up by inspection of the external genitalia. The first glance takes in the formation of the labia majora and the condition of the pudendal hair, the mons veneris and the condition of the neighboring skin. Large labia with abundant hair indicate proper development of the secondary sex characteristics. Alone they are rarely a sign of full-fledged sex maturity. Small, delicate labia majora and a scanty growth of hair bespeak a retarded sex development. Hypertrophied labia minora may be congenital, but they may denote an abnormal increase in response to masturbation. A well-developed, prominent clitoris may have the same significance, but to my mind the most common evidence of onanism in virgins is a fresh erosion around the hymen and at the vestibule. A pigmented, flat, papillary, yellowish eruption on the innermost portion of the small labia is often the result of chronic masturbation. The formation of the labia minora is next noted for anomalous contour, asymmetry, fusion below the commissure and duplication on one or both sides. It may be the most external sign of anomalous development of which there may be some other expression in the internal organs. The hymen is inspected to see whether it is intact or simply stretched or torn with the carunculae myrtiformes characteristic of coital trauma and deflorescence. This is, perhaps, more often the result of parturient trauma than merely of cohabitation. The presence of cystic formations in the labia majora can readily be ascertained. Redness around the urethral meatus, prolapse of its mucosa or pus within its mouth, redness around Skene's ducts with perhaps the escape of discharge—no matter how slight—are very suggestive of gonorrheal infection. The expression of pus from these ducts, after the well-known technic of Howard Kelly, clinches the diagnosis, for there is no nonspecific inflammation that causes this lesion. It is well to wipe clean the introitus before attempting this, because a leukorrheal discharge often fills the urethral meatus and may lead to error. Expression of urethral discharge may be accomplished by massage of the urethra through the vaginal wall. In children and young adults with intact hymen, this urethral expression may be accomplished by massage through the rectum.

The presence of pediculi and of oxyuris may be sought for when pruritus is a symptom. On the other hand, an angry-looking vulva, perhaps swollen and very red and dry, denotes a diabetic condition. Intertrigo is common in fat individuals and is particularly common in the summer time. An irritation of the vulva is very common in the acute cervical and vaginal gonorrhea. The escape of greenish pus from the vagina at the vulval orifice is strongly suggestive of gonorrhea, but not necessarily so, especially in women past middle life and during the pregnant state. Condylomata acuminata and lata, the common warts (verrucae vulgaris), chancre and chancroid lesions are all pathognomonic of the type of infection or of a specific irritation. Lupus of the vulva (esthiomene), massive edema of the large and small lips, varicosities and hematoma form the rarer lesions and are not difficult to diagnose and differentiate. Smaller and larger fibromata molluscum are not infrequently observed, especially during pregnancy, when they have a tendency to increase in size. Kraurosis vulvae is another lesion often difficult to cure and it is the cause of the most obstinate pruritus.

Fissure in ano, external hemorrhoids or perianal intertrigo can at once be seen by spreading the buttocks. The external opening of a fistula in ano must also be sought for as a possible cause for discharge or of pruritus. Very rarely a deep-seated phlegmon or frank suppuration in the retroperitoneal space of the pelvis ruptures or tends to rupture into the perineum or labia. Increasing edema of the labium majus at its upper portion and away from the bartholinian gland site is apt to be due to pointing of a deep-seated abscess that is making its way through the obturator foramen.

Inspection of the Vagina.—The presence of discharge adhering to the vaginal wall and its character, the presence of ulcerations, of tumor formation, of constriction or atresia or anomalous formations, such as septate hymen, septate or double vagina and cysts, may be noted. A peculiar form of eruption which causes a persistent discharge is the colpohyperplasia cystica. Rarely do we have an emphysematous eruption. Tears and scars indicate birth or mechanical trauma. The relaxation of the levators, as evidenced by the gaping vulval orifice with the cystocele or rectocele, is at once evident when the patient bears down.

In the examination of the cervix, its conformation, color, size, anomalous formation, retardation in development, erosions, lacerations, eversions, ulcerations and tumor formations are of chief importance. Tears and the scars of the external os indicate either surgical trauma or that incidental to pregnancy (abortion or labor). This is of some legal importance and even where no litigation is involved, it serves to check up the veracity of the patient's account of her symptoms, when, for some reason, she omits to tell of illicit relations or when she wishes to conceal the fact of a previous marriage or the birth of a child by a former husband. These findings may help to clear up certain psychic traumata or certain physical complaints, the cause of which the history will not reveal nor even suggest. Leukoplakic scars, mucous patches, condylomata lata or the initial lesion may be noted and may be the only evidence at hand of the specific infection. The thick tenacious plug of mucus, which is the residue of neisserian infection, and the greenish mucopus, which is abundant and denotes practically always the same thing, are present whether gonococci are found in the smear or not.

A very abundant discharge of a thin serous fluid from the cervix may come down from a large hydrosalpinx. If this is noted at intervals only, it is fairly pathognomonic. If this discharge is purulent, it probably means the escape from a freely communicating pyosalpinx. Occasionally such discharge comes from a pyometrium and this is more apt to occur in the senile and the post-climacteric condition. In the presence of an amputated cervix with a constricted, new external os, the latter condition should also be considered.

More rarely a thin watery discharge from the cervix can come from a uterocervical fistula. The almost constant flow is characteristic. There are other tests to corroborate this finding. When the discharge is from the vaginal fornix, it is practically always a ureterovaginal fistula. Occasionally the discharge is frankly purulent and may lead to confusion.

Discharge of pus from the lateral wall of the vagina indicates the rupture of a deep-seated abscess.

The presence of a growth at the cervix, especially around the external os, should receive careful attention. If it is irregular in contour, and its surface ulcerated; if it feels hard to the touch and bleeds on contact with the finger or probe, it is highly probable that it is cancer. Exploratory excision with microscopic examination will settle the diagnosis. A similar lesion in the vaginal wall should arouse the same suspicion. Crater formation is practically pathognomonic of carcinoma. Breaking-down gummata are exceedingly rare in the vagina or the uterus. The reason for this local immunity has not been ascertained.

DIAGNOSTIC AIDS OFFERED BY TRANSUTERINE AND TRANSPERITONEAL INSUFFLATION

Historic Note.—The procedure of peritoneal inflation with oxygen for purposes of diagnosis was first introduced into this country by Stein and Stewart in June, 1919. Practically seventeen years had elapsed since Kelling of Dresden first demonstrated the value of inflating the abdominal cavity with air. Kelling, however, had in mind the visualization of the viscera by means of the endoscope introduced through a small abdominal incision. Jacobaeus, later, in 1910 and 1911, employed this new method of laparoscopy and reported his results in one hundred cases. The outstanding feature was the absence of any infection as a result of this new diagnostic method.

Roentgenologic procedures were adapted to the method of abdominal inflation by Weber, in 1912, and by Lorey in the same year. Weber's roentgenograms showed that the following viscera and areas may be rendered visible by means of gas inflation of the abdomen: (1) the liver and spleen as a whole, including the region of the gall-bladder; (2) coils of large and small intestine without bismuth filling; (3) the pyloric portion of the stomach; (4) the walls of the stomach and large intestine with gas contents; (5) the bladder filled with urine; (6) parts of the mesentery; (7) the subphrenic space, not readily accessible to diagnosis; (8) many intra-abdominal tumors. These conclusions were based upon experiments on animals and in fresh cadavers of adults and children. Lorey was the first to demonstrate the diagnostic value of peritoneal inflation and his findings were published in 1912. Rautenberg, in 1914, introduced air into the abdominal cavity in a case of disease of the liver complicated with ascites for the purpose of obtaining more distinct contours of both liver and spleen. About the same time Meyer-Betz recommended drawing the ascitic fluid and replacing it very slowly by oxygen injected by means of an ordinary insufflation apparatus, such as is used for the application of therapeutic pneumothorax. In 1918, Goetze published very remarkable roentgenographic data obtained by means of the new method and concerning nearly all the abdominal viscera. Other observers were Decker, Kirscher and Allessandrini, who reported on the valuable data arrived at through the employment of the new procedure of induced pneumoperitoneum and Roentgen-ray examination. French investigators also reported favorable results; while in this country, Alvarez, impressed with "the beautiful plates taken with this method by Drs. Stein and Stewart," recommended the use of carbon dioxid gas (CO_2) because of its rapid absorption (one half hour, as compared to twenty-four to one hundred hours for the oxygen). A. F. Tyler reported his findings in the study of 36 cases and stated that the method

proved of great value in making a positive diagnosis of adhesions, early uterine enlargement, gastric tumors and gall-stones. He points out that the entire kidney, ovaries and tubes can be visualized by this means.

The indication for gas inflation of the abdomen in connection with roentgenology is chiefly in those cases where the clinician is baffled. It is singularly valuable in (1) demonstrating intra-abdominal adhesions, especially those between the viscera and the abdominal walls; (2) in diagnosing cases of early peritoneal tuberculosis; (3) in detecting adhesions or the contents of herniated abdominal coverings; (4) diseases of the liver, such as cysts, gummas and metastatic tumors; (5) affection of the gall-bladder and bile ducts, especially gall-stones; (6) splenic disease; (7) renal disease; (8) in locating extraperitoneal tumors and in distinguishing whether a projectile is above, within or below the diaphragm; (9) in distinguishing whether a tumor is intra-abdominal or intrathoracic when it is situated near the diaphragm; (10) in detecting the presence or absence of subdiaphragmatic tumors, abscesses and adhesions; and, finally (11) lesions in the pelvis.

The contra-indications to the method are chiefly in elderly persons, notably men who have used alcohol in excess and those suffering from valvular disease and other circulatory diseases. Acute abdominal conditions such as acute appendicitis or peritonitis naturally prohibit the employment of abdominal inflation.

The danger of infection is theoretical because in none of the 150 cases of Stein and Stewart's experience was this noted. Puncture of the intestine was reported as occurring in two cases. In neither of these were any ill effects observed. About one third of the cases of their series complained of pain in the shoulders, especially the right, following distention of the abdominal cavity with gas. This has been remedied largely by avoiding full distention, by deflating the patient after the Roentgen-ray examination (when oxygen has been used), and by using a gas which is rapidly absorbed, such as carbon dioxid. Superficial emphysema can easily be avoided, if one follows exactly the rule stated in reference to introducing the needle into the abdominal cavity before the gas is turned on. Puncturing the epigastric arteries is best avoided by introducing the needle in the median line (linea alba) about two fingers below the umbilicus where there is no artery to be encountered. This technic also obviates the danger of gas entering these vessels.

The authors deserve great credit for bringing this valuable method to the attention of the profession and for their personal contributions in the matter of indicated uses and technical improvements. As they have aptly said, "A great future can confidently be predicted for this interesting method of examination, which, during the short period of its existence, has already passed through several phases, with constant enrichment of its diagnostic value or extension of its clinical applicability."

TRANSUTERINE PERITONEAL INSUFFLATION A TEST OF TUBAL PATENCY AND OCCLUSION

Historic Note.—The present method grew out of a number of attempts begun in 1913 to find a way of determining the fact of tubal patency without resorting to laparotomy. Its specific use was in cases of sterility, for this special phase of gynecology had hitherto been fraught with doubt and uncertainty. Numerous operations were performed needlessly and fruitlessly, because the matter of the normality of the oviducts could not be ascertained beforehand.

Desiring to obviate mistakes in diagnosis and to be able to make clearer and more precise indications for operative procedures intended to relieve sterility, I was led, in 1914, to the adoption of intra-uterine collargol injection as a test of tubal patency. It soon become clear that tubal occlusions could be demonstrated roentgenographically and with perfect safety. Not so, however, with patent tubes. In this case the collargol would have to be injected into the peritoneal cavity and a quantity sufficient to be visible in the roentgenograph would not be without untoward consequences. Several features of intra-uterine collargol injection made its use undesirable for clinical purposes: (1) colic attending the injection and following the injection; (2) possible peritoneal irritation in the patent cases; and (3) inspissation and possibly agglutination of the tubal lumen where none had previously existed. The substitution of thorium nitrate solution and later bromide solution for the collargol eliminated the possibility of inspissation. The chief objection to chemical, opaque solutions, if only on theoretical grounds, was that they might transfer infective material in suspension to the peritoneal cavity and possibly set up a reaction which might result in sealing of normal tubes, if not to graver consequences. But its chief limitation from the diagnostic standpoint, leaving possible objections aside, was the failure to demonstrate normal tubes by that method. The use of saline solution in very small amount, as advocated by Carey, has the same general limitation and, since only 16 minims are used, its inadequacy is apparent; in cases where the tubes are closed but distensible, that amount would be held by them without returning through the external os.

When our attention to pneumoperitoneum was called by Stein and Stewart, it occurred to me that, with oxygen as a medium and the production of an artificial pneumoperitoneum via the uterus, the fact of tubal patency would be at once demonstrable. The harmlessness of gas in the peritoneal cavity had already been amply attested by these authors, and numerous records of intraperitoneal injection of oxygen for therapeutic purposes were at hand to support their contention. The great advantage in employing gas was that it did not carry infective material in suspension; it did not remain in the pelvis but rather it rose almost immediately, when the patient stood up, to the region of the diaphragm. If any infective material were to be, theoretically, carried by the gas, it would probably reach the subphrenic space and, if inflammation were to result, it would at least not affect the tubes and artificial sterility would therefore be avoided. That the gas becomes absorbed very rapidly, especially when CO_2 is used, practically nullifies this theoretical objection, and

increasing experience has demonstrated that no harm to the patient does result. In the event of the gas failing to reach the peritoneal cavity, when insufflated into the uterus, tubal occlusion may at the same time be diagnosed. Here no harm can possibly be produced because, meeting an obstruction in the tubes, the gas regurgitates during the injection or is expelled upon removing the uterine cannula.

Before this test was accomplished, I often hesitated to advise the operations usually performed for sterility and gave no definite promise as to relief unless I had permission to do a laparotomy to make certain about the condition of the tubes. This was not readily obtained from the patient, and I was not sanguine about doing it simply for exploration because, while this might be proper and useful where the tubes were found occluded, the pains taken by the surgeon and the trouble, discomfort, and even needless danger to the patient from a laparotomy seemed altogether out of proportion to the expected result in cases where the tubes were found to be normal. If it is known beforehand that the tubes are open, exploratory laparotomy becomes unnecessary and proper surgical attention can then be given to other defects in the genital organs such as stenosed cervix, etc.

While the primary object of this work was to help clear up the tubal part in the causation of female sterility, it has also been found useful, as we shall see, in associated gynecological conditions.

The determination of the patency of the fallopian tubes has hitherto been possible only by direct evidence obtained through laparotomy. Surgical exploration was the only means available to enable us to say definitely whether the tubes in any given case of sterility were open or closed. Physical examination in this respect was wholly inadequate, leaving the question of patency often a matter of speculation. This was especially the case when the tubes were sealed tight at their fimbriated end without distention of the lumen being present. Bilateral hydrosalpinx with flaccid tube walls is not easily palpable. The diagnosis of this condition was, in most cases, merely conjectural. Some tubes are closed by adhesions secondary to peritonitis of other than venereal or gynecological etiology. There is apt to be no palpable enlargement in this class of cases and, while the history may be clear, the matter of patency must rest in doubt. The same holds true in cases where tumor masses are present.

It is not possible in the vast majority of cases to say whether pathology of the tubes or ovaries contributes most of the swelling found at one or both sides of the uterus. One or both tubes may nevertheless be patent. I have observed a patient with bilateral swelling of the adnexa for several years. She had refused operation at the hands of a surgeon who assured her that she had pus tubes and would not only be sterile but would remain an invalid. I have since established the fact that her tubes are patent by the use of the intra-uterine oxygen inflation. In her case, the ovaries were undoubtedly at fault, as frequently I have elicited alternate intermenstrual swelling. This patient has since been delivered of a normal child.

An accurate knowledge of the anatomical patency of the tubes is admittedly important in formulating prognosis and therapy of female sterility. If we are aware that a patient is sterile because her fallopian tubes are closed,

we will not be likely to undertake to cure her by an operation on the cervix; nor perhaps lose time by treatment with opotherapy. Yet undobutedly all of us have fallen into this unscientific practice in our endeavor to relieve sterility. The excellent methods of tracheloplasty devised by Dudley, Pozzi, Reynolds and others, of undisputed value in properly selected cases, are nevertheless futile as a remedial measure to cure a number of cases which owe their sterility to congenitally or pathologically closed tubes. The numberless times that general practitioners perform dilatation and curettage for the same object in view are also equally useless, if not at times actually harmful. Occasionally the trouble in the tubes is first made clinically manifest after the performance of an operation on the cervix. Rise of temperature, pain, tenderness and swelling, at one or both sides of the uterus, develop within a few days to a few weeks after the operation. The patient may in all innocence charge this to the surgeon, when in reality it is simply a lighting up of an old latent infection.

Assuming that the husband has been definitely proved fertile, the blockade to fecundation in the unsuccessful cases is in some portion of the tube—either at the uterine ostium, along its lumen or at the fimbriated end. In the presence of a small cornual polypus blocking the uterine insertion of the tubes, or occlusion by salpingitis isthmica nodosa commonly at the same portion, hydrosalpinx or some malformation within the tube lumen (complete spurs, blind canals, etc.), any operation on the lower uterine portion must result in failure.

It is well to remember, as Giles states, that practically 11 per cent of female sterility is due to tubal disease. In women under twenty-four years of age, it is higher, reaching 14.4 per cent. If we add to these 4.4 per cent of cases due to peritonitis, where the effect is to seal up the open ends of the fallopian tubes, we have an incidence of 15 per cent of cases of sterility due to pathological tubes. For convenience' sake, we will not include tumor formations and malformations. It will be seen then that one out of six or seven childless women owes her sterility to closed tubes.

Here it may be mentioned that, in certain cases in which no gross physical abnormality can be elicited by examining the woman, when the potency of the male partner is established by the finding of live spermatozoa in the cervix and fundus uteri, a congenital atresia of the tubes or of some part of the lumen may be the real cause of the sterility. Since we would be disinclined to subject such a woman to an exploratory laparotomy, it would be desirable if some method other than surgical were available to elicit this fact.

This I believe has been effected by the combination of oxygen with fluoroscopy and radiography. It is possible to determine whether the tubes are patent or otherwise by inflating the uterus with oxygen and, in normal cases, filling the peritoneal cavity with a measured quantity of oxygen. The artificial pneumoperitoneum establishes definitely the patency of the fallopian tubes. In a preliminary report, I pointed out that the peritoneum tolerates the oxygen introduced through the uterus and fallopian tubes as well as by direct abdominal puncture. I do not mean to offer this method as a substitute for the latter, not having seriously considered its advantages as an aid in the diagnosis of obscure abdominal conditions.

In one case from Dr. H. Lilienthal's service, I injected oxygen via the fallopian tubes for the diagnosis of a possible perinephric abscess complicating an operation for acute perforative appendicitis. An abdominal sinus at the site of the appendix incision was proved to communicate with the peritoneal cavity, because most of the oxygen escaped through it. Bubbles of gas were seen to form through the moisture at the sinus opening, and this leakage prevented the formation of an inclosed pneumoperitoneum.

There is no doubt, however, that the result is the same whether the peritoneum is filled with oxygen through the abdominal wall by puncture or through the uterine cavity without puncture. For general abdominal diagnosis, at least a liter to a liter and a half of gas is necessary. For the specific purpose of establishing the fact of open fallopian tubes, the amount of oxygen need not exceed 300 c.c. and, in the last of my cases tested by this method, about 150 c.c. was the average volume used. Frequently, in thin individuals, 50 to 60 c.c. are ample to produce a distinct subphrenic pneumoperitoneum.

The small volume of oxygen has the advantage of enabling us to *examine the patient in the office and eliminate the necessity of her going to bed for twenty-four hours or more.* The phrenic symptoms are decidedly less and the patients may go about their daily work. When a greater amount of oxygen is injected, it is best to place the patient in moderate Trendelenburg posture. This causes the oxygen to rise to the pelvis and the diaphragm is then free of the column of oxygen which interferes somewhat with its excursions.

In the first patient in whom I injected oxygen through the uterus on November 3, 1919, I did not measure the quantity but allowed it to pass into the peritoneal cavity till a moderate amount of visible distention resulted. This was the manner in which it was judged whether or not the gas actually passed into the peritoneal cavity. The fluoroscopic and radiographic pictures were the same as those described by Stein and Stewart. This patient was allowed to go home one hour after the examination and advised to lie down with the foot of the bed elevated. She was reëxamined at the end of the third day and a small amount of oxygen was still present below the diaphragm. The amount she must have received was estimated at 2 to 2.5 liters.

In the next 32 cases of sterility examined by the intra-uterine oxygen inflation, an attempt was made to establish several points: (1) the tolerance of the patient for the method as a diagnostic procedure, (2) the minimum volume of oxygen necessary to produce a pneumoperitoneum which could be seen by fluoroscopic examination; (3) the possible danger of infection; (4) the danger of embolism; (5) the diagnostic reliability of the findings and interpretation. All these may be summarized briefly. The patients stood the examination with very slight discomfort. At most, it was like the pain produced in some patients by the introduction of a uterine sound. Nervous women complained more from fear than actual pain, because the vast majority of the patients made no complaint during the injection. The passing of the oxygen into the peritoneal cavity is painless. Uniformly there is some sense of pressure about the diaphragm within five to ten minutes, and slight "sticking" sensations in one or both shoulders. A half liter of oxygen causes very

moderate symptoms. A liter of oxygen is followed by greater epigastric oppression and shoulder pains. When more than a liter is used, the symptoms are proportionately increased. When from 100 to 200 c.c. are used, the symptoms are very slight and do not interfere with the patient's daily routine.

There are no pelvic symptoms after the gas inflation. In no case was there evidence suggestive of peritoneal irritation. Not a single one of the symptoms characteristic of peritoneal infection was noted. There was no nausea or vomiting, no pains, rigidity or tenderness, no rise of temperature or pulse rate, no disability referable to a possible peritoneal infection. The patients were all closely observed and frequently seen. They were followed through three or four menstrual periods to note any late sequelae of the oxygen test.

In no instance were there symptoms suggestive of air embolism. This question gave me some concern at first, but by actual experiment on the dog, I found that the animal tolerated 350 c.c. of oxygen introduced directly into the leg vein without any symptoms attending the injection or following it. The rate of oxygen flow was the same as that employed in my sterility patients. As 350 c.c. is the very maximum amount required, I felt that the accident of embolism from oxygen could be disregarded. I have since learned that a number of army surgeons use this method of intravenous oxygen injection for therapeutic purposes, especially in pneumonia.

As to the diagnostic reliability of the findings and their interpretation, when an artificial pneumoperitoneum is effected, it is conclusive proof of the patency of the genital canal from the external end to the internal abdominal end. This, however, can result as well when only one tube is patent. For practical purposes in the consideration of sterility, it suffices that one fallopian tube is patent. Future observations [1] may make it possible for us to draw definite conclusions upon the question of unilateral or bilateral patency and, in the case of the former, as to which side is open or closed. At the present time I am not prepared to present data on this point.

When an artificial pneumoperitoneum does not result from the intra-uterine oxygen inflation, the probability is that there is some obstruction in the genital canal above the internal os. It may be at the uterine ostium of the fallopian tubes, along their course or at the fimbriated end. Whether this is by uterine cornual polypi occluding the opening as a ball valve, by inspissated mucus in the tubal lumen, by agglutination of the plicae of the endosalpinx, or by a sealing over of the fimbria, the result is the same. One negative result is not enough to establish nonpatency. The test should be repeated once or twice with the use of a little more gas each time. If, in the repeated tests, the oxygen fails to pass through, we may conclude that the patient is sterile because of this mechanical blockade. Occasionally, however, when the stenosis operates like a ball valve, as in the case of a polypus at either uterine horn, the greater pressure by the increased gas volume succeeds in forcing the oxygen through and then a pneumoperitoneum results. In this event, however, the test will still have a certain diagnostic value by serving to indicate the

[1]See Improved Technic.

proper therapeutic measure to overcome this difficulty. Inspissated mucus at the uterine end of the tube will have the same effect and here, too, the negative result is significant of mechanical cause of sterility.

I was able to demonstrate these facts on the extirpated uterus with adnexa attached. In one patient, the corroboration of the clinical findings by the application of the oxygen injection was very striking. This patient was twenty-seven years of age and had been married twelve years. She had three children, the youngest of whom was two years old. Since the birth of the youngest child, she believed herself pregnant twice and each time she had an abortion performed. She complained of pains in the pelvis and prolonged menstrual flow. Examination by Dr. H. N. Vineberg showed a moderate cystic enlargement of the right adnexa which was slightly tender, the left side being apparently normal. The uterus was enlarged about 100 per cent. Temperature was normal, pulse 80. The diagnosis was diseased adnexa of the right side. As inflation of this uterus under a pressure of 190 failed to produce an artificial pneumoperitoneum, I felt that the left tube was also diseased and closed. Laparotomy, in this case performed six days after the oxygen injection, revealed an old-standing pelvic peritonitis; both tubes were closed at the fimbriated end, that on the right side being moderately distended, while the left tube was only slightly swollen. They were both embedded in adhesions in which the ovaries were also slightly involved. The inflation with oxygen was attended by no pain or discomfort. There had been no fresh lighting up of the process. The patient made an absolutely uneventful recovery from the operation. While I do not advocate the use of this method in frank inflammatory conditions, this one experience had a definite value in demonstrating its safety of application. Upon the specimen removed by operation, I was able to repeat the oxygen injection and to corroborate the findings, both as to the intra-uterine pressure and as to patency. When the pressure reached 190, the oxygen began to regurgitate through the external os. By tightening the latter around the catheter, the pressure rose to 210 and then fell slightly as the gas escaped along the sides of the instrument. This greater pressure failed to force the oxygen through the tubes or to distend them.

In order to see whether the stream of oxygen bubbles might force infective material into the peritoneal cavity, I opened the clubbed end of one of the pus tubes and repeated the oyxgen injection in the same way as before. Again the same findings; no pus escaped into the basin of water into which the tube was immersed. The explanation for this is that the intramural portion of the tube lumen, normally only about 1 to 2 mm. in diameter, becomes plugged in pathological conditions with pus or mucus. In addition, the swelling of the endosalpinx, as well as that of all the coats of the tube, results in practically obliterating the lumen of the tube and shutting it off from the uterine cavity. While in certain rare cases a large hydrosalpinx or pyosalpinx drains into the uterus, in the majority of cases the uterine end of the tube remains occluded and resists the usual pressure to which the oxygen is subjected. When the fimbriated end is clubbed, there is absolutely no danger of forcing it open. It requires many times the pressure that is needed for the practical application of

the method.   Besides, the external os acts as a safety valve, allowing the oxygen to escape as soon as a certain pressure is reached.

Regarding the possibility of introducing infective material from the uterine cavity into normal tubes and thence into the peritoneum, several factors make this highly improbable.   One is that the cavity of the body of the uterus is, in most cases, free from infection.   Pus or mucus, if present, are more likely to descend from infected tubes.   When the uterine discharge is frankly purulent, the method is not to be employed.   Against this theoretical objection is the fact that in none of the 70 cases has there been any such occurrence.

In the nonpatent cases, one may also use thorium or bromid as a control. The citrate of thorium solution or sodium bromid solution may be injected into the uterus and, under obturation, the skiagraph may be made.   I have done this a few times in the earlier experiments, but have been able to dispense with it in later cases.

SUMMARY OF RESULTS OF EXAMINATION BY INTRA-UTERINE OXYGEN INFLATION [2]

Altogether 70 cases were examined by the method of intra-uterine oxygen inflation; 33 without the control of the manometer and 37 with the manometer.   In the first group, various quantities of gas were used to establish, particularly, the minimum amount required to produce an artificial pneumoperitoneum, while still avoiding the annoying symptoms which would destroy the usefulness of the method as a diagnostic aid.   Various types of sterility cases were tested.   Some were primary sterilities, the marriage dating back one to twelve years or more and in which no operations were performed either to relieve the sterility or for tubal, ovarian or uterine disease.   Some had had one or several curettages for the relief of sterility; some were alleged miscarriages.   A few cases had had one child and had been relatively sterile for a number of years.   A few cases, in which it was definitely known that one or both tubes were ablated on account of pyosalpinx, were used as controls to check up the diagnostic value of the method.   A few had had plastic operations upon the cervix for the cure of primary sterility.

Contra-indications.—The uterus should not be insufflated with oxygen in the presence of pus pouring down from the cervix; in the presence of fever caused by pelvic inflammation; or in the presence of acute bartholinitis, urethritis or vaginitis.   It is not advisable to use it during pregnancy, menstruation or any irregular uterine bleeding.

INDICATIONS FOR APPLICATION OF METHOD

1. In all cases of primary sterility, where all contributing causes, including those for which the husband might be responsible, have been eliminated and some operative procedure is contemplated.   Here it has a definite prognostic as well as diagnostic value.

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[2] This summary is of the results in the 70 cases which made up the first report on this work.

2. Cases of primary sterility in which the patient is known to have passed through a pelvic infection of gonorrheal origin.

3. Cases of sterility following a pelvic exudate or abscess complicating a puerperium or abortion, with or without the history of an operation and where apparent resolution has taken place.

4. Cases of primary sterility in which the patient had peritonitis of appendicular origin in the premarital or postmarital state, to exclude tubal occlusion by a residual peritonitis.

5. Cases of relative sterility in which the patient had a pelvic infection following childbirth or abortion, particularly when induced.

6. In cases of one-child sterility without the definite history of pelvic infection.

7. In cases where it had been necessary to remove one whole tube and part of another for hydrosalpinx or pyosalpinx (conservative surgery).

8. After unilateral ectopic pregnancy to determine the patency of the residual tube.

9. After cases of salpingostomy for the cure of sterility of tubal origin to demonstrate the success of the operation which was calculated to effect open tubes.

10. After sterilization by tube ligation, to test the patency of the tied or severed tubes.

11. After multiple myomectomy, to make certain that at least the uterine ostium of the tube has been left intact.

12. Sterility of long standing where pelvic masses are palpable and clinically diagnosticated as fibroids or "chronic disease of the adnexa." The test shows whether or not the tubes are open.

The causes of sterility are too often obscure and undetermined. It appears, however, that at least the mechanical factor of patency should be possible of determination in most cases. The method of intra-uterine oxygen inflation with the production of an artificial pneumoperitoneum obviates the necessity of surgical exploration and is especially serviceable in the obscure cases.

SUBPHRENIC PNEUMOPERITONEUM AS TEST OF PATENCY OF FALLOPIAN TUBES [3]

Comparison of Abdominal and Uterine Method.—This method cannot enter into competition with the production of pneumoperitoneum by abdominal puncture because of certain natural and pathological limitations: (1) it is obviously limited to women; (2) it is not applicable in all women, particularly the unmarried. Conditions such as pregnancy, menstruation and pelvic inflammation contra-indicate its use for the time being. Abdominal puncture may be employed in the presence of nearly all these conditions without regard to uterine function. In cases where the uterus may be properly insufflated and the tubes are patent, it is of course possible to fill the peritoneal

[3] From paper read in Minneapolis at the Meeting of the American Roentgenological Society, September, 1920.

cavity with any desirable quantity of oxygen, in which case it may also serve as an aid in general abdominal diagnosis. This I have done in several cases at the request of colleagues in the medical and surgical services of Mt. Sinai Hospital. It may only be mentioned here that it can be done very simply without occasioning any appreciable sense of discomfort to the patient and involves no special surgical experience. It is not my purpose to advocate it either to substitute or to supplant the abdominal puncture method for general abdominal diagnosis. I am interested chiefly and practically in the aid it may render in clearing up the etiology of sterility in women.

In the problem of sterility, a negative result equals a positive result in importance. Both prognosis and therapy depend upon whether the fallopian tubes in any given case of sterility are open or closed. I have elsewhere [4] pointed out that, if we could demonstrate occlusion of the tubes beforehand, a great many operations on the cervix of the uterus would not be undertaken. Instead of operating in such cases upon the lower end of the uterus with a fruitless result, the patient remaining sterile and hoping against hope that she may become a mother, proper therapy would consist in immediately opening the abdomen with the object of freeing the tubes and doing some adequate plastic operation. Such operations have not infrequently resulted in curing sterility. Whether or not this type of operation is consented to, we are at least in the position to tell the patient from the very outset what her chances are of becoming a mother. Much time may be saved for those women who would gladly submit to a corrective operation at the very beginning, were we in a position to locate the obstacle to conception at the true portion of the genital canal.

A word as *to the limitation of the abdominal puncture method and its ability to demonstrate patency or occlusion of the tubes.* It has been possible to outline the uterus, tubes and ovaries inclusive of tumors of these organs and inflammatory conditions in the pelvis, by forcing the oxygen into the pelvis in the extreme Trendelenburg posture. In a very limited number of instances, one may be fortunate enough to succeed by this method in demonstrating that the fimbriated end of both tubes are distinct from the ovaries and the uterus. In the absence of adhesions, one might assume them to be normal. In the presence of tumor masses, it is not so easy to distinguish between the tubes and the ovaries, nor are we always fortunate enough in separating the shadows of distorted and dislocated tubes from adherent and overlying ovarian tumors, or from pelvic abscesses and tumors of the uterus. One need only recall in this connection the difficulty of distinguishing structures in pelvic inflammations when the abdomen is opened. Also the demonstration of bilateral masses by the shadowgram does not preclude actual patency of one or both tubes. It is absolutely possible to determine this fact by the method of intra-uterine insufflation of oxygen. I have on several occasions been able to demonstrate patency of the tubes in the presence of bilateral adnexal masses and, at the same time, to establish that the lesion involved the ovaries alone. If the gas fails to produce a pneumoperitoneum

[4] *Journal American Medical Association,* September 4, 1920. Paper read before the section of obstetrics and gynecology at the seventy-first Session of the American Medical Association.

in the presence of pelvic masses it may be safely concluded that the tubes are diseased and occluded at some point of their lumen.

Whether or not gross lesions in the pelvis may be more accurately outlined and interpreted by pneumoroentgenograms than by the physical examination, *the matter of patency or nonpatency is specifically established by the permeability of the tubes to oxygen.* This point, defying the skill of the expert in physical examination, has hitherto been a matter of clinical speculation. The only way by which this fact could formerly be established was by actual laparotomy with inspection of the tubes, palpation, probing them with a sound and inflating them from the fimbriated end, a practice advocated notably by English gynecologists.

Value of Method.—Its value as a practical test in cases of sterility may perhaps be illustrated by the following two cases:

1. A patient married three years and sterile; upon pelvic examination operation was advised; dilatation of the cervix, curettage and stem pessary insertion was performed. Four days following this operation, I was requested to test the patency of her fallopian tubes. The method employed by me resulted in failure to establish a pneumoperitoneum. Laparotomy on the same day revealed the fact that both tubes were closed at the fimbriated end. They were only slightly distended, their walls were flaccid and they were surrounded by soft, cobweb adhesions—in other words, an old-standing bilateral hydrosalpinx. The operation on the cervix in this case was certainly fruitless and could have been avoided by a preliminary examination with oxygen.

2. A patient married five years, sterile, no pelvic lesion demonstrable to account for the sterility. Insufflation of the uterus with oxygen on three occasions (with and without pressure control) failed to establish pneumoperitoneum. She was advised to have a laparotomy performed in the endeavor to remedy the occlusion. This advice she apparently did not heed, because some months later she had a curettage and Dudley operation, following the advice of a physician who assured her that all she needed to become a mother was to have her womb "stretched." The lesion in her case could not have been very pronounced at any time, eluding detection by the palpating finger, because the operation was performed by a gynecologist of considerable experience and one who must have concurred in the opinion of the general practitioner. Yet her fallopian tubes were closed.

Safety of Method and Advantages over Exploratory Laparotomy.— Notwithstanding theoretical objections, all of which I have carefully considered in first contemplating the method, it has proved an absolutely safe procedure in my hands. Thus far I have had occasion to employ the method in 150 cases. As some of the cases were reëxamined for purposes of corroboration, the total number of examinations was 170. In no case was there any evidence of injury or infection. The cases were all observed carefully for a period of several months.

Compared to an exploratory laparotomy for the specific purpose of determining the patency of fallopian tubes, it has several superior advantages, not the least of which is the economic advantage of saving the patient from the usual period required for postoperative convalescence. The method may be

employed as a routine measure in one's office, the patient loses no time and has none of the discomforts and morbidity attendant upon a laparotomy. I am not discussing the question of mortality, assuming that that is practically nil in exploratory surgery. The method proposed by me should never result in mortality. The one theoretical possibility of resulting fatality is offered by the occurrence of embolism. I have satisfied myself on this question by experimentation upon the extirpated uterus and, in the living animal, by direct
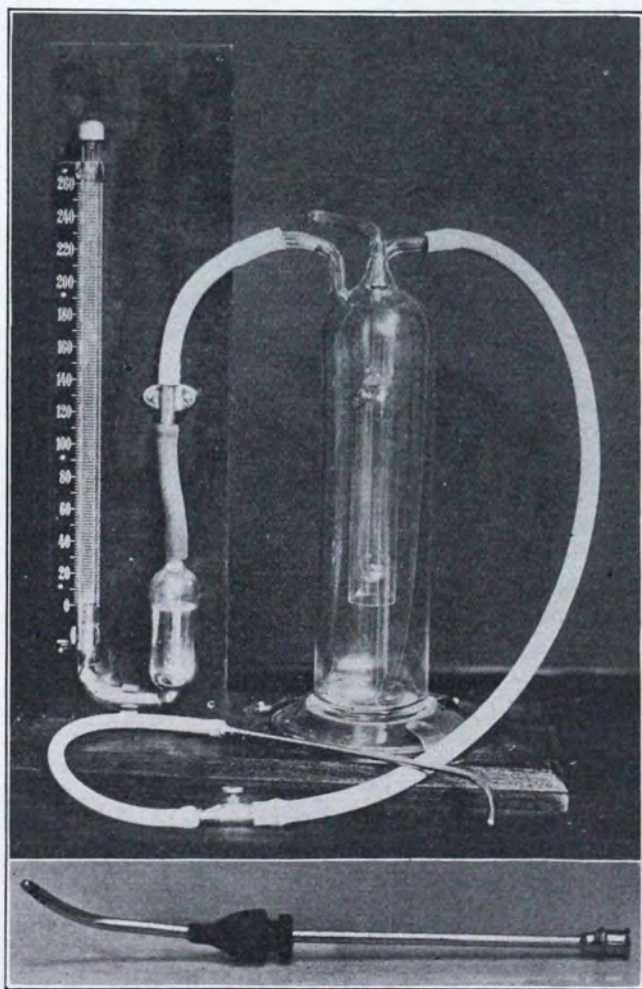
FIG. 34.—VOLUMETER AND MANOMETER WITH UTERINE CANNULA FOR TRANSUTERINE INSUFFLATION.

intravenous insufflation of oxygen, and it can be dismissed from practical consideration. This accident and that of infection have not occurred in my series of cases, and infection should never occur when the procedure is adopted in properly selected cases and for the specific object of testing the patency of fallopian tubes.

