

PART II.

DISEASES AND INJURIES OF SPECIAL TISSUES.

Diseases and Injuries of the Blood Vascular System, Heart and Pericardium.

There are cases of persisting pericardial effusion which may require removal. Paracentesis of the pericardial sac may be performed with an ordinary aspirating apparatus. The surface should be thoroughly cleansed before the introduction of the needle. The fluid may then be pumped out and the opening dressed antiseptically. An aspirating needle should be inserted an inch and a half from the left border of the sternum in the fourth or fifth intercostal space. This is done to avoid the internal mammary artery. Wounds of the heart and great vessels are so quickly fatal that it is hardly necessary to discuss the injury. Injuries to the pericardium, whether they are by knife or bullet, are attended by hemorrhage into the pericardial sac and this blood, clotting around the heart, so interferes with its action, that death occurs. Very often, where this hemorrhage is not great enough to produce death, infection and suppurative pericarditis, which is generally fatal, will follow. Little can be done in the way of operative treatment. The most essential thing is to keep the person quiet, with his head low. The wound should be cleansed, but during the stage of shock, no operative means should be attempted. If the patient recovers from the shock, the wound in the pericardium may be closed.

DISEASES OF THE ARTERIES.

Arteries are subject to acute or chronic inflammation, the result of injury, sepsis, or constitutional disorders.

Acute Arteritis is extremely rare, but is said to be occasionally met with in septic and infective inflammations, where infective emboli lodge in the artery and create ulcerative inflammation. Of course, plastic arteritis occurs in the healing of an artery in an open wound, but the changes attending infection of the artery from infective emboli are different in that they are destructive.

Chronic Arteritis is frequently spoken of as atheroma, endarteritis, or sclero-endarteritis. The tunica intima and media only, are involved. It is the most common disease of the artery and is present in many people over forty years of age. It is most common in the large arteries, especially those of the lower extremities. It is the result of increased intra-arterial pressure, the arteries becoming overtaxed. It is very

much more common in men than in women. Excitement, alcoholism, syphilis, Bright's disease, plethora, gout, together with lesions affecting the integrity of the artery-wall, may be set down as among the causes of the disease.

The *pathology* of the disease is that of a chronic inflammation. The middle coat and the tunica intima become infiltrated with round cells. These may break down and ulcerate (ulcerative endarteritis), or the inflamed part may undergo calcification (pipe-stem artery), or the round cells may form fibrous tissue. Soft inflamed areas may fuse together, making a hard artery (sclerosis). Sclerosis of the arteries may become general. The artery feels like a hard, fibrous cord, and at certain places, the artery-wall may become thickened and calcareous, when it will feel knotty or beaded. In some cases, the degeneration is so great that the artery can not be tied and, being grasped with an artery forceps, it will be found brittle and will break off. The elastic tissue in the tunica intima is most affected, likewise the large arteries which are made up largely of elastic tissues, are affected to a greater extent than the medium sized or smaller arteries. But the inflammation nearly always extends into the tunica media and impairs the integrity of the muscular coat, so that the arteries are unable to dilate to answer the call of the tissues for nutrition.

The degenerative changes which come on later are (1) fatty, (2) calcareous, and (3) fibrous. The effect of this condition in the arteries is that the limb below is cold, congested, and often ill-nourished. The artery becomes tortuous. Aneurysm frequently results because of a weakening of the artery. This occurs when the tissues of the tunica intima break down and ulcerate. Thrombosis may be caused by the debris from the ulcer within the artery, being carried to other parts of the body, also, coagulation of blood at this roughened area may occur. This clot may be detached and carried elsewhere and result in the plugging up of an artery (See Thrombosis and Embolism), or rupture of the artery sometimes occurs because of fatty or calcareous changes, which so weaken the artery that muscular effort or excitement results in apoplexy. Gangrene is not an infrequent result of this endarteritis. (See Gangrene).

The *symptoms* of chronic endarteritis are:—

1. Evidences of degeneration generally, arcus senilis, the person is prematurely aged.
2. History of syphilis, tuberculosis, alcoholism, or Bright's disease, etc.
3. The presence of atheroma of the superficial vessels.
4. Lesions affecting the integrity of the vessel walls.

Obliterative endarteritis sometimes follows in small arteries where thrombosis occurs, or if the inflammation is more violent, it results in the obliteration of the artery and occasions great pain and suffering. It is fortunate that the disease is rare. Chronic endarteritis may con-

tinue for years, and if a person leads a quiet life, he may never know that his arterial system is fragile and may at any time rupture, causing his death. Degenerative changes will continue until the larger arteries are affected. when in excitement, or because of the weakened artery, at a certain point it dilates and an aneurysm results.

ANEURYSM.

An aneurysm is an abnormal dilatation of the living artery, or a pulsating tumor filled with blood, connected either directly or indirectly with an artery. Aneurysms are either spontaneous or traumatic. The spontaneous aneurysms result from disease, while a traumatic aneurysm results from an injury of the artery. Spontaneous aneurysms are the result of obstructions to the circulation, endarteritis, atheroma, arterio-sclerosis, or any diseased condition which makes the artery weaker at one point than another.

Aneurysms are further classified into *false* and *true*. A *false* aneurysm is one having no coat of the artery intact. A *true* aneurysm is one which has one or more coats of the artery intact.

Varieties.—Besides (1) *false*, (2) *true*, (3) *spontaneous*, and (4) *traumatic* aneurysm, there are (5) *fusiform*, in which there is a long, spindle-shaped dilatation of the artery, (6) *sacculated*, where it is in the shape of a saccular dilatation of the artery, (7) *circumscribed*, where it is outlined by a wall of resisting tissue, (8) *diffuse*, where it has not such a definite outline, (9) *artero-venous*, where the aneurysm occurs in connection with a vein (See traumatic aneurysm), (10) *cirroid*, where a number of arteries are dilated and pulsatile, and (11) *cylindrical*, where the dilated artery has the same dimensions for some distance.

Causes.—The causes of aneurysm are, predisposing and exciting.

The *predisposing causes* are male sex, occupation, excitement, and the presence of certain diseases, as alcoholism, Bright's disease, syphilis, etc. It happens more frequently in laborers, inasmuch as during violent muscular contraction, which to some extent will obstruct the circulation, or during the time when the heart's action is increased because of stimulants, the artery may give way at a weak point. Diseases of the arteries, as atheroma and the formation of emboli, also operate as predisposing causes.

The *exciting causes* are obstructions to the circulation, mechanical violence or injury to the artery, abnormal heart action, muscular contractions, blows, strains, etc.

Formation.—Aneurysms are formed in several different ways. When due to atheroma or to an ulcerative endarteritis, the middle and inner coats usually give way. These diseases do not affect the external coat, therefore, it only, forms a covering for the artery. The dilatation may be medium or may be quite great. As the artery dilates, inflammatory tissues form which prevent the sac rupturing. Sometimes it may

be the result of a weakened condition of the artery or embolism of the vasa vasorum and there may be a general dilatation of a piece of the artery when none of the coats is absent. The vessel may rupture at the point of ulceration in the artery, and the flow of blood into the tissues be slow and may excite inflammation and the formation of fibrous tissue, limiting the diffusion of the blood by a distinct sac formed of this inflammatory tissue. In other cases, the blood may extravasate in the middle coat separating the internal and a part of the middle coat from the external coat, with dilatation of the external coat following. This form of aneurysm is called dissecting or consecutive aneurysm. It may happen that from ulceration or injury, the external coat may be weakened so that the middle or internal coat is pushed out through the opening in the external coat, this forming the wall of the sacculated aneurysm. This is rare. In structure the sac may be made up of:—

1. All the coats of the artery.
2. It may be the condensed tissues external to the artery, none of the coats being intact over the tumor.
3. The walls of the sac may consist of the external coat only.
4. The walls of the sac may be the external and part of the middle coat (rare). In other cases, still more rare, the inner wall of the sac may consist of the middle coat, as in dissecting aneurysm.

Contents.—The contents of the aneurysm consists more or less of clot. Coagulation and organization of the blood within the aneurysm, seems to be nature's method of obtaining a cure. The blood flows less swiftly inside the sac, the inner surface of the aneurysm is rough and the conditions are favorable to coagulation. The clot in the aneurysm may be white, or it may be partly white and partly red, or it may be entirely red when it forms quickly. It depends upon how rapidly the clot forms and under what conditions.

Results.—*Spontaneous recovery* in an aneurysm occurs because of the deposit of fibrin in the aneurysmal sac, layer after layer being formed until, after a time, the entire sac is filled up. This may become organized, forming a hard fibrous mass. The artery beyond the aneurysm may be pervious because of collateral circulation having been established, or it may become obliterated, the tissues to which this artery was originally distributed, being nourished from other channels, when a fibrous cord would be the remains of the artery. In other cases, a hard, nodular mass the size of the aneurysm, somewhat shrunken, will remain. The artery above and below being plugged up, an abscess forms and burrows towards the surface and ruptures, the disintegrated blood being discharged, and finally, the wound healing, leaves a mass of fibrous tissue which is the result of the inflammatory process. The arrest of the circulation in the aneurysmal sac is brought about by pressure upon the artery between the aneurysm and the heart, or pressure upon the artery beyond the aneurysm. In other cases, the cir-

culation in the artery is slowed and coagulation may set in. If it sets up, it may continue until the coagula fill up the entire aneurysmal sac. The clots which are formed are classified by some writers as active and passive, but whether some of the clots may be more productive of favorable results than others is, perhaps, not known. Coagulation of the blood in the sac seems to be the end sought for in almost all the operations for aneurysm.

Rupture of the Sac may lead to very disastrous results in the case of aneurysm. Rupture within a joint or the tissues of a member, followed by hemorrhage, will result in the obstruction of the circulation to the limb below and gangrene will occur. Rupture of a popliteal aneurysm within the knee-joint, is an indication for amputation. In aneurysm of the superficial femoral artery which ruptures within the tissues, the blood extravasating along the fascia and muscle-planes will sooner or later obstruct the circulation to the leg, and gangrene will result. Rupture of an aneurysm within the chest, or on a mucous membrane, or in the peritoneal cavity, or externally, will result fatally.

Sloughing during suppuration, following inflammation in the aneurysmal sac, may result in serious secondary hemorrhage.

Destructive changes may follow the pressure of the aneurysm upon other tissues. It is a curious fact that the pressure of an aneurysm upon hard bone will result in the wearing away, erosion, and absorption of the bone. Elastic tissues are less affected by the pressure of the aneurysm than any other. It may result in the paralysis of nerves and the obstruction of veins. Aneurysm of the arch of the aorta may cause absorption and erosion of the sternum and it may appear beneath the skin on the front of the chest. Aneurysm of the descending portion of the arch of the aorta will cause erosion of the bodies of the vertebrae and finally, paralysis, due to pressure upon the nerves. In such cases the intervertebral discs are less affected than the bone, because of the fact that cartilagenous tissues do not yield to the pressure of the aneurysm as does bone. It may press upon the artery, of which the aneurysm is itself a part, causing obstruction to the circulation through the aneurysm, or at least an interference with it, to that extent that coagulation of the blood may occur within the aneurysm, a spontaneous cure resulting. One of the serious results of the pressure of the aneurysmal sac is pressure upon the accompanying veins of the artery, thus obstructing the circulation.

Gangrene is one of the serious terminations of an aneurysm. It is caused by pressure on the main artery, vein, or nerve of a member, or by rupture of the aneurysm, thus interfering with the nutrition.

The effects upon the general health are various, depending largely upon the local conditions. The presence of a diseased condition of the artery affects the nutrition to the tissues generally, and the person is found to be in a condition of bad health.

Symptoms.—The symptoms of aneurysm are (1) pulsation. This pulsation is synchronous with the heart-beat. Aneurysm may be mistaken for a tumor which lies immediately over the artery and which raises up at each heart-beat because of the distension of the artery. The aneurysm not only raises up, but enlarges in all directions, a point which must be kept in mind. The pulsation of the tumor is arrested by pressure on the artery between the aneurysm and the heart. The pulsation in the tumor is markedly increased by pressure on the artery beyond the tumor. After a little time, because of pressure on the artery beyond the tumor, the pulsation in the aneurysm will disappear.