Ideal to Be Sought in Use of Method.—By this I mean that we should be able to employ it in the office as a routine procedure for diagnosis, comparable to cystoscopy and ureteral catheterism, occasioning no more and possibly less pain and discomfort than the urological examination. One of the

chief aims is to make the method tolerable to the patient. It should not require the use of an anesthetic. So far I have not had to resort to any. It should take a short time, only a minute or two, five at the most. It should be followed by very slight symptoms and not interfere with the daily duties and usefulness of the patient. To accomplish this, it is necessary to produce
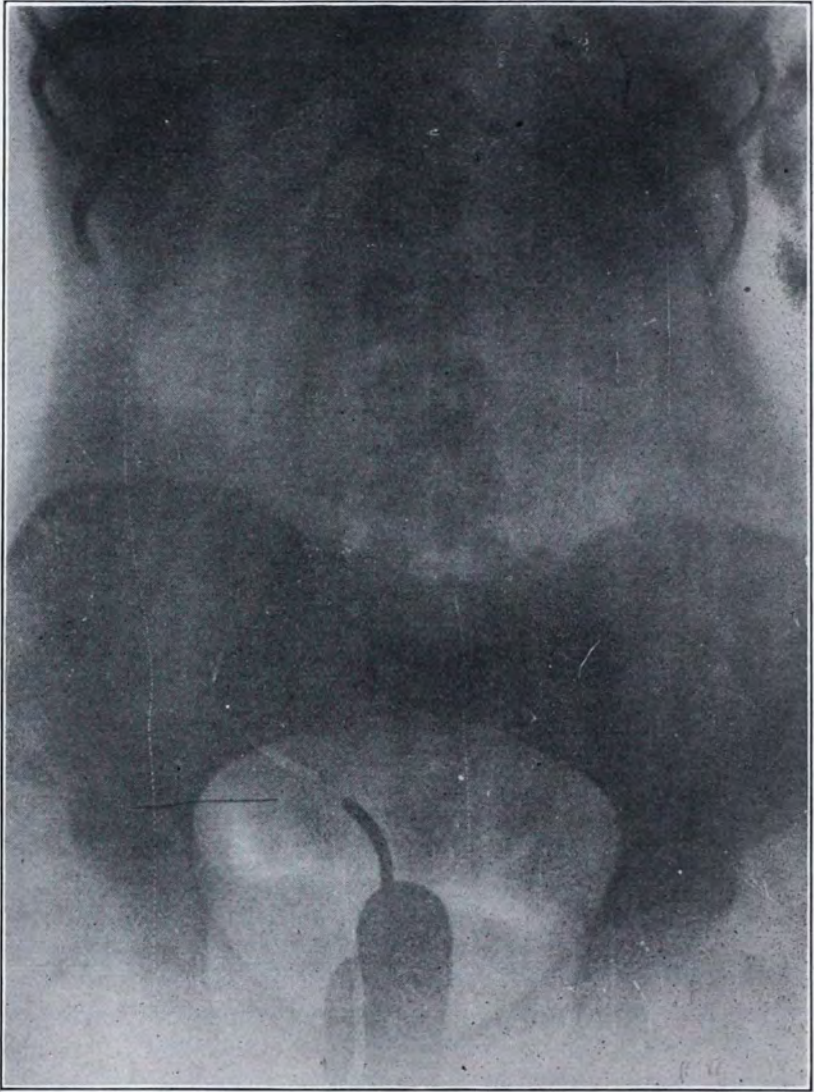
Fig. 35.—The Speculum and Intra-uterine Cannula in Place During the Injection of Gas.

what might be called a miniature pneumoperitoneum, confined, in the erect posture, to the subphrenic space. The smallest amount of oxygen sufficient to show distinctly through the fluoroscope should be injected. I have found, in developing the method, that from 100 to 150 c.c. of oxygen suffice to establish the subphrenic pneumoperitoneum. The most favorable time for the test is in the postmenstrual stage, in the interval of apparent functional quiescence.

Technic.—The armamentarium consists of an oxygen tank connected with a water bottle, the rubber stopper of which is perforated at three points through which bent glass connecting tubes pass. One of these glass tubes is connected directly with the oxygen tank and dips down below the water level. The two other glass tubes dip down one or two inches and do not reach the water level. One of these is attached by rubber tubing to a mercurial manometer and the other is attached in the same way to the metal cannula. This metal cannula is of the Keyes-Ultzmann type and is perforated at the tip by several small apertures. A single tenaculum or bullet forceps, a uterine sound, a dressing forceps and bivalve vaginal speculum complete the apparatus (Figs. 34 and 35). A rubber urethral tip is fitted over the metallic cannula to a point one and a half to two inches away from the cannula tip.[5]

The volume of gas entering the uterus and eventually the peritoneal cavity may be measured by displacing water and taking the time interval measured in minutes. The average amount of water displaced should not exceed 150 to 200 c.c. per minute or be less than 50 c.c. per minute. The rate of flow determines the pressure. The rapidity with which this rises I have found to be best limited to an interval of from 10 to 15 seconds for 100 mm. mercury. At this rate, from approximately 100 to 50 c.c. of oxygen is released per minute. This is determined previously by pinching the rubber tubing with the needle valve shut, allowing the gas to pass through at the rate fixed by the water displacement. With the gas flowing at this rate, it may now be introduced into the uterus. The cervix is wiped clean and painted with iodin. A single tenaculum hook grasps the anterior lip. The cannula is introduced into the uterus well above the internal os and the urethral rubber tip is pushed well into the external os so as to render it air-tight. The gas is allowed to escape during this maneuver through the needle valve release; the pressure is therefore atmospheric. As soon as the cannula is well secured within the uterus, the needle valve is closed, allowing the oxygen to be insufflated within the uterus. Almost instantly the pressure rises. When the cannula is fixed within the uterus, the patient is raised in slight Trendelenburg position and the vagina is partly filled with water to show any escaping gas from the cervix. This is not always necessary and should be done in doubtful cases.

Pressure Reading in the Case of Patent Tubes.—The mercurial pressure rises to at least 40 mm.; more often to from 60 to 100 with a slight momentary fluctuation possibly at that point, when it drops quite sharply 20 to 40 or even 60 points, which later level it maintains more or less until the cannula is removed. The time required for the pressure to reach its maximum point, according to the recommendation as above described, is usually from 15 to 25 or 30 seconds. The rest of the time, say from 30 to 45 or 60 seconds, is allowed for actual inflow into the peritoneal cavity.[6] This will depend on the time interval required for the initial rise to the maximum on the one hand, and on the size of the individual on the other.

[5] Recently, at the suggestion of my friend Dr. E. D. Oppenheimer, I have adopted a simple device for measuring the volume of the gas and hope to describe it in the near future.
[6] The siphon meter of the Wallace & Tiernan type records the volume passing through automatically.

If the individual is narrow-waisted and thin, she does not require as much gas to produce the subphrenic pneumoperitoneum as an ample-waisted patient would. One can learn to gauge these matters after some experience. No hard-and-fast rule can be laid down for these variations. At most they are slight and offer no difficulty. The average amount of oxygen required in a thin individual is from 75 to 150 c.c. In a stout woman, it is well to use from 150 to 200 c.c.

Pressure Reading in Case of Nonpatent Tubes.—The pressure rises steadily, reaching 200 in from 30 to 45 or 60 seconds. The pressure should not be allowed to exceed 200 but should, however, be maintained at that point

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FIG. 36.—SUBPHRENIC PNEUMOPERITONEUM. Oxygen, 250 c.c., insufflated through the uterus and fallopian tubes. Diaphragm distinct on the right side; not clearly visible on the left.

for at least another minute if possible. This can be done by regulating the needle valve to permit a slight escape and still maintain the pressure at 200. In my experience so far, a pressure of 200, provided the rate of flow does not exceed 100 to 150 c.c. per minute, proves fairly conclusively the presence of tubal obstruction. This may, of course, be within the uterus itself, the blockade being at the uterine ostiae of the tubes, or it may be at any point along their lumen. When the rate of flow exceeds 100 to 150 c.c. per minute, the initial rise may occasionally read 200 mm. or more before the gas passes into the fallopian tubes and thence into the peritoneal cavity.

Symptoms During Oxygen Insufflation.—The introduction of the cannula is attended by slight pain in most cases. Grasping the anterior lip of the cervix by the single tenaculum hook is scarcely noticed, if at all, by the patient.

The actual insufflation in the patent cases seldom causes pain. When the initial pressure exceeds 100, the patient may complain of a sensation of fullness or bearing down or occasionally feel as if she were unwell. In the nonpatent cases with the pressure rising to 200, cramps are occasionally complained of, now in the suprapubic region and now in one or both sides. Since the time required for insufflation is the short interval of one or two minutes, practically every case can tolerate it. I have had practically no failure due to intolerance during the examination. A nervous patient will sometimes defeat the completion of the test, but even she can be reassured and will submit to it at another time. This may happen, but only occasionally.

After Oxygen Insufflation; Fluoroscopy in Patent Cases.—Inasmuch as
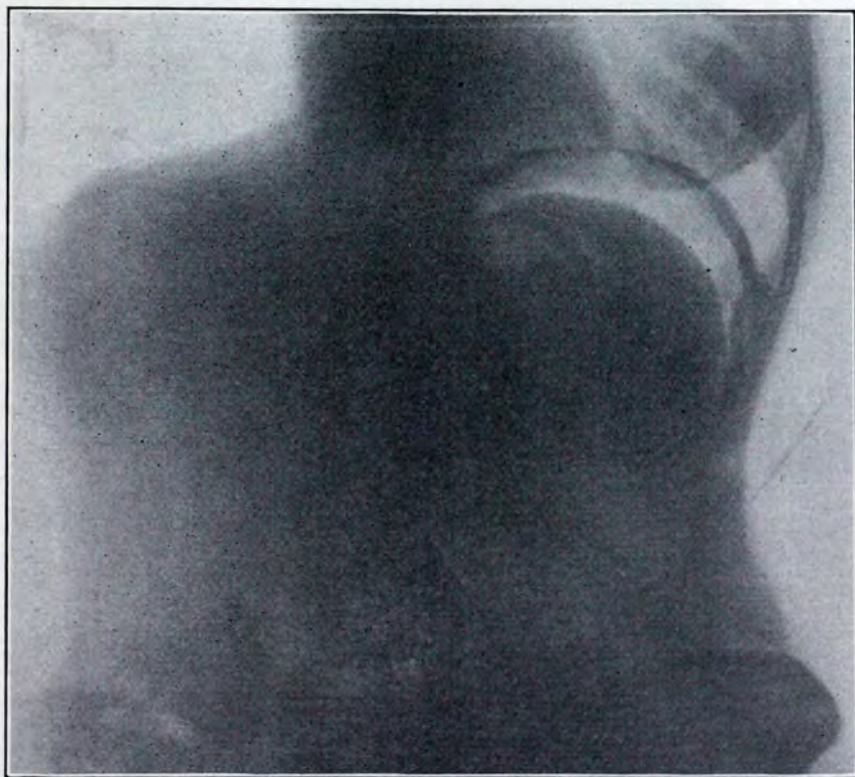
Fig. 37.—Left-sided Subphrenic Pneumoperitoneum in a Thin Individual. CO_2, 150 cc. insufflated via the uterus. Outline of the spleen is visible.

the patient is instructed to stand up immediately on withdrawing the uterine cannula, the oxygen gas rises almost instantaneously to the region of the diaphragm. It occupies the subphrenic space for a depth of one quarter to one inch or more, depending upon the amount insufflated. Within two or three minutes, if not sooner (just as soon as the patient can be set up before the fluoroscopic screen), the transparent "gas" area may be seen under the diaphragm. The liver on the right side is seen displaced in a downward direction (Fig. 36). Not infrequently the gas may be localized to one or the other side (Fig. 37), but, as a rule, the diaphragm may be seen lifted above the underlying abdominal viscera from right to left (Fig. 38). It is discernible as a transverse septum and is unmistakable. When the subphrenic pneumoperi-

toneum is not at once visible, the patient is instructed to lie on her right or left side for a few minutes, after which the gas will show clearly on one side or the other.

It is not necessary, for the purpose of testing the patency of fallopian tubes, to fill the peritoneal cavity with a large column of gas in sufficient quantity to "visualize" the abdominal viscera. The symptoms in such case are rather distressing but may be obviated by reducing the pneumoperitoneum to its diminutive. With from 100 to 150 c.c. of oxygen under the diaphragm, the secondary symptoms are almost negligible. Slight sticking pains between
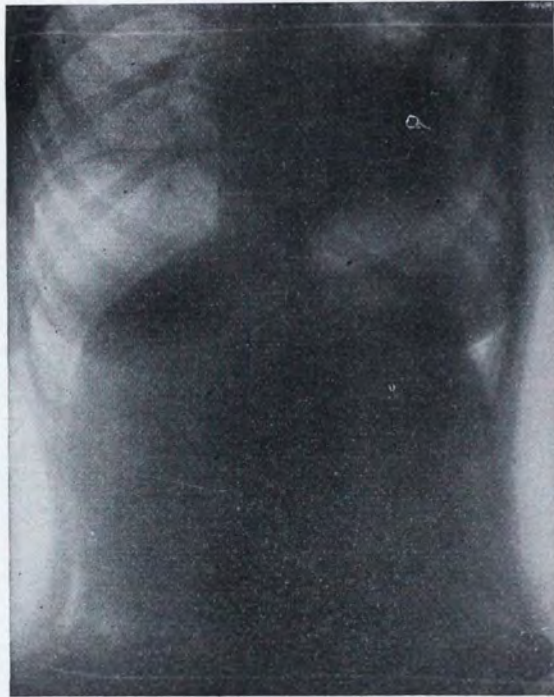
Am. Jour. Roent. VIII, March, 1921.

FIG. 38.—SUBPHRENIC PNEUMOPERITONEUM. Oxygen, 150 c.c. insufflated through the uterus and fallopian tubes. Diaphragm distinctly visible on right and left sides. Abdominal viscera displaced to a considerable depth. For the purpose of demonstrating patency of the fallopian tubes, one-fifteenth of this amount is sufficient and satisfactory in the majority of cases.

the shoulder-blades or in the shoulders themselves are noticed by the patients. There is no abdominal distress and, if at all present, it amounts to a slight sense of discomfort about the diaphragm. The vast majority of the patients leave the office and continue in their ordinary daily routine. Some patients may be required to lie down with their feet elevated for a few hours. As, according to Alvarez, carbon dioxid gas is more rapidly absorbed than oxygen, it may be well to use it and reduce the secondary symptoms to a negligible minimum.

Immediately on withdrawing the uterine cannula, there may be a slight regurgitation of oxygen with a slight oozing of several drops of blood that is readily checked by a sponge applied to the cervix. It is negligible and gives no

further trouble. By selecting the postmenstrual period for the test, one can avoid even this slight oozing.

In the Nonpatent Cases.—Beyond the temporary discomfort produced by the insufflation, there are no further symptoms. The cramps may continue for a minute or two or perhaps five and then subside. None of the referred shoulder pains are complained of and there is no epigastric oppression. The oozing is almost as slight as in the case of patent tubes; the oxygen regurgitation may be more evident. The nonpatent tube cases are perfectly comfortable after the test and leave the office to go about their duties as freely as before.

It is well to mention here that I have made it a rule to repeat the test at least once in the nonpatent cases to check up the findings at the first examination. With the apparatus properly adjusted in each case, the findings will be found to corroborate each other at the second test. Occasionally, however, there may be an error in technic which will invalidate the conclusion. Most scrupulous attention should be given to the possible points of leakage along the entire apparatus.

While in the positively patent cases there may have been some regurgitation, nevertheless, when this occurs and the gas does not enter the peritoneal cavity, we are left in doubt and must, if need be, repeat the test several times. If regurgitation takes place each time, it is highly probable that there is an obstruction within the uterus which is responsible for it. On the other hand, oxygen may escape from the cervix and a sufficient quantity nevertheless reach the peritoneal cavity, as may be determined by the fluoroscope.

Anatomical Consideration in Relation to Test.—The ideal case for the test is one in which there is no thick tenacious plug present, in which the external os is round and intact, the uterus not sharply angulated. In such cases, the cannula (ordinary size) enters easily and obturation is more perfect. When the uterus is sharply flexed forward or backward, it is necessary to shape the cannula accordingly so that it may enter the uterine cavity to a point above the internal os. When the external os is gaping and torn, as obtains in certain cases of relative or secondary sterility, it may be necessary to secure better obturation by grasping the two lips of the cervix with a bullet forceps. The internal os, however, is intact even in these cases and, as the cannula is introduced beyond it, the ordinary cannula insures satisfactory obturation. A mucus plug should be cleaned out and the cervical canal painted with tincture of iodin.

When the external os is narrow, it is necessary to use a cannula of correspondingly smaller caliber or it may be advisable first to dilate it gently to proper width.

Occasionally obstruction is encountered near the internal os. Here, of course, the test cannot be carried out. This is an incidental finding which has particular significance in the problem of sterility for that given patient. In such case, it is first advisable to overcome the stenosis by proper dilatation and then, later on, the oxygen insufflation may be tried. I have had two such cases in my series.

Only exceptionally will one encounter a uterus that may be called irritable to the oxygen. It is more apt to be in a very nervous woman. In my experi-

ence with the oxygen insufflation, I have succeeded in completing the test in every case, although in two instances I had to defer the test for another time,
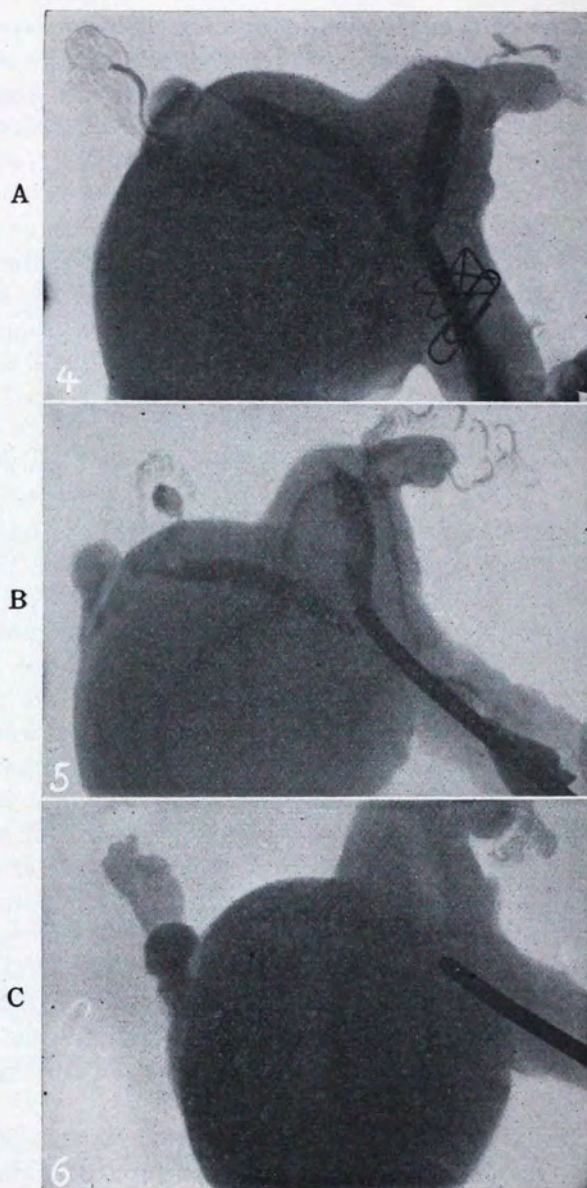
FIG. 39.—A BICORNUATE UTERUS.—*A*, thorium injection. The tubes are closed by a ligature at the fimbriated end.   Note the definite clubbed outline of the tube at point of ligature and the narrow caliber of the intramural portion. *B*, skiagraphed during thorium injection with the ligature removed allowing the solution to escape through the fimbria.   Note the irregular and overlying shadows. *C*, oxygen injection. Note the faint shadows in the horns of the uterus and the absence of any contrast shadows within the fallopian tubes.

owing to apprehension on the part of the patient.   It is conceivable, however, that in cases of endometritis and perimetritis of more recent date the uterus will be tender to the manipulation.

Oxygen does not show in the tubes when patent. In the anatomical specimen, it may show very faintly in the skiagraph (Fig. 39) when the tubes are ligated at the fimbriated end, but not 'in sufficient density to appear in the living subject where the contrast is obliterated by neighboring shadows, etc. Occasionally, in a case where both tubes have been removed and the uterine cavity is large, having a capacity of from 40 to 50 c.c., one may succeed in getting a good picture with oxygen. I have had one such result (Fig. 40). Our experience in attempting to demonstrate the oxygen *in uteri* during the injection has, so far, not been satisfactory, although we have not made a persistent effort in this direction.[7]

Use of Manometer and Flow-volumeter for Transuterine Peritoneal Inflation.—The present apparatus (Fig. 41) enables us to measure the
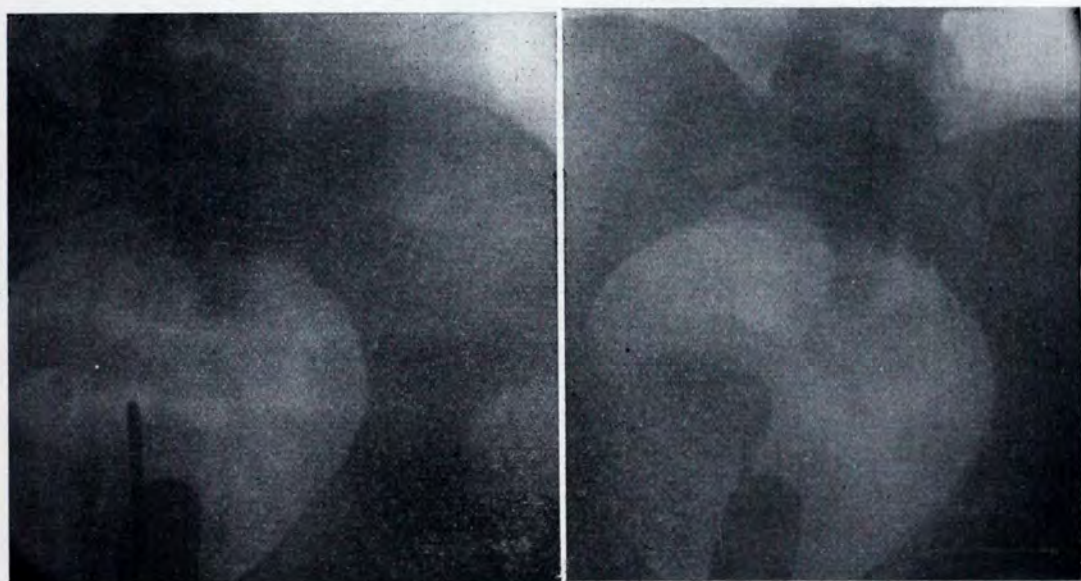
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FIG. 40.—CASE OF ABLATED TUBES; Large uterus *A*, 40 c.c. of oxygen injected into the uterine cavity. This is seen transversely pear-shaped. The speculum, cannula and Thomas pessary are also seen. *B*, thorium citrate 40 c.c., injected into the uterine cavity.

quantity and the flow of oxygen or carbon dioxid gas used in insufflating the uterus to test the fallopian tubes for patency. A manometer of the "tycos" or of the mercury type is attached to it, allowing for pressure reading at the same time the gas is flowing (Fig. 42). This does away with the necessity of first displacing water from another vessel at a certain rate of flow to estimate the volume of gas, which, at best, would give only an approximate estimation.

In this apparatus, the pulsating type of water displacement meter is used. It is adapted from the well-known chlorin control apparatus employed by the firm of Wallace & Tiernan for water purification by the process of chlorination.[8] The meter is of glass and therefore resists corrosion. It consists of an

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[7] Dr. Leopold Jaches, Director of the X-ray Laboratory of Mount Sinai Hospital, has suggested that with improved X-ray technic, especially in the matter of fluoroscopic screens, it may yet be possible to note the escape of the gas from the fallopian tube.

[8] I am indebted to Messrs. Wallace & Tiernan for the courtesy of the use of their volumometer in my work.

inverted glass siphon within a cylindrical glass meter. The latter is calibrated to a given capacity, as a rule 40 c.c. (Fig. 34). It is hydraulic in principle,
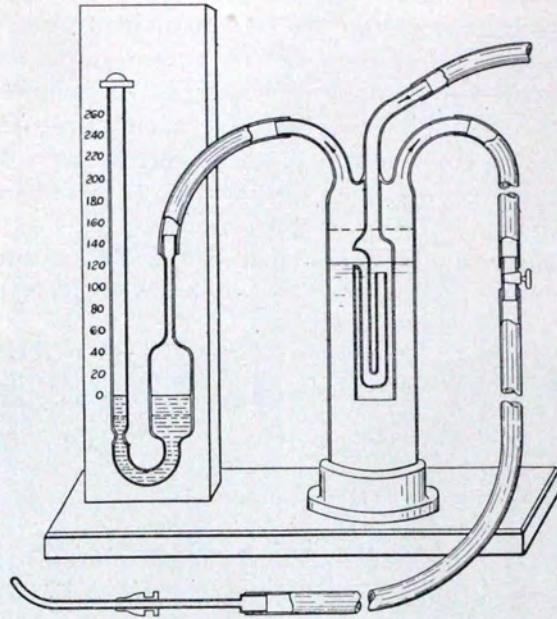
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FIG. 41.—VOLUMETER AND MANOMETER.
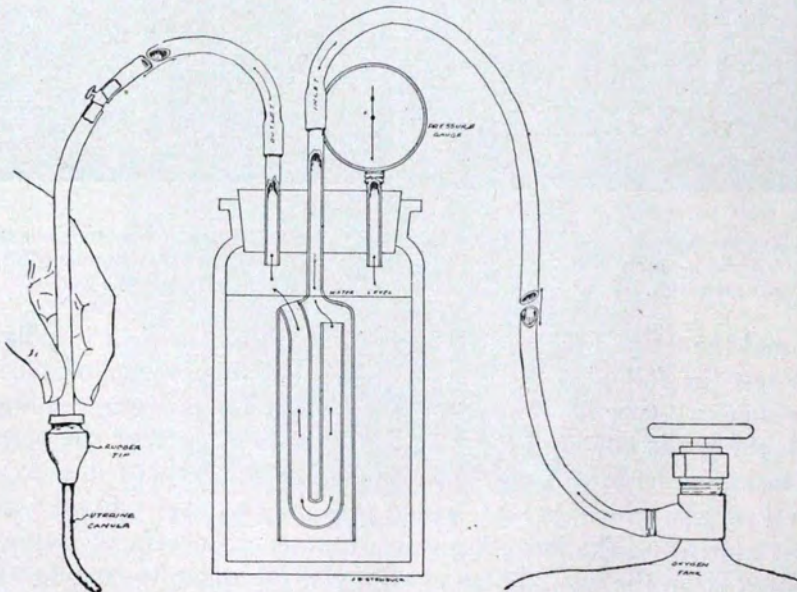
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FIG. 42.—APPARATUS ASSEMBLED.

scientific, accurate and dependable. The upper end of the glass cylinder is attenuated to a narrow tube to which rubber tubing is attached to convey the gas from its source. The lower end dips down into the water contained in a

large glass tube or jar of convenient size (Fig. 42). This glass tube or jar is provided with a rubber stopper perforated at three points, through one of which the narrow end of the volumometer passes. Two separate glass tubes pass into the container to just below the lower limit of the stopper (Fig. 42) To one of these, the pressure gauge is attached; and to the other, a piece of rubber tubing for the outlet of the gas. To this piece of rubber tubing, the intra-uterine cannula is attached. A spring relief valve may be provided which works automatically or, in lieu of this, a needle valve is placed in the course of the outlet tubing. I have found this latter to be effective and easy to handle. The spring valve is regulated to blow off at a pressure of 250 mm. of mercury. While this can be dispensed with, it is an aid and is well combined with the

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X   Y.
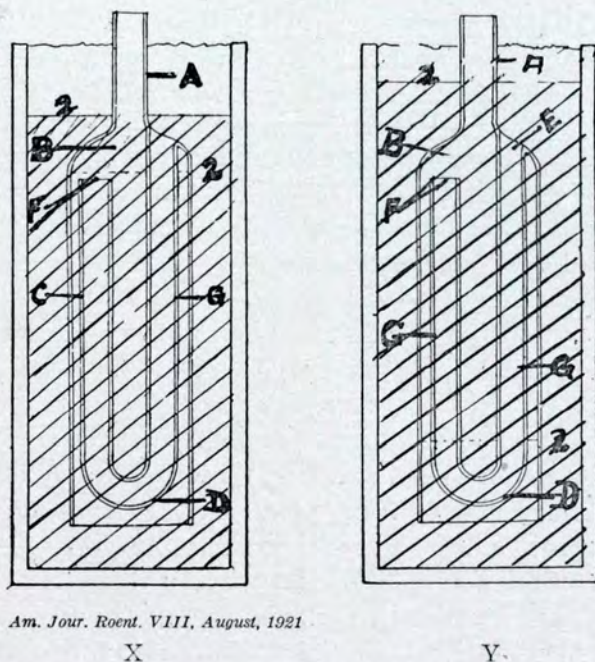
FIG. 43.—SIPHON METER, SHOWING OPERATION X AND Y.

needle valve relief. Fig. 42 represents the apparatus as assembled from the parts as described. For the convenience of those who do not care to take the trouble to do this, I have had the siphon meter and glass jar with outlet and inlet connections blown in one piece and attached to a mercurial manometer (Fig. 41).

The operation of the siphon meter is as follows: (Fig. 43) View X shows the water level 2 in the meter at the beginning of the pulsation, and view Y shows the water level 2 just before the siphon C-G breaks at D, which completes one pulsation of the meter. When the downward flowing gas in A reaches the point D, it will rush up through the tube G of the siphon, and the bell or compartment B will refill with water up to the upper end of C. This completes one pulsation or measure of the meter, and the amount of gas delivered by this one pulsation is, of course, the capacity of the compartment B between the points F and D. The siphon meter used in my work has a capacity of 40 c.c.

The amount of gas flowing may be determined by counting the number of pulsations of the meter per minute.

For the purpose of determining the patency of the fallopian tubes, four pulsations delivering 160 c.c. of gas are all that are required. In thin individuals, from two to three pulsations will suffice to produce, in the patent cases, the subphrenic pneumoperitoneum which will be clearly seen with the fluoroscope.

The pressure reading is of considerable importance and I have found that the rate of flow is best regulated previously to a rise of 100 mm. within 15 seconds. This can be determined readily by pinching the outlet tubing, as the flow is regulated till it causes a rise of pressure to 100 mm. Hg in 15 seconds' time. A ratio of 10 seconds to 100 mm. will also be satisfactory, but in the nonpatent fallopian tubes, where the matter of pressure is of somewhat greater importance than in the case of patency, it is better to have the slower rate of flow, that is, the 15 seconds to 100 mm. Hg. With this rate established, and this is done in a few seconds, the gas is allowed to pass through the volumometer and thence through the outlet tubing and cannula into the uterus. The needle valve is released until the cannula is inserted well into the uterine cavity beyond the internal os, when it should be shut, making the system air-tight. Almost instantly the pressure rises at the rate predetermined and will vary somewhat in cases of patency. In order to measure the amount of gas accurately, the release valve should be tightened the moment the water displacement reaches bottom, just as pulsation is about to take place.

The pressure required to overcome the resistance of the uterus and tubes, where there is no tubal obstruction to the free passage of the gas, will vary between 40 and 100 mm. When reaching these points, it will fall sharply or slowly or even fluctuate about them. Occasionally the initial rise of pressure in the patent tubes will be higher, reaching 160 before it drops.

Matter of Stenosed Tubes.—Unfortunately with the gas method, the tube may not be demonstrated in the skiagraph. From experiments on the specimen, it has been seen that the initial pressure rise depends upon the degree of stenosis. When the latter is extreme, the pressure will rise to 200 mm. or more; when moderate, to from 150 mm. to 160 mm.; and when less marked, to 120 mm. When normal, the initial pressure rise does not as a rule exceed 100 mm. Hg. In attempting to reëstablish patency by laparotomy, I have had occasion to note the behavior of the mercury column as gas was introduced into the uterus and through the tubes before a new opening was cut into them. Whereas the pressure rose constantly to 200 mm. and upwards while the tubes were occluded, it fell as soon as patency was established by opening the clubbed end of a hydrosalpinx, by freeing the tube of constricting adhesions or by splitting the tube lumen in an obliterative endosalpingitis till a fine opening was reached that permitted the gas to escape into the peritoneal cavity. Thus we may draw the conclusion of relative stenosis when the initial pressure rise is between 120 and 200 before a drop is noticed.

Is One or the Other or Both Tubes Stenosed or Sealed?—Here, too, a precise answer may not always be given by the gas insufflation, because we cannot obtain a shadowgram of inflated tubes in a way that might compare

with pictures produced after the injection of solutions opaque to the X-ray (Figs. 44, 45, 46). Without immediately resorting to this latter method, however, a subjective symptom, namely, pain produced during the transuterine in-
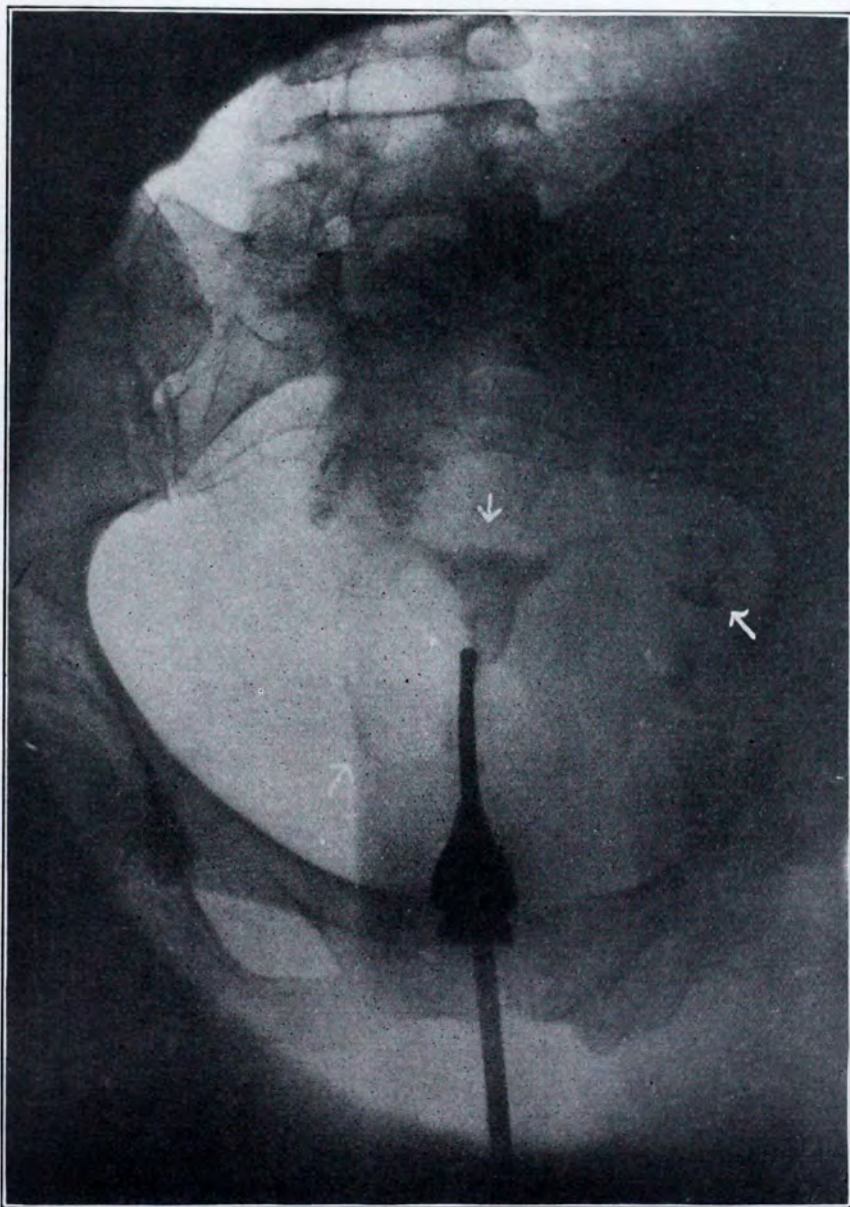
FIG. 44.—SKIAGRAM OF UTERUS AND TUBES AFTER INTRAUTERINE COLLARGOL INJECTION. The left tube is seen occupying a transverse position due to the fact that it was elevated by a parovarian cyst of the size of an orange. The right tube is prolapsed. Dark shadows are seen in the neighborhood of the fimbriated end of the tube (left) indicating the escape into the peritoneal cavity of collargol. It is this factor which has led to the abandonment of its use as a diagnostic aid in gynecology.

sufflation of gas may be utilized as a diagnostic sign. In normal patency, as a rule, there is no pain experienced lateral to the uterus as the gas passes through the tubes. When, however, stenosis of the tube is present, very often the patient will state that she has a sudden sticking or colicky pain in either iliac fossa just

above Poupart's. When both tubes are stenosed at some point of their course, the pain is bilateral. It is momentary, lasting from a half minute to a minute. When complete bilateral stenosis exists at the uterine insertion of the tubes, the pain is confined to the suprasymphyseal area in the midhypogastric fossa, indicating uterine colic. This is also of very brief duration, ceasing as soon as the uterine cannula is removed when more or less loud gas regurgitation is noted. It might be possible to palpate distended tubes immediately after the

FIG. 45.—TUBES THAT HAVE BEEN DEMONSTRATED TO BE OCCLUDED. It is safe to use collargol or some other opaque substance in order to determine the exact site of closure. In this case evidently both tubes had been ablated by a previous operation.

insufflation in the completely occluded cases, as in bilateral hydrosalpinx, when examination made before the test has failed to elicit tubal enlargement. Similarly a one-sided tube distention might also be observed after the insufflation where the pressure was as high as from 150 to 160 before it dropped. It may be well to make systematic observations in the future on this point. It has been my impression in the few instances in which this was done that I made out distinct distention which rapidly disappeared. Certainly this occurs when the tube is available to inspection, as when insufflation is made with the abdomen opened to view. It may be added, in passing, that the

side in which the subphrenic pneumoperitoneum is seen does not indicate the
side of the patent tube, for both tubes may be perfectly normal and the gas
may be seen now on the right side and now on the left.   This depends on
other factors within the abdomen, such as fullness or emptiness of bowels,
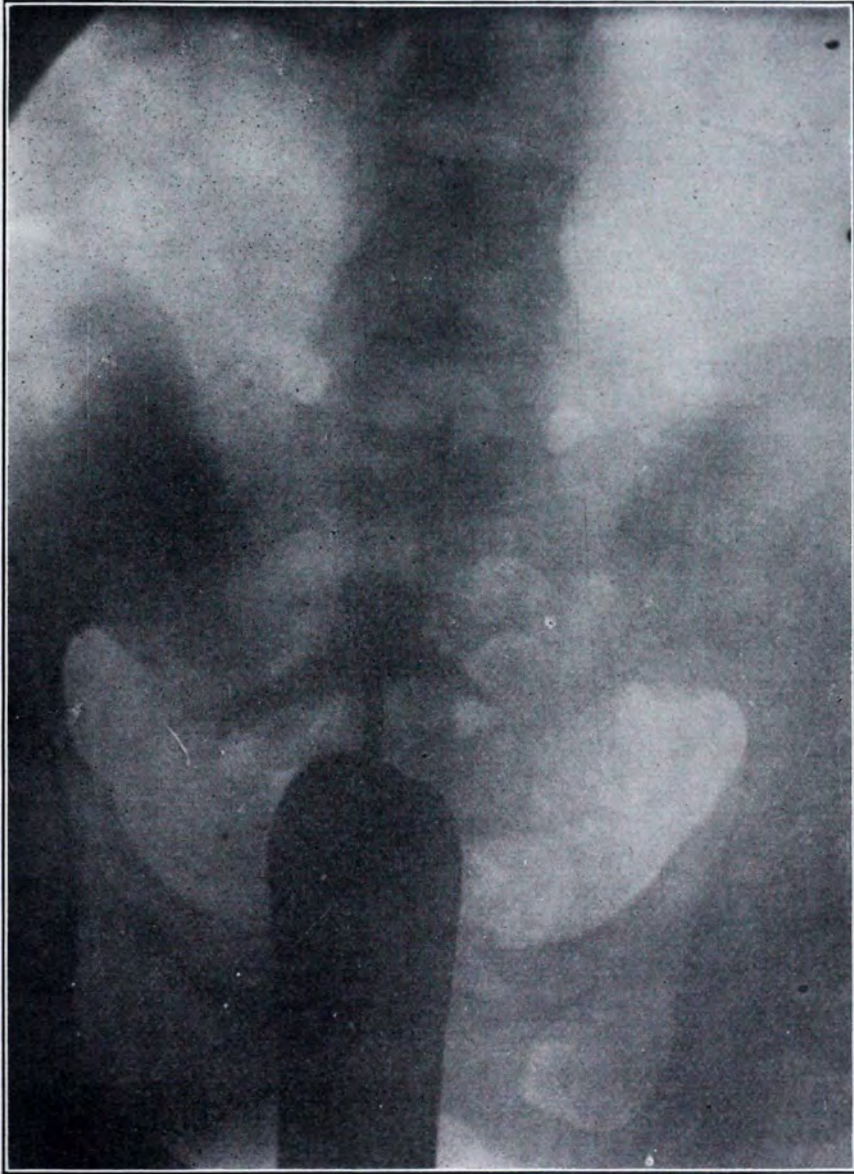
FIG. 46.—THORIUM SHADOWGRAPH OF UTERINE CAVITY AND TUBE IN A PATIENT UPON WHOM A
   BILATERAL PARTIAL SALPINGECTOMY HAD BEEN PERFORMED.   The thorium was injected to
   demonstrate the length of the tube stumps, after oxygen, insufflated, failed to pass through.

weight of liver as compared to that of an empty or full stomach; posture,
too, may influence markedly the side of the subphrenic pneumoperitoneum,
if unilateral.   I have been able to cause the subphrenic pneumoperitoneum to
shift from the left to the right side by having the patient lie upon her left
side and, making moderate pressure over the right costal margin and vice

versa, have caused the gas to shift from the right to the left side. The gas distribution is more apt to include both sides when its amount exceeds 150 c.c. In a diminutive pneumoperitoneum, with the patient in the upright position, one side is more prone to show the gas under the diaphragm.