2. Pulse. The pulse beyond the aneurysm is very small, weak, or even absent, while, on the proximal side of the aneurysm, the pulse is equally as strong as it is in corresponding parts of the body.

3. Bruit. Upon auscultation, an abnormal sound may be heard over the tumor. It is a swishing sound produced by the liquid rushing from a smaller into a larger space. This is synchronous with the heart-beat.

4. Circulatory disturbances are often very marked. In consequence of pressure upon the *venae comites* of the artery, there is edema of the part below or beyond the tumor, and there may be even a varicosity of the superficial veins in some cases. The pulse beyond the tumor is less, and if the limb is raised, it may be absent. Upon elevating the limb in which the aneurysm is located, the tumor will be found less tense and the circulation to the limb almost arrested, whereas, on lowering the limb, the tumor becomes more turgid and the return circulation of the limb is affected. Sphygmographic tracings show that the dicrotic wave has disappeared and that the pulse beyond the tumor is somewhat delayed.

5. Changes in arteries and other degenerative changes. The presence of *arcus senilis* and degenerative changes in the arteries generally (*atheroma*), and a history of the case, of diabetes, syphilis, Bright's disease, etc., will be sufficient, when taken with the symptoms present, to make a diagnosis of aneurysm.

Internal Aneurysm.—Internal aneurysm is more difficult to recognize. There is no tumor which can be palpated and the signs are often obscure. It may be mistaken for valvular heart disease. Pressure upon the thoracic viscera, producing dyspnea, violent cough, obstruction to the circulation upon the side of the neck and head, or dilatation of the pupil, or evidence of pressure upon the large nerves of the neck, will be important evidences of thoracic aneurysm. When taken into consideration with the interference with the general circulation, or the interference in the circulation upon one side of the body and not the other, together with the abnormal sounds of the heart upon auscultation, the diagnosis of thoracic aneurysm may be made. Aneurysm of the abdominal aorta is more easily diagnosed, inasmuch as the tumor is more readily accessible. The evidences of rupture of an aneurysm

FIG. 27.



Specimen showing the heart and an aneurysm of the arch of the aorta. *a*, right subclavian; *b*, right common carotid; *c*, left common carotid; *d*, left subclavian branches.—From laboratory of anatomy, American School of Osteopathy.

into one of the serous cavities of the body, are those of internal hemorrhage with rapid collapse. Where the rupture takes place within the tissues of a limb, there will be rapid distension of the tissues, together with an obstruction to the return circulation. The pressure in the tissues occasions great pain. Oftentimes there will be, from escape of blood in the tissues, a loss of the pulse beyond and a disappearance of the bruit. The rapid and intense swelling ends in edema and coldness below. Where the loss of blood in the tissues is not sufficiently great to immediately bring on death, gangrene in the member below will follow. Where the rupture of the aneurysm is in one of the large cavities, death results quickly from hemorrhage. The rupture of a carotid aneurysm may result in almost instant death, whether in the tissues of the neck or in the pharynx. Rupture of an aneurysm externally, is so rare, and the symptoms so evident, that it merits no description. Sometimes an aneurysm is spontaneously cured. Evidence of spontaneous cure will be the increased hardness of the tumor and the fact that it diminishes in size. There is loss of pulsation and the disappearance of the bruit. Sometimes, where the aneurysm involves a nerve by the formation of fibrous tissue, because of cicatricial contraction occasioned by the plugging of the aneurysm, great pain will be experienced.

Diagnosis.—The diagnosis of aneurysm is sometimes difficult. It may be mistaken, under certain circumstances, for (1) tumor over the artery, (2) an abscess about an artery, (3) enlarged thyroid, and (4) valvular heart disease. The diagnosis between aneurysm and tumor can be made upon careful examination. The tumor, while it raises up with each pulse beat, is not *expansile*. There is no bruit heard over the tumor. Very frequently the tumor may be raised up away from the artery. The history of the case and the absence of atheroma will be sufficient to form the diagnosis. Furthermore, the pulse beyond the tumor is not seriously affected.

In abscess, the inflammation is more severe. Traumatic aneurysm, the result of injury of one or more coats of the artery where inflammation is excited, may be puzzling. As for instance, a lady in ironing, while turning around to face the table upon which an ironing board lay, struck the inside of her leg in Scarpa's triangle, against the side of the table. She experienced some pain from the injury, but gave it little thought and continued with her duties. Swelling followed and within four or five days, an acute inflammation set up. There was considerable interference with the return circulation. Upon examination it was found that the tumefaction, which had been diagnosed as an abscess, was an aneurysm of the superficial femoral artery. The inflammation was not severe enough for an abscess, and an abscess would not have occasioned the interference with the return circulation. The bruit heard over the tumor was distinct and upon operation the diagnosis was confirmed. The aneurysm was removed and the case recovered without untoward symptoms.

Aneurysm of the common carotid artery and an enlarged thyroid gland, are frequently confounded. In exophthalmic goitre, where the exophthalmos is not very great and where there is a bruit or abnormal sound over the gland, together with a cardiac murmur and tumefaction in the neck, the case is often called aneurysm of the carotid artery. In these cases the pulse beyond the tumor is found not to be affected. If the case is inquired into carefully, this mistake need not be made. In goitre there is tachycardia and Graves's sign is present, that is, widening of the palpebral fissure. The pulse in the temporal arteries on either side is alike. This would not be true of aneurysm. Furthermore, the enlarged thyroid gland will move with the larynx on deglutition, the aneurysm will not. In cases where there is no pulsation in the aneurysm, the diagnosis is extremely difficult. At all events, where the diagnosis is in doubt, an opinion should be withheld until every means of obtaining knowledge of the case is exhausted.

The diagnosis of aortic aneurysm will oftentimes depend upon one's knowledge of, and skill in, physical diagnosis.

Treatment.—The treatment of aneurysm is (A) Osteopathic, (B) Operative, and (C) Dietetic and General.

Osteopathic Treatment has for its purpose, to decrease the intra-arterial tension and to favor coagulation of the blood within the sac. Should such coagulation take place, the tumor will become organized and harmless. In brief, it simulates nature's method of spontaneous cure. When the obliteration of the aneurysm is not possible, as where the aorta is involved, the sac wall may be strengthened by removing lesions affecting the trophic and vasomotor nerves distributed to the arterial wall. For a full discussion of the osteopathic methods of treatment, lesions, etc, a text book on the Practice of Osteopathy should be consulted.

The *operative treatment* consists of (1) pressure. Pressure may be administered in several ways:—(a) Digital pressure, which is made by the thumbs, assisted by a shot-bag. Pressure is kept up by means of intelligent assistants. Pressure is made on the proximal side of the tumor in order to lessen the circulation in the tumor, with the hope that coagulation of the blood will follow. Cases of good results from this treatment are reported to have taken place within a few hours. The aneurysm having filled up with a clot, the clot later becomes organized and the aneurysm cured. This method is not practicable in certain parts of the body, as in the neck, but it is practicable in the gluteal region or in the femoral, popliteal, or tibial aneurysms. (b) Flexion. Pressure by flexion may be made in cases of popliteal aneurysm, or a hollow ball of rubber may be used in case of axillary or subclavian aneurysm, the arm being held to the side, while pressure is exercised directly upon the tumor. (c) Direct pressure by tourniquet. This was formerly used quite extensively, the object being to excite inflammation in the sac and adhesion of its walls or the formation of clot.

This method is now rarely used. (d) Pressure by bandage is of service and might be tried in aneurysms in the extremities. This consists of applying snugly to the limb an Esmarch's elastic bandage, (in case of the lower extremity, from the toes up to above the aneurysm. The bandage must be loosely applied over the aneurysm and rather tightly above it. This cuts off the blood supply to the aneurysm somewhat, making the flow of blood through it slower, rendering coagulation more likely. This method is said to be quite successful. In all these forms, the pressure should not be kept up continuously. In digital pressure, the operator may press for a period of ten minutes, when the assistant takes up the duty and keeps up pressure for the same length of time. This may be kept up for four or five hours during the day, on successive days, and should be left off at night. Esmarch's bandage may be applied so long as it can be borne by the patient, or so as not to seriously interfere with the circulation to the limb, or so as not to cause excruciating pain. It can be applied during the day time and removed at night. This method, or the method of digital pressure, may be used before operative means are begun.

(2) Ligature. Ligation of the artery is, perhaps, the best method of treatment. It should be tried where the aneurysm is a menace, especially after other methods have failed. Operation for ligation of the artery varies according to the part of the body in which the aneurysm is located. Of the methods in use, the following may be mentioned as being of interest, if not the safest to follow: (a) Hunter's method. This method consists in ligating the artery at a distance from the aneurysm. It was devised by the illustrious John Hunter, recognizing the fact that the artery adjacent to the aneurysm, is often diseased, and that ligation some distance above is safer. If the operation is done within the healthy tissues, it does not entirely interfere with the circulation to the part below. Pulsation does not return in the tumor. Secondary hemorrhage is not so common. Collateral branches finally distend and take up the function of the artery below, the inflammation disappears, and the aneurysm becomes more or less absorbed. Occasionally it is found that after Hunter's operation, an abscess, or symptoms like those of an abscess, follow. Should this happen, as soon as pus is evident, the abscess is opened and drained and the cavity packed with gauze.

(b) Anel's method. Anel's method was to ligate the artery immediately above the aneurysm. This operation is no longer used except in special locations. Furthermore, it has no advantage over the Hunterian operation.

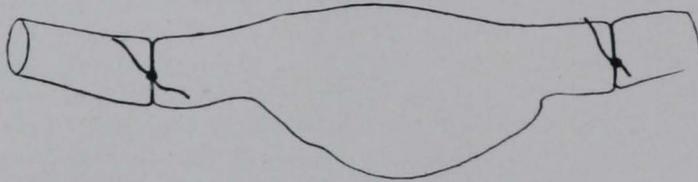
(c) Antyllus's method. The old operation of Antyllus is no longer used, inasmuch as abscess or suppuration is likely to occur. This method consists of ligation of the artery immediately above and below the aneurysm. It is perhaps valuable for traumatic aneurysms, but is not a good method for the treatment of a spontaneous aneurysm where

there is disease of the artery. This method has given way to extirpation.

(d) *Basdor's method.* Basdor's method consists of ligation of the artery beyond the aneurysm. This prevents blood going from the aneurysm, but allows it to go in. It arrests pulsation in the tumor, favors coagulation and the formation of a clot. The clot, of course, may become organized and the aneurysm disappear.

(e) *Wardrop's operation.* This consists in ligating the main branch

FIG. 28.

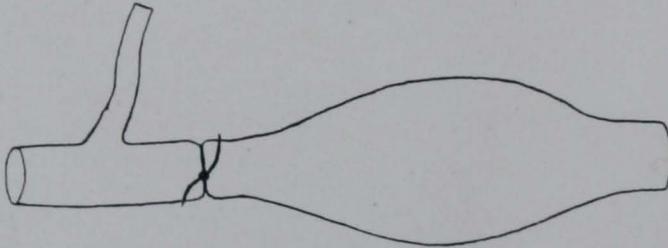


Method of Antyllus for treatment of aneurysm.

of the artery beyond the aneurysm, in an effort to arrest the rapidity of the circulation through the tumor. These operations are hardly advisable.

(3) *Excision.* Of late years excision has grown into favor. The objection to excision is that it is a prolonged and difficult operation, and that it is frequently necessary to remove the *venae comites* with the aneurysm. Where this occurs it may so interfere with the return

FIG. 29.