An ingenious suggestion has been offered by H. Henderson and T. G. Amos [9] to listen over the lower abdomen with a stethoscope while the injection is being made. A high-pitched bubbling is heard over the side corresponding to the tube which opens first. When the sound of escaping gas is heard loudly on one side and faintly on the other, it is said to be symptomatic of · one-sided closure. When the pressure is raised, a high-pitched, shrill sound may be heard on the side which was apparently closed and this is taken to indicate an incomplete stenosis. The remarks made about the distribution of the gas in the peritoneal cavity may also be borne in mind in this connection. As these authors say, both tubes may be prolapsed in the Douglas culdesac, and hence produce no distinct unilateral sound. Another factor deserving attention is the transmitted sound emanating from the cervical regurgitation.

Two things are necessary to establish the fact of tubal patency: (1) an initial rise of the mercury column to 60 mm. and not more than 100 mm. before a drop is observed; (2) a subphrenic pneumoperitoneum demonstrated by fluoroscopic examination or by skiagraphy. In doubtful cases, the X-ray plate may demonstrate the gas which may have been missed by fluoroscopic inspection.

Shoulder pains are so constant that they are regarded as having pathognomonic importance. But, like all subjective symptoms, they may vary with certain individuals and require for their appearance, if they are to be depended upon as a diagnostic sign without resort to fluoroscopy, an amount exceeding from 75 c.c. to 100 c.c., at least, and in proportion to the weight of the patient and the girth of her waistline. If the fluoroscope and X-ray are not available, it is better to inject a greater amount of CO_2 gas, say 250 c.c., for shoulder symptoms will then be quite definite and characteristic.

The filling of the vagina with boric acid solution, as recommended by H. D. Furniss [10] who uses the syringe method of injecting the gas, and as it was employed in my earliest cases, is of help in controlling the factor of leakage. I have not found this necessary, however, because regurgitation may readily be heard either as a fine hiss or as a coarse loud gurgle. By fitting the rubber urethral tip snugly into the external os, regurgitation can be avoided in the vast majority of cases. It has already been pointed out that gas may enter the peritoneal cavity in spite of external os regurgitation. While the 50 c.c. syringe may be ample in many cases to produce a subphrenic pneumoperitoneum, it has a few disadvantages and may lead to faulty interpretation.

The release of the gas from the ordinary oxygen tank may be regulated to a constant flow at a uniform pressure. This cannot be accomplished with the hand; therefore the pressure readings must vary out of all practical range.

[9] "Sterility studies," *Journ. Am. Med. Assoc.*, June, 1922, Vol. 78, No. 23.
[10] *Surgery, Gynecology and Obstetrics*, November, 1921, 33:567.

The gas is furthermore subject to compression in the uterus before the uterine ostiae permit its escape through the tubes. In the anatomical specimen, I have often introduced as much as 30 c.c. before the gas escaped from the fimbriated end and before the pressure dropped. *By fixing upon a definite standard pressure-rate-flow ratio, such as 15 seconds of time to raise the mercury column in the average sphygomanometer to 100 mm. Hg, we may the better arrive at definite conclusions with regard to normal patency, relative stenosis and absolute stenosis.*

The safety of this method has been attested by hundreds, perhaps thousands, of cases. The total number reported up to the present time by Reuben Peterson, over 300 cases; A. H. Aldridge from George Gray Ward's service at the Woman's Hospital, 600 cases; and the author, over 600 cases; aggregate more than 1,500 cases without a mishap. The number of cases accumulating in the experience of others, but not yet reported, will probably raise this figure several fold. It is to be hoped that more reports will soon be forthcoming, as each man's experience may contribute some refinement in technic, some new interpretation or finding.

This chapter may not be concluded without special reference to the valuable contributions made by Peterson. He has extended the scope of application of the new method of pneumoperitoneography in gynecology and obstetrics by combining the transuterine with the transperitoneal route. To him and Van Zwaluwenberg must be given credit for the terms "transuterine peritoneal gas inflation" in contra-distinction to the term "transperitoneal."

Peterson was among the very first to appreciate the diagnostic possibilities of this new method. He writes thus:[11]

Any new procedure introduced as an aid to diagnosis must meet certain requirements before it will be generally accepted. It must be practical, that is, its technic must be such as to require no elaborate or complicated apparatus. Especially is this true if the diagnostic procedure requires the presence of the patient. For example, one of the most universally employed diagnostic procedures, the Wassermann test, does not need to conform to the above requirement, since blood can be removed from the patient and sent to a laboratory. Whether the result of the test has been arrived at by simple or complicated technic is a matter of indifference to the average physician who makes use of this diagnostic procedure. The same applies to other routine laboratory tests.

Secondly, the new procedure must be safe where ordinary, common-sense precautions are taken. This means that there shall be nothing inherently unsafe about it in the hands of examiners of ordinary skill. For example, demonstration of spirochetae by puncture of the skull may be a most valuable diagnostic procedure, but it will be employed only by experts because of the dangers of such a procedure in hands of only ordinary skill.

The diagnostic procedure cannot in any sense be called new, as it has been used since 1912, when Weber employed the X-ray after air inflation of the abdomen. The extensive, careful, and successful work of Stein and Stewart in New York is known and practically has demonstrated that Roentgen-ray examination of the abdominal and pelvic organs, after the

11 "The X-ray after the Inflation of the Pelvic Cavity with Carbon Dioxide Gas as an aid to Obstetric and Gynecologic Diagnosis," *Surgery, Gynecology and Obstetrics,* August, 1921, 154:157.

introduction of air or gas into the peritoneal cavity, is a safe and useful diagnostic procedure. However, the procedure has not been generally adopted, especially as an aid to the diagnosis of pelvic lesions, for reasons which will be set forth later.

I am free to confess that at the start I was prejudiced against the method. In my ignorance and egotism, I was quite convinced that I could make a better diagnosis by bimanual examination than could be done by Roentgen-ray examination after peritoneal gas inflation. Again, even in spite of the testimony of Stein and Stewart, I was not at all convinced that the method was entirely free from danger. In fact it required considerable urging on the part of my X-ray colleague, Doctor Van Zwaluwenburg, before I seriously took up this work at the University Hospital some six or eight months ago.

I was influenced to introduce this diagnostic procedure into my clinic by the work of another New York investigator, Doctor Rubin. While Rubin frankly states that his work with tubal peritoneal gas inflation has been and should be limited to the single diagnostic point of determining the patency or nonpatency of the tubes, it seemed to me that the two methods, transperitoneal and transuterine gas inflation, could, in certain cases at least, be combined to advantage. In fact I believe that a clear realization of this fact will prove of immense advantage to the gynecologist.

First of all, let us consider the question whether or not pelvic roentgenography can be an aid to obstetrical and gynecological diagnosis. If the bimanual examination is all-sufficient, pelvic roentgenography would be an interesting but altogether unnecessary diagnostic procedure. The answer to the question depends entirely upon what is meant by pelvic diagnosis.

Perhaps I can illustrate this best by some of our experiences in the University Hospital Gynecological Clinic. We got into the very reprehensible habit of stating after bimanual examination that a given pelvis was inflammatory either on one side or the other or both. Upon the degree of the inflammatory process as revealed by vagino-abdominal and recto-abdominal examinations rested the decision as to whether the case was or was not operative.

This word "inflammatory" was all-inclusive. It included lesions of the tube, ovary, adhesions, etc., but no attempt was made to be definite as to what organs or tissues were involved in the inflammatory process. In certain cases this is very difficult and in certain other cases impossible of determination by bimanual examination. From experience with hundreds of cases with approximately the same feel to the examining finger, we draw our conclusions as to what this particular inflammatory mass probably is. However, in the past we have not been very exact because of the difficulties of stating definitely the particular tissues involved and because we knew full well that the matter would be definitely settled at the operation.

Granted that this practice and reasoning be correct, what about borderline cases? Is the tube or ovary enlarged or thickened? Are they adherent or freely movable? Failure to make definite diagnoses prior to operation inevitably leads to slipshod, careless, and often very unfortunate diagnoses or errors in diagnosis. I will even go so far as to assert that the very fact that the pelvic organs are easier to palpate with accuracy than, for instance, such organs as the stomach or liver, leads to inaccuracy in diagnosis.

After some thirty years' experience in a special field of work, I took it for granted there was very little to be felt in the pelvis that I could not feel. I must confess that after my experiences with pelvic roentgenography my

eyes have been opened to the fact that there are possibilities in relation to preoperative diagnosis that I never dreamed of.

These remarks are for those of you who are receptive, ready to take advantage of any safe procedure capable of aiding diagnosis. On the contrary, my remarks are not addressed to those who are never guilty of preoperative mistakes in diagnosis, to those who are backed up by three or four diagnoses, so that there is little chance of missing them all; nor am I much concerned with the man who will deliberately lie out of a mistake in diagnosis. My remarks are addressed to those who know they make mistakes and are ready to place themselves in a position where such errors may be avoided in future. To these I will say that pelvic roentgenography has been one of the most helpful and interesting studies I have ever made. It has been of immense help not only to me but to all members of my staff. It has led to more careful diagnoses, to the study of diagnostic errors in order that similar mistakes may be avoided, in short it has given new life and impetus to our routine work. We still perform a certain number of exploratory laparotomies for the reason that at times we are uncertain as to the exact intra-abdominal and pelvic conditions even after all methods of preoperative diagnosis have been employed. However, I may add that such explorations are far fewer in number now than was the case six months ago. Moreover, this improvement has been due both directly and indirectly to the use of gas inflation roentgenographic methods.

Safety.—The pelvis has been inflated with gas in over 150 cases with no reaction which could be attributable to the gas itself or to the method employed. This coincides with the experience of Stein and Stewart with transperitoneal gas inflation and with Rubin where transuterine inflation is employed. The combined experience of several hundred cases is more valuable than pages of theoretical objections to gas inflation on the ground that the methods are dangerous. It goes without saying that modern surgical methods of sterilization must be employed, but this is true when we introduce a uterine sound or perform abdominal paracentesis.

Actual experience and animal experimentation have shown that there is no danger of injuring the intestines by the needle thrust through the abdominal wall where the intestines are not adherent to the parietes. Where the puncture is made in the presence of adhesions, common sense would lead the operator to select a locality on the abdominal wall free from adherent gut.

Discomfort from Gas Inflation.—Very rarely will a patient be found who will suffer no discomfort from the injection of enough gas into the abdominal cavity to insure a satisfactory roentgenogram. The discomfort is not connected with the passage of the needle, for this can be rendered practically painless by local anesthesia. The discomfort is associated with and caused by the rapid distention of the peritoneal cavity. The more gas injected, the greater the discomfort; hence our efforts should be directed to elaborating a technic which will give a good pelvic picture with the minimum amount of gas.

The average patient will begin to complain of discomfort about the lower abdomen when 400 or 500 c.c. of gas have been introduced. The discomfort increases with the amount of gas injected so that patients may complain very bitterly after the introduction of more than 1,000 c.c. Rarely now do we find it necessary to inject more than this amount.

It has been our experience that chronic pelvic and abdominal peritoneal

inflammation increases the amount of the discomfort. This is what one would expect, since the gas undoubtedly, by distending the peritoneal sac, stretches the adhesions.

Discomfort is increased by the rapid injection of the gas. This also is what we would expect, as the same thing can be observed in rapid distention of such organs as the bladder or stomach. Always there exists a tendency to inflate the patient more quickly than is necessary. This tendency should be controlled if we are to reduce discomfort to a minimum.

Further experience will undoubtedly lead to improved methods by means of which there will be practically no discomfort and certainly no pain connected with gas inflation. I am convinced of this when I see how little the patients complain now in comparison with what they did when the gas was introduced in large quantities and more quickly than necessary.

The Kind of Gas to Be Used.—We first used oxygen gas but have abandoned it for carbon dioxid gas because the latter is absorbed in from fifteen to twenty minutes after the inflation has been completed. I say absorbed although I have not determined this fact experimentally. At any rate, the patient ceases to complain of discomfort ten or fifteen minutes after the gas has been injected. In one half hour, patients walk from the examining room or leave the hospital without any discomfort. This is not the case when oxygen has been used, as patients suffer for hours unless the gas be removed by another abdominal puncture.

The rapid absorption of the carbon dioxid gas necessitates rapid work in taking the X-ray plate, but that simply means the perfecting of a smoothly working technic.

Transuterine Gas Inflation.—We have made some changes in Rubin's technic of passing gas through the uterus and tubes into the pelvic cavity. The uterine cannula is introduced in the Sims' position, since in this position a better exposure of the cervix can be made. In this way, iodin sterilization of the cervix is easier and the cervix possibly better steadied by the tenaculum prior to the introduction of the cannula. The gas is passed with six excursions of the siphon meter to the minute and no higher pressure than 200 mm. is employed, since we have found that pressure to be sufficient for the passage of the gas if the tubes be permeable.

If the gas passes freely, the inflation is continued until between 500 and 1,000 c.c. have entered the pelvis. The plate is then taken exactly as if the inflation had been made through the abdominal wall.

In acute or subacute pelvic conditions, the transuterine route is contraindicated and is never employed. The same holds true for patients beyond the menopause.

Transperitoneal Route.—In by far the largest number of cases, this route for one reason or another is the method of choice. In 105 inflation cases, 77 were by the abdominal, and 23, by the transuterine route, while in 5 cases the transperitoneal method was employed after the tubes were found to be impermeable.

We have abandoned the gas-bag inflation method of Stein and Stewart in favor of the simple accurate method of Rubin. By this technic, rapidity and pressure can be accurately gauged and the method has proved eminently satisfactory.

Position of the Patient.—To insure successful pelvic roentgenography, the patient must be so placed as to allow of the gas rising upward

and displacing the pelvic organs and forcing the intestinal coils out of the pelvis. After many trials with different positions, we are securing the best results with the moderate knee-chest position with an inclined board beneath the thighs with a notch cut out for the tubes. The table is then tipped, as for the Trendelenburg position, the patient being prevented from slipping by shoulder straps.

An 18-inch square of opaque fabric with a 6½-inch circular hole cut out of its center is laid on the buttocks and serves as a diaphragm. A plate-changing tunnel is then placed horizontally on the table, double-screen films are used, and a Coolidge portable unit operating in the ordinary lamp circuit furnishes the X-ray. An exposure of from 14 to 20 seconds is usually required.

SUMMARY

1. The uterus together with the tubes and ovaries can be clearly shown by pneumoperitoneal roentgenography.

2. Owing to their distention with gas, the tubes are rather more clearly demonstrated by the X-ray where inflation has been brought about through the transuterine route than where the inflation has been made transperitoneally.

3. On account of the rapid absorption of carbon dioxid gas, with equally rapid subsidence of the discomfort produced by the inflation, this gas should be used in preference to oxygen which is very slowly absorbed.

4. Irregularities of the uterus, omental and bowel adhesions are clearly demonstrated by the pneumoperitoneal X-ray.

5. In not a few instances, the diseased and enlarged appendages are more clearly made out by pelvic roentgenography than by the most careful and searching bimanual examination even under anesthesia.

6. With the improved position (knee-chest and Trendelenburg) smaller and smaller quantities of gas will be necessary for inflation. Thus discomfort will be reduced to a minimum.

7. If the technic of pelvic roentgenography be good, retention of bowel coils in the pelvis will be proof of adhesions.

8. The pneumoperitoneal X-ray is able to demonstrate pregnancy at a much earlier period than is possible by the examining finger.

9. With good technic and good judgment in the selection of cases, both transuterine and transperitoneal gas inflation are free from danger.

10. Bimanual pelvic examination and pelvic pneumoperitoneal roentgenography are not antagonistic diagnostic methods. Each is valuable and their value is enhanced if they be used in conjunction, each acting as a check upon the other.

Again, in a more recent publication, Peterson gives his experiences with more than three hundred cases in which pneumoperitoneal roentgenography was employed in obstetrics and gynecology.[12] His paper is given here as originally published, because in it he treats the matter of diagnosis in the frank and objective manner so essential in interpretation of gynecological lesions as, indeed, it is in that of all other lesions.

Roentgenographic examination of the female pelvic organs after gas inflation has been rather extensively employed during the last eighteen months

[12] *Journ. Am. Med. Assoc.*, February 11, 1922, 78:397–400.

in the clinic of obstetrics and gynecology of the University of Michigan Hospital. Previous reports on this comparatively new diagnostic method purposely dwelt on the technic of the procedure as it has been developed in this clinic. It was felt that first of all it must be determined whether transuterine and transabdominal gas inflation under proper aseptic technic is attended by dangers serious enough or so unavoidable as to preclude gas inflation as a justifiable or practical diagnostic method in obstetrics and gynecology.

As case after case was added to the list under technic employed without the slightest peritoneal irritation resulting, it was felt that the safety of the method had been established beyond the shadow of a doubt. Naturally, the next question to be answered, as clinical material has accumulated, is the value of gas inflation as a diagnostic procedure. In what proportion of cases is it of real value in establishing or confirming the preoperative diagnosis? In short, is this new procedure a fad and therefore transitory, or is it a valuable aid to pelvic diagnosis, not to be depended on alone but as a help in making the diagnosis of pelvic conditions more accurate, so that the physician is in a better position in a given case to decide on the line of treatment to be employed? It is to answer these and other interesting questions connected with gas inflation that the present attempt has been made to draw conclusions from certain groups of the 325 patients in whom inflation was performed for various reasons from July 1, 1920, to December 1, 1921.

Obviously, since the only way of determining the correctness of diagnoses arrived at by bimanual examination and the Roentgen-ray is by direct palpation through an abdominal incision, only those patients operated on after gas inflation can be considered. Of the 325 patients subjected to pneumoperitoneal Roentgen-ray examination, 152 were operated on through the abdomen. In 14 cases, for one reason or another, excessive or uncontrollable moving of the patients, too little gas in adipose patients, etc., the roentgenogram from a technical standpoint was so poor as to be worthless. There remain 138 cases in which the clinical and Roentgen-ray diagnoses were carefully made and recorded prior to operation.

Before judging the value of the pneumoperitoneal roentgenogram as an aid to preoperative pelvic diagnosis, it will be well to state just how these roentgenographic diagnoses were made, and to set forth the criteria adopted in arriving at decisions as to whether the diagnoses were correct or otherwise. As has been explained at some length in previous communications, the rule of the clinic has been to use the transuterine gas inflation route whenever possible. It was felt that, aside from the question of sterility, it was of the greatest practical interest in every pelvic case to be able to state definitely whether the fallopian tubes were or were not permeable. However, no chances are taken to determine this fact. Whenever there is a history of acute pelvic infection, or in the presence of a bloody or purulent uterine discharge, the transuterine route is decided against and the gas is injected by the transabdominal route.

To show the conservatism of the clinic in this regard, out of the 138 operative cases after gas inflation, the gas was introduced 73 times through the abdomen as an elective procedure. In 43 cases, the gas was passed through the uterus and tubes in quantities sufficient for Roentgen-ray purposes. In 22 cases, the transuterine route failed, and the gas was injected through the abdominal wall.

The routine of gas inflation is as follows: A careful history is taken of

each patient. There have been no exceptions to this rule, since the determination of the route for gas inflation depends largely on the history. Whenever there is a history of acute or subacute pelvic inflammation, since it is the rule not to subject such patients to transuterine gas inflation, it is carefully considered whether such a patient is suitable for even transabdominal gas inflation. If the pelvic inflammation is acute, it is deemed a case unsuited for any form of inflation. If it is one of subacute pelvic inflammation, if there is no rise of temperature or pulse rate after a bimanual examination, transabdominal gas inflation is resorted to in the large majority of cases.

While it is not believed that there is any particular danger of forcing the contents of the fallopian tubes into the pelvic cavity by gas inflation under moderate pressure, to be on the safe side, as stated before, transuterine inflation is ruled out in the presence of profuse purulent uterine discharges, and when there is a hemorrhagic discharge from the external os.

No patients with serious circulatory changes have been inflated. Even when moderate amounts of gas are introduced into the abdominal cavity, it can readily be seen that the sudden rearrangement of the abdominal organs resulting from the gas inflation, together with upward pressure on the diaphragm, might well embarrass a diseased and badly acting heart, and possibly give rise to alarming symptoms, if not leading to fatal results. For the same reason, great care has been taken not to use gas inflation in the presence of large uterine or ovarian tumors. Not only might the presence of the gas produce the symptoms just referred to, but in reality there is very little to be learned from the pneumoperitoneal roentgenogram under such conditions.

The greatest care is used in the presence of suspected bowel adhesions to the abdominal wall. Either a site reasonably certain to be free from such adhesions is selected for the abdominal puncture, or the case is deemed unsuitable for transabdominal gas inflation. In short, every case is critically gone over pro and con prior to gas inflation; and, if there is any doubt, the procedure is decided against and the patient is operated on without the inflation.

At the beginning of our work with the pneumoperitoneal roentgenogram, Dr. Van Zwaluwenburg and I agreed that we would work out our diagnoses independently. This arrangement was entered into deliberately, since neither the clinician nor the roentgenologist desired to be influenced by the other's opinion so far as diagnosis was concerned. This was hardly fair to either, but was particularly unfair to the roentgenologist, who, without the specialist's knowledge of pathologic conditions of the pelvis, attempted to interpret what he saw on the Roentgen-ray film. As will be shown later in reviewing the roentgenographic diagnoses, it was remarkable in what proportion of cases, as shown by subsequent operation, correct diagnoses were made by Dr. Van Zwaluwenburg, working in practically a new field and with no knowledge of the clinical histories of the cases.

The details of vagino-abdominal and recto-abdominal examinations without anesthesia were carefully recorded and the tentative diagnosis made for each of the 138 patients subsequently operated on. An attempt was made to have these preoperative diagnoses very accurate. For instance, the size, position and movability of the uterus were recorded. The same was done with the appendages. If for any reason it was impossible to palpate either ovary or tube, it was so stated, and the same with adhesions. Such indefinite

terms as "pelvic inflammatory," "tubal masses" and "thickened broad liga-ment" were discarded in favor of accurate findings and diagnoses.

The Roentgen-ray report was sent to the departmental office and studied in connection with the recorded physical findings in a given case. It was then decided whether or not the case called for operation. If the case was operative, the patient was always carefully examined under anesthesia and these findings were recorded. This is only fair when accurate determination of the pelvic contents is being attempted, since, in so many instances, in a certain class of patients, rigid abdominal walls prevent satisfactory pelvic examination. However, it is well to bear in mind that the Roentgen-ray report was not allowed to influence the examination under anesthesia so far as the findings were concerned. If an ovary or tube could not be felt, or if it was determined that no adhesions existed, it was so recorded.

In order to compare the clinical with the Roentgen-ray diagnoses, the most difficult class of cases from the diagnostic standpoint has been selected for comparative study. Of the 138 operative cases, there were 54 salpingitis with adhesions, and these have been carefully analyzed. It must be borne in mind that in stating that diagnosis is difficult in this particular disease of the pelvis, the word is not used in its ordinary sense. Clinically it is not at all difficult to determine whether or not a patient has salpingitis or probably has the condition. Especially is this true in severe types of the disease in which the uterus is immovable or its movability is impaired, when there is distinct inflammatory thickening at one or the other side of the uterus. Minor degrees of tubal enlargement, with or without adhesions, may or may not be felt by the examining finger. From experience with hundreds of cases, verified by subsequent laparotomy, the gynecologist may judge that the tube and possibly the ovary is affected; but in many cases the examining finger is absolutely unable to outline these organs, which are backward in the pelvis and to one side and covered with plastic lymph. In quite a percentage of cases, such a condition exists on one side, while the tube is enlarged and adherent and easily palpated on the other.

So difficult has been the differentiation of the appendages or portions of the appendages in certain types of inflammatory disease of the pelvis that in many instances it is not attempted at all, but accurate diagnosis is reserved until the pelvic contents can be palpated through the abdominal incision. Now it cannot be denied that such a course is one of intellectual cowardice. It is dodging the question of preoperative diagnosis because of attendant dif-ficulties which the gynecologist should strive to overcome, if possible.

The clinical diagnosis in relation to the 54 cases of tubal disease relates to this more accurate preoperative diagnosis, and should be considered in this connection; otherwise it would be inexcusable for the specialist to fail to make a diagnosis in such a large percentage of the cases. In other words, failure does not mean that the clinician did not know he was dealing with pelvic inflammation, but that he failed in part to state definitely what organs were affected by the inflammatory process.

In 54 cases of salpingitis with or without adhesions, in the sense defined above, the clinical diagnosis was correct 33 times, or 61 per cent of the cases. In 17 cases it was partially correct, and in 4 cases it was incorrect in that no inflammatory tubal disease was found prior to the operation. Turning to the Roentgen-ray diagnostic side of the question, it was found that, in the type of pelvic disease under consideration, tubal disease was

correctly diagnosed 24 times or in 44 per cent of the cases. In 21 cases out of the 54 patients with salpingitis, or 39 per cent, the Roentgen-ray diagnosis was partially correct, while in 9 cases or 17 per cent, it was incorrect.

It seems to me that, all things taken into consideration, this is a very creditable showing for this new aid to pelvic diagnosis, and holds out great hope for greater accuracy in the future, since these statistics were made up from all operative cases of salpingitis with adhesions when the roentgenologist had to feel his way in making a diagnosis. Again, great improvement in diagnosis may be expected from now on, since the future plan of the two departments will be to furnish all factors in the cases before the final diagnoses are made prior to operation. For example, the clinician provided with the history of the case plus the bimanual findings goes over the film with his Roentgen-ray colleague and aids in the interpretation. In one instance he will point out that there is no history of inflammatory pelvic disease, and that the shadow seen low down in the pelvis is probably a cystic ovary and not salpingitis with adhesions; again, that the uterus which is enlarged and backward probably is not due to pregnancy, since no menstrual period has been missed.

It is well to call attention to the fact that even as the Roentgen-ray diagnosis has improved and will still further improve with added experience, the clinical diagnosis, even under the rigid conditions laid down for correctness in diagnosis, has improved nearly 10 per cent in the last 20 cases under analysis. This demonstrates how valuable is the pneumoperitoneal roentgenogram in that a study of the films in conjunction with careful bimanual examinations leads to better interpretation of the next case by the examining finger.

It may be urged that such refinements of diagnosis are hardly necessary, since an abdominal incision will clear up all doubts. A little consideration will show this reasoning faulty, and especially unfair to the patient. An exploratory laparotomy may be comparatively free from danger, but not entirely so. The physician is in duty bound to save his patient from unnecessary pain, anxiety and expense, and thus should welcome any additional aid to diagnosis.

The well-known fact that, in a certain percentage of cases, the ordinary methods of pelvic examination fail to reveal certain types of pelvic disease causes the examiner to hesitate and take the easiest course, exploratory laparotomy, in the presence of pain or other lower abdominal symptoms—this, even when he can find nothing and really feels there is nothing pathological in the pelvis. If his negative pelvic findings are supported by a pneumoperitoneal roentgenogram showing normal pelvic contents, he will refrain from a useless exploratory operation and seek another explanation for the existing symptoms.

At least, this is the trend of our practice in the clinic since the advent of the pelvic roentgenogram. In fact, it has been found that this new method of diagnosis has been of the utmost service in doubtful cases, when something is felt by bimanual examination but not enough to make one positive as to diagnosis; when nothing, or practically nothing, is palpated, but the roentgenogram discloses a distinctly pathologic condition; in short, in those cases in which one would gladly palpate through an abdominal incision in order to arrive at a correct diagnosis. The pelvic roentgenogram plus the careful

bimanual examination is the next best thing to this direct palpation, and in time, with added experience, may be almost as effective.

A case illustrative of what is meant is being investigated as this paper is written. A woman, aged twenty-one, healthy, in fact an athlete, has noticed for the last year something wrong low down in the right side. She has never had a vaginal discharge, or abdominal pain and fever. Examination reveals an unruptured hymen, no signs of infection, and a normal-sized uterus in good position, but of somewhat limited mobility. The left ovary is of normal size, slightly movable, the tube not palpable. In the region of the right tube and ovary and behind in the culdesac to the right of the

Am. Jour. Roent. VIII, Fig. 1.

FIG. 47.—NORMAL PELVIS. Note the optical cross-sections of the isthmus and fundus of the uterus (R. Peterson and Van Zwaluwenberg.)

median line is an irregular, adherent mass not particularly sensitive and not well definable on account of the rigidity of the abdominal walls.

Formerly this patient would have been informed that she had a pelvic mass, that she should be operated on, and that the exact diagnosis would be made after the abdominal incision had been made, in spite of the fact that this particular patient, because of the probability of marriage in the near future, has every reason to demand that the condition of her pelvic organs and the extent of the operation be told her prior to the abdominal incision.

In this particular case the pneumoperitoneal roentgenogram revealed the irregular mass on the right adherent to intestinal coils, presumably the tube and ovary, since these organs gave no shadow. The left ovary and tube

were enlarged and adherent. The Roentgen-ray diagnosis was bilateral sal-pingitis, more marked on the right side.

The patient has been informed that she has trouble with both appendages, more marked on the right; that she may and probably will have to sacrifice the right tube and ovary, but that part of the left probably can be saved. While all the facts in this particular case have not been ascertained by clinical and Roentgen-ray diagnostic methods, for there is no history of pelvic infection further borne out by the unruptured hymen, the condition of the appendages is well enough known to permit an intelligent discussion of the case with the patient prior to operation.

The pneumoperitoneal roentgenogram has been extremely valuable as an
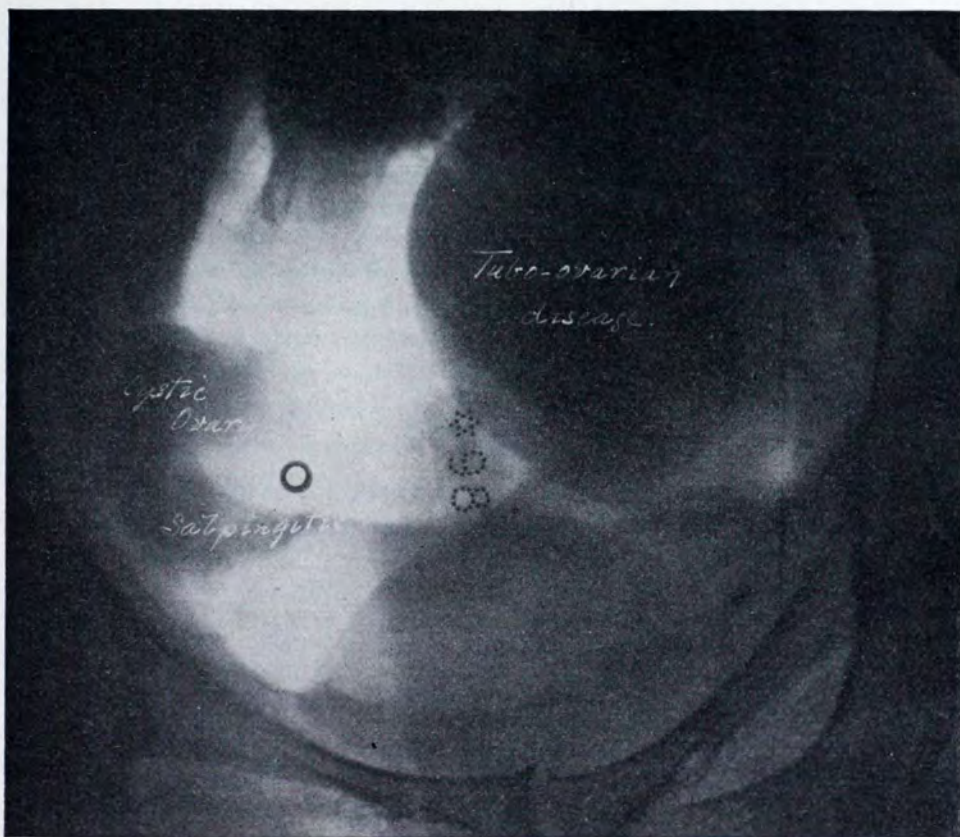
Am. Jour. Roent. VIII, No. 1, Fig. 4.

Fig. 48.—Bilateral Tubal and Ovarian Disease (R. Peterson and Van Zwaluwenberg).

aid to diagnosis in early cases of pregnancy—from the sixth to the ninth or tenth week. In these early weeks of pregnancy, the expert examiner may detect enlargement and softening of the uterus, but he is very loath to say more than that he suspects pregnancy or that the condition is very suspicious of pregnancy. Especially is this true if skipping of the period is admitted. His suspicions are made quite positive if the pneumoperitoneal roentgenogram reveals an enlarged uterus and isthmus. In 8 cases of pregnancy from the sixth to the tenth week, the condition was positively diagnosed by the roent-genogram without knowledge of the history or the vaginal examination find-ings. In each instance the diagnosis was confirmed by the subsequent history.

The Roentgen-ray picture of early pregnancy shows almost uniformly an enlargement of the isthmus, the cross-section of the uterus at a point corresponding with the lower uterine segment (Fig. 47). Not only is the isthmus enlarged in the long axis of the uterus, but it is shown to stretch out on the sides toward the broad ligaments. In pregnancy advanced more than ten weeks, this thickening of the isthmus is very marked, so that beyond the tenth week pregnancy can invariably be recognized by the pneumoperitoneal film at a time long before the fetal bones can be demonstrated. This diagnostic sign is especially valuable in cases of fibroids complicated by pregnancy. Again, the absence of the sign is valuable in demonstrating the nonpregnant uterus, when menstruation ceases at the menopause, giving rise to great mental disturbance in patients who have been exposed to and fear pregnancy.

Time does not permit a description of other pelvic conditions, such as fibroids with and without diseased appendages, small pelvic growths, unruptured ectopic pregnancies, etc., in which the pneumoperitoneal roentgenogram has proved invaluable as an aid to diagnosis (Fig. 48). It is realized that this work is just beginning, and that the interpretation of such films will improve as they are numbered by the thousands instead of by the hundreds. Even at the present stage of the study, the pneumoperitoneal roentgenogram has become an invaluable aid in the clinic, and would be dispensed with only with the greatest reluctance, aside from the indispensable aid of pneumoperitoneum itself in determining the patency or nonpatency of the fallopian tubes in cases of suspected or actual sterility. However, this is another subject and will be left for subsequent discussion.

CONCLUSION

The method of intra-uterine oxygen or carbon dioxid insufflation to produce an artificial pneumoperitoneum establishes the fact of patency or occlusion of fallopian tubes. Under manometric and volumometric control, it is a scientific, diagnostic procedure and may be employed with safety to determine the mechanical factor involved in the etiology of female sterility. For this purpose, it obviates the necessity of surgical exploration and is specific.

As the fact of tubal patency is, in most cases, primarily a matter for speculation, its scope for general abdominal diagnosis as compared to that offered by the direct abdominal puncture method is necessarily limited. In cases where the tubes are patent, however, a pneumoperitoneum of any size may be produced by the uterine route.

For the definite object of establishing tubal patency by intra-uterine insufflation, only a diminutive amount of gas is necessary, because the result desired is to produce a localized subphrenic pneumoperitoneum which shall be followed by scant if any symptoms. The vast majority of the patients tolerate this method very well and it may be employed as a routine office procedure. It is well, however, to bear in mind the primary object of the test and to apply it only in cases properly suited for its use.

CHAPTER XIX

DIAGNOSIS OF PREGNANCY AND ITS COMPLICATIONS

The diagnosis of pelvic conditions by physical examination alone is not entirely dependable. Even in the hands of the expert, it may be confusing, misleading and uncertain. Winter sought to establish rules for the examination in order to arrive at an accurate diagnosis. It cannot be done. Even he has been obliged to take account of the symptoms in many cases.

It must impress itself upon every gynecologist that, with increasing experience in vaginal touch, many more mistakes are made later in one's career than at the beginning. The fewer the cases examined, the less the chances of error, for I have often observed that the house surgeon makes a correct diagnosis where his attending gynecologist may have wavered between two or even three diagnoses.

In the simple cases, which are perhaps the most common, it may suffice to base the diagnosis on one characteristic finding. Thus, for example, a cystic, movable tumor lateral to the uterus would in the majority of instances be correctly designated by the house surgeon. But we have all seen tubo-ovarial cysts, hydrosalpinges, pedunculated cystic myomata give the same physical sensation.

Or, again, if the tumor be hard and in the neighborhood of the uterus, the same house surgeon would call it a fibroid. In my experience, the fibroid is the most common of the tumors, whose chief physical characteristic is hardness; but these tumors commonly undergo physical changes, so that they may be confounded with inflammatory masses, cystic tumors, pelvic exudates, dermoid cysts or fibroma of the ovary. If the tubes and ovaries are prolapsed and held together with the uterus by firm adhesions, they will move as one mass and what may have appeared to be fibroid nodules will in reality be due to the thickening of the adnexa. It is exactly in conditions such as this that transuterine insufflation can be of decided help in the diagnosis, for if the tubes are proved to be occluded, this fact would point rather to an inflammatory process than to multiple fibroids. It goes without saying that, before this diagnostic test is employed, there must be no fever or purulent discharge present.

While the last is somewhat uncommon, the pelvic exudates occur so frequently as to occasion confusion. Fluctuation is characteristic of cysts but it is just as true of a hematocele.

There are undoubtedly simple cases in which the diagnosis may accurately be made by mere vaginal bimanual examination; the history of the symptoms in these cases need not even be considered. But, in the majority of cases, this cannot be done, nor is it desirable.

Symptoms not only have a significance as to the organic disease underlying them, but they also put us in contact with the whole organism. The finding of an ovarian cyst may be purely accidental and have no bearing upon the complaints; so with the fibroids and again with the malposition of the uterus or ovaries.

There is scarcely a single pathological condition in the pelvis which is so unique in its physical manifestations that it is not liable to be mistaken for some other condition. Where the lesion is accessible to inspection this is, of course, different; but in this category will be included only a limited number of lesions, such as the erosion of the cervix, carcinoma portionis and polypus. These are so obvious as to require very little experience in diagnosis. Self-evident as these may be, there nevertheless exist associated conditions which necessitate a complete examination, including an analysis of the symptoms.

It is well, then, to consider the subject from the combined standpoint of symptomatology, subjective and structural. The latter ought to be recognized, as nearly as possible, in causal relationship with the former. Physical signs are of extreme importance when they can reproduce or accentuate subjective symptoms. It is the disturbance of function caused by pathological lesions of uterus, tubes and ovaries, together with a careful account of the history of the clinical evolution of symptoms and the physical examination, that will lead in the greatest proportion of cases to an exact diagnosis.

THE DIAGNOSIS OF PREGNANCY

The diagnosis of pregnancy is a problem with which the gynecologist is often confronted, whether he practices or does not practice obstetrics. Perhaps the patient applies to the general practitioner most frequently for the "verdict" of pregnancy. In the first two months, the diagnosis of pregnancy may be very difficult to establish. It will be simpler, perhaps, to rule out pregnancy in cases of functional amenorrhea of long duration. Thus, if the patient gives a history of six months' amenorrhea, with or without subjective signs which usually associate the gravid state, it is an easy matter when one finds the uterus of normal or nearly normal size to say definitely that there is no pregnancy. The same may be said of cases of amenorrhea of four, three or even two months, when the uterus is found to be of normal size and consistency.

The greatest difficulties arise during the first six weeks of pregnancy in instances where no irregularity in the menstrual cycle has previously been noted. From the physical examination alone it may or may not be possible to diagnose the condition with a great degree of certainty. This much is clear, that pregnancy under a month—that is, at least six weeks must have elapsed from the last regular period—cannot be diagnosed except in a moderate number of cases. This may occur in thin women who offer no obstacle to delicate palpation. It may be possible to make the diagnosis in women who were previously examined on several occasions, one of these being just before the period. In other words, if a patient whose gynecological status is well known to the examiner skips her period by two weeks and the uterus exhibits a change

in consistency as well as a definite increase in size, whether or not subjective symptoms are present, the diagnosis of pregnancy may be made with reasonable assurance of accuracy. In the absence of this definite increase in size and softening, though the period has not returned, one may not exclude pregnancy altogether, but there is reasonable assurance that it is not present.