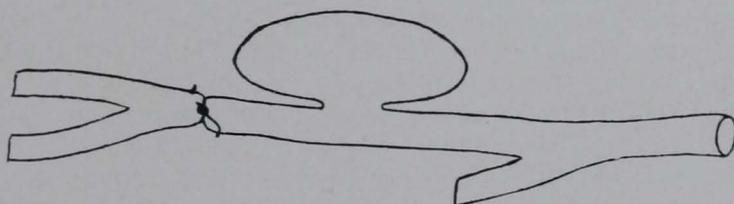
Anel's method of ligaturing an aneurysm.

circulation through the limb that gangrene will follow. With improved technic and a knowledge of the tissues in which the aneurysm is located, together with a careful consideration of the condition of the artery, it is perhaps the safest operation. Should the patient be feeble and aged, a prolonged operation should not be undertaken. Then the *Hunterian operation* is, perhaps, the best, or *Wardrop's* or *Basdor's operation* may be undertaken. These operations are not so difficult nor are they attended with such danger. But where the patient is in good physical condition, excision may be undertaken. The

argument that the artery near the sac is diseased, is not of sufficient weight to warrant going higher than the end of the aneurysmal sac, since, if there is a condition of general atheroma, it will be at all points. In an excision under approved surgical conditions where the ligatures are absolutely sterile, suppuration will be less likely than by ligation above and below the tumor.

(4) Galvano-puncture or Electrolysis and Injections are all now obsolete. They are attended with too much danger and should never,

FIG. 30.

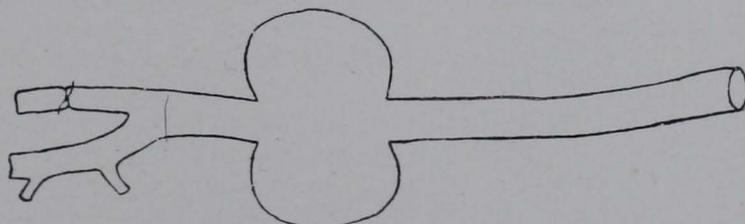


Basdor's method of operation.

under any circumstances, be undertaken. None of them has been attended with sufficient success to warrant any such procedure. Irritation of the inside of the sac by McEwen's method, is of no value.

(5) Manipulation is one of the operative methods which may be undertaken in the treatment of aneurysm. It consists in manipulating the aneurysm, with the idea that a piece of the clot may be dislodged and plug up the mouth of the sac. This method is not unattended with danger. In case of aneurysm of the common or external carotid artery,

FIG. 31.



Wardrop's method of operation.

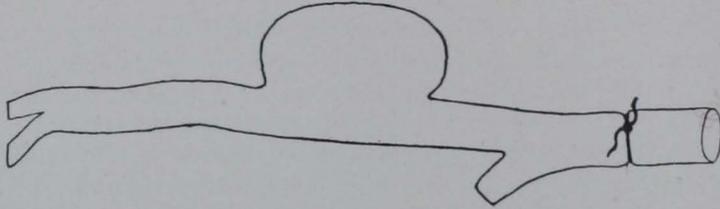
a piece of clot may be dislodged; embolism of one of the cerebral arteries results, producing hemiplegia. It may be undertaken in an aneurysm of the lower extremity. Here it would not likely be attended by any such serious results.

Dietetic and General Treatment.—Absolute physical and mental rest should be enjoined. The person should be free from excitement and mental worry. All muscular effort in the member should be stopped. The patient should be confined to his room, and, at least a part of the time, in bed. Where it is an unfavorable case, it should be explained to

the patient, that he carries his life in his own hands and that a sudden rupture of the aneurysm would be serious. The diet should be simple and only sufficient to nourish the body, and should consist of plain food well cooked and not a great variety.

Cirroid Aneurysm.—The treatment of cirroid aneurysm is somewhat different from the treatment of ordinary aneurysm. This variety of aneurysm consists of a general dilatation and pouching and lengthening of one artery, or several arteries, with their branches. After the disease continues for some length of time, it involves even the veins and capillaries in the same area. The walls of the vessels become thin, lose their contractility and there seems to be absorption of the muscular and elastic coats, only the outer coat remaining. Rupture is not unusual. Their location is on the face and scalp. In some cases, they may embrace the whole of one side of the head. They are more common in the temporal artery. The diagnosis is easy, but differs somewhat from ordinary cases of aneurysm. The thrill and bruit are somewhat differ-

FIG. 32.



Hunter's method of ligation of an artery for aneurysm.

ent. Ligation of the larger arteries which supply the tumor, is a failure. Subcutaneous ligation seems to be successful in some cases. Direct pressure is also successful in certain cases and should be tried in all cases at first. Ligation en masse is the only successful method of treatment. Where the veins and capillaries are involved, the treatment is somewhat different. (See Nevus.)

Traumatic Aneurysm.—In this condition, there has been puncture or rupture of the artery, which results, either in the formation of a sac with part of the artery for its wall, or an effusion of blood within the tissues sets up an inflammation and the resulting tissues become condensed and form a wall for the slowly flowing blood. In traumatic aneurysm, there is a large, and somewhat oblong, fluctuating tumor. In the limb below the aneurysm, there is no pulse, and it is cold and perhaps swollen. The skin is purple, and if the vein is also ruptured, the obstruction to the circulation may be complete or, if there is rupture in a joint, an amputation is indicated.

The most frequent aneurysm produced by injury is the artero-venous or Pott's aneurysm. This aneurysm is now rare. In former times, when bleeding was common, an aneurysm was frequently seen on the front of the elbow. It was produced by wounds of both the vein and artery, the two healing together. There are two forms of this aneurysm, one the

varicose aneurysm, in which the communication between the artery and vein is through an intervening sac. The second variety is aneurysmal varix, a condition in which there is no such intervening tumor between the connecting vein and artery, but the vein dilates and forms a tumefaction, the blood flowing directly from the artery into the vein. Conditions may still arise in civil practice, in case of punctured wounds, where the artery and vein are both wounded, the blood flowing from the artery directly into the vein. Where the opening into the vein is not so large as that in the artery, more blood will perhaps get out of the artery than goes into the vein, under which condition the varicose aneurysm will result, that is, a considerable sac will exist between the artery and the vein. The vein will not be so dilated.

Symptoms of Artero-Venous Aneurysm.—The symptoms of this form of aneurysm are a large swelling, with pulsation. On auscultation, a loud bruit is heard which is transmitted along the veins. The veins above and below the tumor, are tortuous and pulsatile. The limb is swollen and congested and the parts painful. There is a distinct thrill in the tumor, which is lessened on pressure. The diagnosis between aneurysmal varix and varicose aneurysm is often very difficult. When the pressure upon the main artery causes a disappearance of the tumor, it is said to be one of aneurysmal varix, but when such disappearance does not occur, it is said to be varicose aneurysm. Varicose aneurysm may be emptied by direct pressure. Palliative measures should be used. The vein does not tend to rupture, but becomes thickened and, after a time, cease to enlarge. Usually some form of support is necessary. The part is much swollen and very painful. The artery should be tied above and below the tumor. Both vessels may be ligated, providing they can be separated with ease. Ordinary pressure treatment for aneurysm should be used here before any other kind of treatment is applied. If this fails, the artery should be tied. It is a good plan in these cases, to excise the mass if it can be readily done.

Indications for Amputation.

Amputation is frequently required in case of aneurysm. The conditions which demand amputation may be summarized as follows:

- | | |
|---|--|
| 1. When gangrene of the limb is imminent. | it recurs it often becomes much worse. |
| 2. Suppuration of the aneurysm after other methods have been tried. | 5. Rupture of the aneurysm into a joint, or the erosion of bones. |
| 3. Where severe secondary hemorrhage follows and threatens life. | 6. Rupture of the aneurysm subcutaneously, causing rapid effusion of blood, may call for amputation. |
| 4. Recurrence of the aneurysm. When | |

INJURIES TO ARTERIES.

Wounds of arteries may be classified as wounds of other tissues, or incised, contused, punctured, gunshot, etc.

Contused Wounds.—A contused wound of an artery may entirely destroy the vitality of the coats, and sloughing, followed by hemorrhage,

result, or the contusion may rupture the blood-vessel, which will be evidenced by the effusion of blood among the tissues. The evidence of rupture of the artery will be plain—a rapidly forming, fluctuating tumor and absence of the pulse beyond the injury. There will be no bruit and likely no pulsation over the swelling. The limb will become cold from effusion of blood causing obstruction to the return circulation. If collateral circulation is more or less set up and there is not too much obstruction to the return circulation, swelling will occur only at the site of injury. The swelling may extend to other parts of the limb. If there is rupture of a large vein, a tumor occurs at the point of rupture, and if the obstruction to the return circulation is very great, which happens if the main vein of the part becomes ruptured, edema of the member will be one of the chief signs. In contusions of an artery, unless it is of a very large artery, nature will arrest the hemorrhage. The internal coat curls up and favors coagulation. If collateral circulation is not sufficient after the formation of the clot which may involve some of the branches of the artery, gangrene of the member will follow. The results of contusion might be summed up as gangrene from thrombosis and secondary hemorrhage.

Incised Wounds.—Incised wounds of an artery are more apt to be serious. Hemorrhage is rapidly profuse, but contraction of the middle coat and a curling of the inner coat will, after a time, occur. A transverse wound causes profuse bleeding, but is not so serious as an oblique wound. The clot which forms within the artery is called the internal clot. That which forms on the outside is called the external clot. The place of the internal clot will be taken up by fibrous tissue. The external clot will be absorbed. Circulation will take place around this area. The small arteries will become enlarged and if the circulation is sufficient, the vitality of the member will be only temporarily held in abeyance. If the circulation is almost entirely cut off, necrosis will likely follow.

Lacerated Wounds.—A lacerated wound of an artery causes little primary hemorrhage, as a rule, since the conditions present favor coagulation. Secondary hemorrhage may come on, which will give considerable trouble sometimes. This should be looked for in all cases of lacerated wounds affecting arteries.

Punctured Wounds.—Punctured wounds are not immediately serious, but traumatic aneurysm often follows.

Gunshot Wounds.—Gunshot wounds may, because of contusion of the artery wall, result in thrombosis, hemorrhage, gangrene, etc., or may cut the artery entirely off, serious hemorrhage resulting. In some cases, the wound will be clean-cut, in other cases it will be in the nature of a contusion. When the wound is adjacent to an artery, in some cases it may cause laceration. The results of these wounds are similar to others.

LIGATION OF ARTERIES.

The ligation of an artery in continuity is sometimes required in the treatment of aneurysm, as it may be the only method, other than amputation, which will give relief. The operation consists in dividing all the tissues evenly, parallel to the vessel in question, and opening the sheath of the artery, without disturbing the neighboring structures, then passing a ligature of silk, chromicised catgut, or some other suitable ligature material about the artery and tying it so as to obstruct the flow of blood along the artery. The ligature should be tied sufficiently tight to entirely constrict the lumen of the artery.

Instruments.—The instruments needed are a scalpel and dissecting forceps, a grooved director, artery forceps (a half dozen or more), retractors, aneurysm-needles, blunt hooks, ligature material, and ordinary needles for the closure of the wound.

Operation.—In general, the operation consists of the following procedure. The strictest asepsis must be maintained in every particular. The ligature material must be not only properly prepared, but it must be known to be aseptic. After every preparation has been made, the line of the artery marked out, the muscular guide located, an incision is made, generally parallel with the artery, and all of the structures divided in equal length down to the sheath of the artery. The skin and fascia may be divided with a scalpel. A dissecting forceps may then be used and the fascia lifted up and divided until the sheath of the artery presents itself, then the sheath of the artery must be lifted up and divided and the artery itself entirely separated from the surrounding structures. Where it is deep seated, a double curved aneurysm-needle is necessary. The aneurysm-needle may be threaded with a very fine strand of catgut or silk and passed around the artery. To the end of this fine strand of silk is attached the ligature material proper, which is then pulled through, bringing the ligature beneath the artery. It is said this subjects the artery to less irritation. Under most circumstances the artery can be so exposed and the needle so readily passed around the artery to be ligated, that the above procedure is hardly necessary. In making the incision in the sheath of the vessel, the back of the knife should be kept towards the artery. The sheath should be picked up, a delicate incision longitudinal to the artery should be made, when the sheath may be stripped off by means of dissecting forceps. The opening in the sheath should be from three-fourths to one inch in length. The sheath of the artery may then be grasped in forceps and held steady while the operator passes an aneurysm-needle around the artery. He should note that he has no other structures engaged than the artery itself. The ligature may then be passed through the eye of the needle around the vessel. It is tied in a direction exactly at right angles to the longitudinal axis of the artery. Under no circumstances should the artery be dragged out of the wound, but it should be tied in the position in which it is