A not inconsiderable group of women consult the gynecologist much too prematurely to determine whether they are pregnant, before a definite statement can be made either way. They are patients who fear pregnancy—the psychoneurotics, and those who do not want to be pregnant for social and economic reasons. A number of these, the more or less circumspect, will make sure whether they are pregnant before resorting to measures which in their experience are successful to interrupt pregnancy. Criminal abortions are attempted upon a nongravid uterus more often than we can determine, and it is safe to say that they are very numerous. The causes of amenorrhea other than pregnancy are manifold. These will be discussed under a separate chapter, but here it may be noted that, in modern life, *fear* is a common cause of amenorrhea which impairs the usefulness of the wife and young mother. Occasionally it may also interfere with the well-being of the husband to whom the fear is directly transmitted and who is further charged with the responsibility of the condition. It is not an infrequent experience when such a patient is sent away with the assurance that the period will come if she will only stop worrying about it, and providing she does not undermine her health further by injurious medicaments, to find that menstruation sets in a few days, even a few hours, later.

With some patients this question is a burning and vital one; particularly women who anticipate the onset of the period by the administration of emmenagogues a day or two before or the very day of the expected period. They also form that large group who have repeated interference to bring on an abortion, although pregnancy may never have existed in them, relative sterility actually being the case.

If the conditions favorable to the diagnosis of pregnancy are not present, one is compelled to wait till two periods have been missed to be able to say definitely one way or the other. After the second month, there should be slight difficulty. The essential changes are increase in volume and softening over a smaller eccentric or a larger concentric area (Ladin's sign). The increase in size is due to a general parenchymatous hypertrophy, in which the decidua plays the chief part; the softening is due to the succulence of the decidua and the increased vascularity of the uterus and, more especially, to the placental site and the amniotic sac. As these are situated at different portions of the uterus with each pregnancy, the softening will vary and will be found, now on the anterior, now on the posterior surface, and occasionally near the horn of the uterus, or again nearer the cervix or the fundus. When the placental site is upon the anterior wall of the uterus or either lateral wall, it is easier to feel the softened area than when situated upon the posterior wall.

After the third month, the diagnosis of pregnancy is comparatively simple in cases where no abnormality in the menstrual cycle was previously present, or when there was no irregularity in the bleeding since the onset of the

amenorrhea from which the pregnancy would date. Hegar's sign is helpful in the third month and thereafter.

Nausea and vomiting, when present together or separately, are symptoms of such varying character that they should not be depended upon to any great degree. For in just those cases where these may be corroborative or of help in the diagnosis, they are often absent, although it turns out that the patient is pregnant. On the other hand, they may both be very annoying symptoms associated with a purely functional amenorrhea. It is remarkable to what striking degree nausea may be present in women who fear being pregnant. The objective sign of the vagina (Chadwick) may also be found in the non-pregnant condition, although it is a more constant physical sign of pregnancy than are the subjective symptoms of nausea and vomiting. Other symptoms which may have been present in a previous pregnancy and, so far as the patient knows, only during her pregnancy, if recurring in a succeeding amenorrhea, are suggestive. Thus one patient will state that an obstinate constipation is relieved only during pregnancy, or, vice versa, constipation first sets in during pregnancy, etc. For these particular patients, such symptoms are as significant of pregnancy as nausea or vomiting.

The presence of colostrum is a very important sign. Occurring in a multipara, it has a pathognomonic importance. In the presence of an enlarged uterus with a history of amenorrhea, the diagnosis is almost certain. Unfortunately colostrum persists even after pregnancy has been terminated and, in those rare cases of early dissolution of the ovum or when abortion takes place without its proper recognition, the succeeding menstrual period being delayed, this sign cannot have the same diagnostic value.

In the second half of pregnancy, there need be no doubt of the condition. Fetal heart sounds and fetal motions are absolutely diagnostic.

When, as sometimes happens during palpation, the uterus is found to become tense and hard as if in contraction, then, after a short interval, relaxes and regains its softness, one may be sure of pregnancy. This does not occur in any condition other than the gravid state. Hydatid mole, one of the degenerations of pregnancy, may be associated with very marked intermittent contractions.

I have seen one case of hydatid mole in a uterus enlarged to about the size of a four months' gravidity, although the last menstrual period had taken place two and a half months before. There was slight spotting and indefinite pains in the lower abdomen. The uterus had a cystic consistence and was enlarged beyond the limits of a gravidity of two and a half months. The uterine contractions, as elicited by palpation, were so absolutely pronounced that the diagnosis of a twin pregnancy with possible hydramnion was made. This combination, it was believed, could account for the large size of the uterus. The alternating hardness and softness of the uterine wall, it was thought, could obtain only in a gravid uterus. X-ray examination failed to demonstrate a fetal skeleton. The condition, however, proved to be one of hydatid molar pregnancy. Unfortunately this seldom occurs in the earlier months and, while fairly common in the second half of pregnancy, is not then needed as a diagnostic sign.

Swelling, pain and tenderness of the breasts with enlargement of the Montgomery tubercles and venous distention, while concomitant signs of pregnancy and perhaps appearing early, can be of diagnostic value only in nulliparous women. In women who have been sterile for several years, suffering from amenorrhea of shorter or longer duration, these breast changes are of less importance from a diagnostic point of view because they may occur in the premenstrual stage. The reaction in the breasts appears often to be directly proportionate in intensity to the length of the amenorrhea. Colostrum, however, seldom appears without an underlying gravidity. When this is present without other physical evidence of pregnancy, one should bear in mind the possibility of a mucoid breast secretion which results from perverse stimulation of the mamma.
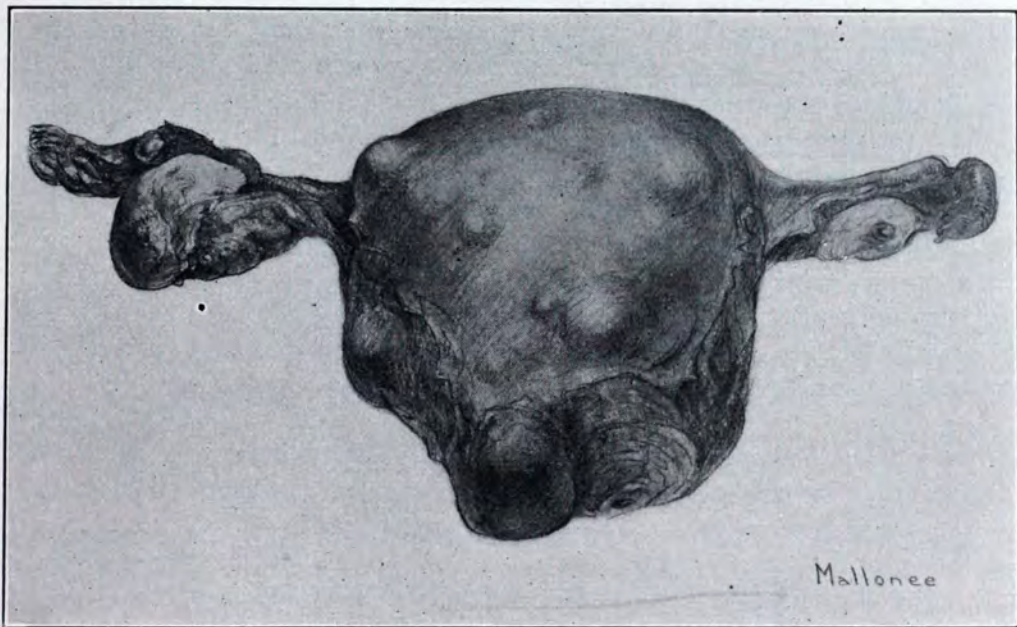
FIG. 49.—PREGNANT UTERUS (THIRD MONTH) WITH MULTIPLE FIBROIDS. The left ovary contains the corpus luteum of pregnancy as shown in Fig. 3 (frontispiece). Without a history being available of amenorrhœa of ten weeks previous to the bleeding, the conditions could have been well suspected because of the areas of softening (almost cystic) palpable between the multiple nodules.

Differential Diagnosis.—In the early months, one has to distinguish at times between extra-uterine pregnancy, a myoma or an ovarian tumor. Hematometra and spurious pregnancy also enter into the differential diagnosis. Naturally, only when abdominal symptoms are present, such as bleeding and pain—more general symptoms—do these conditions enter into consideration. On the other hand, without such disturbance, they may first be suggested by the physical examination.

Skipped bleeding, particularly when associated with pain on one side of the lower abdomen, immediately raises the question of ectopic pregnancy. If the uterus is appreciably enlarged, is softer than normal, is movable from side to side, and is not tender, and, especially, if there is no tender enlargement on either side, ectopic pregnancy may be excluded. It is when a mass,

no matter how small, is found lateral to the uterus that the suspicion of extra-uterine pregnancy arises. If the mass is considerably larger than the uterus, the latter being of normal size and somewhat dislocated, while at the same time tenderness is very marked, intra-uterine pregnancy may be excluded. The differentiation of a lateral mass from inflammatory disease of the adnexa and of ovarian cysts will be discussed later.

A small submucous myoma will give the same palpatory findings as an early gravidity. Without bleeding, the uterus may present the same tactile evidence, particularly when the myoma is edematous or partially cystic. The history alone can offer some aid and if the patient states that, except for this one period of amenorrhea, the periods were inclined to be profuse and associated with the passage of blood-lots, the diagnosis of myoma is probable.

Interstitial and intramural tumors will not cause confusion in the early stage. Larger tumors associated with amenorrhea may, however, give the impression of fetal parts. In such cases, a thorough analysis of all the findings should serve to exclude or establish pregnancy (Fig. 49).

Chronic metritis with amenorrhea of two months' duration may be mistaken for pregnancy. Here it is well to remember the normal gravid uterus with its rather broadened-out fundus and its softer consistence which is seldom present in the uterus with chronic metritis. In the latter condition, the uterus is very firm and hard and at times tender. A uterus which is the seat of a chronic metritis will not be apt to increase in size rapidly, so that if it becomes absolutely necessary to make a decision, a period of two weeks waiting and watching will be sufficient to determine the change.

An ovarian tumor of small size will not give much difficulty, for the uterus can readily be separated from it. Tumors of large size may so overshadow and dislocate the uterus as to render the diagnosis more obscure. The consistence may be quite the same as in the gravid uterus of, say, four months; for the gravid uterus of that stage is an abdominal organ, the vaginal portion being displaced backwards because of the increased anteflexion. As it is necessary to identify the tumor mass as continuous with the cervix, it may not always be possible to make the differentiation.

It is precisely in such a dilemma that some other method must be enlisted. The Abderhalden test has proved to be uncertain. But in the X-ray we have an agency that can be utilized to clear up the diagnosis of pregnancy. In the last few years with improved technic, the fetal skeleton may be demonstrated by roentgenography. The X-ray is particularly helpful in obese women. The following case will illustrate the value of the X-ray in the diagnosis of pregnancy.

This patient was thirty-four years old and married eleven years. She had one child nine years old and one miscarriage of twins at three months six years before examination. She had been curetted twice because of hemorrhages. Her last regular menstrual period was five and a half months before. Her weight at the time of examination was 224 pounds. The patient had become stouter for the past three months. Not having had any of the subjective signs of pregnancy, she had consulted several physicians to find out whether she was pregnant or was possibly undergoing change of life. The

diagnosis varied between functional amenorrhea associating obesity and pregnancy. On examination, marked obesity was found, the abdomen was pendulous, the breasts contained fresh colostrum and the vagina and cervix exhibited a violaceous hue. The cervix was soft and the uterus appeared to be as large as a four to five months' pregnancy. No fetal heart sounds could be made out nor any fetal motion. Patient stated that she felt life while carrying her first and only child at three and a half months. In spite of an amenorrhea of five and a half months, no sense of quickening had been experienced. Although the diagnosis seemed fairly certain from the physical examination of a dead fetus, in view of the discrepancy of opinion, an X-ray picture of the abdomen was taken and resulted in the demonstration of a fetal skeleton of four months' gestation. The patient's membranes were ruptured soon after and a macerated fetus and placenta were spontaneously expelled.

Hematometra will produce a very firm, tense enlargement of the uterus. The amenorrhea is out of all proportion to the size of the tumor. There is a history of menstrual molimina, with occasionally simultaneous spotting accompanied by the severest cramps. The introduction of the sound will show a stenosis of the cervix, complete or incomplete. Occasionally one succeeds in introducing the sound into the cavity of the uterus, relieving the obstruction and enabling the dark blood to escape. Where it is possible to wait two weeks, the diagnosis from pregnancy is facilitated.

Since the diagnosis of pregnancy does not involve the matter of immediate life or death, it ought to be possible to defer the final decision in questionable cases for at least two weeks. During that time, the changes are sufficiently noticeable to be detected by the examination. Sometimes the patient evinces the greatest uneasiness about her condition and is unwilling to await the interval. The impatience of one woman was rather humorously expressed in answer to her family physician upon his informing her that he would be able to tell her whether or not she was pregnant in a month's time. "By that time," she retorted, "I could tell you!" This was a case in which a gravida of some six weeks had severe abdominal pain and vomiting and I operated upon her for the relief of a twisted ovarian cyst complicating early pregnancy. The diagnosis was not as simple as this patient believed.

Yet it is uncanny how some patients will know when they are "caught." While the statement of the patient with regard to pregnancy must always be proved by the physical examination, in some cases the patient is absolutely right in her conjecture. It is as though she were able to establish the diagnosis by objective means. Such are women who take precautions against conception and become pregnant at will. There can be no doubt that fertility of a high degree exists among certain women and they are conscious of being pregnant with the greatest certainty. This is, however, exceptional. The majority of women suspect pregnancy at the slightest provocation and hold themselves guilty, so to speak, until the condition is disproved by further developments. The onset of the period, though delayed, is to them the surest or only sign of restored menstrual function.

ILLUSTRATIVE CASES

Right-sided Broad Ligamental Cyst in an Imbecile Girl; Hemorrhagic Cyst with Bladder Symptoms Erroneously Diagnosed Outside the Hospital as Pregnancy

R. F., fifteen years old, was admitted December 25, 1921. There was no history of mental disease in the family.

The menses of the patient had begun at fourteen years and had always been regular. The last menstrual period was forty days previous to examination. Her birth was normal. Teething, walking and speech occurred late. Between the ages of four and nine, she was at Randall's Island. The patient was in an ungraded class at public school at the time of examination and could not write. Her memory was extremely poor but she was good-natured and did ordinary housework. She had never had any other illness.

Three days previous to admittance, she began to have sticking pains in the lower abdomen, worse on the right side. She had been taken to a physician who diagnosed pregnancy. The next day she began to bleed. The period was ten days overdue. The bleeding and pain continued but there was no vomiting or rise in temperature.

Examination showed the vagina stretched and admitting a finger. There was slight bleeding from the cervix. The uterus was small and connected to it on the right side was a large, tense, thickly encapsulated cyst nearly reaching the umbilicus. The left side was free. A diagnosis of ovarian cyst was made.

Note.—In spite of the fact that the patient voided eight hours before, the bladder was still distended by 24 ounces of urine. Catheterism made the tumor more distinct. Dr. B. considered the cyst intraligamentous because of the bladder disturbance. The tumor evidently compromised and dislocated the bladder.

At laparotomy the bladder was found to occupy a higher position than normal. On the right side and occupying the broad ligament was a cyst the size of a large grapefruit.

Diagnosis: Large Parovarian Cyst Complicating Early Pregnancy, Abortion Followed

B. L., aged twenty-three years, was admitted December 22, 1919. She had been married two years and nine months and had one child two years old. At childbirth she had had a severe postpartum hemorrhage. Menses had begun at twelve years, regular and from five to six days in duration. The last period was due nine days before. Patient complained of pain in the right loin and right lower abdominal quadrant for one and a half years which increased on walking or fatigue. There was no vaginal discharge and no constipation. She had lost some weight in the past two years and had had influenza the year before without sequelae.

Examination showed a large cystic mass reaching the level of the uterus, which was retroposed but not distinctly mapped out.

At operation on December 23, the findings were: a large parovarian cyst the size of a basket ball with *left tube* stretched out over it and the left ovary occupied by a large *corpus luteum* (gravidarum). The uterus was as large as a gravid uterus of six to seven weeks' gestation. The tumor was removed, leaving the ovary *in situ*.

On December 26, the patient began to bleed. There soon followed abdominal cramps. She passed a clot of blood the size of a half dollar during micturition. On December 30, the vaginal discharge became serous.

COMMENT.—Was the abortion due to cutting off the blood supply to left ovary and corpus luteum in removing the parovarian cyst?

ABDOMINAL PREGNANCY SIMULATING RETROFLEXED GRAVID UTERUS

S. J., thirty-six years of age, was admitted to the hospital February 9, 1921. She had been married eleven years and had two children, ten and seven years of age. There was no difficulty at childbirth. The patient had a tumor removed from the right thigh three and one half months before at another hospital. Her menses came every twenty-six to twenty-eight days and were of one to three days' duration with no dysmenorrhea. There was no leukorrhea complained of. The last period was October 20. Patient complained of pains in the lower abdomen when overdue two weeks and a physician thought that the delayed menses may have followed her stay in the hospital. She had three attacks of severe pains in the lower abdomen and back. Three weeks later, another physician thought she was normally pregnant and that she would miscarry. There was no staining. Three days before admission, the patient was seized with severe abdominal cramps during the night which she did not think were normal for pregnancy. A staff physician of experience believed the patient had a retroflexed gravid uterus of the size of a three months' gestation.

February 11, a manual restoration of a supposedly incarcerated pregnant uterus was attempted under anesthesia and the uterus was reposed and was supposed to be held in normal position by a Thomas pessary. Three days later, the abdomen became markedly distended and the patient complained of severe cramps. She then passed some blood-clots and a piece of membrane (three and one half by one and one half inches).

On February 15, an anterior hysterotomy was done with the view of emptying the uterus. To the operator's surprise, the uterine cavity was free and it was then first realized that the gravidity was extra-uterine. The findings at the laparotomy were: The peritoneal cavity contained many large blood-clots, the uterus was small and firm and the right tube was markedly distended, fibrous and laid open as if by rupture. A six-inch fetus lay free in the abdominal cavity with placental attachments to the neighboring intestinal and omental structures. The ovaries were not seen as distinct structures but only as fibrocystic nodules.

Ectopic vs. Retroflexed Gravid Uterus (Aborting); Prolonged Menstruation Complicated by Fibroid Growth

A. R., aged thirty years, was admitted March 27, 1920. She had been married three and a half years and had two children, the younger being six months. There had been no miscarriages. Menses had begun at fifteen years, every thirty days of six days' duration with moderate flow. There had been lactation amenorrhea of four months followed by two normal periods (Fig. 50). Since the last regular menses two and a half weeks before, she had been bleeding and also complained of severe pains in the back and left lower quadrant. Patient had no fever but poor appetite and vomited a week previous to entrance during a severe attack of pain. The urination was burning and painful at times. Vaginal examination showed the uterus markedly retroverted, drawn somewhat to the left with some thickening of the tissues in the left fornix; the adnexa were not palpable.

On March 28, uterus was found enlarged about 100 per cent, in masked retroflexion, its body rather tender and to the left of the median line. The sound passed in a backward direction for three inches. The tentative diagnosis was retroflexed uterus with fibroid growth complicated by an incomplete or inevitable abortion. Examination showed the uterus to the right about normal in size, forward, distinctly separate from the mass on the left side which was globular, tense, semifluctuating, tender, somewhat fixed and the size of an orange.

Pre-operative diagnosis was left-sided ectopic pregnancy with hematocele. Points in differential diagnosis were: (1) prolonged menstrual phase with severe pains on the left side and vomiting; (2) urinary difficulty; (3) mass to one side of the uterus (here the physical examination was important, clearly demonstrating the inadequate experience of the hospital internes all of whom interpreted the condition as one of retroflexed or retroverted uterus); (4) patient held herself rigid which was suggestive of some peritoneal irritation.

At operation on March 29, a tubal abortion and partial tubal rupture were found. The ovum extruded from the fimbria of the left tube in a blood-clot the size of a small orange. There was about a pint of blood in the abdomen. The ovaries were normal.
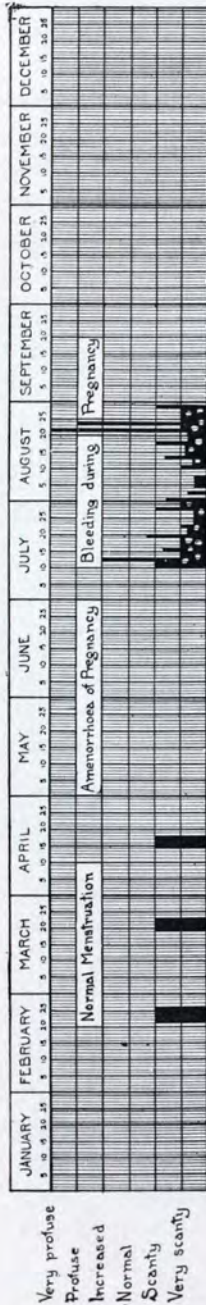
Fig. 50.—Bleeding During Pregnancy.

Diagnosis of Advancing Pregnancy and Death of the Fetus.—In the second half of pregnancy, when fetal motions are no longer experienced

by the patient, death of the fetus must be suspected. If this continues for several days, the diagnosis is more probable. If no quickening is felt for a week or more and no heart sounds are heard by the examiner and fetal motions cannot be evoked, the diagnosis is reasonably certain. The nearer the full term of pregnancy, the more important is the patient's statement concerning the cessation of fetal movements. At this stage, it is possible to make a definite statement as to the fetal heart sounds and fetal movements. In obese women no such absolute importance may be attached to these findings because of the thickness of the abdominal wall. In this condition, the motions of the fetus are transmitted more feebly, so feebly indeed that they evoke no reflex sensation of which the patient becomes conscious. Troubled by the absence of palpable fetal activity, the prospective mother may be in a state of constant anxiety till the actual birth of the child. The same applies to cases of hydramnion. The cessations of fetal activity for a day or two is noticed by the average pregnant woman at some time during her advanced gestation and is not to be taken as evidence of fetal death.

In the earlier weeks of the second half of pregnancy, when the subjective sign positive of fetal life ceases to be manifest, one has to content oneself with waiting several weeks to see whether the increase of girth or the rise of the fundus takes place. If the uterus shows no evidence of growth during a period of from three to four weeks, one may definitely conclude that the fetus is dead. Careful notation of the size of the uterus must, of course, be made. The tape measure and the calipers are helpful.

In the earlier stage of pregnancy, one can determine this fact only by comparing the findings from time to time over a period of from two to four weeks. During this interval of observation, should an actual reduction in the size of the uterus—such as that occasioned by absorption of the liquor amnii, perhaps mummification of the fetus and involution of the uterus—be found, the diagnosis can be made with certainty. It is only in cases where there is a discrepancy between the duration of the amenorrhea and the size of the uterus for the corresponding period of gestation that one will have to withhold the diagnosis. For pregnancy can ensue during lactation when the stage of its advancement may be gauged by the size of the uterus as compared with one's experience of what such size in normal cases would indicate. Or in an individual who is habitually amenorrhoic, the periods may have been absent for six months while the uterus is the size of a three months' gravidity. In such a case, one has to make further observations over a period of at least one month before deciding upon the question of progress in growth. This matter is of importance in prognosticating the onset of labor or the term of pregnancy. Without going into the importance of knowing how far advanced the pregnancy is, it is of advantage, both to the patient as well as the obstetrician, to know when the delivery may be expected.

Normal Advance of Pregnancy Determined by Palpation.—It is well in this connection to have some notion as to the average findings in apparently normal cases of pregnancy in order to be able to express an authoritative opinion in any give case of doubt.

Bleeding During Pregnancy.—Bleeding in the early weeks of pregnancy is due to some associated accidental condition, to some trauma to the ovum or its adnexa. Of the accidental or incidental causes, small cervical polypi, papillary or simple erosions, ulcerations of the vaginal portio or of the vagina or vulva may be mentioned. More rarely carcinoma of the cervix or vagina may cause the bleeding. Examination with the speculum readily determines the presence and nature of these causes. In the absence of such lesions, the cause must be sought in the uterine cavity. Any cause that increases pelvic congestion, such as trauma or inflammation, will cause intra-uterine bleeding, for example, extravasation of the blood in the decidua, ovum, placental or retroplacental septa. The ovum either dies at once or is expelled by the contraction of the uterus which the sudden increase in tension incites, the ovum acting as a foreign body. A not uncommon cause of bleeding and habitual abortion is a submucous myoma. This acts probably by mechanical interference with the expanding ovum in addition to the hyperemia and bleeding which it produces. Excessive coitus in some cases and moderate coitus in others, particularly in recently married women, are frequent causes of habitual abortion. The explanation of its mechanism has been given in describing habitual abortion.

Endometritis as a cause of hemorrhage during pregnancy is no longer to be considered as being of serious moment. Formerly this was regarded as the most common cause of protracted bleeding (Winter). This teaching is not accepted to-day for two reasons: first, our conception of endometritis has changed. It has been established chiefly through the work of Hitschmann and Adler that endometritis is a very uncommon occurrence. The cyclical changes that the uterine mucosa undergoes were confounded with inflammatory lesions. It is also more likely that, in the presence of a real endometritis, pregnancy will not take place. A deciduitis, however, is not unknown and may be based upon an occasional endometritis or may be due to hematogenous infection.

Perhaps a cause, more common than has been supposed, of hemorrhage during early pregnancy is placenta previa. While this condition cannot be substantiated in the early months because of the closure of the cervix, I have followed several such cases to term where the placenta previa was demonstrated. When the cervix is open, as in the latter part of pregnancy or at the onset of labor, the diagnosis is easy. The bleeding at this late stage of labor is most often spontaneous and sometimes traumatic; in the early months, the bleeding is probably mostly traumatic, coitus playing an important part.

Diagnosis of Abortion.—When it is known that the patient is pregnant, the diagnosis of abortion is not difficult. There are times when the patient is unaware of that fact and the physician is obliged to translate his findings as if he were armed with a proper history. When patients who have been sterile for a long time and who perhaps are near the menopause begin to spot or have a brownish granular discharge with cramps which may be noticed for the first time, are we dealing with a delayed menstruation, with a beginning menopause or with an abortion? The statement of the patient is of little or no help. Bimanual examination may serve to establish

the status.   In the first two months of pregnancy it is not always possible to do this, for the uterus may not be appreciably enlarged; the cervix may not be sufficiently open to permit an exploration.   It is best to treat the patient as a threatened abortion till further developments.   Should bleeding persist with the passage of clots and some cramps of an intermittent character, suspicion of an abortion may be entertained.   In such cases, however, the curet and the microscope render the diagnosis.   In the typical case, spotting begins to be followed by more profuse bleeding, the external os becomes patulous, and in the third month it may admit the finger beyond the internal os.   Intermittent contractions of the uterus may be elicited which correspond to the subjective symptoms of cramps; the size of the uterus, moreover, corresponds to the month of pregnancy according to the number of menstrual periods overdue.   When this condition obtains, abortion is *inevitable*.   A complete abortion is to be recognized by the total expulsion of the products of conception, whether they are intact or not.   Ocular evidence by the physician is far better than the report of the patient, for she cannot be expected to recognize embryonic parts.   That an abortion has taken place may be accepted on the statement of the patient herself when she definitely says that she saw a fetus, but the completeness or incompleteness of the abortion can best be determined by physical examination.   If the uterus feels contracted, the cervix more or less closed, no irregular consistency palpable in the body of the uterus and the bleeding practically or totally stopped, one may say the abortion is complete.   But when the uterus remains large, perhaps boggy, a condition which is very apt to exist in the third or fourth month, whether or not fetal fragments or ovular parts are palpable, and in the presence of more or less active bleeding, the case should be regarded as one of incomplete abortion.

In a great many cases, this fact can be established through a curettage.

A polypoid protrusion through a dilated cervix may consist of an adherent ovular portion, but a degenerated pedunculated submucous myoma may present the same clinical picture.   The concomitant signs of pregnancy are to be considered, but in the atypical cases the microscopic examination establishes the diagnosis.

In considering cases of relative sterility in which the history records one or several abortions, while the palpatory findings point to an undeveloped uterus which in all probability never was the site of pregnancy, one desires reliable data on the matter of the abortions.   Patients should be instructed to save the bloody discharges whenever they are irregular, so that they may be subjected to proper anatomical and histological study.   The importance of this measure can be realized only when one is dealing with those tragic cases of sterility with a history of one interrupted pregnancy, the "abortion" having been induced or said to have been spontaneous.   For while the uterus may shrink through lactation atrophy, it is not probable that a small undeveloped uterus could have ensued after one or two curettages or one or two abortions which were unoperated.

DIAGNOSIS OF EXTRA-UTERINE PREGNANCY

The diagnosis depends upon the same factors no matter where the implantation has taken place in the tube. The same holds true for ovarian pregnancy and that situated in a rudimentary horn of the uterus. The one exception, perhaps, is the extremely rare occurrence of cervical implantation of the ovum of which less than a dozen cases have been observed. In the latter, the symptoms are rather those of a placenta praevia totalis. In the case reported by the author, the clinical history was a typical one of a ruptured extra-uterine pregnancy occuring in the fourth month of gestation.

The vast majority of extra-uterine pregnancies are terminated in the first half of the pregnancy period; the greatest number before the third month. Very rarely the pregnancy advances to the point where fetal parts may be demonstrated by physical examination. Of these, quite a few have been recorded as advancing to full term or beyond, and there is a creditable series of live children of extra-uterine origin delivered by abdominal section (Cragin, etc.).

The cases may be divided into: (1) the early terminated without very troublesome symptoms; (2) the early undisturbed cases in which pregnancy still progresses; (3) the interrupted pregnancy cases with or without tragic phenomena; (4) the cases that proceed to the second half of pregnancy and full term or beyond.

Of all these varieties, the interrupted type associated with tragic symptoms (internal hemorrhage) is probably the most easily recognized. The advancing ectopic pregnancy may be recognized without much difficulty if one is on the lookout for the possibility of its occurrence. The uninterrupted ectopic pregnancy and the early terminated ectopic pregnancy are the most difficult to recognize.

It is well to emphasize that a number of ectopic ova may be blighted at such an early stage of their development as to give rise to no, or very slight, symptoms, so slight indeed as scarcely to be noticed by the patient. There is no reason to suppose that this may not occur at least as frequently as intra-uterine pregnancy. In the case of ectopic pregnancy under favorable circumstances, there may not be any irregularity in the period or any pain present. The next period in order appears with no, or very slight, change and the patient may state that this time she bled perhaps less than usual and she is apt to ascribe strange causes. A great many of the irregularities in bleeding in the young married woman may be traced to the spontaneous regression of an ectopic ovum at a very tender stage of its evolution. (The explanation for this will be taken up later.) It goes without saying that a diagnosis of this condition is at best merely conjectural. Occasionally we encounter it as an accidental finding at laparotomy when there was not even a clinical suspicion of its presence. Such observations are naturally very scarce, but it may not be far-fetched to assume that a young tubal ovum may be impeded in its further development by hemorrhage just sufficient to destroy it without perforating the tubal wall or inundating the peritoneal cavity. Of such character were the following two cases.

In these two exceedingly early cases of ectopic gravidity in my experience, the diagnosis was made upon the history combined with wrong physical findings. The enlarged ovary containing a corpus luteum in each of these two cases was mistaken for the supposedly dilated tube.

The first case [1] was that of a recently married woman whose last menstrual period was skipped and who six days later began to spot. Pain in the right side of the lower abdomen accompanied the scanty bleeding. On examination, an enlargement was palpable to the right of the uterus and this was exceedingly sensitive. At the laparotomy, undertaken for ectopic pregnancy, a small amount of tinged fluid was seen in the pelvis. The right and the left tube both appeared normal. The right ovary was enlarged to about twice its normal size and contained a hemorrhagic corpus luteum. Indeed, in view of the history which was suggestive of an ectopic pregnancy and the negative appearance of the tubes, the ovary was removed by the surgeon and the tube was allowed to remain *in situ*, for he believed he was dealing with an ovarian pregnancy. At my request, he removed the tube, but only its outer two thirds. I suggested that, in order to prove an ovarian pregnancy, it would be necessary to exclude the presence of a tubal pregnancy. The tube
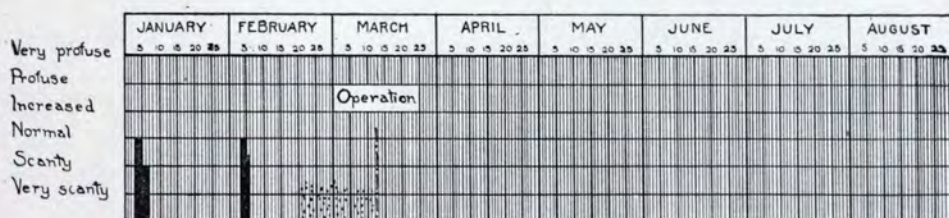
FIG. 51.—OCCASIONAL ECTOPIC. No skipped period.

appeared to be so normal that the operator removed the uterine end of it with reluctance. This proved, however, to be the portion that contained the molar pregnancy, forming a nodule no bigger than a pea and making no change in the normal contour or dimension of the isthmic portion of the tube. I felt it between my fingers as a nodular thickening and on microscopical section it turned out to be an exceedingly young tubal pregnancy.

The second case was a young woman of twenty-three who had been married ten months. She had always been regular in her menses. Her last regular period was November 26, 1917, of four days' duration as usual. December 15 she began to bleed again and spotted on and off for twelve days, when I saw her (Fig. 51). She was obliged to go to bed for one week because of pain on the right side of the abdomen, but she had often complained of right-sided pain before her marriage. The uterus appeared slightly enlarged and sharply anteflexed. The right adnexa were somewhat enlarged and tender. The left adnexa appeared normal to palpation. The patient appeared pale and anemic. An exploratory laparotomy was decided upon for suspected early ectopic pregnancy and for purposes of examining the appendix. A pre-

[1] Case published by Dr. S. W. Bandler, *American Journal of Obstetrics and Gynecology,* 1912, and by the writer in the *Bulletin of the New York Pathological Society* the same year.

liminary curettage resulted in the removal of small shreds of apparently normal endometrium. The pelvic organs were found to be bathed by a small amount of tinged fluid. The right ovary was enlarged and prolapsed; it contained a corpus luteum of pregnancy. The tube on close inspection showed a small nodular swelling at about its middle portion and felt thickened at that point (Fig. 52). It was removed and on section showed a very young tubal pregnancy. The appendix, which was also removed, contained a hard coprolith of the size of a date stone. It is interesting to note that the family physician would have been content with a curettage, and consented to the laparotomy because of the long-standing history of pain which was very suggestive of chronic appendicitis. The diagnosis of suspected ectopic was in this case based upon the spotting (functional disturbance) and the erroneous palpation of an enlarged ovary for a swollen tube. It is evident at once that the tubular swelling as actually found could not have been palpated by bimanual examination.

FIG. 52. — EXCEEDINGLY EARLY TUBAL PREGNANCY WITH NO AMENORRHEA. Condition suspected because of irregular intermenstrual. The enlargement caused by this very young tubal mole is too slight to permit of its palpation by abdominal vaginal examination. The ovary in this case was adherent and slightly enlarged and was mistaken for the pregnant tube. The appendix removed from the same patient is here shown for comparison as to the relative sizes.

If ectopic pregnancy was suspected in each of these cases, the diagnosis was made upon the wrong physical finding and was based entirely upon the clinical history. It is impossible to palpate a slight thickening of the tube with any reliability. In the first case, the tube swelling was not even apparent to the eye, so that were it not for the fact that I deemed it necessary absolutely to exclude tubal pregnancy in order to establish the fact of an ovarian pregnancy, it would have been left *in situ*. But it is quite obvious from the microscopic appearance that pregnancy was terminated. In the second case, we were dealing with an ectopic ovum so small that it was suggested by onlookers that perhaps it was the ovum unimpregnated caught on its way from the ovary to the uterus.

Early ectopic pregnancy before rupture will most often be diagnosed in the course of an examination to determine pregnancy (Fig. 53). The symptoms are not different from those of normal pregnancy. The proper diagnosis of the ectopic nature of the pregnancy is perhaps seldom made because most women fear examination in the early months of pregnancy, preferring to wait till the third or fourth month of amenorrhea. During this time, most ectopics

have been interrupted and have given rise to symptoms pointing to an abnormal progress of pregnancy. There are two groups of women in whom the uninterrupted ectopic pregnancy may be diagnosed: (1) those desirous of being pregnant and, in their great anxiety to know the fact, come for an examination very shortly after skipping a period; (2) those who consult the physician from quite a different motive. They feel quite certain they are pregnant and hope to terminate it through the examination, if interference is not actually solicited.

The symptoms in such instances are those of normal pregnancy. The bimanual examination reveals the presence of a mass lateral to the uterus; the latter is not appreciably enlarged and, by watching the progress, the lateral mass is observed to become larger and perhaps tender, while the uterus fails to increase in size. If laparotomy is performed, the ectopic pregnancy is established. If the operation is deferred for a sufficiently long time, say two or three weeks, there may ensue one or several of the symptoms which usually attend a disturbed ectopic pregnancy. There may be the passage of a decidual cast with or without slight bleeding or cramps. Increase in size of the mass is most significant because, in the absence of fever, there is nothing that can cause such rapid increase in volume as hemorrhage; and hemorrhage
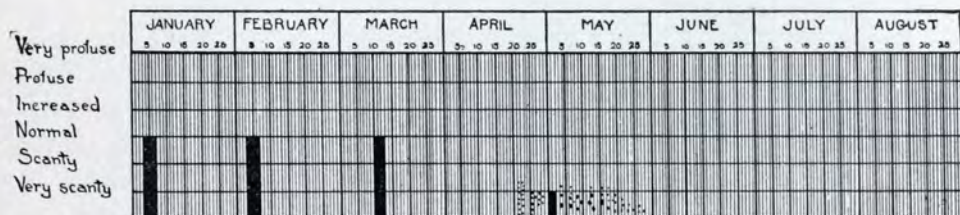
FIG. 53.—TYPICAL ECTOPIC PREGNANCY (UNCOMPLICATED) DELAYED PERIOD.

in this case means ectopic pregnancy in the vast majority of cases. There is no tumor that can increase in size several fold in one or two or three days unless a hemorrhage within it occurs. The only tumor that may be confused with ectopic gestation is a twisted ovarian tumor; this makes a definite mass and need not be associated with antecedent amenorrhea, while in hemorrhage from ectopic gestation the hematocele gives different physical findings and menstrual disturbances. In addition, a twisted ovarian tumor frequently gives pain referred down the thigh, while in ectopic pregnancy this is not nearly so common.

The interrupted ectopic pregnancy (Fig. 54) while the easiest of all to recognize, can nevertheless be simulated by a number of conditions which require careful differentiation. The typical characteristic history and physical findings have already been referred to. When the complete symptom complex is present, the condition is unmistakable. In cases with intro-abdominal hemorrhage of a graafian follicle or corpus luteum, no differentiation is possible; but, as the operative indication is the same, no harm can be done to the patient. Bleeding in the abdomen from a perforated gastric ulcer or intestine naturally can simulate that of tubal rupture or abortion. The history in such case is of far greater differential value than the physical examination, because, aside from the escape of blood into the free peritoneal cavity, nothing abnormal is

palpable in the pelvis. The writer recalls several instances of ruptured ectopic pregnancy of the third or fourth month of gestation where vaginal examination was practically negative; because of this fact a lesion in the upper abdomen was suspected. It was found at operation that the fetus was in the free abdominal cavity high up and floating in blood. The tube itself was torn away and its uterine portion not sufficiently thickened to be elicited by vaginal touch. In this connection, it may be well to bear in mind that, as a rule, peritonitis accompanies perforating lesions of the gastro-intestinal or biliary tract, while hemorrhage from a ruptured ectopic pregnancy is apt to give rise merely to a mild peritoneal irritation. Very unusually a peritonitis associates a ruptured ectopic in cases where there is a more or less simultaneous suppuration of the ruptured tube, when the spilled blood disseminates the infection in the general peritoneal cavity. It is my impression that the occasional fatal case of ruptured ectopic pregnancy, the case that does not respond favorably to
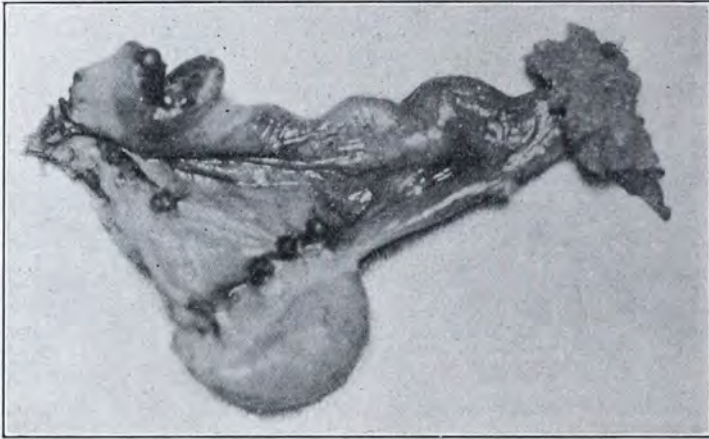
FIG. 54.—SMALL ISTHMICAL PREGNANCY. Mole as large as a lima bean. L. G. Age 26; married 3 years; one child 2 years old; menses delayed ten days; patient in collapse; abdomen filled with blood; adnexa not palpable. Diagnosis. Ruptured ectopic pregnancy.

early operative intervention, is probably one in which a virulent organism is carried to fresh portions of the peritoneal cavity and causes death. Fortunately this occurs only in one half or one per cent of all cases.