found. A reef knot is the one used. It is better than a friction knot and is not so complicated as other knots. It is a general rule that, when passing the needle around the artery, it should be directed away from the other important structures which may lie adjacent to the artery. If, by accident, the accompanying vein to the artery is punctured, the needle must be withdrawn and the opening in the vein ligatured before further procedure. In case of small arteries, no trouble will arise from the ligation of the accompanying vein along with the artery, but this should not be done in case of the brachial or femoral, inasmuch as it will interfere quite seriously with the return circulation.

The ligature used should be a specially prepared form of chromicized catgut and should be at least a foot or more in length to permit of the ends being sufficiently long that tying may take place easily and rapidly. No one should attempt the operation until he is thoroughly familiar with the location of the artery and the landmarks or muscular guides. Both deep and superficial guides should be kept in mind at all times. Every structure divided in continuity by the surgeon should be recognized. When the artery is reached, it can be told by pulsation. It is more easily recognizable in the living subject than in the dead.

After Treatment.—The after treatment of the operation consists in maintaining the strictest asepsis and cleanliness. Under ordinary circumstances, the wound should be healed and the stitches removed in from seven to ten days. A limb must be elevated and kept quiet. It should be bandaged snugly with a woolen bandage to keep the limb warm, and if it is necessary, hot water bottles should be applied. In debilitated conditions, or in elderly people, the patient should be kept quiet a longer period than ten days, to allow the tissues to consolidate, so that subsequent inflammation will not arise. Should the operator be afraid of gangrene, for some little time before the operation, the limb should be thoroughly washed several times with antiseptics, while the limb may be elevated and enveloped in aseptic lamb's wool.

Dangers of Ligation.—The dangers of ligation of an artery are secondary hemorrhage and gangrene.

Secondary hemorrhage from the ligation of an artery occurs in septic conditions, where the artery sloughs and the clot formed within the artery is not sufficient to entirely plug it up, or where the ulceration extends into the accompanying vein. This secondary hemorrhage, if it is severe, may necessitate amputation unless the artery can be ligated a second time higher up.

Gangrene may arise from several different conditions; usually it is simply from a loss of vitality. The maximum amount of blood distributed to the limb by means of collateral circulation is not sufficient to keep the tissues alive. Collateral circulation will depend upon the

condition of the artery and the location. If arterio-sclerosis or atheroma is present, collateral circulation will not likely be sufficient. In any case where gangrene occurs, it will begin in the terminal structures, e. g., in the ends of the fingers, ends of the toes, or the structures near the cortex of the brain.

Should primary or secondary hemorrhage occur, the gangrene is then of the dry form. Gangrene occurs also where there is an obstruction to the venous return. It frequently happens that, in the removal of an aneurysm or the ligation of an artery, the accompanying vein is caught up with the artery, or because of some other condition existing, there are inflammatory tissues thrown out. These form an obstruction to the return circulation. A sufficient amount of blood enters the limb, but after getting in, it can not get out, therefore the tissues die from a lack of nutrition. The kind of gangrene occurring under such circumstances, is moist. Bandages, too tightly applied, may operate as an obstruction to the return circulation with similar effect. Gangrene may also occur because of an attack of erysipelas, or because of injudicious after-treatment, in the use of ice-bags, or in not keeping the limb warm, or in too high elevation. Every precaution should be taken to prevent the occurrence of gangrene and when it does appear, every precaution should be taken to limit it. It is not unusual that in ligating the femoral artery there will be death of the toes. Gangrene may extend no farther if the patient is well nourished and the limb is properly treated. Such parts, after having dried, may be removed by a secondary operation, when the circulation seems to have been thoroughly established to the limb.

Position of the Patient During an Operation.—The position of the patient during the operation should be that which makes the artery most easily accessible and exaggerates the outline of the muscular guides.

Ligation of Special Arteries.—Arteria Innominata.—To ligate the innominate artery, an incision should be made along the lower one-third of the anterior border of the sterno-cleido-mastoid. The incision is usually extended down across the suprasternal notch. The inner tendon of the sterno-mastoid should be divided and the anterior jugular veins secured. The sterno-hyoid and sterno-thyroid muscles should be successively divided. The carotid sheath should be located and followed and opened, and the artery traced down to where it is given off from the arteria innominata. At this point the innominate artery may be ligated. It has been ligated six times successfully out of thirty or more operations. The tissues to be avoided are the internal jugular and innominate veins which lie to the outer side of the vessel. The vagus nerve and the pleura also, are to the outer side, and these should be carefully separated from the artery. The aneurysm-needle should be passed from without in. Collateral circulation is established by means of the vertebral, basilar, circle of Willis, branches of external

carotid, superior intercostal, aortic intercostals, deep epigastric, internal mammary, and phrenic arteries.