Not infrequently the blood collects in the culdesac, where it becomes clotted and encapsulated by a fine membrane to which intestines, omentum, etc., become lightly adherent. Inflammation alters the picture. The differential diagnosis of the retro-uterine hematocele from a retroflexed gravid uterus is perhaps most important, for if attempts are made to correct the supposedly wrong position of the uterus, rupture of the hematocele may occur. The differentiation from tumors will be described later.

The diagnosis of extra-uterine pregnancy in the second half of pregnancy has the same general features as normal pregnancy. There are, however, these differences. There is a history of irregular bleeding in the course of the pregnancy. Unwarranted and prolonged bleeding follows upon one or several attacks of abdominal colic. The uterus is made out distinct from the pregnant sac and is not proportionately enlarged. The fetal parts are very easily pal-

pable; distinct parts are readily felt. Where fetal motion is present, it is more violent and attended with pain. Fetal death is suggested by the disappearance of fetal motion, absent fetal heart sounds and puerperal changes in the uterus, while the other subjective and objective signs of pregnancy also regress. The X-ray is a rather valuable aid in diagnosis. The only kind of pregnancy which will always cause difficulty in diagnosis is the one in which the pregnancy lodges in the broad ligament. In cases where there has been irregular prolonged bleeding and when there is good reason to believe the fetus to be dead, there can be no objection to the use of the intra-uterine sound for diagnostic purposes. In the rare cases of calcification, lithopedion results and most often is undiagnosed. Very rarely, following suppuration and adhesions to hollow viscera, fetal parts, as portions of bone, will be discharged through bowel, bladder, navel or the abdominal wall.

ILLUSTRATIVE CASES

Right-sided Salpingitis with Blood-clots in the Pelvis and Old Blood in the Right Tube (Hematosalpinx)—Pre-operative Diagnosis Ectopic Suspect

T. S., aged thirty-six years, was admitted January 7, 1920. She had been married fifteen years and had had two children, the younger eleven years. She had had one miscarriage eight years before, scarlet fever sometime during childhood and diphtheria at three years. Her menses had begun at fifteen and one half years, every twenty-eight to thirty days; the last period, November 13, 1919. She had skipped the normal December period and thought she was pregnant. Since December 29 she had been spotting and discharged some very dark looking blood. She had pain in the back at the onset with occasional abdominal pain which had since become generalized. There had been no frequency of urination. Patient complained of very slight discharge between her periods.

In the Out-patient Department, an examination showed a fixed, globular mass in the right fornix which was tender. Diagnosis of ectopic vs. corpus luteum cyst and diseased adnexa was made.

Examination in the hospital showed the uterus retroverted to the third degree with no appreciable enlargement of the left adnexa. There was tenderness in the right fornix high up and the adnexa were not distinctly outlined. The tentative *diagnosis was diseased adnexa*. The mass evidently had ruptured while the patient was in the ward, because it had been distinctly palpated at the time of her hospital admission.

At the operation by postvaginal section, a few old blood-clots were released. At the laparotomy, the left tube was found normal and the right tube thickened, congested and adherent posteriorly. The pathological report was chronic salpingitis and appendicitis.

COMMENT.—The specimen showed the tube thickened at the fimbriated end and an old hemorrhagic area which was covered with adhesions. There was no evidence of an ectopic. Was this originally an ectopic? Could blood-clots have shown evidence of chorionic elements? Inasmuch as the ovaries

were small and contained no corpus luteum, it may be assumed that a recent pregnancy was not present and that the abnormal bleeding was due to inflammatory disease..

ECTOPIC; FAINTING VS. PROFUSE BLEEDING

C. R., thirty-four years of age, was admitted June 15, 1919. Her menses began at sixteen years and were regular every three weeks. She had been married nine years and had had two children, the younger being twenty-one months. The last period was April 15, which was two months before her admission. May 17, she began to bleed, at first profusely and then moderately, continuing for three weeks. The bleeding stopped one week before her admission to the hospital. Cramps and pain in the right lower quadrant, associated with the onset of the bleeding, continued till the date of admission. She fainted several times the week before.

Examination showed the uterus slightly enlarged and an indefinite mass on the right side. Under anesthesia, a definite mass adherent in the right side could be made out, with adhesions and fixation. The diagnosis of ectopic with diseased adnexa was made.

At laparotomy, there was found a dissecting ectopic with tubal rupture, blood-clots, a small corpus luteum cyst and adhesions. The tube and ovary were embedded in adhesions. The appendix and left adnexa were normal.

COMMENT.—In spite of the profuse bleeding which ordinarily speaks against an ectopic, the diagnosis of ectopic was the logical one because of the definite history of fainting attacks. The profuse bleeding was due to the associated inflammatory process.

RIGHT-SIDED ECTOPIC AND LEFT-SIDED CORPUS LUTEUM CYST

B. K., aged thirty years, was admitted December 1, 1920. She had been married ten years and had had one child which died three years before, at the age of six years. There were two miscarriages following the birth of this baby. The patient had a curettage three years before and "gas poisoning" also three years before. Her menses had begun at seventeen years, occurring every twenty-eight days and of from five to six days' duration. The last period was about nine weeks prior to the date of her admission. Three weeks after the last period, she began to spot on and off for three weeks, which was then followed by a profuse flow for five days. Then for two days there was no bleeding. Six weeks after the last period, the patient complained of severe cramps and passed shreds of tissue which "resembled skin." There had been severe pains in the right side since then; pain in the breasts four weeks before.

Examination revealed a firm introitus, slight bleeding, tenderness in both fornices, bulging in the right side and a freely movable mass like that of an enlarged tube in the left side.

On December 2, examination showed the uterus small, not appreciably enlarged; high up on the right side there was a little resistance as if the tube were slightly thickened. The left adnexa were prolapsed and thickened. The pre-operative diagnosis was suspected ectopic gestation on the right side.

Another examiner found fullness and tenderness on the left side and suspected ectopic gestation on that side. Still another examiner found a cystic adherent mass on the left side, and tenderness and thickened tube on the right side, too high up and too rigid an abdominal wall to permit of distinct palpation. He made the diagnosis of a right-sided ectopic and left-sided corpus luteum cyst with inflammatory reaction because of (1) severe pain on the right side; (2) the passage of the decidua at six weeks after the last menstrual period; (3) the continued spotting of the corpus luteum cyst palpable on the left side.

NOTE.—But there was a corpus luteum cyst palpable on the left side as well.

The pathological findings at laparotomy were: two ounces of free blood in the lower pelvis; the left tube inflamed and distended, the left ovary cystic and enlarged to the size of a lemon, containing a corpus luteum or inflammatory cyst. There were peritoneal adhesions in the posterior culdesac, omental adhesions to the pelvic viscera and the right tube distended and containing a shimmering blue nodule the size of a lima bean. The right ovary had a hemorrhagic and cystic corpus luteum. The appendix was distended and covered by an inflamed peritoneal coat.

RIGHT-SIDED ECTOPIC WITH RUPTURED CORPUS LUTEUM CYST AND ADHESIONS. DIFFERENTIAL DIAGNOSIS: PELVIC ABSCESS WITH PREGNANCY AND TWISTED CYST

R. G., thirty-two years of age, was admitted February 14, 1921. She had been married eight years and had two children living, seven and three years old. The labors were not difficult. There were two induced miscarriages two and six years ago, followed by curettages. Her menses began at fourteen years, were irregular at intervals of twenty-one to twenty-four days and lasted six to seven days with marked dysmenorrhea. There had been no leukorrhea and the patient remembered no sickness of childhood or adult life. She had suffered *pain in the right lower quadrant since the second induced abortion two years ago.* This pain seems to be brought on by indiscretion in diet. The patient feels better when she eats simple food. Her bowels are constipated; there is no urinary disturbance. For the past three days, she has complained of severe cramps in the lower abdomen. She has had three attacks similar to the present one. The last menstrual period was November 5 and on November 27 she began to spot. This lasted five days. Two days later bleeding began which lasted two days; the breasts were painful and tender. Vomiting at this time made her believe she was pregnant. On January 15, the patient began to bleed profusely for four days, then spotted for three days and again on February 1 and 2 there was mild bleeding.

Physical examination showed the abdomen distended, tympanitic with tenderness in the pelvic region and rebound tenderness in the epigastrium and right subcostal region. Vaginal examination: The introitus admits two fingers, the cervix is lacerated and slightly patulous, the uterus is in complete retroversion with the cervix near the symphysis and pointing toward it. On the left side of the uterus, there is a tortuous-shaped mass which is quite

tender and elastic. The tentative diagnoses were: (1) pelvic abscess with pregnancy; (2) twisted pedicle cyst; and (3) intraligamentary cyst or ectopic.

Owing to rigidity of the abdomen, it was decided to examine the patient under anesthesia. Then the mass on the right side was made out more distinctly; there was fullness and bogginess in the pouch of Douglas and thickening in the left side of the pelvis. The preoperative diagnosis was therefore changed to ruptured right-sided ectopic pregnancy.

At the operation, the peritoneum showed the shimmer of blood before the incision was made; the pelvis was full of blood-clots and free blood; the right tube was the size of a lemon, adherent deep down in the pelvis to the posterior leaf of the broad ligament. The left ovary was found to be the seat of a ruptured and collapsed corpus luteum cyst.

COMMENT.—Here again the profuseness of the bleeding, the fixation of the mass in the right side and the thickening on the left side all indicated a complicated ectopic pregnancy.

LEFT TUBAL PREGNANCY; OBSERVED FOR URETERAL CALCULI AND IN WHICH
NOTHING WAS PALPABLE EXCEPT RUPTURED CORPUS LUTEUM CYST;
PALPATED BY HOUSE SURGEON ON ADMISSION; POSTVAGINAL
SECTION FOR DIAGNOSIS

B. S., aged twenty-five years, was admitted October 11, 1920. She had been married two years and had one child fifteen months old. No difficult labor was experienced. Her menses began at thirteen years, regular every twenty-eight days, lasting from three to five days. There was no dysmenorrhea or menorrhagia. The last period was September 14, continuing till the time of admission—three and a half weeks. The first few days there was a profuse flow associated with *severe pains in the right lower quadrant*. These were never present before and had not occurred again till her admission to the hospital. There had been only spotting the last two weeks and the *patient felt weak and faint*. There had been no vomiting and no sharp pain since the onset. The bowels are regular and there are no other symptoms.

Vaginal examination by the interne showed an oval, cystic and extremely tender body rather high up in the *right adnexal region*. It was freely movable. The *left adnexa were not felt*. The diagnosis was ectopic and endocervicitis.

October 12, another examination found the uterus forward, rather small, the left adnexa prolapsed and not enlarged or tender. On the right side high up, there was a small body not much larger than the ovary and somewhat tender. There was some mucous discharge from the cervix. The blood count showed 3,500,000 red blood corpuscles, 85 per cent hemaglobin, 12,600 white blood corpuscles, 35 per cent polynuclears and 65 per cent lymphocytes.

October 15 bleeding began again, it being almost the regular date for her period, and the patient complained of severe sticking pains in the lower abdomen. On account of the scanty physical findings, an X-ray examination of the genito-urinary tract was made which failed to show any concretions in either tract or in the bladder. Both kidney shadows were normal. The urine examination was negative.

NOTE.—The pallor of lips and face was due to *vasoconstriction*.

A postvaginal section was made and about 30 ounces of old, dark blood were obtained. At laparotomy the right ovary was found large and covered at one point with a yellow clot. The same was found on the left ovary which was *collapsed*. There was an ectopic gestation in the left tube.

RECURRENT ECTOPIC

M. L., aged thirty years, was admitted March 10, 1920, and discharged March 25. She was readmitted October 4, 1920, and discharged October 25. The patient had been married twice. She had lived with the first husband one year and was then divorced. Eight years ago she had one induced abortion at three months and was ill for three weeks. Her periods began at fifteen years, every twenty-eight days of from five to six days' duration with no pains. The patient had no children. She had typhoid fever seven years before.

With the first attack, her history was as follows: The last period was late in December and then she spotted at monthly intervals. There was some pain for five days before her admission which became severer each day and one day before there was a blood-tinged discharge. Micturition was very painful and there was nocturnal frequency. Physical examination showed a mass the size of a lemon in the left fornix, very tender and firm. The diagnosis of ectopic was made.

The finding at operation was an elongated bluish tumor the size of a lemon at the middle third of the left tube. There was no rupture and a fetus 1½ cm. long was found present.

With the second attack, the history was as follows: The patient had been well for four months. Her periods had been regular, lasting six days during which time she worked very hard. Eight weeks before, when the period was due, the patient had severe sticking pain on the right side and slight oozing of dark blood for one day. Then she spotted for six weeks with several attacks of severe pain similar to that of the onset. Bleeding stopped for one week and started again three days before her hospital admission, with oozing and severe pain which was repeated on the day of admission. The diagnosis of ectopic was again made. Vaginal examination showed a firm mass on the right side of the culdesac reaching the level of the umbilicus and very tender. The diagnosis was ruptured ectopic.

At operation the findings were: a fetus three months old, free and clotted blood; placenta implanted at the fundus and against the pelvic parietes and wrapped about by the omentum. The amniotic sac ruptured during the manipulation and the fetus was liberated. The tissues were very friable and bleeding, and counter-drainage was done.

TUBAL GESTATION

R. S., aged thirty years, was admitted January 21, 1921. She had been married eight years and had had two children, the younger five years of age. There had been no miscarriages. Her menses began at sixteen years, regular

every twenty-nine days, lasting four days. There had been no dysmenorrhea or leukorrhea. The last period was November 17, 1920, and the next period was due December 16 but came on December 26, being ten days late. It was normal in duration and character. There was an interval of a week when she began to bleed again, more profusely and lasting two weeks till the time of her admission. During this time there was a severe cramplike pain in the lower abdomen slightly more marked on the left side. There were no other symptoms.

On vaginal examination, the introitus admitted two fingers; the cervix was normal; and in the right fornix there was a large mass the size of an orange, tender, bulging into the fornix and slightly movable. There was also a cystic, slightly tender mass on the left side.

The operative findings were a small amount of free blood in the right side of the pelvis; the right tube doubled on itself, held down by adhesions and distended by dark red fluid blood and dark clotted blood. The left ovary was cystic, containing thick mucoid material. The pathological diagnosis was tubal gestation.

COMMENT.—Here again the profuse flow was accounted for by complicating adhesions.

INFECTED RUPTURED ECTOPIC

E. McC., aged thirty-three years, was admitted October 9, 1920. Her menses began at fourteen years, had been regular, four to five days' duration with no pain. There had been no leukorrhea. The patient had one child sixteen years old, living and well; one pair of twins born dead due to prematurity. There had been two spontaneous miscarriages. The last period, due September 10, had been delayed ten days, when bleeding had begun but was accompanied by severe pain in the right lower quadrant. The patient had had occasional severe pain before this in her right lower quadrant and had been suspected of having a chronic appendicitis. One week before admittance, the pain had been severe and "cutting" so that she had been forced to go to bed. She was bleeding the day of admittance. There had been no chills or fever.

Vaginal examination showed a tubular tortuous mass deep down in the right fornix extending partly toward the culdesac. Overlying this there was a firm ovoid mass, movable as compared to the tubular mass, which was adherent but contained flaccid walls. The left adnexa were not palpable. The diagnosis was inflammatory disease of adnexa plus ruptured ectopic.

Points in Diagnosis.—(1) The patient admitted later that she interfered with herself by passing slippery elm into the uterus shortly after the period was due; (2) she began to bleed with severe pain which was unusual for her; (3) the temperature, however, was but slightly elevated; (4) the pain was intermittent (unusual for an acute infection of the adnexa); (5) the adherent tube spoke for an old inflammatory process.

The findings at operation were as follows (Fig. 55): Stale blood was obtained on postvaginal section, but no great amount. At laparotomy the general abdominal cavity was practically free. In the pelvis, on the right side,

there was a mass the size of a half fist with fleshy mole partly aborted. In separating it from adhesions, the tube tore longitudinally, liberating the mole. The ovary was edematous, containing a few surface and deeper lying cysts
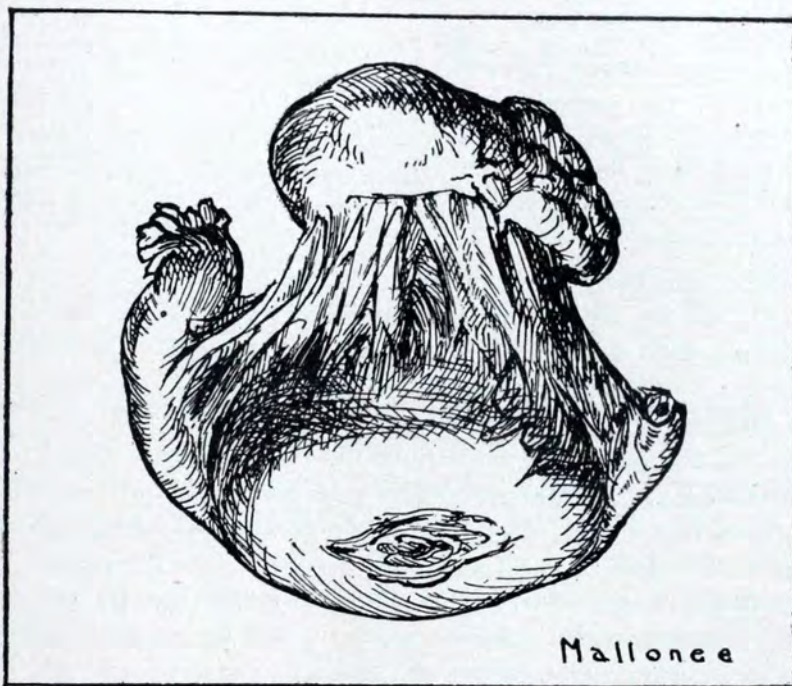
FIG. 55.—INCIPIENT RUPTURE OF ECTOPIC PREGNANCY. Adhesions between tube and ovary denoting an inflammatory process which always causes more profuse bleeding than obtains in uncomplicated extra-uterine gestation.

and one small yellow corpus the size of a pea just under the surface, with soft adhesions around it. The left adnexa also were surrounded by fibrin and soft adhesions.

SUSPECTED ECTOPIC; PREVIOUSLY CURETTED; UNDETECTED; A PIECE OF INFLAMED DECIDUA WAS DISCHARGED; PROLONGED BLEEDING WITH PROFUSE FLOW FOR A FEW DAYS; HEMATOSALPINX WITH ADHESIONS (NO AMENORRHEA, NO DEFINITELY LOCALIZED PAIN, NO SYNCOPE)

Y. B., thirty years of age, was admitted January 2, 1922. Her menses began at fourteen years, always regular every twenty-eight days, of from three to five days' duration with no pain. The patient had been married three and one half years, had two children living and had had no miscarriages. The last menstrual period was three weeks before. She had had typhoid fever fifteen years ago. She complained of frequent vomiting with no relation to any known cause. Her bowels were constipated; there were no genito-urinary symptoms. In October, November and December, 1921, the periods appeared at irregular intervals, about five to ten days before the expected time. The patient had been bleeding continuously since December 12. She complained of various vague *pains in the back, neck and legs;* had had no fever or chills.

The condition appeared to be getting worse, though the patient's statements had to be somewhat discounted because of a decided neurotic tendency.

January 3, by vaginal examination, the cervix was found to admit the tip of the finger. The uterus was forward, movable, firm, enlarged about 100 per cent, but the adnexa were negative. During the examination, a piece of membrane was discharged from the cervix. A diagnosis of incomplete abortion was made. The pathological diagnosis of this membrane was inflamed decidua. Since the bleeding continued, a curettage was done. A large amount of tissue was removed. Nothing was palpable under anesthesia.

January 9, the vaginal examination showed the uterus well involuted and anterior, the cervix still admitted a finger tip. There was no exudate.

The patient was discharged from the hospital January 10 and readmitted January 24 with the following interval history: moderate bleeding for the past two weeks with slight pain in the lower abdomen. Three days ago the bleeding became quite profuse and the patient passed several small clots. There were no chills, fever, vomiting, or syncope.

January 25, by vaginal examination, the bleeding was found to be slight. The uterus was forward and not much enlarged. Behind the uterus and to the right, there was a soft, elastic mass which was intimately associated with the uterus.

A laparotomy was performed on January 27 by Dr. B. The right tube was found adherent in the culdesac and covered by adherent omentum and appendices epiploicae. The uterus and left adnexa were normal. The adhesions were freed and the right tube and ovary delivered into the wound and removed.

The specimen proved to be a hematosalpinx without evidence of pregnancy.

RUPTURED ECTOPIC; ATTEMPT AT INDUCTION OF ABORTION SIX AND A HALF WEEKS AFTER A REGULAR MENSTRUAL PERIOD; DIAGNOSIS WAS POST-ABORTIVE SALPINGO-OÖPHORITIS AGAINST ECTOPIC GESTATION

M. G., aged twenty-nine years, was admitted August 29, 1921. Her menses began at fourteen years, always regular every twenty-eight days and of three days' duration. She had been married eleven years, had two children, nine and eleven years of age and had had one induced abortion three years ago. Following her last menstrual period on June 23, the patient missed her period in July. Suspecting pregnancy, she had a curettage for an abortion, August 12, but her symptoms of pregnancy, that is, nausea and vomiting, were apparently not relieved. The day prior to admission she passed some small clots of blood. The following afternoon she was taken suddenly with a severe attack of cramplike pains in the left lower quadrant, not associated with vaginal bleeding. A high medicated enema relieved her temporarily until the following morning, when she began to bleed from the vagina with severe pain in the lower abdomen. General Condition: the patient appeared fairly well developed and nourished but pale-looking. The head, heart and lungs were normal. The fundus of the uterus was felt below the umbilicus and there was tenderness and rigidity in the left lower quadrant.

Vaginal examination showed the external os patulous; the uterus forward and enlarged. In the left side of the pelvis, there was an indefinite, tender, adherent mass somewhat elastic to touch, moderately movable. *Diagnosis:* (1) Postabortive salpingo-oöphoritis; or (2) ectopic suspect. The urine examination showed a trace of albumin and many white blood-cells. The blood examination showed 3,060,000 red blood-cells, 10,200 white blood-cells, and 78 per cent polynuclears.

August 31, the diagnosis of ruptured ectopic was made and the patient operated. A lower median abdominal incision revealed the abdomen filled with blood-clots, the left tube ruptured near the uterine end and marked parametritis present with numerous adhesions in the pelvis. The uterus was enlarged to the size of a three months' pregnancy, soft and congested. The right tube was markedly enlarged and occluded by an inflammatory process; the right ovary was cystic.

DIAGNOSIS: INTRALIGAMENTOUS PELVIC HEMATOCELE; RUPTURE OF TUBAL PREGNANCY

M. M., thirty-two years old, was admitted. She had been married twelve years, had one child five and a half years old and one abortion at six weeks, four months before. She had had a curettage two years before and had been operated five years before at another hospital for falling of the bladder. Her menses began at sixteen, always regular. There was moderate bleeding of four days' duration, with pain several days before the onset. Her last menstrual period was April 8, 1922. The patient had been bleeding continuously since April 8, a period of six weeks.

On examination, the cervix was found to be small; the uterus small, forward, slightly dextroverted, pushed out of position by a boggy mass which occupied the entire left broad ligament and culdesac, extending somewhat into the right side of the pelvis. The upper limits of the mass were just palpable above the symphysis; it was only slightly movable. At operation, an intraligamentous hematocele was found, due to the rupture of a left tubal pregnancy.

ECTOPIC PREGNANCY AGAINST INFLAMMATORY CYST; PROFUSE BLEEDING; FAINTING ATTACKS; A SOFT MASS FOUND TO SIDE OF THE UTERUS; OPERATIVE FINDINGS; HYDROSALPINX AND CYSTIC OVARY

R. M., aged thirty years, was admitted February 1, 1922. Her menses began at thirteen, always regular every twenty-eight days, of four days' duration up to the first operation, when an oöphorectomy was done ten years before for an "inflamed" ovary. Since that time, the periods had been irregular, always from one to two weeks before the regular time, with clots and pain. She had been married thirteen years, and had had two children who died at the age of several months. The last child was born eleven years before. In ten years, the patient had had seven curettages for pelvic pain and miscarriages. While the periods were becoming somewhat more regular, they were very profuse, lasting from seven to ten days and with clots. The

patient complained of very little leukorrhea. The last menstrual period was December 15 and was due again on January 15. On January 5, she complained of severe pain in the median epigastrium, felt dizzy and fainted. A few hours later, vaginal bleeding began and lasted for three days. After a free interval of several days, the bleeding began again. Since January 16 the bleeding has been constant, profuse, and with clots. Three days after the first attack, the patient fainted again and passed clots. The patient had no pelvic pain and otherwise felt well at the time of her hospital admission.

February 2, vaginal examination showed the uterus to be soft and a soft mass was located on the left side. *There was profuse bleeding.* A diagnosis of ectopic pregnancy was made.

Under the same date, a curettage was done and a very slight amount of endometrium was obtained. There was much bleeding, free and clotted. Under anesthesia, a mass the size of an orange was felt at the left side of the
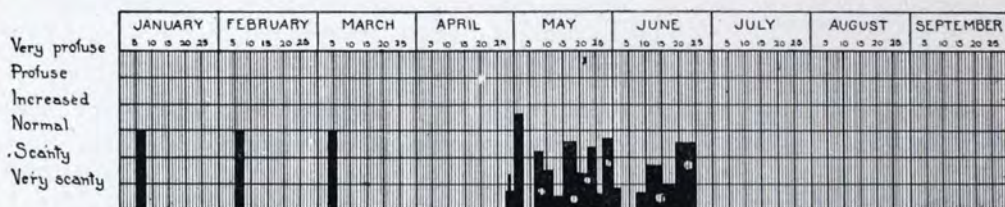
Fig. 56.—Bleeding in Ectopic Pregnancy Complicated by Inflammation of the Adnexa.

uterus. At laparotomy, the left tube was found convoluted, retort-shaped, distended to two finger-breadths. The ovary was converted into a cystic mass the size of a plum and adherent to the uterus and the intestine on the left side.

ECTOPIC AND MULTIPLE FIBROIDS; PARTIAL LEFT SALPINGECTOMY FOR TUBAL PREGNANCY AND MULTIPLE MYOMECTOMY

R. S., 28 years old, had been married seven years and had no children. Her menses began at sixteen years, every twenty-eight days, of three days' duration with no pain. Five years before, the patient had had a miscarriage but no curettage and no other operation. The last period was due December 5, but appeared ten days before that time. There had been no skipping. December 5, she flowed profusely for three days and then stained for a week. Since then she had not bled for two weeks, but began to bleed again the day before admission. Occasionally the patient passed clots of blood, had pain and felt faint.

Examination showed the uterus to be enlarged, with its surface very irregular and nodular and very hard in consistence. The diagnoses were: ectopic pregnancy associated with inflammation, fibroids with bleeding, and adnexitis with bleeding.

At operation on December 27, 1918, multiple fibroids were found and a left-sided tubal pregnancy as thick as a thumb with molar pregnancy dissecting into the mesosalpinx. The interstitial portion of the tube was thickened, there were adhesions between the tube and ovary, one submucous tumor

was shelled out and there were many other subserous ones. One subserous fibroid pedunculated on the left side was probably felt as the adnexal mass which was taken for the ectopic. On the right side, the tube was closed off by a hydrosalpinx and the ovary was bound to it by adhesions.

ECTOPIC AGAINST TWISTED OVARIAN CYST, AGAINST MISSED ABORTION, AGAINST CORPUS LUTEUM CYST WITH RUPTURE; SPOTTING FOLLOWING AMENORRHEA WITH A LARGE BOGGY TENDER MASS TO ONE SIDE

F. M., twenty-three years old, was admitted June 25, 1921. Her menses began at thirteen years, appearing at intervals varying from four and six weeks, of two days' duration and no pain. The last period was January 20, 1921. The patient had one child five years old and no miscarriages. She had taken no precautions against conception. The patient had had morning sickness for two months following her last period, January 20, and spotted for two days the latter part of March. The morning before her admission to the hospital, she complained of intense bearing-down pains which were most marked in the left lower quadrant persisting to date. Spotting began at the same time. The patient had vomited twice the previous night and had had no bowel movement for two days.

The physical examination proved negative, especially on the left side; no real rigidity could be made out. Vaginal examination showed no Chadwick sign; a slight amount of blood was seen to ooze from the cervix; the latter was hard and very tender on movement. The uterus was anterior and not appreciably enlarged, nor did it feel gravid. It was pushed somewhat to the right by an elastic, tender, cystic mass occupying the whole left pelvis.

Diagnoses with the outstanding features: Amenorrhea, pain in the abdomen, spotting and vomiting: (1) *Twisted ovarian cyst* may cause amenorrhea but in that case it would have to be bilateral. (2) *Missed abortion with ovarian cyst*—the uterus did not feel like a pregnant uterus as would happen in a missed abortion. There was no history of the passage of clots either. (3) *Ectopic gestation with rupture*—in favor of this diagnosis was the history of the amenorrhea, some spotting and then the local symptoms as pain in the left side. (4) *Corpus luteum cyst with rupture*—the mass was too large though such size was possible.

At operation, the findings were as follows: considerable amount of free and clotted blood in the peritoneal cavity, the uterus slightly enlarged, a ruptured left tubal ectopic free in the abdominal cavity; the right tube occluded.

RUPTURED ECTOPIC ASSOCIATED WITH LARGE-SIZED UTERUS WHICH WAS THOUGHT TO BE PREGNANT (ONLY HEMORRHAGIC DECIDUA) ON VERY FEBRILE WOMAN WITH ONLY ONE RESIDUAL ADNEXA; PREVIOUS SALPINGO-OÖPHORECTOMY AND APPENDECTOMY; PATHOLOGY SHOWED VERY MARKED DECIDUAL REACTION OF THE TUBE AS WELL AS IN THE UTERUS

H. W., was admitted July 11, 1921. Her menses had always been regular and the last period was May 18. The patient had been married four years and had one miscarriage at three months during the first year; stillborn

twins one and a half years before. The Wassermann report was negative. An appendectomy had been performed at this hospital three years ago.

Two weeks before, that is, five weeks after her last regular period, the patient complained of severe generalized abdominal pains accompanied by vomiting. At first the pains were localized on the left side. There were three such attacks, one during the day, one at night and one a week later. No weakness or pallor was noticed. There was spotting for half an hour a week before and three days after the first attack. Profuse leukorrhea had been complained of for the past three months.

The general physical examination was negative. The vaginal examination showed the uterus to be forward and slightly enlarged. Behind and to the left of the uterus there was a somewhat elastic, tense mass, fixed and about the size of an orange.

The following diagnoses were made: (1) inflammatory disease; (2) ectopic; (3) pregnancy with inflammatory disease; (4) pregnancy with ectopic; (5) dermoid cyst with twisted pedicle. The diagnosis, in spite of very little spotting, would point towards ectopic gestation.

At laparotomy, the pelvis was found full of old blood-clots and the right tube and ovary were absent. There was a left tubal ectopic with perforation at the middle of its posterior surface. The uterus was enlarged to from two and a half to three months' gravidity. The left tube was partially resected. A hysterotomy was performed for what was thought to be an intra-uterine pregnancy, and what appeared to be a dead ovum was obtained by the curet. Microscopical examination, however, showed only decidual reaction.

The points to be particularly noted are the slight spotting, the amenorrhea associating an enlarged uterus (which is unusual in ectopic) and the presence of a left-sided, tense, somewhat elastic mass in the absence of interference.

DISEASED ADNEXA AGAINST ECTOPIC, AGAINST INFECTED INCOMPLETE ABORTION; INTERFERED GRAVIDITY FOLLOWED BY PAIN, FEVER AND PROFUSE BLEEDING; DIFFERENTIAL POINTS: (1) PROFUSE BLEEDING; (2) ENLARGED UTERUS WITH PATULOUS EXTERNAL OS; (3) BILATERAL LESION POINTING TO POSTABORTIVE INFECTION

A. D., single, aged twenty-one years, was admitted January 9, 1922. Her menses began at eleven years, always regular with moderate dysmenorrhea. The last menstrual period began four days before at the usual time. The patient had influenza three years before, tonsillectomy a year before, followed by cellulitis of the neck for which an incision was necessary. About six days before admission, the patient began to have sticking pain in the right lower quadrant. The onset as gradual and increased when she began to menstruate four days previous. One day later the pain became more severe and was accompanied by a rise of temperature. There were no chills or vomiting. The bowels were regular and there were no urinary symptoms. The bleeding had been profuse since the last period began.

Examination shows the uterus anterior, slightly enlarged, hard, the cervix

patulous, admitting a finger tip. On the right side there is a soft, very tender mass, elongated and movable. On the left side, there is a thickening and tenderness which, however, are less marked than on the right side.

POINTS: (1) The periods being profuse, and (2) the open cervix, are in favor of intra-uterine pregnancy interfered with and infected. The open cervix also points to an attempt on the part of the uterus to expel the products of conception. (3) The mass on the right side points to inflamed adnexa.

NOTE.—The patient admitted that she had had coitus two weeks before the last regular period which was two weeks overdue when an attempt at abortion was made. She was curetted and bled a little. The next period came on in the regular time.

Diagnosis of Myomata.—A hard tumor which appears to be part of the uterus, which moves with it in all directions, the transition from the portio vaginalis to the tumor being continuous, will give no difficulty. Multiple tumors of varying size enlarging the uterus beyond the normal limits make the diagnosis even more certain. Not so certain, however, is the diagnosis when the tumors are interstitial and do not project beyond the surface, especially when the uterine hypertrophy is not marked. Nor is the diagnosis so simple in the case of the single small-size submucous fibroid or growths that extend into the broad ligament or occupy the region of the adnexa. The submucous myoma can be diagnosticated with certainty by physical signs only when it is visible or palpable through a widely dilated, external os. In the average case, it does not reach below the internal os and, hence, escapes detection. It may be possible to feel the deformity of the uterine cavity, but with the sound it will not be possible here to exclude by this means a bicornate uterus or uterus septus. The latter was diagnosed several times when, after operation, the uterus was found to be the seat of a submucous myoma.

When the exclusion of lesions of the adnexa is an issue, the uterine sound may be of decided help, for most large myomata cause an extension of the long axis of the uterine cavity as well as an increase in its capacity. One may readily determine the length of the cavity with the sound. When this measures over three and one half inches, the probability is very great that the tumors are myomata. Occasionally it is possible, as Winter suggests, to feel or actually to see the distal end of a submucous myoma during menstruation, when it is not so palpable at other times. But for obvious reasons it is not desirable to make the examination at such a period unless the case presents urgent features.

Winter lays stress upon the value of palpating the round ligament in cases where myomata are suspected, and points out how these structures may serve to help in identifying them. It has already been pointed out that the round ligaments are not easily palpable and are not easy of recognition themselves; furthermore, to attempt to locate them and to pursue them from their pubic attachment to the uterus, one would have to make very deep palpation which is not always feasible or desirable. Where the ovaries may be distinctly made out, especially when prolapsed, they may help in identifying the laterally placed tumors as myomata rather than adnexal. But in cases of doubt, par-

ticularly where the conclusion from physical examination is dubious, the clinical history is of greatest help.

ILLUSTRATIVE CASES

CHOCOLATE-COLORED CYST COMPLICATING MULTIPLE FIBROIDS; PRE-OPERATIVE DIAGNOSIS; MULTIPLE FIBROIDS COMPLICATED BY DISEASED ADNEXA OR ACUTE RED DEGENERATION

J. R., thirty years of age, single, of Finnish birth, was admitted November 28, 1921. Her menses began at fifteen years, always regular, of five days' duration with considerable flow. The patient was single but admitted coitus; no pregnancies. There had been no dysmenorrhea. The patient had had influenza two years previous to examination, and a lacerated wound of the abdomen in childhood. She had had an operation six years before for pus in the right kidney. She complained of occasional dysuria, frequent urination twice every hour and one or two times at night. There had been no hematuria, no night sweats, or hemoptysis but she had lost 16 pounds in weight in the six months before admission. The patient also complained of an occasional cough. For three years she had had a dull pain in the left lower quadrant, usually appearing two or three days before each period and continuing several days afterwards. The pain was aggravated by walking. The menses were regular in duration and flow during that time. The last menstrual period was a week before examination. There had been no fever or vomiting.

Examination November 30 showed the vagina to be short and narrow; the cervix was found in the sacral hollow; the fundus was nodular; there were several prominences to the right and one large nodule the size of a lemon in the anterior fornix which pressed the cervix backward. The appendages were not distinctly felt.

December 1, the physical findings by another examiner were: the uterus dislocated so that the cervix pointed toward the hollow of the sacrum. In its natural place was a hard nodule slightly larger than the cervix in the region of the bladder. The uterus was also somewhat irregular in outline on its upper surface. To the right of the uterus was an elastic semicystic mass the size of a small orange, which was not to be separated from the uterus because of its great sensitiveness; it appeared to be fixed. The diagnosis was multiple fibroids and inflammatory disease of the adnexa, or multiple fibroids with acute red degeneration of the fibroid.

At laparotomy on December 2, the findings were as follows: a hemorrhagic cyst occupying the lower deep half of the pelvis, somewhat fixed. It was the size of an orange and ruptured on manipulation, the chocolate-colored contents escaping. The cyst wall was moderately thin and suggestive of a corpus luteum. The left ovary was enlarged but not cystic. There were two nodules in the uterus: one on the fundus, pedunculated and the size of a large walnut; and the other in the vesico-uterine peritoneal reflection, the size of a walnut and adherent to the bladder.

MULTILOCULAR CYST-ADENOMA VS. MULTIPLE FIBROIDS; NOTE—TENDER-
NESS, CRAMPLIKE PAINS AND ABSENCE OF MENORRHAGIA; PATIENT HERSELF
PALPATED TUMOR

L. S., aged thirty-eight years, was admitted January 29, 1919. She had
five children living and well and had had no miscarriages. Menses began
at fifteen years, regular, of five days' duration, and not painful. Bowels were
constipated. The last period was January 25, 1919. Patient had been con-
scious of the presence of a tumor for two years. She had had cramplike
pains in the lower abdomen and increased swelling of the abdomen for two
weeks before admission.

The physical examination showed the tumor occupying the lower abdomen
and reaching to the level of the umbilicus. It felt hard, irregular and tender
and did not seem to be connected with the cervix. The preoperative diag-
nosis was *fibroids*.

At the laparotomy, January 31, a multilocular cyst-adenoma was found.
It was hemorrhagic and twisted on a thick pedicle springing from the right
side. There were thrombosed vessels in the pedicle and ascitic tinged fluid
in the abdomen.

COMMENT.—In the absence of pains on the right side, extending down
into the thigh, the important diagnostic point was the absence of menorrhagia,
which would have favored a large ovarian tumor rather than large fibroids.

PHANTOM TUMOR AGAINST DIAGNOSIS OF A UTERINE FIBROID, DISEASED
ADENXA AND OVARIAN CYST; FECAL IMPACTION; SYMPTOMS PRESENTED BY
THE PATIENT ARE PECULIARLY ASSOCIATED WITH THE MENSES;
IMPORTANCE OF RECTAL EXAMINATION

L. DeC., thirty-three years old, was admitted June 18, 1921. The patient
had had two children, the older eight years and the younger six years, both
living and well. Her menses had been normal until three years before, when
dysmenorrhea commenced. There had been cramplike pains in the left lower
quadrant, occasionally radiating to the back, lasting an hour or two, stopping
for a short time and then recurring. The pains usually lasted from two to
three days at first and had gradually increased in duration until, at the time
of examination, they lasted several weeks after the menses. They increased
at night and after exertion. There had been a constant tenderness in the
left lower quadrant since the onset and the periods had become scanty, last-
ing from two to three days only, when they were followed by a flow of pus
for two or three days and then by a yellow discharge for the rest of the
month. The patient had a curettage a year before, which was followed by
three months' relief. In the past three months, these symptoms had become
increasingly worse.

The physical examination proved negative on admission and thereafter,
except for some left lower quadrant tenderness and slight rectocele. The
patient then began to bleed, but not at the regular periods; examination still
proved negative. Three days later (July 8) examination showed a hard,

nodular, irregular, freely movable mass, apparently not connected with the uterus and situated on the left side.

The *diagnoses* entertained were: (1) *uterine pedunculated fibroid;* supported by the irregularity of the periods; fibroids usually give menorrhagia and metrorrhagia. (2) *Diseased left adnexa;* freely movable, however. The leukorrhea, menstrual disturbances and pain in the left lower quadrant support this diagnosis; the mass is also hard and irregularly nodular. (3) *Ovarian papillomata or malignancy;* there is no cachexia and the mass is freely movable. (4) *Ovarian cyst;* the mass is too irregular for that.

Rectal examination, however, revealed the true nature of this mass because, after preliminary catharsis, oil enema, etc., about three pounds of hard scybalous masses were evacuated from the sigmoid and rectum, clearing the pelvis of the phantom tumor. The explanation of the irregular bleeding is another matter.

(1) Suppurative Multilocular Ovarian Cyst Against (2) Degenerated Fibroids; Against (3) Peritonitis, or Combination of 1 and 3 and Possibly 2

J. G., forty-five years of age, was admitted May 13, 1921. Her menses began at fourteen years, always regular every four weeks, four to five days' duration, no dysmenorrhea. The patient had two children living and well, no stillbirths. There had been one miscarriage twenty years before, followed by a curettage. Two months before, the period was profuse and prolonged, lasting seven days, and after a few days' interval was followed by further profuse bleeding for two weeks. The last period was April 10. The patient had osteomyelitis twenty years before in the right forearm and was operated upon at another hospital.

Ten days before admission, the patient was taken with a chill and a temperature rise to 102 degrees, which continued at that level. She complained of constant pain in the lower abdomen and severe headaches. Her bowels moved daily with the aid of cathartics. The patient vomited twice the day before and once during the day of admission.

The physical examination showed a moderate amount of general abdominal tenderness, profuse purulent vaginal discharge, a slight rectocele, a lacerated cervix, the uterus forward, fixed but not to be mapped out because of voluntary rigidity. The temperature at that time was between 102 and 103.3.

The patient was given exudate treatment. The urethral and vaginal smears were negative for gonorrhea and tubercle bacilli.

May 16, there was a large mass to the left side of the uterus to which it was closely adherent. The temperature then dropped to 100 and 101.

April 25, there was a rather profuse purulent discharge from the cervix, the uterus was enlarged and irregular (fibroid), and the left adnexa were enlarged, tender and also slightly adherent.

May 1, the temperature was still 102. A sense of bogginess was elicited in the pouch of Douglas.

May 3, a postvaginal section was done under gas and ether anesthesia, and a large amount of foul-smelling pus was evacuated.

May 13, the abdominal mass was found smaller. The temperature ranged around 103 degrees during this whole period.

May 20, another postvaginal section was done. Several septate pockets were found and opened.

May 24, the vaginal section opening was dilated and considerable foul-smelling pus was obtained.

June 28, the patient had projectile vomiting, and the temperature rose to 107 degrees with a violent chill lasting for half an hour. There was tenderness in the lower abdomen and right costovertebral region, though the general abdomen was soft; the pelvic mass was still present and tender.

June 29, there was another such rise in temperature. The white blood count was 21,500 and polynuclears 86 per cent. The diagnosis was much in doubt, both as to the original nature of the lesion, and also as to the nature of the complication. The possible diagnoses were:

(1) Pyelonephritis; the urine examination, however, was negative. (2) Pyelophlebitis. The blood culture to be sure was negative but there was no liver tenderness or enlargement. (3) Sepsis; the blood culture was negative and there were no other signs in other viscera (lungs, etc.). The patient looked too well for a septic attack. (4) Pelvic phlebitis with retroperitoneal cellulitis, spreading lymphangitis. (5) Subacute bacterial endocarditis; there was no demonstrable cardiac lesion. (6) Rupture of an abscess into the intestinal tract either by: (a) localized burrowing, or (b) localized thrombosis with gangrene of the intestinal wall by direct or metastatic thrombosis. (7) Separate distinct intra-abdominal condition: appendix, gall-bladder. These were ruled out by the absence of other localizing signs during the subsequent course.

June 29, the stool showed pus and mucus microscopically. There was also some blood-tinged discharge from the postvaginal section which apparently confirmed diagnosis number 6. The possibility of a coexistent pelvic thrombosis in addition to a cellulitis was to be considered because of the spontaneous profuse purulent discharge through the postvaginal section.

July 2, the abdominal hypogastric mass was still present. A great amount of discharge was obtained upon stretching the postvaginal wound.

July 3, the mass in the abdomen was noted to be smaller. The temperature was ranging around 100 and 102 for the next five days, during which time the sinus behind the cervix uteri was stretched daily, with marked discharge of foul, purulent character. The general condition of the patient was very much improved.

MASS OF INTESTINAL COILS KNOTTED TOGETHER OVER A LARGE TUMOR,
IRREGULAR, NODULAR, THE SIZE OF A GRAPEFRUIT; ONE COIL POLE INFIL-
TRATED; QUESTION OF INFILTRATED MESENTERIC TUMOR INTO
INTESTINE OR METASTASIS INTO THE MESENTERY FROM THE
INTESTINE; RETROPERITONEAL TUMOR AGAINST
FIBROID AGAINST OVARIAN TUMOR

B. S., aged forty-five years, was admitted December 3, 1921. Her menses
began at fifteen years, always regular every twenty-eight days, and from four
to five days in duration; menopause eight years before. The patient had been
married twenty years and had three children; no miscarriages. About six
months before admission, she had first noticed a small hard swelling on the
right side of her abdomen which had been slowly growing larger. During
the four weeks previous to examination, the patient complained of pain in
the left lower quadrant, which came on suddenly and was sharp and colicky
in character. There had been slight fever and slight frequency of urination
but no chills, no hematuria or vomiting. There was no history of collapse
or symptoms of hemorrhage, but there was a slight loss of weight.

General examination showed a middle-aged woman with flabby skin, look-
ing as though she had lost a good deal of weight. Abdominal examination
showed an irregular mass about the size of a grapefruit, the upper border
of which was felt above the umbilicus and extended more to the left. It
was apparently independent of the pelvic organs and was only slightly mov-
able. There was moderate tenderness, but the mass seemed to have no con-
nection with the kidneys. The vaginal examination showed the uterus to
be small and anterior and the mass seemed to be independent of the uterus;
the adnexa were not palpable. The white blood count is 9,800, polynuclears
88 per cent, and lymphocytes 12 per cent. Diagnosis of retroperitoneal sar-
coma or lymphosarcoma of the intestine was made.

Vaginal examination by another observer was made on December 5, which
showed a slight rectocele, no cystocele, the uterus forward, atrophic and mov-
able. On the right side, extending from just above the symphysis to well
above the umbilicus, there was a smooth, rounded, elastic, movable mass.
Diagnosis: ovarian cyst, probably a dermoid.

Points to be Noticed: The history made fibroids improbable, but ovarian
tumor more likely. On physical examination, however, the uterus was en-
tirely free from the tumor and the latter could be moved upward into the
left subcostal space and appeared fixed on the left side where pulling caused
tenderness. The surface of the mass was irregular and the consistence very
hard. The striking features were its position; retroperitoneal growth; and
the significance of a history of cachexia; the menopause eight years before;
and the absence of definite genital lesion.

Soft Parenchyma between Fibroid Nodules; Hemorrhages and Prolonged Bleeding

E. G., forty-seven years old, was admitted July 15, 1921. Her menses began at eleven years, always regular every twenty-eight days, and of seven days' duration. The last period was February 1, 1921. The patient had had five children and three miscarriages; also one curettage eight years before. Five months before, beginning with a regular period, the patient had continued to bleed for three months with no pain. She was clean for a week, then was suddenly seized with a hemorrhage (the estimated loss was a pint of blood); she then became clean again for two weeks. After that she had a hemorrhage practically every two weeks. The bleeding stopped ten days before admission. There was no loss of weight, but there was progressive weakness.

Examination showed the uterus to be the seat of several small nodular tumors varying in size from a marble to a plum. The *uterine parenchyma* between them appeared very soft. On the left side, a larger nodule was felt in the region of the adnexa. The diagnosis made was multiple fibroids with diseased adnexa against multiple fibroids alone. A cystorectocele was present.

At laparotomy, on July 18, 1921, the findings were as follows: (1) Near the cervix, there were varicose veins on the surface of the capsule of the tumor, which projected into the uterine cavity and into the substance of the tumor itself; some reddish degeneration was present, but mostly edema. (2) The largest fibroid nodule was partly intraligamentous, broken up by edema and degeneration. (3) The ovaries were lobulated and elongated; and no cysts were found, with the exception of one small corpus luteum cyst of the left ovary. (4) There were also typical small fibroid nodules.

Multiple Fibroids of Large Size and of All Types; Menorrhagia; Dysmenorrhea Due to Submucous Fibroid; Patient Felt Abdominal Tumor

B. S., forty-seven years old, was admitted February 24, 1922. The family history was irrelevant. She had been married twenty-four years and her husband had died in the war. She had had two miscarriages, twenty-two and twenty-three years before. The patient remarried five years ago, her second husband was living and well but she had not been pregnant during that time. Her menses had begun at fifteen years and were always fairly regular. The last menstrual period was February 14 and the one before that January 17. The patient had had pneumonia and pleurisy ten years before and had been operated upon in Russia. She had had influenza three years before but otherwise had been healthy. The cardiorespiratory, genito-urinary and gastro-intestinal histories were negative. *For the two years previous to examination the patient had noticed considerable bleeding at her periods, the menses lasting two weeks.* The past five months, the patient had noticed a small mass in the right lower quadrant. There were pains in the back and lower abdomen and some dysmenorrhea at times. She had had leukorrheal

discharge for the past six years. There was no metrorrhagia, and no other symptoms were present.

Examination showed a well-developed and corpulent woman, not acutely ill. There was a six-inch scar in the left side of the posterior chest. The abdomen was lax, not distended, and there was a large solid, movable, non-tender tumor, extending from just below the umbilicus to the midclavicular line on either side. There was slight left lumbar tenderness, no cysto-rectocele, but a small nulliparous cervix which passed into a large, hard, irregular, nodular mass which filled the pelvis and reached up to just below the umbilicus. The pre-operative diagnosis was multiple fibroids. The hemaglobin was 50 per cent.

The laparotomy showed a small amount of clear free fluid in the peritoneum, and the uterus the seat of irregular fibroids, making it the size of a five months' gravidity. On the right side, one of the fibroids, apparently springing from the cervix, was intraligamentous. The specimen consisted of a large fibroid uterus about the size of a five months' gravidity. There were numerous fibroids, intramural and subserous. There was a large pedunculated submucous fibroid occupying the cavity of the uterus, which was enlarged about four times. This pedunculated fibroid measured about 10 by 5 cm. The mucous membrane was not hypertrophied.

Both ovaries were cystic (hemorrhagic and clear cysts). The tubes were patent.

LARGE FIBROMYOMA (EDEMATOUS) INTRAMURAL AGAINST OVARIAN CYST ON ACCOUNT OF GREAT MOBILITY IN AN UNMARRIED WOMAN; DIAGNOSTIC POINTS: (1) PHYSICAL FINDINGS; (2) MENSTRUAL DISTURBANCE; (3) ABSENCE OF THIGH SYMPTOMS (NO PEDUNCULATED OVARIAN TUMOR); QUESTION OF PREGNANCY INFLUENCE ON FIBROIDS AND AGE OF OCCURRENCE

G. Y., aged thirty-one years, was admitted February 18, 1922. The family history was irrelevant. The patient had never been married. Her menses began at fifteen years, always regular every twenty-eight days, of seven days' duration but the first three days *very profuse*. The last menstrual period was January 25 and the previous period January 5. There had been no dysmenorrhea or metrorrhagia and no cessation of menstruation at any time. There was no vaginal discharge and the patient denied coitus. The patient had had small-pox as a child. Six months before admission she went to the dispensary on account of a cough and was then told she had an abdominal tumor. She recalled that the discomfort had existed for three years. For the six months previous to admission, the patient complained of difficulty in breathing, abdominal discomfort and increasing abdominal swelling. There were no pains in the thighs radiating toward the knee.

February 19, vagino-abdominal (hymen ruptured) examination showed the cervix edematous, the external os round, no erosion; the cervix merged into a hard, globular mass extending to the umbilicus and laterally to the

mammary line, having a smooth surface, and movable toward the flanks and toward the diaphragm. The cervix moved with this mass in all directions. The uterine cavity measured three inches, the sound passing up without much .deflection. Per rectum, a small portion of the body of the uterus projected backwards from the tumor.

Diagnosis: Fibromyoma springing from the anterosuperior portion of the uterus. Ovarian tumor could not be ruled out. On February 21, a laparotomy revealed a large symmetrical tumor the size of a fetal head, intimately connected with the uterus by a broad pedicle; the right ovary presented a corpus luteum cyst and was twice the normal size. The left ovary was enlarged and cystic, the tumor edematous. A hysterectomy was done, leaving the left ovary *in situ.*

CHAPTER XX

DIAGNOSIS OF FIBROMYOMATA, OVARIAN TUMORS, AND PELVIC INFLAMMATION

By ovarian tumors, we understand, clinically, an enlargement of the ovaries to such a degree that we may presume they are the cause of symptoms. The pathological classification is quite another matter. While it is well to try to identify each histogenetic type clinically, if possible, the microscopic examination after all is the court of last resort in the matter of its clinical importance to the patient. Contrary to fibromyomata, probably all types of ovarian tumors sooner or later give symptoms and must receive surgical consideration.

From this point of view, the *cystic* tumors may be divided into:
1. Simple retention cysts.
2. Inflammatory cysts (actinomycosis).
3. Neoplasms—dermoid—cystadenoma (glandular and papillary).

The *solid* tumors into:
1. Fibromata.
2. Sarcomata.
3. Carcinomata.
4. Endothelimata.
5. Teratomata.
6. Chorio-epithelioma.

By ovarian tumor, we also mean any tumefaction of the ovary, whether it is a nonproliferating follicle cyst or a malignant neoplasm. A carcinoma of the ovary, particularly if it is a metastasis, may be as small as a pea or a lima bean. At this stage of its growth, it will naturally escape detection by palpation and will be discovered only at laparotomy or at autopsy. Such tumors are fortunately rare and their clinical importance not great, because the patient usually succumbs to the primary carcinoma. A notable exception in this respect are the Krukenberg tumors, usually bilateral and of such size as to cause symptoms. The primary tumor in the stomach or intestine may be of smaller size than the metastases in the ovaries.

An ovarian tumor, to be clinically worthy of the name, has been more or less arbitrarily limited to a swelling the size of at least a hen's egg. The purely inflammatory swellings of the ovary are not included in this category. Two varieties of ovarian tumors are distinguished: (1) the nonproliferating cysts, which include simple follicle cysts and corpus luteum cysts (Fig. 59); (2) new growths, which include (a) those arising from the epithelial ovarian elements (germinal epithelium, follicle epithelium, rete ovarii and of the ovum, including simple cyst adenoma, pseudomucinous cysts and papillary cysta-

denoma as well as carcinoma) and (*b*) those arising from the stroma, including fibromata, sarcomata and peritheliomata and endotheliomata.

FIG. 57.—LUTEIN—RETENTION CYST OF THE OVARY ASSOCIATED WITH IRREGULAR BLEEDING AND SIMULATING ECTOPIC PREGNANCY. The clinical history is almost identical. The differential test is in distinguishing an enlarged ovary from an enlarged tube.

A special group is formed by the dermoids and teratomata which are of embryonic origin (ovigenetic origin).
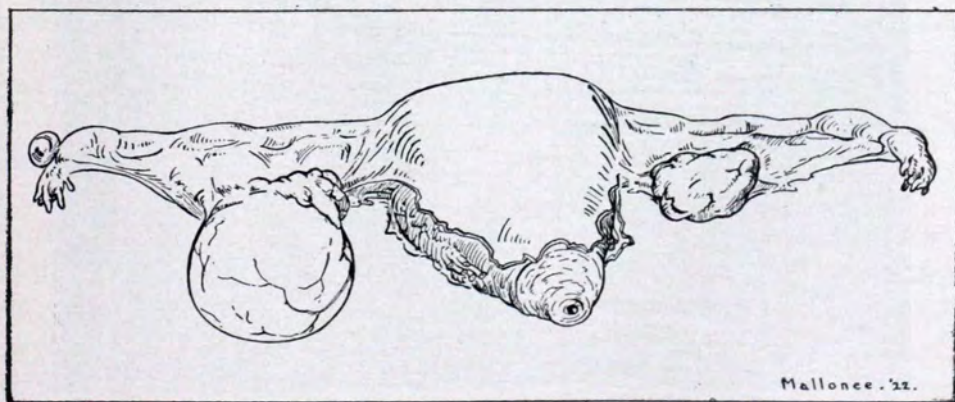
FIG. 58.—RETENTION CYST OF THE LEFT OVARY. Associated with hypertrophied uterus in a woman 50 years old.

The retention cysts often become resorbed (Figs. 57 and 58). This fact is of some importance, because its proper recognition would obviate many

laparotomies. The same may be said of some of the inflammatory cysts, although the latter may cause very serious difficulty in certain instances.
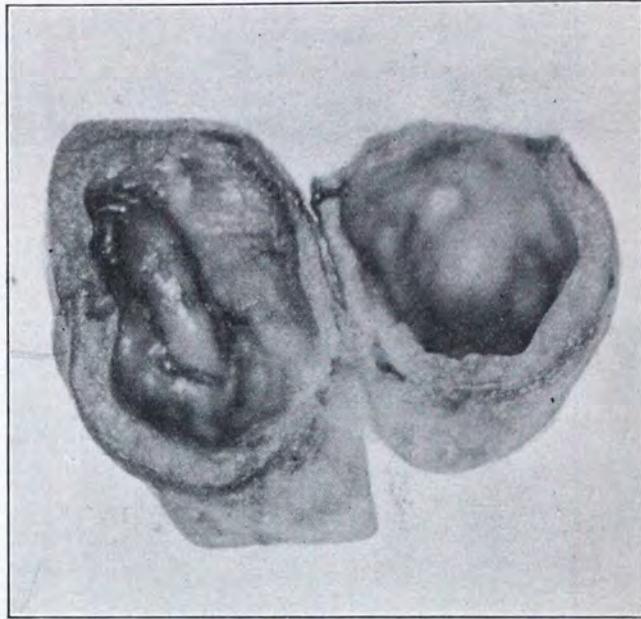
FIG. 59.—CORPUS LUTEUM CYST REMOVED BY MISTAKE IN DIAGNOSIS OF ECTOPIC PREGNANCY
The menses in this patient, who was 24 years old, were delayed three days. Severe abdominal cramps especially marked on the right side were then associated with staining of brownish discharge for four days. The cyst was the size of a small lemon.
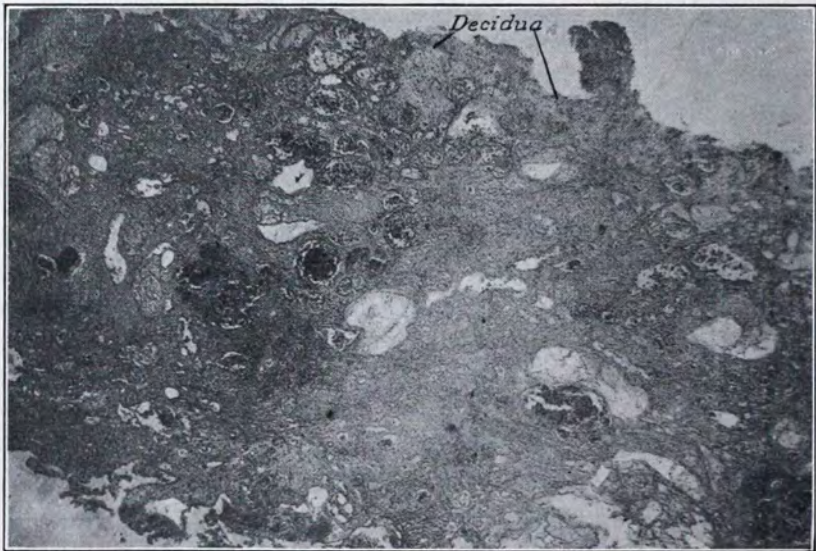
FIG. 60.—TRUE DECIDUA IN CURETTINGS OBTAINED FROM CASE OF CORPUS LUTEUM CYST (FIG. 59) INDICATING UTERINE PREGNANCY. An early induced abortion was later confessed by this patient.

In several cases in the writer's experience, extreme difficulty in urination was caused by a large-sized inflammatory cyst. That of a young woman

of twenty-six years was particularly interesting.   This patient had been married six years and was sterile.   Her last regular period was from September 10 to 14, 1918.   She consulted me September 18, because she was unable to urinate voluntarily.   This difficulty, first noticed by her some weeks before, became worse a fortnight preceding her examination.   She had had to be catheterized once before.   With the catheter, 30 ounces of urine were removed.   The abdominal muscles were held in spastic contraction; this became less marked when the bladder was emptied.   It was then possible to examine the pelvis satisfactorily; and a cystic mass, moderately tender, of the size of a three and a half months' size gravidity, was palpated, occupying the false pelvis and attached to the uterus.   The external os contained a sero-sanguineous mucous plug; the uterine cavity was not enlarged; the sound measured two and a half inches.   At the laparotomy, a large inflammatory ovarian cyst on the right side was found, and the left ovary was the seat of a smaller simple cyst.   The right-sided cyst was adherent to the broad ligament and the uterus and adhesions connected these with the bladder. The urinary difficulty cleared up after the operation.

All the rest of the tumors need not be expected to disappear, for it would be the greatest rarity to find a dermoid, for example, diminish in size.   The solid tumors, if not already malignant, exhibit a malign tendency to such a marked degree that surgical removal is nearly always indicated.

Differential Diagnosis of Ovarian Tumors.—The diagnosis of a moderate-sized, freely movable, ovarian cyst is perhaps the easiest to make.   Bimanual palpation is quite adequate to identify it.   The diagnosis of smaller cysts is, as a rule, also readily made and with great certainty.   But larger tumors are more difficult to differentiate, for they so frequently simulate other intra-abdominal tumors.   Notwithstanding this fact, Winter urges the all-important reliance upon the palpatory finding as the basis of the diagnosis, declaring that the symptoms are quite worthless for purposes of differentiation.   The most important physical sign, according to Winter, is the cystic consistence of the tumor.   That this can no longer be subscribed to will be clear to any one with a large experience.   Not only the cystic degenerations of myomata but the massive edema, particularly of the intraligamentary myomata, as well as the larger intramural myomata, may well resemble ovarian tumors.   While ovarian tumors may, on the other hand, because of increased stroma elements, assume the firmness which is so characteristic of fibromyomata.

Nor is the definite identification of a pedicle pathognomonic of ovarian tumors, because not infrequently subserous fibroids may hang from the side of the uterus by a long, flexible pedicle which may fill the one side of the pelvis and permit of its being displaced in any direction.   Solid tumors of the ovary act in the same way.

Given a woman who can voluntarily relax her abdominal muscles, where there is no distention or abundant panniculus, and a cystic tumor which is lateral to the uterus, the pedicle being distinct (consisting for the most part of the utero-ovarian ligament), the diagnosis may be made with every degree of certainty.   The practice of giving an anesthetic for diagnostic pur-

poses has become an exceeding rarity, although in border-line cases, where the indication for an operation has once been decided, the patient is often so examined with the idea of refining the preoperative diagnosis. The frequency with which this is practiced points to the difficulty of establishing a correct diagnosis.

However, closer attention to the relationship between pelvic tumors and symptomatology has led to better differentiation of the type growth and its origin, whether it is from the ovary or the uterus. In general, it is true that ovarian tumors are rather common in the comparatively young, under thirty, and comparatively uncommon in the old. In fibroids, the reverse obtains. On the other hand, fibroids do occur in younger women but scarcely ever cause symptoms sufficient to occasion a pelvic examination in young girls of twenty and under. Simple cysts seldom occur past the menopause, although dermoids and the pseudomucinous cysts are not uncommon at that age.

Symptoms that are Important in Differentiating Ovarian Cysts from Myomata.—With small cysts, there will be no, or very slight, difficulty, because it is possible to locate them between the palpating fingers and because they are so easy of displacement from the uterus. Occasionally squeezing will elicit pain, a symptom which cannot be produced by pressure upon a fibroid. Larger cysts, because of their weight and dislocation, may cause pain which is reflected down the thigh and toward the inner side of the knee. This is a symptom which has often helped me to identify the side from which the ovarian tumor takes its origin. Particularly is this helpful when the tumor has the tendency to locate itself toward the median line—a differential point from pedunculated fibroids.

Perhaps the two most distinguishing points about ovarian tumors are their cystic consistence and their pedunculated attachment to the uterus. In the presence of both these physical signs, one is always safe in diagnosing an ovarian cyst. The pedicle, however, is not always distinctive, since the cysts may tend to grow between the two leaves of the broad ligament (intraligamentous cysts), or, by further growth downward, separate the base of the broad ligament and continue to develop in the retroperitoneal space, extending on the one side to the retromesenteric tissue of the sigmoid flexure or behind the cecum. Occasionally the cyst lifts the posterior leaf of the broad ligament, growing against the posterior pelvic wall, or, by pushing upwards the loose uterine peritoneum of Douglas' pouch, it may encroach upon the anterior aspect of the uterus. This may also occur when the cysts tend to grow anteriorly, pushing upward the anterior leaf of the broad ligament, thus encroaching upon the bladder and occupying the space of Retzius. These cysts are practically fixed, if of large size. They possess a moderate degree of mobility, if of small size, but they always offer greater resistance to attempt at displacement than the pedunculated tumors, and tend to occupy their original fixed positions. In this respect, it may be well to mention that their mobility is confined to an anteroposterior displacement rather than a lateral or from above downwards. The cysts arising from the mesovarium or broad ligament (parovarium) are the more common broad ligament cysts. The small ones occupy rather the external portion of the broad ligament.

Occasionally a pedunculated tumor becomes twisted and incarcerated in the pouch of Douglas. There it becomes adherent to the broad ligament which it underlies. Its further growth upwards forces both leaves of the broad ligament with it, so that it is then spoken of as a retroligamentary ovarian tumor (Pawlik).

It will thus be seen that the nature of the pedicle will depend upon the development and growth of the ovarian tumor. In general, solid tumors, especially of a malignant variety, form short pedicles because they tend to grow toward the mesovarium. Ovarian cysts and dermoids have a tendency to gravitate to the anterior culdesac (vesico-uterine pouch); not infrequently their pedicle is sufficiently long to allow of its dislocation to the opposite side of the pelvis where it may remain for a shorter or longer period. A dermoid tumor of the size of a grapefruit may be displaced upward as high as the epigastrium; and in capacious abdominal cavities, particularly in women with a fat panniculus, the ordinary bimanual examination may fail utterly to discover it.

The patient previously referred to was one of dystrophia adiposogenitalis with total amenorrhea. This girl was seen by a gynecologist of very extensive experience the day after she consulted me. He was surprised to find no tumor. His failure to locate the tumor was due to the fact that it had maintained its elevated position in the upper abdomen and was missed by the palpating hand over the symphysis and in the iliac fossae, a manipulation which is ordinarily practiced in the gynecological examination. He believed that I took the panniculus abdominis to be an abdominal tumor, but I was able to push down the cyst into the upper pelvis and removed it by laparotomy the next day.

This case demonstrates the necessity of routine palpation of the whole abdomen, particularly in stout individuals. Gynecologists of great experience fall into the error of depending entirely upon the bimanual examination for physical diagnosis. It will not be amiss here again to emphasize the importance of examining the abdomen from above, first, before placing the patient in the position for the vagino-abdominal examination, not only to avoid the mistake just mentioned, but because it at once marks the upper limit of the tumor and its site with respect to the abdominal quadrants.

While small ovarian tumors are usually round or oval, larger tumors need not conform to these shapes, unless the tumor is a solitary cyst. Where more than one cyst is present or where the consistence is partly solid and partly cystic, the configuration of the tumor may vary greatly, becoming irregular, nodular, deeply indented or forming large protrusions. When the cystic portions are under great internal tension, they will give the impression of solid parts and, if they happen to be close to the uterus, will offer great diffculty in palpatory distinction. The small cysts with thin capsule walls, and those in which the fluid content is both thin and under no great pressure, will offer no difficulty in diagnosis, because the pathognomonic sense of fluctuation will readily be elicited. It may be well to mention here that, when an irregular tumor lateral to the uterus presents both solid and cystic portions, it is safe to say that we are dealing with multilocular pseudomucinous cysts. Multiple

fibroids may simulate these ovarian tumors, but they are seldom cystic in parts. The intramural or submucous fibroid is the variety most apt to exhibit cystic degeneration, but, when this is present, it simulates the simple solitary ovarian cyst adenoma.

The size of the ovarian tumor varies from that of a small hen's egg or a billiard ball to that of a man's head, or it may even occupy the greater part of the abdomen. The smaller cysts are, as a rule, intrapelvic, tending to sink down to the pouch of Douglas, occasionally occupying the anterior vesicouterine pouch or the lateral fornix. Those ovarian tumors which may attain the size of a man's head are entirely intra-abdominal, while the largest-sized cysts reach well into the subcostal space and into the flanks.

The *differential diagnosis* of ovarian tumors may be considered from three aspects: (1) the small tumors; (2) the moderate-sized tumors; and (3) the large or giant-sized ovarian tumors.

1. Small tumors are to be distinguished chiefly from acute or chronic oöphoritis. From the latter, they will be diagnosed by their lack of sensitiveness and their larger size; the ovary in chronic oöphoritis does not assume the size of a hen's egg. It will be distinguished from the ovary of acute inflammation by the lack of fever, tenderness and absence of provocative infectious signs. Ovarian tumors (cysts) may, as a rule, be distinguished from myomata by the difference in consistence; cystic tumors are, as a rule, ovarian tumors; solid tumors, as a rule, are myomata. Errors in this respect, Winter asserts, are usually due to faulty elicitation of the sense of consistence. Thick abdominal walls, accumulation of intestinal coils, abdominal distention, voluntary muscle spasm and, lastly, thick-walled cysts offer obstacles to fine palpation. It need only be mentioned here that a distended bladder should never offer any difficulty, because, as a routine, the patient should be asked to void before the examination is made. When this is difficult, one should use the catheter. The experienced gynecologist will almost always be able to determine the presence of a full or distended bladder. Carelessness and an overweaning confidence in one's perceptions, however, may lead even experienced examiners into error.

Definite separation of the tumor from the uterus also helps to establish its true origin. If the pedicle is very thick, or if it springs from the corpus or superior anterior aspect of the uterus, it will serve to identify the tumor as a fibroid. In some cases where fibroids are considered in the diagnosis, the adnexa may be distinctly palpated, indicating that there is no ovarian tumor. The use of the sound is not of help in distinguishing small ovarian tumors from myomata, as in the case of larger tumors, but a uterine cavity that measures from 10 to 12 cm. in length will speak rather for myomata.

Ovarian tumors may be distinguished from exudates by their lack of fixation and relative lack of sensitiveness. The greater diffusion of exudates and other evidences of pelvic inflammation are also helpful.

Hematomata of the broad ligament may resemble ovarian tumors closely. They are very rare and tend to disappear. The same is true of exudates,

while ovarian tumors either remain stationary for a long time or increase in size. An exception to this is the corpus luteum cyst, which may shrink through absorption of the cyst content and regression of the lutein substance.

A large retort-shaped hydrosalpinx will often resemble a smaller ovarian cyst. In general, however, the hydrosalpinx is very apt to be double-sided; it is associated with other signs of inflammation; bands of adhesions may even be palpable. The uterine end of the tube is thickened and this portion may be followed into the cystic mass. Where the shape of the tumor is rather elongated, instead of being round or oval, it will be less difficult to distinguish the two.

The presence of the moderate-sized tumor may have been noted by the patient, because it rises out of the pelvis and approaches the anterior abdominal wall which it bulges over a circumscribed area. By abdominal palpation, percussion and inspection, the tumor is located. It remains only to establish its connection with the uterus by palpation of its pedicle attachment. Those tumors which are not easily separated from the lateral wall of the uterus offer diagnostic problems, but at least the fact of their genital origin is settled by palpating them through the vagina. In doubtful cases, Hegar's procedure is applicable. The cervix is pulled down by a tenaculum forceps, while palpation is made per rectum and the tumor pushed upward by an assistant or held fixed to see whether motion of the uterus is synchronous with the tumor.

These tumors enter into differential diagnosis with a greater number of conditions than the smaller tumors, because they may simulate tumors, not only of the pelvic organs, but of the abdominal viscera and even of the abdominal wall.

Encapsulated ascites or peritoneal exudate have a greater fixation and a more irregular outline. There is also mixed dullness with tympany from overlying and adherent intestines. Other evidences of peritoneal tuberculosis, or of carcinosis, are encapsulated cysts and nodules in the peritoneal cavity, palpable chiefly in the pouch of Douglas.

From fibromata of the abdominal wall, chiefly those arising from the transversalis, oblique internus and the posterior rectus sheath. The tumor is very firm and situated superficially and not intra-abdominally as may be demonstrated by palpating the abdominal wall while the patient is raised from the recumbent posture. *Contraction* of the abdominal muscles makes the superficial tumor more prominent, while an ovarian tumor, even though adherent to the anterior abdominal parietes, becomes less prominent. The demonstration of a pedicle naturally establishes the ovarian character of the tumor.

Tumors of the omentum usually exhibit greater mobility in every direction. When they are adherent in the deeper portion of the pelvis, they can simulate ovarian tumors. When this is suspected, ask the patient to breathe in deeply and exhale fully while holding the tumor fixed in one's grasp; pain is felt at the site of the tumor and in the region of the epigastrium.

A large, full bladder, especially if the seat of a chronic cystitis with thick-

ened walls, may resemble an ovarian cyst. The bladder, however, is less movable, being extraperitoneal for the most part. Pressure over it causes pain and gives rise to the feeling of distention. Where there is dribbling, a distended bladder should be strongly suspected (ischuria parodoxica). The catheter may be the deciding instrument in the diagnosis.

Echinococcus cysts are rare pelvic occurrences. They may share all the physical signs of ovarian cysts. Greater fixation, however, association with liver tumors, a history of operations for similar tumors elsewhere in the body or the presence of fistulae elsewhere are helpful diagnostic points.

From Pregnancy.—There are certain cases of uterine pregnancy in the third or fourth month in which the uterus is extremely anteverted and anteflexed; the cervix is situated high in the pelvis, is more or less firm, the lower uterine segment being very soft, almost cystic; the uterine wall thin; and perhaps an increase of liquor amnii in excess of the period of gestation is present, and the uterine body is displaceable with the greatest ease in all directions and appears to be pedunculated. I have seen several cases in which the uterus, gravid only four months, could be made to reach the costal border. Except for its more central situation, although this is not necessarily the case, the pregnant uterus makes the complete impression of an ovarian cyst. Only the absence of a distinct normal uterine body of nonpregnant size, the demonstration of the merging of the vaginal portion of the cervix into the cystic mass by posterior and anterior palpation, the joint mobility of the "cystic" tumor with cervix, the corresponding history of amenorrhea, the presence of fresh colostrum in the breasts with their concomitant changes incidental to pregnancy, perhaps the history of nausea and vomiting, experienced only in previous pregnancies, will together establish the correct diagnosis. On the other hand, patients may complain of increase in abdominal girth, an associated menstrual irregularity, even amenorrhea, feeling of "life"; but a tumor corresponding perhaps in size to a gravid uterus of five or six months and nodules taken to be fetal parts may be palpated. If, in addition, the uterus is not distinctly made out, one is greatly puzzled to know whether or not one is dealing with a macerated fetus. Not only a large pseudomucinous cyst, but a large multiple fibromyomatous uterus may present the same physical diagnostic problem. The successful demonstration of a small uterus by rectovagino-abdominal palpation definitely settles the diagnosis. In the early months, especially when there has been menstrual irregularity, the use of the sound will be of the greatest help. With an amenorrhea of three or four months, it may be necessary to wait and to observe the further progress for a period of from two to four or six weeks. In the second half of pregnancy, the absence of fetal motions and of fetal heart sounds speaks against pregnancy, but here, as well as in the earlier period, resort to X-ray and particularly pneumoroentgenography will prove of inestimable value. If it is reasonably possible to establish the presence of fibroids or ovarian tumors, one is perplexed as to whether there has been a missed abortion. Here, again, waiting for several weeks may be the only alternative.

From Extra-uterine Pregnancy.—The greater sensitiveness, irregular contour, greater fixation, typical history of amenorrhea, symptoms of rupture,

perhaps the expulsion of a decidual cast, as well as other signs of pregnancy, colostrum, etc., serve, as a rule, to distinguish the condition.

From Parovarian Cysts.—Ovarian tumors may sometimes be distinguished with a great degree of certainty. This is most likely to occur in thin women in whom the ovary of the same side as the cyst is distinctly palpable. It may here be recalled that the identification of the ovary is not made simply by its position and contour and relation to the uterus, but by its peculiar sensitiveness to squeezing or pressure. Parovarian cysts are, as a rule, single, with thin cyst wall and clear contents. The tube is closely connected to the superior aspect of the cyst over which it is stretched and thinned out so that its palpation is out of the question. Furthermore, the more lateral situation of the cyst with its moderate fixation may help in distinguishing it from the ordinary varieties of ovarian tumors. On the other hand, the parovarian cyst is not immune to torsion and, in that case, no exact differentiation can be made.

3. Large ovarian tumors are tumors that reach well up into the upper abdomen and into the flanks. There are cases in which huge abdominal distention from meteorism, from excessive fat accumulation, with or without intestinal distention, and, furthermore, cases of voluntary lordosis in hysterical women, in which the exclusion of a giant-sized ovarian cyst-adenoma becomes a matter of necessity. Without resorting to narcosis, a simple device may here be employed that has helped the author in excluding advanced pregnancy from a case of pseudocyesis. This consists of instructing the patient to increase the girth of the abdomen and then to draw the abdominal wall in. It is often astonishing to what a marked degree the enormously protuberant abdomen becomes flat or even scaphoid. Where meteorism exists, it will be evidenced by the uniform tympany to percussion and the absence of shifting dullness. A high enema or dose of pituitrin (1 c.c.) will often help to dispel the phantom tumor. There are other cases where the thickness of the abdominal wall is so excessive as to defeat all efforts at deep palpation. Even anesthesia may not avail in these cases. Here one must depend upon a circumscribed area of dullness to percussion which shifts but slightly, an increased sense of resistance over the same area and the presence or absence of characteristic symptoms. Thus, for instance, if there is sudden acute agonizing pain, with pain radiating down the thigh, absence of urinary disturbance or of renal change, and slight or no fever with abdominal prominence and dullness, the presumptive diagnosis of a twisted ovarian tumor is very strong. If, in addition, a tense mass is felt in the pelvis by vaginal or rectal touch, this diagnosis will not often be wrong.

From general ascites, large ovarian tumors may readily be distinguished. The shifting dullness, edematous abdominal walls and other clinical evidence of cardiorenal disease, etc., make a symptom complex that is characteristic. A circumscribed area of fluctuation or of percussion wave speaks naturally for an ovarian tumor. The presence here of a pedicle and its delineation is, as in smaller tumors, of pathognomonic value. Ovarian tumors may give rise to a large amount of ascites, but in such cases the tumor masses, usually papillary carcinoma or fibromata, may be palpated abdominally or vaginally, or both.

The large, single, simple cystadenoma of the ovary with a thin wall may,

in all respects, simulate ascites, because the fluid contained in the thin flaccid cyst wall gravitates and shifts with change. The use of the trocar with morphological and chemical differentiation of the contents has been abandoned. It is supplanted by pneumoperitoneography or by the safe, modern, aseptic, exploratory laparotomy. A small incision into the median portion of the abdominal wall can positively determine the presence or absence of a tumor in the extremely doubtful cases. If ascites alone is present, no harm has been done; if a tumor with ascitic fluid, an attempt to remove it may be made or a piece may be excised for microscopic diagnosis.
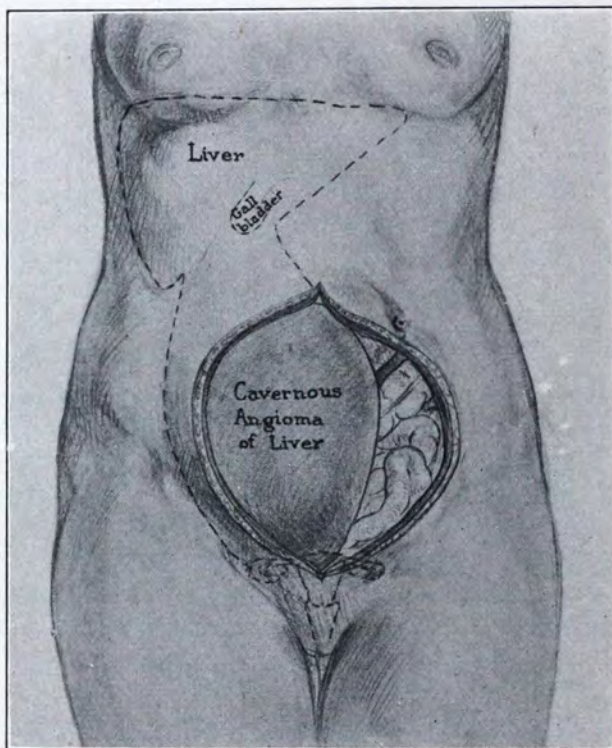
Am. Jour. Obstet. LXVII, No. 2, 1918.

FIG. 61.—LARGE CAVERNOUS ANGIOMA OF THE LIVER EXTENDING DOWN INTO THE PELVIS AND OVERSHADOWING THE UTERUS AND ADNEXA. The correct diagnosis might have been made had attention been paid to the sign of dullness which was continuous over the tumor from the liver area. The lower pole of the tumor was easily palpable from below and the erroneous diagnosis of ovarian cyst was made.

From large descending tumors of pancreas, liver, kidneys and spleen, the history will sometimes be of help. If the patient volunteers the information that the tumor has increased in size from above downward, it would point to an upper abdominal origin. When the uterus and adnexa may be definitely palpated and recognized as such, it at once excludes ovarian tumor. Only when the lower limit of the abdominal tumor reaches down into the pelvis and crowds the uterus out of reach will mistakes readily occur. In this respect, one case operated by the author of a giant-sized cavernous angioma of the liver will be instructive (Fig. 61).

Occasionally an ovarian tumor becomes attached to the upper abdominal

viscera—the liver, for example—either during pregnancy or labor or in the puerperium. In this case, physical examination will leave one entirely in the lurch. Without adhesion, descending tumors will allow readier displacement upwards, while ascending tumors will allow displacement downwards. When the lower limit of the tumor is just barely palpable to the fingers in the vagina, and the tumor cannot be pushed downward into the pelvis, it is safe to conclude that the tumor is extragenital in origin. Whether this arises from the retroperitoneal and mesenteric spaces is another matter which must be established by other means. Without going into the detailed differentials in
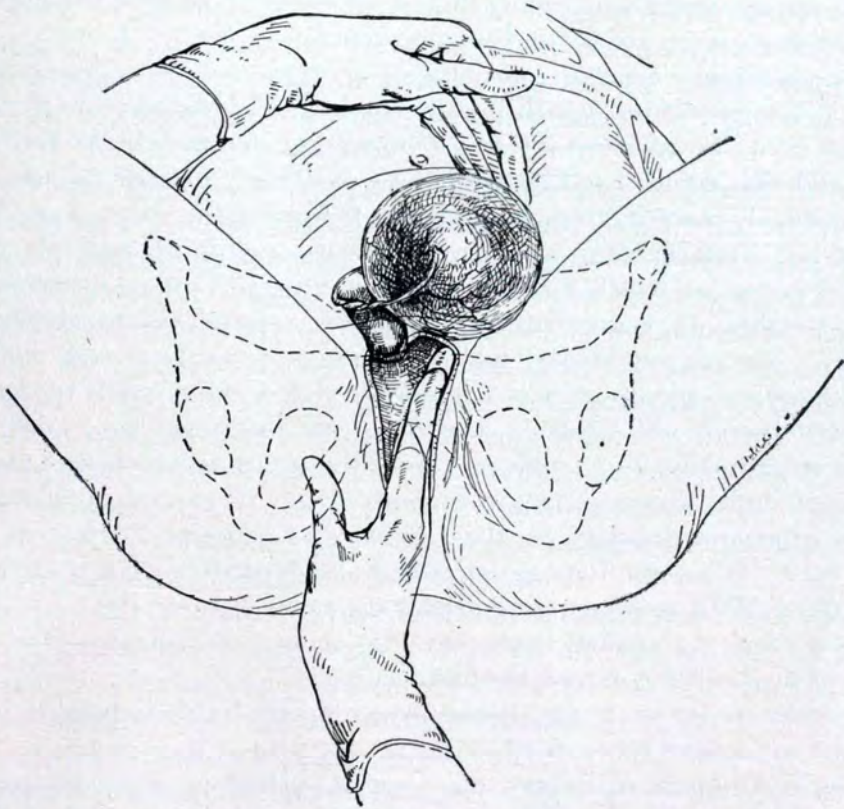
FIG. 62.—TWISTED OVARIAN CYST PALPATED ON THE LEFT SIDE BUT ARISING FROM THE RIGHT OVARY. The tumor can be slightly displaced toward the right side, but the pain complained of radiates from the right side of the lower abdomen down the right thigh and knee. This pointed to the origin of the cyst from the right ovary. At operation the tumor was found to spring from the right ovary and to be twisted several times around its own pedicle.

the diagnosis of these abdominal tumors, it may be mentioned that mesenteric and retroperitoneal tumors have well-marked fixity and, being underneath the intestines, give rise to tympanitic percussion at the most central portion. The contrary is the rule in the case of ovarian tumors. Splenic enlargements and tumors of the spleen disappear under the costal border and have a more oblique position. The incisures in the splenomegaly also serve as distinguishing physical characteristics. From *kidney tumors:* the well-established urologic methods of diagnosis, especially cysto-urography and urine morphology, will clear the diagnosis.

Diagnosis of Complications of Ovarian Tumors.—Ovarian tumors, except nonproliferative cystic follicles, as opposed to uterine fibroids, never recede. They either remain stationary or increase in size, and take on proliferative and degenerative activities that develop into malignant tumors or suppurations. Torsion and hemorrhage from their surface and intracystic hemorrhage or rupture are the acute accidents that necessitate imperative surgical interference (Fig. 62). Gangrene of the twisted cyst and peritonitis from spilling of suppurative cyst contents are the more serious complications. Mild grade infection, with adhesions to surrounding tissues, or more acute suppurative inflammations, with adhesions to other viscera and rupture of their contents, are not unknown. Thus the escape of dermoid cyst contents in the bladder or the rectum are no uncommon occurrences.

More commonly a large collection of pus, as in pelvic abscess or suppurative pelvic peritonitis, which is encapsulated and isolated from the general peritoneal cavity by adherent intestines, omentum, etc., may break through the bladder and thus empty itself completely or partially. One of the most septic cases personally encountered, a woman of forty-eight, who was operated upon by Dr. Brettauer for an infected uterus containing multiple fibroids, embedded in one of which was an old clavus inserted for contraceptive purposes a number of years before, developed a large pelvic abscess after operation. She was delirious, had involuntary defecation and micturition and a secondary operation was contemplated but temporarily deferred on account of her poor general condition. In the meantime, the patient passed a large quantity of frank pus from the urethra, which was associated with a noticeable temporary improvement of the fever and permitted, soon after, incision and drainage by the vaginal and abdominal route of a huge abscess cavity filling the hypogastric fossa and liberating over a quart and a half of pus. With drainage established, the urine became clear.

Rupture into the vaginal vault may also occur. Fistulization through the abdominal wall is less common but has occurred.

Intraligamentous cysts are distinguished chiefly by their limited mobility. The limitation to motion is chiefly upward; because of its attachment between the leaves of the broad ligaments, it cannot be pushed up out of the pelvis into the abdominal cavity. Its intimate connection with the lateral wall of the uterus is another important sign. The uterus may be pushed to the opposite side and, if the cyst attains a good size, it may even cause the uterus to be stretched out and dislocated above or in any direction. If the cyst be of parovarian origin, there may be a gap between it and the uterus, and its mobility may be as free as a pedunculated simple ovarian cyst. The lateral pelvic attachment, moreover, gives the broad ligament cyst a certain amount of fixation, preventing its dislocation to the opposite side of the pelvis. When both broad ligaments contain cysts, or when the cyst arises on one side, encroaching also upon the other side, it will be felt to stretch across the pelvis, the uterus being made out in some more or less eccentric position with respect to the cystic mass—now in front, now in back, and most often on top of the cyst. In any event, the definite identification of the uterus helps to diagnose the fact that the cyst is in the broad ligament. Where there is an additional

inflammatory disease of the adnexa, it is hardly possible to distinguish it from the incarcerated adherent retro-uterine ovarian cyst. From the simple intra-ligamentary cyst, however, this condition will be clear because of the presence of bands of adhesions or "thickening" and tenderness about the surface or base or roof of the cyst.

Cysts adherent low down in the pelvis are easily diagnosed by the palpation of the "bands" of adhesion in the fornices or in the pouch of Douglas. When adherent high up, especially to the abdominal wall, the intestines are most often also adherent. This may be assumed when one feels soft bandlike resistances and particularly if gurgling is elicited. Adhesions of omentum, as well as of the spleen, cannot be recognized. This is also true when the liver and ovarian cysts are adherent. Nevertheless, by fixing the lower tumor while the patient holds a deep breath, a twofold pain may be noted—one radiating to the back and right shoulder, and the other down the right knee and the thigh.

In nervous, hypersensitive women, one may find it difficult to move the tumor, thus falsely concluding that it is adherent. This is particularly noted when the tumor is not adherent to the abdominal wall and when its entire delimitation cannot be mapped out. Here one has the same experience as in deciding whether a retroverted uterus is adherent or not adherent. Frequently it has been my experience to find that the uterus was actually free and capable of positional correction by getting the patient to relax her abdominal walls. In the same way, an incarcerated, supposedly adherent ovarian tumor may prove to be freely or moderately movable when the patient is made to "soften" her abdominal muscles. In such cases, it is well to seek for the cause of the voluntary rigidity occasioned by reflex visceral motion, the primary irritation being in the rectum (constipation, fissure, etc.).

Adhesions of the tumor to the abdominal walls, if well formed and firm, may cause indentures of the parietes when an attempt is made to push the tumor away. This will be noted rarely, however, and only in thin women. Adherent intestines can occasionally be diagnosed on palpating soft bandlike resistances, particularly when gurgling is elicited. Otherwise they may only be conjectured in the presence of extensive adhesions of the abdominal wall. For adhesions always mean the end result of a peritonitis in which the intestines, as well as the omentum, are generally implicated.

Two symptoms will be of further diagnostic help. One is disturbed intestinal function leading usually to constipation, although in exceptional cases the most extensive intestinal adhesions may exist without constipation or obstipation. As a rule, constipation is present and dates from the onset of the attack of peritonitis incident to the disease. Adhesions of the omental edge and surfaces to the pelvic structures will give *pain in deep expiration, etc.* When this symptom is present, the omentum, as a rule, is found tightly adherent to the pelvic structures.

ILLUSTRATIVE CASES

A Tumor Palpated by the Patient; Hypernephroma of the Right
Kidney; Differential Points in Diagnosis

J. E., aged thirty-seven years, was admitted September 26, 1919. She had
been married twelve years and had one child four years old; no miscarriages.
She had measles and whooping cough as a child, malaria three years before.
Nine years before, she had been operated upon for falling of the womb and
chronic appendicitis. Her menses began at twelve years, regular, of three
days' duration with no pain. The patient complained of feeling a lump in the
right side of the abdomen for one year and a sudden onset of pain in the
right side six days before examination. This became severe and was asso-
ciated with vomiting but no fever. One chill occurred four days before
admission, also severe headache initiating the onset of her last menses which
were anticipated by two days. There had been constipation the previous three
weeks but no urinary disturbances.

Cystoscopy showed the bladder and the meatus normal; both ureters were
catheterized and showed no obstruction. The right kidney had a normal flow;
there was no indigocarmin output the first thirty minutes. The left kidney
showed a normal flow, but of cloudy urine with a fairly strong indigocarmin
excretion within thirteen minutes. A thorium pyelogram of the right kidney
showed a distorted, flattened-out kidney pelvis. Indigocarmin appeared in
good concentration from the right kidney at the end of one hour (7 cm.
thorium). The specimen of urine from the right kidney showed numerous
epithelial cells, urea (3 gm.); from the left kidney, numerous epithelial cells,
urea (2.5 gm.). There were a few red blood-cells in both specimens.

Points in Diagnosis:

I. *Site of origin* apparently too high for a pelvic tumor.

    A. Flatness over the tumor area continuous with liver flatness pointing
        to its situation as extrapelvic.

    B. Liver edge palpable apart from tumor.

    C. The tumor mass does not move with respiration.

    D. No pedicle is palpable.

II. *Absence of evidence* indicating any direct connection with the genitals.

    A. No tenderness on moving uterus from side to side.

    B. Lower level of tumor not palpable to vaginal fingers.

    C. No menstrual disturbance.

III. *Evidence of renal* disturbance definitely pointing to right kidney as
the source of the tumor.

    A. Indigocarmin delayed to one hour from the right ureter, prompt
        from left.

    B. Thorium nitrate picture—flattened out right renal pelvis.

RETROPERITONIAL TUMOR WITH LUNG METASTASIS; DIFFERENTIAL DIAG-
NOSIS FROM OVARIAN TUMOR (MALIGNANT OR BENIGN)

E. F., aged thirty years, was admitted January 21, 1920. She had been married five and a half years and had one child four and a half years old; no miscarriages. Patient remembered no previous illness. Menses had started at fourteen years, regularly every thirty-two days and of five to six days' duration. She had noticed a gradually increasing abdominal mass for the previous four years. She complained of no pain and no urinary symptoms except that she thought there had been blood in her urine recently. For a few weeks previous to examination, her bowels had not moved without catharsis. Her appetite was poor and she had had a dry cough for two months. At times she vomited after coughing, and for two weeks there had been dyspnea and orthopnea. She could sleep only in the sitting posture. She had lost thirty pounds in the year previous to admission.

Examination showed chest retraction in the supraclavicular and infra-clavicular spaces. There was marked dyspnea and orthopnea. Breath sounds were harsh at both bases with many coarse râles. There was dullness and râles in the axilla just outside the cardiac apex. Abdominal examination showed the lower half of the abdomen distended by a hard mass which had slight mobility to either side and from above downwards. There was a very hard projection in the left flank which was tender. The liver was not enlarged and liver dullness did not continue down to the mass, nor was there continuous dullness extending to the mass on the left side from the spleen or kidney area. There was dullness over the tumor, which was very hard and had an irregular surface. Vaginal examination disclosed the uterus in retroflexion entirely separated from the tumor, the lower portion of which was barely palpable and presented a few small nodules on its posterior surface. The uterus was not appreciably enlarged. The tentative diagnosis was carcinoma of the ovary. Another examiner found the tumor more movable and elastic and considered the case one of pseudomucinous cyst and not malignant.

The diagnosis of retroperitoneal lymphosarcoma, or carcinoma vs. neo-plasm of the kidney, was made for the following reasons: (1) Slight mobility of the tumor, which was very firm, solid and irregular in outline. (2) Its extension on the left side suggesting intramesenteric involvement and on account of increasing constipation compression of the descending colon; but it could also point to the left kidney as the seat of the tumor. (3) Its distinct separation from the uterus. (4) Nodules in the culdesac septum indicated some malignant intraperitoneal lesion. (5) No ascites present, this would more likely be the case if the tumor were a cancer of the ovary. (6) The lung signs show possible metastasis. The X-ray showed disseminated nodules in both sides of chest. (7) An ovarian cancer during such a long period of time, whether primary or secondary, would undoubtedly cause abdominal metastasis; a primary carcinoma of the ovary reaching so large a size would be apt to perforate and spread in the peritoneal cavity and abdominal metas-tasis would be far more likely before lung metastasis.

A tumor of the kidney was suggested by the hematuria reported in the

patient's history. The disseminated nodules seen in the chest could be in the lung itself and point to hypernephromatous metastasis. Ureteral catheterism with argyrol injection was suggested but, since no hematuria was observed during the six days' stay in the hospital and no red blood-cells were found in the urine examination, it was not done. Moreover the operator considered the patient's condition too wretched for a purely "scientific" diagnostic procedure.

At operation on January 27, a hypernephroma of the left kidney was found simulating an ovarian tumor palpable in the pelvis. The tumor was almost as large as a normal liver, completely embedded in the transverse and descending mesocolon. There was a small portion of necrotic kidney parenchyma in the upper and posterior portion. The uterus and adnexa were free. The tumor was peeled out and one vessel was almost as large as the vena cava. No bleeding was encountered that could not immediately be secured by clamps.

INTRALIGAMENTOUS CYST AGAINST INTRALIGAMENTOUS SOFT EDEMATOUS MYOMA WITH A HISTORY OF BLEEDING FOR SIX MONTHS, TWICE MONTHLY, DUE TO ALTERED OVARIES WITH CYSTS

G. B., thirty-eight years old, was admitted July 2, 1921. The patient had been married sixteen years and had had three pregnancies and one miscarriage. The menses had been always regular until eight months before admission, when she had begun to have menorrhagia and metrorrhagia. The bleeding occurred every two or three weeks. The patient complained of an abdominal tumor of one year's duration and pain in the lower abdomen for eight months.

Examination per vagina showed the cervix in the axis of the vagina facing the left lateral vaginal wall. The uterus appeared to lie obliquely, leaning toward the left lateral pelvic wall. The left fornix was partly obliterated by the uterus and the adnexa were not palpable. On the right side, a semicystic mass was palpable and appeared to merge with the cervix. There was a separation between the fundus of the uterus and the junction of the lower third and middle third of the tumor. The latter extended to an inch above the umbilicus, moved slightly, if at all, laterally. It could be pushed upward for a short distance but the cervix did not move along with it. When its upper surface was pressed down, the cervix was only slightly moved from its original position. To the vaginal and abdominal fingers, the tumor gave the impression of semisolidity, but abdominal palpation with both hands gave more the impression of a cyst. The percussion wave was not elicited. The sound entered toward the left side for a distance of from three to three and three quarters inches. The abdominal wall was irregularly distended, making an uneven prominence on the right side. The patient was of medium weight and the tumor caused distinct asymmetry in the abdominal contour. Percussion was dull below the umbilicus and there was no free fluid in the abdominal cavity. The diagnosis of intraligamentous tumor, fibroid against a cyst, was made.

POINTS—*Physical:* (1) The tumor is cystic; this favors an ovarian cyst, but a soft edematous myoma of the uterus could give the same palpatory

sensation. (2) In favor of the ovarian cyst is the fact that it is more common. (3) The bleeding favors a fibroid. If it were an ovarian cyst, what kind of a cyst would it be? It could not be a dermoid because of its too cystic consistence and dermoids cause amenorrhea. Some change in the tumor would have to take place. (4) A fibroid with diseased adnexa would cause bleeding irregularly. An ovarian cyst with diseased adnexa of the other side would cause the same symptoms, that is, bleeding would be best accounted for in the presence of the cystic mass by an inflammatory cyst with diseased adnexa.

The laparotomy showed a large intraligamentous cyst of the right side. The tube was converted into a hydrosalpinx and ovarian substance identified as a separate structure attached to the uterus and tube. It was peeled out intact after incising the anterior layer of the broad ligament. The left tube and ovary were both embedded in adhesions. The tube was in a condition of hydrosalpinx and the ovary was converted into several cystic masses, one of which was hemorrhagic. The right ovary was similarly changed. The uterus was embedded in numerous adhesions and the omentum was attached to the cyst, the uterus, the adnexa, and the abdominal parietes. The sigmoid mesentery was adherent to the left adnexa.

The uterus on section was negative except for thickened walls. No polypus was found in it, although this might have been suspected as a cause of the hemorrhage if the tumor had been a simple cyst.

Diagnosis of Twisted Ovarian Cyst.—In the classical case, one will have previous knowledge of the existence of a pedunculated ovarian tumor. Following trauma of some sort, usually sudden straining (lifting a heavy weight, turning in bed, getting off the street car in the wrong way), there is an attack of sudden, violent lancinating pain radiating down the thigh or localized to one or the other iliac regions. When seen early and while the tumor is not too large, it may be definitely possible to palpate the rigid, swollen, tender pedicle with perhaps a twist or two. As a rule, even in these favorable cases, the pedicle is palpated close to the tumor but as an indurated distinct columnar portion. In the presence of marked abdominal distention, however, it is not easy to make the diagnosis, or when the tumor is large and in the lower abdominal quadrant underlying rigidly held abdominal muscles. Here the general signs of an ovarian tumor with the history of an acute onset with vomiting and peritoneal irritation will serve to fix the diagnosis. The differential diagnosis lies chiefly with an acute appendicitis. The history of repeated attacks fits both conditions. In general, there is less prostration, less fever, no sharp localization at McBurney's point and less marked leukocytosis with polynuclear increase in twisted cysts. The distinct palpation of a cystic tumor partly movable, with or without the palpation of a distinct pedicle, serves, of course, to positively differentiate the two.

ILLUSTRATIVE CASE

Twisted Pedicle Cyst Five Years after the Menopause

E. R., aged fifty-three years, had been married twice and had had three children by her first husband, the youngest being thirty years. The patient had passed through the menopause five years before. She was admitted to the hospital on March 22, 1920, complaining of pain in the lower abdomen for the week previous. The *pain radiated to the back and down the left thigh.* There was increased urinary frequency with no pain. The patient vomited for from two to three days prior to admission but had no fever.

Examination showed the lower abdomen occupied by a mass reaching the level of the umbilicus. There was a good deal of rigidity and flat note over the center of the mass, more on the right flank than on the left. The capillaries of the abdominal wall were enlarged. The *diagnosis* was twisted pedicle cyst of the left ovary. Rigidity, voluntary and involuntary spasticity made it impossible to make out the pathological nature of the tumor.

At operation a left-sided ovarian cyst with three twists was found.

From a Pyosalpinx or Acute Torsion of a Tube.—Suppuration of ovarian tumors, as a rule, is associated with tubal infections. Occasionally, however, the tumor is invaded by bacteria transported to it chiefly through the blood stream. The hemolytic streptococcus is the most common offender. The intestines are another source of infection. The close proximity of the ovarian tumor with the sigmoid and the not infrequent occurrence of perisigmoiditis and diverticulitis serve to account for the manner in which bacteria find their way by direct contiguity from large bowel to tumor. Such accidents as incarceration with passive hemostasis, or acute pedicle torsion with the resulting disturbance in ovarian circulation, predispose the tumor to infection. The most frequent suppuration of the ovary occurs in the cystic type with or without associated tubal involvement. These tumors, like fibroids, are especially subject to infection after the puerperium. This may arise through displacement and exposure to the sepsis of labor and the postpartum period. Of the systemic diseases, typhoid fever is particularly liable to induce suppuration, for typhoid bacilli have been found in the tumor many years after the initial attack. When the capsule of the tumor has not been penetrated by the suppuration, the systemic symptoms, chiefly fever, may cause confusion in the diagnosis. Only careful and routine physical examination will hit upon the presence of the suppurating pelvic tumor as the cause of the fever. When there is peritoneal involvement, the symptoms will point more directly to the pelvis, and indicate the necessity of a pelvic examination for the finding of the true cause of the sepsis.

Pregnancy Complicated by Ovarian Tumors.—In the early months an ovarian tumor may be separated from the gravid uterus. If the tumor is large, for example, as large as the pregnant uterus, or if it is intraligamentous, it will not be so easy to distinguish the uterus from the ovarian tumor and one may think he is dealing with bilateral dermoids. If the gravid uterus

contains hydramnion, the difficulty will be even greater. Twisted pedicle tumors complicating pregnancy will not give much trouble in diagnosing. The uterus, it should be remembered, is always continuous with the vaginal portion of the cervix and normally there is no distinct furrow between them; a furrow is much more apt to be present in the case of the ovarian tumor. The uterine walls are so thinned in certain cases of pregnancy as to give the sensation of a cyst. When the uterus lies retroverted or retroflexed, the difficulty is enhanced because the size and general characteristics of the uterus elude the palpatory efforts. An interesting case in this connection was that of a young woman, a nurse by training, recently married, who was operated upon for appendicitis two months before, at which time it was found she was pregnant about six weeks. In the beginning of the fourth month of pregnancy, she began to bleed slightly. There was no backache and no pain; in fact, except for the bleeding which made her apprehensive of an impending miscarriage, she felt very well. Examination was deferred for the same reason, but, when the bleeding recurred, the patient submitted, and it was found that the uterus was enlarged to the size of a three months' gravid organ, was in complete retroversion and incarcerated in the depth of the pelvis, causing marked bulging into the rectum. On the right side of the uterus, underlying the abdominal scar, was an elastic mass the size of a lemon. An attempt at its restitution was not made because of great local sensitiveness and voluntary and involuntary muscle spasm. Several days after this examination was made, the patient reported that she fell through her bed and then noticed a brownish vaginal discharge. One month later, the fundus had reached the level of the umbilicus, but the bulging in the rectum and the posterior vaginal wall was still well marked. The cervix was crowded well up against the symphysis, about as it was found to be on the first examination. A week later, there was a sudden gush of blood from the vagina and the next day a considerable escape of water was noticed. At this time, the right-sided mass, as noted at the first examination, appeared to be much firmer and seemed to be part of the uterus. The left portion of the uterus was much softer and was the part that dips down into the rectovaginal septum. The patient was seen by two of my colleagues; the one made a diagnosis of large fibromyoma complicating pregnancy, the other diagnosed the condition as ovarian cyst complicating pregnancy. Conservative treatment was advised and instituted. After a period of rest in bed of several weeks, the patient arose and soon experienced paroxysmal abdominal pains, as severe as labor pains; bleeding increased. The mass on the left side now became dislodged upward and occupied an abdominal situation. The vagina appeared "drawn up" and elongated. The cervix was slightly more median. The right mass seemed smaller than the left. It was at this time that fetal motions and heart sounds, which had been present for a few weeks, suddenly disappeared; the bleeding became more profuse and clotted and had an offensive odor. One of the examiners maintained that the uterus was smaller and that the greater part of that organ was occupied by a rapidly growing tumor, which had meanwhile undergone necrosis as evidenced by the offensive smelling discharge. The temperature, however, had continued to be normal.

In view of the assurance of the surgeon who removed the appendix, that no tumor or other abnormality of the uterus was noticed when the pelvic organs were inspected at the time of the laparotomy, the diagnosis was an extremely difficult one to arrive at. My impression at first was that a distortion of the gravid uterus had occurred, partly by adhesions and partly by the incarceration in the pelvis. Pregnancy in one horn of a bicornate uterus was another possibility, but against this diagnosis was the finding at the laparotomy for the appendix performed in another city. As the bleeding continued and the abdominal cramps were distressing, while no return of fetal motions was observed, the patient was examined under narcosis. The uterus was then found to be cordate in shape, both lateral portions merging into the one cervix. The uterus was now frankly abdominal. The cervix was open to a finger and the margin of the placenta could be felt low down in the left side of the uterus. It now became clear that we were dealing with an abnormal implantation of the placenta in an anomalous uterus.

Through an anterior vaginal hysterotomy, I delivered a macerated fetus of some four and a half to five months' development, with the placenta and old blood-clots. In the cavity of the uterus, I could make out the septum at the fundus which extended down, incompletely dividing the uterus into two uneven parts. No fibromyoma was palpable. In the convalescent period, the uterus was found, on examination, to lie in retroversion and the cordate configuration to be hardly perceptible.

The Diagnosis of Malignancy.—Weakness which steadily increases, with a sallow, yellowish tinge to the complexion and pallor, are the symptoms that suggest some malignant process. Pernicious anemia may be differentiated by a blood examination. (1) The presence in the pelvis of bilateral, equally, or nearly equally, enlarged tumors with involvement of the broad ligament; (2) the presence of ascites; (3) the palpation of nodules of smaller or larger size (pea to hickory nut) in the pouch of Douglas or in the neighboring peritoneum; (4) the possible "crunching" sensation elicited by rubbing the nodules between the fingers in the vagina and those over the abdomen; and (5) the palpation of very dense almost cartilaginous nodules which are immovable and which spring from the basis of the pelvic tumor— all speak for malignancy. From the discrete nodules palpated in the pouch of Douglas, it will be necessary only to exclude fecal scybala, which is readily accomplished by rectal digital examination or by cleaning out the bowels. Advanced cases of tuberculosis may closely resemble malignant neoplasms. Exploratory laparotomy with excision of a specimen is usually necessary for differentiation.

Diagnosis Concerning the Nature and Type of Ovarian Tumor.— Simple follicle cysts have very thin capsules which are easily compressible by the fingers; they are sometimes associated with a delay or irregularity in the menses. They seldom reach a size greater than an orange. Corpus luteum cysts are, as a rule, unilateral and associated with amenorrhea and simulate an ectopic gestation. The capsule is firm and thick. Not infrequently they are associated with referred pain in the iliac area, and palpation of the tumor evokes pain. Corpus luteum cysts are distinguished from ectopic pregnancy

by their rounded, spherical shape and their less intense sensitiveness. They follow, in my opinion, fetal death, although primary corpus luteum formation may be the cause of early embryonal death. In the light of a history of interference with pregnancy, it is absolutely safe to say that one is dealing with a corpus luteum cyst. This is quite contrary to the observation of Winter, who stated that these cysts are without any clinical significance. The reason for this statement becomes at once apparent when it is recalled that the entire theory of corpus luteum function in relation to uterine function has been developed within the last two decades and, therefore, followed Winter's publication.

The *simple serous cystadenoma* is suspected when its capsule is smooth, when it is unilocular, and when it attains the size of a grapefruit or larger. *Pseudomucinous cysts* may reach the same size as the simple serous cysts, but, owing to the variation in pressure of mucinous collection in various loculi, there is an irregular consistency which is significant.

The *papillary cystadenomata* are usually bilateral and are distinguished by the presence of papillary nodules upon their surface. They may be as large as a man's head. Ascites is a most common occurrence.

Dermoids that occur in young women are usually unilateral, have a thick capsule, feel heavy and give a sense of semifluctuation and at the same time of semihardness. Occasionally it may be possible to cause pitting by impressing the finger into the cheeselike débris that fills the cavity. The occasional palpation of a bony hard nodule or the cartilaginouslike, hard tubercle is pathognomonic. By the X-ray, one may be able to demonstrate one or several teeth. As between a dermoid ovarian tumor and pedunculated fibroid, the tendency in the former for the menses to be delayed or scanty, while menorrhagia is usually associated with the latter condition, is helpful. Bilateral dermoids are practically always associated with amenorrhea; this fact is sufficient to differentiate them from multiple fibroids.

Teratomata may be strongly suspected when occurring in young individuals. In older women, the diagnosis from dermoids may only be made when large masses of bony tissue are made out.

Fibromata of the ovary may be distinguished by their irregular shape and contour and their exceeding hardness. From pedunculated fibromyoma, they may only be distinguished in the presence of definite ascites which most commonly accompanies fibroma of the ovary. Ascites is rare with myoma of the uterus.

Sarcoma of the ovary may be suspected when exceedingly hard tumors of large size (that of a man's head or larger) are found and when ascites is also present. The fibrosarcomata are relatively benign and may be observed over a long period of time. The round-cell sarcomata have a more parenchymatous consistence and also attain a large size, but they have a tendency to break through the surface and cause peritoneal sarcomatosis. Pelvic tumors in young girls before the age of puberty are, as a rule, ovarian sarcomata. A distinguishing test between sarcomata and teratomata is the great tendency for the sarcomata to yield to Roentgen therapy while the teratomata do not.

Diagnosis of Acute and Chronic Oöphoritis.—The diagnosis of acute oöphoritis is a most difficult one, chiefly because it is so rarely unassociated with tubal infection. During the early stage, palpation is hindered by rectus spasm. When the ovary is situated high and when it is not prolapsed, it escapes the palpating finger. The history of gonorrheal infection, of uterine manipulation, postabortive infection and indiscretion during menses would point alike to tubal as well as ovarian involvement. In exceptional cases where the ovary is accessible, it is enlarged, at times to the size of a hen's egg, and yields the tenderness on pressure that is characteristic of the ovary. When the stroma is mostly involved, it may maintain the general conformation of the ovary. The swelling is due at this stage to an exudate in the stroma, perifollicular infiltration and edema making together a hard, tender mass which still retains the round shape of the ovary. When suppuration ensues, there is fluctuation, adhesions are formed, the tube may frequently become involved, the omentum becomes adherent, so that the diagnosis of ovaritis cannot be made. In such a case, one is obliged to include the tube in the diagnosis of diseased adnexa.

In virgins, an acute oöphoritis may follow a streptococcus infection by way of the blood stream. A favorable time for the invasion of the ovary by bacteria, the coli communis, for example, is when the graafian follicle ruptures. Coming just before the period when the internal genitals are generally congested, a raw surface is formed; in some cases more blood is discharged from the site of the rupture than is normal and offers a nidus of infection from neighboring coils of intestine. Thus arise corpus luteum abscesses, acute, nonspecific and specific (tuberculous). In such cases, there is a general etiologic factor, such as malignant endocarditis. Left-sided ovarian infection is naturally easier to distinguish than right-sided oöphoritis.

Chronic oöphoritis exists only rarely, as compared to associated ovarian and tubal infection. A chronic ovarian infection (nonsuppurative) is rare without a perioöphoritis. The type of oöphoritis which is least apt to be associated with adhesions is the *large ovary* which hangs down in the fornix or the pouch of Douglas and is the seat of chronic passive congestion. Here the follicles become cystic, the stroma is thickened and both make the ovary as large as a walnut. Cases do occur, however, in which the ovaries themselves are the seat of a chronic inflammation, without much or any tubal involvement. When a mass is felt at the side of the uterus, smooth and rounded and freely movable, retaining the contour of the ovary but larger and more sensitive, it may be safe to diagnose chronic oöphoritis. Perhaps the most helpful diagnostic aid in excluding associated tubal involvement is the transuterine insufflation test which, if it results in establishing the fact of tubal patency, at once excludes strictures, adhesions or hydrosalpinx with clubbed fimbriated ends.

Such was the case in a woman of thirty-two who was always well until six months ago when, upon attempting to move a piano, she suddenly had a severe pain in the right lower abdomen. She felt something "snap" inside of her. There had been three similar attacks since then. The menses, which had always been regular, have lately been associated with severe pain. On

examination, the uterus was found in retroposition, and adherent, and there were nodular, tender thickenings immediately adjacent to it on either side. A transuterine insufflation test, however, demonstrated normal patency of the tubes. It, therefore, pointed almost specifically to the ovaries as the seat of disease. At the laparotomy, the uterus was found to be bound down by fine adhesions, the sigmoid and both ovaries; these were converted into cystic masses containing hemorrhagic chocolate-colored material. They were held firmly against the posterior surface of the broad ligament, the lateral walls of the uterus, by dense adhesions. The tubes were practically uninvolved. An adhesion bound the left tube to the ovary at its middle portion but did not circumscribe it, leaving the fimbriated end open.

Diagnosis of Tubal Disease.—An acute infection of the tube is suspected when there is a history of venereal exposure after a recently terminated menstrual period or during the period itself. There is acute pain in the lower abdominal quadrant on one side or the other; the pain is lancinating and is more or less localized above Poupart's ligament; vomiting is not infrequent at the onset. Motion aggravates the pain and there may be frequency of urination and dysuria. On examination, there is evidence of gonorrheal cervicitis and endocervicitis; a urethral discharge may be expressed, gonococci are demonstrated in the smear, and there is tenderness lateral to the uterus; peritoneal irritation, as evidenced by pressure over the lower right rectus and transversalis muscle, is also present.

In the acute stage structural changes may be practically absent. The tube is only palpable when the amount of secretion contained is profuse and particularly when the fimbriated end is closed by adhesions—in other words, when an acute pyosalpinx is present. When the secretion is scanty and there is no marked thickening of the tube walls, it will not be possible to depend upon the physical finding for the diagnosis. When the process is still fresh, palpation is defeated by the muscular resistance of the abdominal wall and the tightening of the vaginal canal by reflex contraction of the levator ani and other pelvic muscles. This prevents the examiner from outlining the tube. When this is possible, one may follow the tube to its insertion and hence identify it as such. There are instances, however, in which the tubes are primarily displaced to the posterior portion of the pelvis, as when associated with a retroverted uterus; when this occurs, one cannot palpate the tubes with any certainty. The same is true when the tubes are well anterior, as when the uterus is markedly anteverted.

When the right fallopian tube is affected, it is difficult to differentiate from an attack of appendicitis. In favor of the latter is the greater rigidity and spasticity of the right rectus muscle, the higher localization of the point of tenderness and the utter absence of tenderness in the right fornix or on moving the uterus from side to side. The history of venereal exposure and evidence of gonorrhea naturally speak for salpingitis. The clinical course of the appendix inflammation is very apt to be more stormy. The tendency for a rapidly spreading peritonitis from a ruptured appendix is far greater than is that in the case of the suppurating tube. An inflammatory mass readily palpable in the lower right quadrant is almost surely associated with the

appendix, while affections of the tube sufficiently large to be palpated through the lower abdomen are exceedingly rare and then are encountered only in chronic conditions.

Inasmuch as the tubes are scarcely ever affected without involvement of the neighboring organs, chiefly the ovaries, it is rare indeed to meet with a tube in which the organ alone is diseased. So the diagnosis of acute or chronic pyosalpinx must always be made with the reservation that the ovary is probably also involved. The same may be said of a hydrosalpinx. The latter, however, may enjoy a considerable range of mobility, because, after weeks or months, the perisalpingitic adhesions fixing the tube to neighboring organs may so far disappear as to leave the tube practically free. In such case, it will naturally offer difficulty in distinguishing it from an ovarian cyst.

Occasionally a retort-shaped cystic tumor may be palpated in the pelvis lateral to the uterus. This may be formed by a hydrosalpinx or a chronic pyosalpinx, but usually the ovary is included in the tumor, its cystic portion contributing the clubbed expanded portion of the retort retention tumor.

The diagnosis of acute salpingitis, even of the right side, is particularly strengthened when symptoms of involvement of the other tube arise after a period of quiescence. This is common. It is naturally of greater diagnostic importance when the right tube is the first to be affected, because, in this case, the appendix offers the diagnostic confusion.

In the subacute and chronic case, it will be well-nigh impossible definitely to diagnose whether the tube alone is affected. One has to content oneself by saying that one is dealing with diseased adnexa. In this instance, one may be able to determine whether the tube or the ovary has the greater degree of involvement. This much may be assumed with a large degree of certainty— *that when the physical finding is associated with disturbances in the menstrual cycle, the ovaries are inevitably affected.*

The diagnosis of a hematosalpinx apart from ectopic pregnancy and hematometra will be difficult to make. When the history leads one to suspect torsion of the ovary, it may be possible to distinguish a hematosalpinx by its general conformation; in general, also, the tubal mass causes greater tenderness than a twisted ovarian cyst.

The nature of the infection of the tube resolves itself into three varieties: (1) gonorrheal, (2) septic, and (3) tuberculous. The gonorrheal infection, by far the most frequent, being about 85 per cent of all tubal infections, can be diagnosed by associating signs. The demonstration of the intracellular, gram-negative, biscuit-shaped diplococcus of Neisser is pathognomonic. The septic type of infection usually follows upon the puerperium, intra-uterine trauma as after abortion or even in the nongravid state. While the gonorrheal infection may also be lighted up under these circumstances, the absence of previous evidence of gonorrhea, or associated evidence of gonorrhea, would point to the septic nature of the infection, that is, staphylococcus or streptococcus. A simultaneous parametritis or exudate would also favor the nongonorrheal character of the infection.

The tuberculous salpingitis is not as easily diagnosed. While it is true that tubal involvement in the presence of ascites suggests a tuberculous infec-

tion, the two conditions may be merely coincident. If, in addition to these, small nodules are palpable in the culdesac of Douglas, if there are frank evidences of bone tuberculosis, lymph-node tuberculosis or lupus facialis, the diagnosis may be strongly supported. Perhaps the best evidence is the finding of tubercle bacilli in the uterine secretions or in the uterine scrapings. According to Pauker and Jaschke, the uterus is involved in at least 50 per cent of the cases, and it will be seen that the endometrium will be likely to show positive evidence of tuberculosis. In such cases, it may be safely assumed that the tube is tuberculous. The use of tuberculin has not proved dependable. A very important point in the history of the patient is the presence of sterility. At least from 85 to 90 per cent of patients with tuberculous tubes are sterile as against from 30 to 50 per cent with nontuberculous tube infections, so that this point may also be brought to bear in the differential diagnosis.

In favorable cases, that is, where abdominovaginal palpation is eminently satisfactory, one occasionally will be able to outline thickened areas along the isthmic portion of the tubes. Usually bilateral, the condition of salpingitis isthmica nodosa can thus be distinguished. The only source of confusion will arise from the presence of small fibromyomata situated in the horn of the uterus. But this is not likely to be bilateral. The nodular types of salpingitis are frequently tuberculous, but they may also be the result of other chronic inflammation.

Chronic affections of the tubes, not distending them sufficiently to be palpable to the examining fingers, result, as a rule, in complete or incomplete occlusion of the tubes. The fimbria may be closed without distention of the tube lumen, or the endosalpinx may be agglutinated along its entire course or only in scattered portions. Closure of the lumen may be affected by adhesions resulting from a perisalpingitis, whether this is caused by a primary affection of the tubes or secondarily from some inflammation of a neighboring organ. These are conditions that escape detection by physical examination. If, as occasionally happens, the change is sufficiently manifest to lead to the venturing of an opinion that there is "thickening" in the adnexal areas, the matter of tubal patency is nevertheless left in doubt. In the presence of a long-standing history of sterility, the presumption in the presence of such "thickening" is well-nigh equivalent to a positive diagnosis.

Fortunately, we are now in a position to determine this factor of occlusion of the fallopian tubes without having to resort to an exploratory laparotomy. The intra-uterine gas insufflation, as elsewhere described, offers a method of physical diagnosis which is conclusive.

Diagnosis of Perforation and Rupture of a Pyosalpinx.—The diagnosis of the perforation of a pyosalpinx may be made definitely when, with the knowledge of the previous existence of a tubal swelling, there suddenly appears a foul-smelling purulent discharge from the rectum, vagina, abdominal wall or even bladder; the tumor mass collapses considerably and pressure over it causes obvious escape of secretion of the same character. In the absence of previous knowledge of the existence of a pyosalpinx, the latter may be strongly presumed when a tender, fixed mass is palpable to one side of the uterus. Between the actual point of rupture and the uterus, an area

of "thickening" consisting of inflammatory tissue may sometimes be palpated. In the rectum, the aperture may be very small and can be identified by proctoscopy; in the bladder, by the cystoscope. When the discharge is from the vagina or the abdominal wall, a sound will pass in the general direction of the tube.

This discharge may appear intermittently, the periods of absence being associated with fever. The same is true of perforation of a chronic, suppurating, ovarian cyst. It is impossible to make this fine distinction, but the clinical significance of all three conditions is the same.

If, in the presence of a pyosalpinx, there is an attack of acute lancinating pain, abdominal rigidity and distention with fever and all the signs and symptoms of a diffuse general peritonitis, it will not be difficult to trace the origin to a ruptured pyosalpinx. The diagnosis is more easily made when, in addition, the previous history points to pelvic infection and when there are inflammatory, partly cystic masses in the pelvis, as evidenced by the following case:

The patient, forty-six years old, complained of excruciating pains in the abdomen beginning on the right side and radiating throughout the general abdominal cavity. A chill and rise of temperature followed the onset of pain. She had had severe menorrhagia for the past two years, bleeding sometimes continuing from twelve to thirteen days. She had suffered from pain on the right side for the past six years. The last menstrual period was unusual in that she bled only for five days and very slightly. At examination, the abdomen was distended, the muscles were rigid, the legs drawn up, temperature 104, pulse 120, free fluid was elicited by percussion, the pelvic organs were matted together, extreme tenderness being elicited by palpating the fornices, especially that of the right side. At the laparotomy, a large pyosalpinx was found ruptured, spilling its contents into the general peritoneal cavity. Culture made of the pus proved to be sterile and the patient made a good recovery.

The diagnosis of *neoplasms of the tubes* can seldom be made. When there is a history of an old standing adnexal process and when ascites appears and the tubal swelling increases markedly in size, a malignant degeneration may be suspected. Perhaps of the greatest diagnostic significance is the appearance of quantities of thin, serous discharge from the uterus without any changes in the latter, and when the adnexa are definitely enlarged, irregular and perhaps nodular or distended. This type of serous discharge will be present in papillomata of the tube as well as in carcinomata (hydrops tubae profluens). The intermittent escape of serous fluid is more characteristic of a large hydrosalpinx.

The Diagnosis of Pelvic Peritonitis.—Pelvic peritonitis is ushered in by severe pain in the lower abdomen coincident with vomiting. The lower abdominal muscles are rigid and there is also deep and "rebound" tenderness. The thighs may be flexed to lessen the strain on the rectus abdominis. The bowels are constipated or there is a mucous colitis: fever may be as high as 103, but may not, however, exceed 101.5. The pulse is, as a rule, rapid and perhaps is of as much diagnostic significance as the muscular rigidity. A

spreading peritonitis is always associated with an increasingly rapid pulse, the volume of which becomes constantly smaller.

If the peritonitis ensues upon a gonorrheal tube infection, there will be evidence in the pelvis of a recent or older inflammatory process. Vaginal palpation elicits tenderness in the fornices and in the pouch of Douglas. In the later stage, a sense of fullness, then of fluctuation and finally of a definite collection of fluid in the pouch of Douglas becomes palpable. When this stage is reached, the condition becomes known as a pelvic abscess, the pus burrowing down between the layers of the rectovaginal septum, where it assumes the shape of a wedge, hard nearer the tip and softer, perhaps fluctuating, near the base. The roof of the abscess may be formed in part by adnexa or by intestines and omentum.

In less favorable cases, there is no attempt at encapsulation and the peritonitis becomes diffuse, rapidly proving fatal. Fortunately, in the vast majority of cases, the inflammation becomes localized to the pelvis. Thanks to the protective agencies offered by the ligaments of the pelvis and the numerous appendices epiploicae, which act as so many diminutive omenta, the process becomes walled off and confined to the pelvis. Another favorable factor is the dependent portion of the pelvis even when the patient assumes the recumbent posture. The sigmoid, on the one side, rectum below and cecum, on the other, form the bulwarks against the upward spread of the infection. Only in rupture of a pyosalpinx, which may primarily be situated above the false pelvis, will a spreading peritonitis be apt to take place. As a rule, however, the pyosalpinx has already become walled off and even when it ruptures the pus may be entrapped between coils of adherent intestine to which the omentum may also be attached.

Pelvic peritonitis usually resolves by the formation of a pelvic abscess. This may easily be opened through the vagina and result in healing with adhesions in the nature of bands or "false" membranes. In these days, eventualities due to untreated and neglected cases, such as rupture into the vagina, bladder, rectum, etc., are rarely encountered.

An almost constant finding, as a result of a pelvic peritonitis, is a retroposed, retroverted or retroflexed uterus adherent by its posterior surface. On attempting to restore the uterus to its normal position, these adhesions and fixation can be felt. The sacro-uterine ligaments may often be felt thickened. Another evidence of a terminated pelvic peritonitis is offered by the prolapsed, fixated tubes and ovaries, the result of perisalpingitis and perioöphoritis which are a part of the process in the pelvis.

Here it may be well to mention that, when the uterus cannot be lifted out of its retroposition, it is not necessarily adherent, because it has often happened that, after further attempts, the uterus may be brought well up toward its normal anterior position.

Another effect of pelvic peritonitis is the formation of peritoneal inflammatory cysts which arise between broad thin adhesions (adhesion cysts). These may attain the size of a fetal head, or larger, may even fill the pelvis and cause bladder symptoms, especially retention. The bladder may be dislocated, the trigonal area may be compromised or displaced and distorted, and

the patient may not be relieved except by catheterism. These cysts are char-
acterized by their fixation, exceedingly thin capsule and rather irregular con-
tour, in contradistinction to simple ovarian cysts and neoplastic cysts of the
ovary. They may be opened through the vagina by puncture or by a posterior
colpotomy, liberating, as a rule, stained, thin, serous fluid.

As distinguished from a serous collection in the culdesac of Douglas and
purulent fluid collections, the exquisite tenderness to touch per vagina, the
edema and succulence of the vagina and further tender infiltration in the
neighborhood of the fluid mass, all favor suppuration. In chronic or even
at the end of a subacute process, fever may no longer be present and a leuko-
cytosis may also be absent. Naturally when a leukocytosis is present, it
favors a suppurative process.

Vaginal paracentesis is not employed by gynecologists as a purely diag-
nostic method to the extent that it was used formerly. In doubtful cases,
the question lies between an exudate which is frankly fluid and fluctuating or
one that is, for the most part, brawny induration with a central collection of
fluid. A posterior colpotomy is preferable, because it permits drainage in
either case, preventing secondary infection.

Diagnosis of Parametritic Exudates.—The term "parametritis" is in-
tended to embrace any inflammation of the pelvic connective tissue which lies
between the peritoneum and the levator ani, inclusive of the connective tissue
in the spaces between and surrounding the organs in the deep pelvis. There-
fore, paraproctitis and paracystitis may be included, since the connective
tissue surrounding the bladder and rectum is continuous with that of the
uterus and adnexa. While the connective tissue of the parametrium is by
far the most frequently involved, the inflammation may extend by continuity
to the space of Retzius and to the retroperitoneal space by way of the sacral
connective tissue. Furthermore, parametritis may be secondary to an exten-
sion from an inflammatory process, arising in the connective tissue surround-
ing the gut, for example, paratyphlitis or a paranephritis.

The inflammation is characterized by an exudative process which may
or may not break down into an abscess, become absorbed completely or leave
in its wake cicatrices which by themselves cause symptoms. The exciting
causes are almost always the streptococcus and staphylococcus—commonly the
gonococcus or bacillus coli; exceedingly rare are cases which owe their origin
to the tubercle bacillus or the Actinomyces boris. In the fresh stage, a gelatin-
ous, jelly-like fluid is poured out between the connective tissue meshes and
presents a soft elastic swelling with indefinite boundaries. When frank sup-
puration takes place, fluctuation and exquisite tenderness may be elicited.
More commonly, however, the edema disappears, the encapsulated abscess
becomes inspissated and the exudate then assumes its most characteristic
feature, namely, hardness plus fixation and tenderness. In later stages, the
two latter features may not be present.

The process may become a spreading one, each succeeding territory of
invasion assuming the original character of this type of inflammation. Thus
there arise multiple abscesses, etc., that remind one of a carbuncle formation.
These small abscesses may become confluent and form a large abscess which

may rupture in one of several ways, depending upon the extent and spread of the inflammation. The pus gravitates, as a rule, toward the point where the inflammation proceeds. Thus the pus may leave the pelvic cavity through the sciatic notch and reach the free margin of the gluteus maximus, appearing on the posterior surface of the buttocks as an abscess. Occasionally, perhaps even more frequently, the pus may appear at some point in the vagina. Sometimes also it sinks by way of the pararectal spaces and appears at some point in the perineum. Perhaps the most frequent trend for the pus is toward the space overlying Poupart's ligament, because the commonest variety of parametritis is that involving the broad ligament. The inflammation starts by trauma severe enough to tear into the paracervical and broad ligament connective tissue. If the inflammation becomes widespread and extends to the posterior and lateral abdominal wall, it may also extend upwards along the anterior abdominal wall above Poupart's ligament where it becomes apparent as a fluctuating swelling. Before this actually occurs, the exudate may readily be palpable above Poupart's ligament.

The most infrequent situation of the exudate is in the anterior parametrium, that is, that portion of the connective tissue lying between the cervix and the bladder. Here the inflammation appears as a tender thickening reaching halfway up the uterus and disappearing in the lateral connective tissue spaces.

The conformation of the exudate varies widely with its situation and the circumscribing, neighboring organs. In general, where the exudate is limited by peritoneum, for example the upper border of the broad ligament, it has a tendency to be round; usually it forms irregular, hard, flat masses, being narrow at one end and broad at the other. The posterior parametritis gravitating into the rectovaginal septum has a wedge-shape, the sharp edge tapering halfway down the vagina toward the introitus, while laterally it fades off and superiorly it is broadest.

While immobility is one of its distinguishing characteristics, an exudate may be freely movable, as, for instance, when it is situated between the leaves of the broad ligament and is without other attachments. The consistence of an exudate varies from a soft elastic sensation in the fresh state to one of bony hardness in the later stages. Tenderness may be entirely absent in old exudates; it may be exquisite in the fresh stage.

Of great corroborative importance in distinguishing exudates is the clinical history. As a rule, the patient will volunteer the history of a difficult labor with fever and perhaps chills; an induced abortion, or other uterine manipulation; more rarely, injury during menses. Operative procedures per vagina may be complicated by exudates. The exudate makes its appearance several days after the injury. It has a tendency to spread and this rapid extension is very characteristic if one has the opportunity of observing the patient in the early stage. During this time, a remittent fever occurs which gradually abates while the lesion becomes stationary, and then shows a tendency to resorb and become smaller. So-called exudate treatment is at the same time of corroborative diagnostic value, as lesions such as pyosalpinx and ovarian abscesses do not yield to these measures nor do

they tend to resorb. Only the exudative process associated with these lesions become resolved so that later the tubal disease, etc., becomes more manifest.

These factors will serve to differentiate exudates from subserous myomata. Observation over a sufficient period may alone serve to distinguish the exudate from a complicating myoma. Other conditions entering into differential diagnosis are fixed retroflexed uterus, hematomata, perityphlitis and paratyphlitis and carcinomatous infiltrations of the pelvic connective tissue. While palpation may be the same in all these instances, in the case of hematoma, a leukocytosis is less frequent than when an exudate is present. The history, cystoscopy and proctoscopy may help to distinguish carcinoma of the uterus, vagina, ovaries, bladder and rectum.

The masses in perityphlitic and paratyphlitic exudates are more apt to present themselves above, while the median portion of the broad ligament may be entirely free. Also, a history of attacks of colic, suggesting appendical attacks, speak in favor of the primary lesion in the cecum.

The distinction between perimetritic and parametritic exudates cannot be made with any degree of accuracy. In general, retro-uterine collections of fluid with rounded lower margin are pelvic abscesses of peritonitic (perimetritic) origin. A parametritic origin is suggested when the lower margin is sharp and tapering. Laterally situated masses are more apt to be of parametritic nature with a uterus displaced to the right or left. A forward dislocation of the uterus speaks in favor of a perimetritic lesion. The definite palpation of the corpus uteri speaks in favor of a parametritic lesion, since the connective tissue is delimited more or less by the serosal reflection of the peritoneum over the uterus, while in pelveoperitonitis the uterus outline may be completely lost. Perhaps of the most important diagnostic value, as Winter pointed out, is the encroachment of the exudate upon the rectum. When there is a paraproctitis, the lumen of the rectum is, as a rule, compromised. This bulging is readily elicited by rectal examination. In perimetritis, this is not to be found. There is bulging in the pouch of Douglas but the rectum is not compressed.

When the inflammatory process has subsided, leaving cicatrices chiefly in the pouch of Douglas fold (parametritis posterior) and in the infundibulopelvic ligaments, the uterus is distorted so that more or less fixed retroflexion, retroversion, sinistroversion and dextroversion are present. The parametrium on the affected side, that is, the side toward which the uterus is pulled, is thickened and shortened. Occasionally the ovary may be distinctly palpated against the lateral pelvic wall, where it is fixed by the shrunken but fixed infundibulopelvic ligament. Attempts to move it cause pain. The condition is known as parametritis atrophicans. Where all the connective tissue of the pelvis has been involved, a host of symptoms arise which are not easy to relieve and are the cause of the worst forms of hysteroneurasthenia.

These symptoms are caused by changes in posture, by certain occupations which entail movements of the uterus, causing traction upon the ligaments. Pain occurs when the patient jumps, extends her arms, in turning and during coitus and defecation. The diagnosis can be made by eliciting thickening of the posterior parametrium which is accomplished by pushing the portio

vaginalis forward, spreading the fingers and elevating the vaginal vault. The thick folds and strands may be palpated. Moreover, these folds are distinctly tender. On the other hand, besides locating thickening in the lateral fornices, there is also tenderness when the cervix is pushed to the opposite side. These thickened strands are even better palpated through the rectum.

These residues of a terminated pelveoperitonitis or parametritis are, as a rule, overloooked. They are often too delicate to be detected by ordinary palpation. If tenderness is obtained by moving the portio vaginalis, it does not mean that the uterus is the tender organ. It need only be mentioned here that the uterus, including the vaginal portion, is an insensitive organ in the normal state and there is no tenderness present when its parenchyma is affected (except by suppuration) unless the serosa is inflamed. The only sensitive points in the uterus are the external and internal os. Therefore, when the cervix is displaced forward, pain is produced and it may be assumed that the posterior (uterosacral) ligaments are tender. When pain is caused by pressure over the area occupied by the infundibulopelvic ligament, it is the latter which is diseased and not the ovary.

Whether one is dealing with the remains of a perimetritis or parametritis cannot always be settled with certainty by palpation. It is true, however, that, inasmuch as parametritis involves the ligaments, thickened, unyielding and tense bands will be found chiefly in the neighborhood of the folds in the pouch of Douglas. Those due to perimetritis are more delicate and are of the spider-web variety. These, however, are seen during a laparotomy and cannot be felt per vagina. Nor is the thickening in the neighborhood of the adnexa to be construed as significant of a past perimetritis and perisalpingitis, because a small cicatrix in the upper border of the broad ligament may be the only residue of a parametritis.

In these cases, it is important to determine whether the tubes are patent or not. While in parametritis the tubes may remain and stay open in many cases, they are nearly always closed by peritoneal inflammation. If this fact can be established, we have at once an answer to the diagnosis between perimetritis vs. parametritis. Transuterine pneumoperitoneum has proved of value in such cases. Four patients in my series gave a definite history of parametritic exudates, in whom I could demonstrate that the tubes remained patent, complete functional restitution having resulted.

ILLUSTRATIVE CASE

CASE OF A PARAVAGINAL PARAMETRITIC SUBFASCIAL PELVIC ABSCESS WITH PAIN IN THE THIGH, BUTTOCKS AND KNEE; IRRITATION OF SEVERAL PELVIC NERVES

G. P. was admitted April 28, 1921. The patient had three children, oldest thirteen years and youngest five years. Six weeks before she had had a spontaneous miscarriage of three months completed by a physician who extracted the fetus and performed a curettage. Severe pain, vomiting and distention followed. Three days later another curettage was done. This was

followed by *pain in the right loin, buttocks, thigh and knee, fever, vomiting and insomnia.*

Physical examination: The patient was not acutely ill, complained of pain in the right lower quadrant. The abdomen was tender to the touch and there was a large mass palpable in the right lower abdomen. There was also partial immobility of the right hip joint. Pelvic examination revealed a slight sanguineous discharge, the uterus enlarged and forward, the left adnexa free, the mobility of the uterus free, the right parametrium thickened, and the appendages on the right side not palpable. In the region of the right ischium there was induration and tenderness which extended (apparently subfascial) along the ilium and was palpable to the distance of three fingers away from the anterior superior spine over the lower right quadrant of the abdomen. Diagnosis: extraperitoneal subfascial abscess. On April 30, the blood count was as follows: 17,000 white blood-cells, 82 per cent polynuclears, 18 per cent lymphocytes.

May 2, incision and drainage of the subfascial abscess in the right side of the abdomen was done by Dr. B. A three-inch incision was made in the right groin with the release of about eight ounces of thick, greenish pus. The bacteriological report of the culture made of the pus was streptococcus hemolyticus.

June 7, bimanual examination showed the uterus displaced somewhat to the left, movable and not enlarged. There was no mass palpable per vagina.

June 20, an exploration of the inguinal sinus was done. The findings were: A large, smooth-walled cavity lined by necrotic granulation tissue. It appeared to run from behind the psoas muscle high up into the dorsal region. The tract curved around the outer side of the psoas to about the level of the first or second lumbar vertebra and then ran anterior to the psoas and extended down over the symphysis pubis into the region of the groin. The lower limit was felt with the finger.

July 3, there was roughness as of grating on the bare bone at the bottom of the sinus. It was apparently in some part of the os innominatum, probably in the ischium. The impression was that the condition was primarily a gynecological one and that the bone infection, if any, was secondary. X-ray of the os innominatum was advised.

July 9, a revision of the abdominal sinus was done. The tract was laid wide open and found to extend up into the region of the right kidney. The wound continued to discharge.

February 5, 1922, after a prolonged febrile course, the patient was examined with the following findings: The uterus was well forward, freely movable, about normal size. The right parametrium was absolutely free. X-ray examination of the spine and pelvis failed to show evidence of Pott's disease, of osteomyelitis of the hip or the femur.

CHAPTER XXI

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS OF SEPTIC GENITAL LESIONS

In every septic condition of the female genitalia, there must be an antecedent history of a direct predisposing factor, such as childbirth, abortion, coitus, or gynecological operative interference. In the virgin, sepsis originating from the genital sphere is exceedingly rare, if not altogether improbable. The uterus is, as a rule, the portal by which sepsis makes its entry into the pelvis after infection has been introduced from the outside. A history of repeated examination, particularly after the membranes have ruptured, after operative obstetric procedures, placental retention or criminal abortion, points to the provocative cause. While in the majority of instances such history is available, there are cases in which it is more difficult to come to a conclusion concerning the causal relationship of the puerperium to the sepsis. The fever may have made its appearance at too late a date for ordinary postpartum sepsis and yet, as in gonorrheal infections, it may have had a gradual and insidious course at the onset. A parametritis may be the only evidence of a tardy gonorrheal infection.

Other provocative causes of genital sepsis are onanism, cohabitation and self-examination *sub partu*. A very puzzling case in the writer's experience of apparent postpartum sepsis, rigors and high temperature, was finally solved when it was learned that the patient had permitted sexual intercourse the seventh and again the tenth day after labor. An interesting coincidence in this case was the fact that the first wife of this husband had lost her life from postpartum sepsis. When no exciting cause can be traced, but before concluding that we are dealing with a spontaneous infection, it is well to exclude extragenital causes of infection, such as tonsillitis, pyelitis, etc. For although true puerperal sepsis implies childbed infection, it may in exceptional cases be simulated by nonpuerperal infections occurring during that period, such as typhoid, influenza, appendicitis, and cholecystitis.

When local evidences are present, such as puerperal ulcers, gangrenous or diphtheritic genital wounds, great tenderness and swellings in the pelvis, and abdominal rigidity, there can be very little question about the puerperal rôle in the sepsis. When such signs are absent, one has to think of other systemic conditions simulating sepsis. In this the blood culture has at least the value of establishing the bacteremia, although in not every case can organisms be demonstrated in the blood. Repeated chills associated with high rises of temperature with cultures of streptococcus or staphylococcus in the blood rule out such conditions as malaria, typhoid, miliary tuberculosis and eclampsia.

Acute general miliary tuberculosis may give rise to the high fever, rapid pulse, cyanosis and dyspnea, but there is always apt to be some evidence of pulmonary tuberculosis which may be suspected by pulmonary signs; absence of these speaks against miliary tuberculosis. The presence or absence of chorioid tubercles is also of first importance in the differential diagnosis, but these must not be mistaken for white spots in the retina common in sepsis. As mentioned above, the positive finding of streptococci or staphylococci in the blood speaks for puerperal sepsis. Metastatic abscesses in other parts of the body, in the absence of positive blood cultures, speak in favor of sepsis of puerperal origin. Very rarely intermittent and remittent fever, running a chronic course and due to tuberculous bronchial or mesenteric lymph-nodes, may simulate sepsis. The finding of signs of pulmonary tuberculosis, especially with the aid of the X-ray, is a great help in the diagnosis.

When brain symptoms are conspicuous, such as headache, rigidity of the neck and cutaneous hyperesthesia, one has to think of meningitis resembling sepsis. In cerebrospinal meningitis, spinal puncture will yield a turbid fluid loaded with polynuclear leukocytes together with the specific meningococcus. In metastatic meningitis, the other pathogenic organisms, such as strepto-staphylococci and pneumococci, may be found. In tuberculous meningitis, the cerebrospinal fluid is apt to be clear or only very slightly turbid; the sediment consists almost exclusively of mononuclear lymphocytes, and tubercle bacilli may be found if careful search is made.

When lung symptoms characteristic of a pneumonia are prominent, it may be difficult to say whether the pulmonary infection is secondary to genital sepsis or whether the latter is secondary to the pneumonia. In the blood culture findings, a diagnostic aid may be had. Thus when streptococci or staphylococci are found, it is safe to assume that the lung involvement follows the genital sepsis. In rare cases, however, the pneumococcus may enter the blood stream through the genital tract. In such a case, when pelvic symptoms are definitely present and antedate the pneumonia, a correct interpretation may be made. In all events, the critical fall of the temperature, so characteristic of a genuine uncomplicated pneumonia, is of decided diagnostic importance. The septic type of typhoid fever may simulate puerperal sepsis very markedly, particularly when the general symptoms are pronounced. The slow dicrotic pulse is suggestive of typhoid fever, while in sepsis it is very apt to be accelerated to 120 or more beats per minute. Characteristic of typhoid fever is also the leukopenia, while in sepsis there is most often a definite leukocytosis. Of pathognomonic importance is the positive Widal reaction, which occurs at the end of the second week of typhoid and, more especially, the blood culture which is often positive much earlier than the Widal.

Pyelitis may simulate puerperal sepsis in many of its symptoms, particularly when meteorism, abdominal rigidity and paralytic ileus and bloody urine are present. Favoring pyelitis is the onset of fever before labor pains begin or shortly after, say within the first forty-eight hours. When there has been no vaginal examination or operative procedure, when the daily fever curve shows wide differences and when, in addition, there is tenderness in

the region of the kidney, renal enlargement and bacilluria with pyuria, pyelitis as a diagnosis may be fairly well established. In some cases, rapid lysis and sudden sharp decline of the fever may occur after several days. In the less septic type of pyelitis, the comparatively healthy look of the patient is of special significance; she may be very comfortable and the pulse may not be increased beyond 100. The latter is always of favorable diagnostic as well as prognostic significance.

When the puerperal infection is due to the bacillus coli, however, the primary focus is very apt to be found in pyelitis.

When peritonitic symptoms are prominent, the diagnosis from appendicitis may become important and may present great difficulties. In the history of the case, data may point to an appendicular origin. Repeated attacks of right-sided pain are suggestive of appendicular trouble. In general, it is well to bear in mind the typical evolution of the attack; pain in the epigastrium, vomiting and localization to the right iliac fossa, tenderness and rigidity localized at McBurney's point, spreading of tenderness and rigidity to the general abdomen. When the uterus and adnexa are found to be free of inflammatory signs, the diagnosis becomes easy. But, in the presence of adnexal tumors, it becomes a matter of careful palpation. The mass formed by appendicular abscess is generally higher; it can barely be palpated by the finger tips in the vagina, while the deeper situation of the inflammatory mass favors an adnexal origin. In the first few days after labor, the fundus of the uterus reaches near the umbilical level, so that the adnexa may occupy a position normal for the appendix.

An accurate preoperative diagnosis is of rather decided importance in the puerperium, since puerperal adnexal infections are best left alone, at least until they become quiescent, because they offer an unfavorable prognosis as compared to appendicitis. The situation is different in the presence of peritonitis, because the indication is to establish drainage in any event.

Inflammatory adnexal tumors of nonpuerperal origin and their differentiation from appendicitis, from twisted ovarian cyst and extra-uterine gravidity have already been discussed. It remains to distinguish septic genital infections from articular rheumatism, scarlatinal exanthemata, measles, hemorrhagic variola and malaria.

Inasmuch as joint symptoms and evidence of valvular disease occur also in sepsis, it may be difficult to distinguish polyarticular rheumatism from it. Yet a single joint involvement in typical rheumatism is rare, while, in genital sepsis, especially of gonorrheal origin, a monarticular process is more characteristic. In sepsis, splenic enlargement, retinal hemorrhages and positive blood cultures are more common. Sometimes joint puncture may shed light on the nature of the infection. Septic joints, as a rule, contain fluid in which bacteria may be demonstrated by smear or culture. The administration of salicylates in doubtful cases will clear up a joint rheumatism, while sepsis is thereby scarcely influenced.

Scarlatinal exanthemata may be confused with sepsis. The typical angina, swelling of the lymph glands of the neck, strawberry tongue, drop in temperature after the rash is fully developed, are characteristic of scarlet fever.

The eruption in puerperal sepsis is seldom localized to the face and upper extremities, which is the case in scarlet. The desquamation typical of scarlet may be the last and only corroborative symptom to appear. Here again the blood culture findings are important.

Although measles seldom attacks adults, the rash of sepsis may closely resemble rubeola. The absence of snuffles, conjunctivitis, and the mildness of the temperature course, which abates with the height of the rash, are typical of measles.

Hemorrhagic variola may be closely simulated by the skin changes in puerperal sepsis. Blood culture may be the only way of settling the diagnosis.

Remittent and intermittent fever of puerperal sepsis of chronic type may resemble malarial infection. The finding of plasmodia in the blood or bacteria makes the diagnosis clear.

In conclusion, it may be said that, in cases of septic infection in which the etiology is doubtful, the cause may be traceable to the genitals. A careful history may reveal the association of pregnancy or labor antedading the infection and also possible provocative causes, such as criminal interference or surgical operations.

CHAPTER XXII

DIAGNOSIS OF ABDOMINAL TUMORS

There are times when one has to content oneself with the limited diagnosis of "abdominal tumor" without being able to define its origin and nature. Exploration by laparotomy may be the only and last resort to establish the diagnosis. This, however, has been becoming increasingly unnecessary. By carefully scrutinizing the physical characteristics of the tumor, an approximate idea can be reached. Thus, the matter of size, conformation, consistence, mobility, relationship to organs, type of fixation and preferential situation yields data which may be taken to indicate the nature of the tumor.

Factors in Diagnosis—*Size.*—When the tumor is large enough to be palpated much above the pelvic brim, it at once rules out lesions of the tube, because these rarely, if ever, attain a size exceeding the pelvic cavity. Carcinoma of the uterus or tubes may also be excluded, because the case proves fatal long before the malignant growth reaches so large a size. Carcinomatous degeneration of an ovarian tumor or of a fibroid cannot be excluded on the ground of large size. Large ovarian cysts and fibromyomata may become abdominal tumors and enter into differential diagnosis with such lesions as hydronephrosis, echinococcus cysts, encapsulated ascites, etc.

Contour.—In general, it may be said that all new growths and retention tumors are round or oval. This holds good for ovarian tumors and fibroids, for parovarian tumors and large tubal tumors, for new growths, retention cysts of the kidney and retroperitoneal growths. An exception to this rule is the malignant tumors which have invaded neighboring structures, thereby losing their original contour. When the contour is flat with limited borders, the mass is very apt to be inflammatory and tender. The surface of the tumor also indicates some characteristic typical of certain conditions.

Thus, a surface studded with discrete nodules indicates multiple fibroids; when it is irregular and divided by indentures into irregular prominences, it is apt to be a multilocular cyst. It goes without saying that, in addition to these physical characteristics, other phenomena must be linked to arrive at a proper diagnosis. A characteristic finding is met with in a papilloma, particularly when it has broken through the surface and is palpable in the pelvis. When the tumor mass is irregular and adherent the adhesions, as a rule, are formed by several loops of intestines matted together. Tortuosity is a characteristic of tubal tumors.

Consistence.—This is of great importance in pelvic tumors. Whether the tumor is solid or cystic, it indicates at the same time its probable origin and pathology, for it is well known that cystic tumors spring as a rule from the ovary, while solid pelvic tumors arise from the uterus. The determination of the fact of cystic consistence is fraught with difficulty. The chief source of confusion is the abdominal wall itself. A distended bladder can

also cause mistakes but, when borne constantly in mind, it need offer very little trouble in diagnosis. While solid tumors of the ovary occur and cystic degeneration of uterine fibroids may result, these are nevertheless rare by comparison. A distinguishing feature is their effect on function. This has been discussed elsewhere.

In tumors of other organs, solidity and hardness, as a rule, suggest carcinoma. The bony hardness, as spoken of in describing the consistence, is noted in hypertrophy of the liver and spleen, for example. Encapsulated ascites gives a cystic impression to touch, as do ovarian and parovarian cysts. Very large tubal sacs may also present cystic consistence. Retention cysts of the kidney, of the mesentery and retroperitoneal space and pancreas are to be thought of in the differential diagnosis.

Site.—This is an important factor in the diagnosis. It is important to note its tendency to find its original position after an attempt has been made to displace it. Thus deep-lying tumors are very apt to come from the genitals. Tumors of the uterus and ovaries tend also to occupy a more median position. Tubal tumors, on the other hand, are unilateral as a rule.

Mobility.—When the tumor is found not to move with respiration, it is apt to be retroperitoneal, such as mesenteric tumors; while, when the tumor moves with respiration, it is apt to arise from the liver, kidneys or spleen. As a rule, genital tumors permit of some degree of mobility which naturally does not depend upon the respiratory excursion. Only the intraligamentous tumor, or a tumor that is incarcerated in the pelvis, has a limited range of motion. In rare cases, an ovarian tumor or a fibromyoma becomes detached and enveloped by mesenteric peritoneum, causing it to be firmly fixed.

Origin.—The origin of the tumor, when once determined, is of great diagnostic importance, because it becomes merely a task of identifying one of several well-known varieties which are likely to arise from the organ in question. This holds good for neoplasms of genital origin. In distinguishing between tumors of the abdominal viscera and those of the genital organs, it is well to bear in mind that the latter have a tendency, when they reach a large size, to rise above the pelvic brim and, although easily palpable by external abdominal examination, some portion of them will be found to remain in the pelvis. That portion may be identified by its attachment to a pelvic organ. It is different with tumors that dip down from above into the pelvic brim. Although its lower limit may be palpable to the vaginal fingers, it will be found more readily displaceable toward the diaphragm; there is no definite pelvic organ attachment and an area of intestinal tympany may separate the tumor thus displaced from the pelvis. On the other hand, as significant of a higher abdominal organ origin, there may be contiguous flatness to percussion from liver, spleen or kidney. Exceptions are to be found in large pelvic tumors which become attached above and, vice versa, tumors from liver, spleen and kidneys which become fixed to pelvic inflammatory masses. Here other symptoms and their development will have to be brought to bear upon the diagnosis.

Physical Differentiation.—An important physical differential sign is the behavior of the tumor after an attempt is made to displace it. If it

tends to sink deeper in the pelvis, it is very likely to arise from it; while, when it tends to rise above the pelvic brim, it is more apt to originate from an extragenital organ. Tumors occurring in wandering kidneys or spleens cannot, as a rule, be differentiated by physical signs. When they are discovered by examination, when the symptoms complained of are not definitely genital in character, a proper diagnosis may sometimes be made. In this respect, pneumoperitoneography, chromo-ureteroscopy and X-ray ureteroscopy are naturally of pathognomonic importance. Usually, however, they are conditions which become revealed upon performing laparotomy. Bimanual examination, which is ordinarily relied upon to distinguish genital from extragenital conditions, leaves us in the lurch because it is not always possible to palpate tubes and ovaries. Were this possible in every case, one could exclude these wandering tumors and ectopic kidneys.

Ectopic kidneys situated in the pelvis (intraligamentous site) escape diagnosis in the vast majority of cases. They may lie so close to the uterus as to simulate fibromyomata. The palpation of a kidney-shaped tumor, possibly pulsation from large renal vessels, the situation of the kidney nearer the lateral pelvic wall or the position of its lower pole higher in the pelvis, are factors suggestive of renal ectopia. When the condition is suspected, it is simple enough to make certain of the diagnosis.

When the tumor, though of large size, has been identified with the genitals, it can arise only from the uterus or ovaries. The uterine origin of the growth can be established if the portio vaginalis is found to merge directly into it. When there is a separation between the portio vaginalis and the tumor, the latter may nevertheless arise from the uterus. In this case, both uterus and tumor should be movable together. Occasionally, however, an intraligamentous ovarian tumor may be very intimately connected with the uterus, while a pedunculated subserous myoma may have acquired a completely detached position and not share simultaneous motion with the uterus. It happens also that the lower segment of a gravid uterus may be so softened that its transition from the cervix may not be appreciated, thus giving a false impression of pedunculation. In cases of doubt, the uterine sound is of great help because, when the tumor forms part of the uterus, the cavity will be demonstrated to be in the general locality of the tumor. The direction of the sound also indicates whether the uterine cavity is in the midst of the new growth. In submucous myomata, the sound will come upon a prominence, perhaps eliciting a division into two cavities. Elongation of the uterine cavity is a strong indication of uterine tumors, but it must be borne in mind that a cavity measuring four and one half inches may be found in a so-called metritic uterus without tumors and in subinvolution.

Having excluded the uterus as the tumor-bearing organ, it will next be our task to differentiate between tumors of the adnexa, hematoceles and large inflammatory masses which may be palpable above the pelvic brim. Aside from the differences in contour exhibited by these conditions, the matter of their history and symptoms of functional disturbance will be of the greatest help. These have been discussed elsewhere.

In considering essentially pelvic tumors, the same principles apply. Once

the original site is located, the secondary nature of the tumor is easier to determine. The important landmark here is also the uterus with its portio vaginalis. Whether the tumors spring from one side or the other or both, whether they are broadly attached or not, they have a significance for the diagnosis. But, in general, extra-uterine tumors are separated from the uterus by a more or less deep furrow or space, while tumors arising from the uterus show a narrow or broad pedicle. Here, too, the sound points to the proper diagnosis; elongation usually means uterine tumors. In the midst of a number of tumors, the uterus may be identified as occupying a middle point in consistence between cysts and tubal swellings, on the one hand, and fibroids on the other. In the first case, the uterus may be felt to be hard; as compared to fibroids, it may be said to have a soft consistence. When the uterine cavity is measured and found to be no more than two and one half inches in length it may exclude fibroids of appreciable size. But multiple fibroids may exist without affecting the capacity of the uterine cavity. A soft-feeling uterus suggests gravidity or degenerations. Puerperal subinvolution and a hard-feeling uterus suggest rather chronic metritis, myomata or carcinomata. Yet myomata may be softened through edema or cystic degeneration, while certain cases of gravidity may be associated with decided hardness for the first three months of pregnancy. In the same way, while solid tumors as a rule exclude ovarian cysts, a small dermoid may feel very hard; a hematocele with coagulated blood may feel very firm, while a peritoneal exudate in the stage of resorption is not only solid but very hard. So that, for proper differentiation, other signs and symptoms will have to be drawn upon.

Tumors of the neighboring pelvic organs may be confused with those of the genitals. Thus tumors of the periosteum, of the pelvic bones, of the pelvic lymph-nodes, paratyphlitic exudates, tumors of the bladder and rectum all will have to be distinguished from the genitals. An interesting source of error is the partly resorbed exudate in the parametrium which has a more lateral situation and so can simulate bony tumors. The same applies to carcinoma of that locality. The nearer the tumor approximates the uterus, the more difficult it will be to determine its origin. For example, rectal carcinoma may break through the perirectal tissues, become agglutinated to the uterus and simulate a posterior parametritis. Rectal examination naturally establishes the correct diagnosis.

In conclusion it may be said that the more carefully and uniformly a routine examination is made in each case, the less frequently will mistakes occur. All physical signs, subjective and other functional symptoms, the history and further observations, are collated from an objective point of view. In this, also, the gynecologist should avoid the temptation of snap diagnosis which is based upon recalling one or two or a few similar experiences resembling one or two features of the case and not all the principal factors of major and minor importance. In all this, a rigid mental discipline of self-criticism and of honest avowals of mistakes made on the part of the specialist, go a long way toward bettering his "batting average" and enable him to add something, no matter how small, to the art of diagnosis.

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