Carotid.—The carotid artery is ligated below the omo-hyoid in the inferior carotid triangle or above the omo-hyoid in the superior carotid triangle. It should always be ligated in the superior triangle if possible. The superficial muscular guide is the sterno-mastoid, the deep muscular guide, the omo-hyoid. The vessel should be uncovered at a point where this muscle crosses the artery and it may then be ligated above or below. The course of the artery may be indicated by a line drawn from the sterno-clavicular articulation, to a point midway between the angle of the jaw and the mastoid process. An incision, two and one-half inches long, should be made along the anterior border of the sterno-mastoid. The edge of the muscle should be uncovered and pulled back, which exposes the common sheath, including the common carotid artery, the jugular vein and pneumogastric nerve. The artery is on the inner side, the vein on the outer side, and the nerve between the two, but on a plane posterior to both, while in front of the sheath will be found the filaments from the loop of communication between the descendens and comunicans noni nerves. The sheath should be opened with care not to destroy these nerves. Preliminary hemorrhage, incident to uncovering the sheath, should be staunched. After the sheath is opened, the sheath of the carotid itself should be opened and separated and the needle passed around the artery. The needle should be passed from without inward. The sheath should be opened sufficiently, so it will be plain that the pneumogastric nerve is not included in the ligature. The operation above the omo-hyoid does not differ in any way from that below, except it may be necessary to pull the depressors of the os-hyoid inward, while the sterno-mastoid may be pulled outward. It may be necessary to divide the anterior fibres of the sterno-mastoid. The effect of the ligature of the common carotid artery is curious and interesting. Either soon after, or in a few days, brain symptoms manifest themselves in about twenty-five per cent of the cases. These symptoms are in the nature of syncope, because of anemia, and in a few days there are evidences of cerebral softening, convulsions, coma, and death. In the cases thus affected, about one-half will terminate fatally. In some cases there may be congestion of the lungs, perhaps due to irritation of the pneumogastric nerve. In other cases, the sympathetic nerves seem to be affected; perhaps inflammatory tissue involves the sympathetic trunk. Collateral circulation is then established chiefly by means of the vertebrales, profunda cervicis, arteria princeps cervicis, inferior thyroid, superficial cervical, and occipital arteries.

Internal Carotid.—Ligature of the internal carotid artery may be demanded, under rare circumstances, for aneurysm and hemorrhage. It may be done in any part of its course, but preferably, just after the bifurcation of the common carotid. The operation is similar to that

for ligation of the common carotid, but a trifle higher up. A three-inch incision along the anterior border of the sterno-mastoid muscle, (which is the muscular guide), opposite the greater cornu of the os-hyoid, should be made. The aneurysm-needle is passed toward the middle line, away from the internal jugular vein. Collateral circulation is established chiefly through the circle of Willis.

External Carotid.—The external carotid artery may be ligated in any part of its course, but the operation seems easiest above the point where the superior thyroid branch is given off. A three-inch incision is made along the anterior margin of the sterno-mastoid, when the muscle is uncovered and drawn backward and the digastric muscle is exposed. Care should be taken not to injure the hypoglossal nerve. The sheath should be opened below the hypoglossal nerve, where it winds around the occipital artery. The ligature is applied below the cornu of the os-hyoid, and the aneurysm-needle should be passed under the artery toward the middle line of the neck. Enlarged glands make the operation difficult. Furthermore, any irregularity in the position of the anterior branches of the artery, will make the operation more difficult. It is also necessary to avoid the loop of communication between the descendens and communicans noni and the superior laryngeal nerve which lie in close connection with the external carotid.

Superior Thyroid.—An incision is made as in ligating the external carotid. The superior thyroid is tied just where it is given off.

Lingual.—Ligature of the lingual artery is sometimes done for malignant disease or injury of the tongue. The operation is difficult and requires the utmost care. The artery is preferably ligated beneath the hyo-glossus in the submaxillary triangle of the neck. It may be ligated just at its origin in a manner similar to the ligation of the external carotid. For the technic of the operation, larger works should be consulted.

Facial.—The facial artery is best ligated where it crosses the lower jaw in front of the masseter muscle. A vertical incision, an inch long, dividing the skin and deep fascia, will uncover the artery, when it may be readily tied.

Temporal.—The temporal artery is best tied where it crosses the zygoma. At this point it is quite superficial and is covered only by skin and fascia. Sometimes the auriculo-temporal nerve is in relation with the temporal artery and care should be taken not to wound it or to engage it within the ligature.

Occipital.—An incision, two inches long, backward and upward from the mastoid process of the temporal bone, should be made, uncovering the posterior fibres of the sterno-mastoid. The fibres of the trachelo-mastoid and the splenius capitis are divided. This will expose the artery as it emerges from behind the mastoid process, when the ligature may be readily applied.

Subclavian.—This artery is most frequently ligated in the third part of its course, between the scalenus anticus muscle and the lower border of the first rib. The operation may be done for the purpose of controlling hemorrhage after wound of the brachial, or aneurysm of the subclavian, or because of injury. The patient should be placed in a recumbent posture and the face turned to the opposite side. The arm should be depressed and the shoulders drawn close to the edge of the table. A four-inch incision is made over the clavicle after the skin has been drawn down, so that on relaxation, the skin is returned over the clavicle. The deep structures are exposed beneath the sterno-mastoid and trapezius in the subclavian triangle. The external jugular and communicating veins are drawn to one side. The connective tissues are divided, care being taken to avoid severing the suprascapular and the transversalis cervicis arteries. If the posterior belly of the omo-hyoid muscle presents itself, it should be drawn upward. The connective tissues are separated, when the finger may be introduced and the scalenus tubercle on the first rib located. The artery should then be isolated from the vein, and the cords of the brachial plexus may be pulled to one side. Great care is necessary to avoid wounding, injuring, or including any of the cords of the brachial plexus, inasmuch as one cord is on the inside, one posterior, and one on the outside of the artery. Serious injury may be done to the veins in the neck, also the pleura may be wounded. These are the chief dangers of the operation. Collateral circulation is set up through the branches of the thyroid axis and subclavian, axillary, and external carotid.

Internal Mammary.—The internal mammary artery is best ligated on the front of the chest, by removal of a costal cartilage. The costal cartilage is either incised or removed and the artery exposed without opening the pleura. It lies a half-inch to an inch from the margin of the sternum. In case of hemorrhage, it may be necessary to secure both ends of the artery.

Vertebral.—The vertebral artery can readily be ligated just before it enters the foramen at the base of the transverse process of the sixth cervical vertebra. A three and a half-inch incision is made along the posterior border of the sterno-mastoid. The scalenus anticus muscle must be located and the phrenic nerve by all means avoided. The interval between the scalenus anticus and longus colli muscle, should be noted. It is in this interval in which the vertebral artery is found. If a few sympathetic nerve branches are included in the ligature, contraction of the pupil results.

Inferior Thyroid.—The inferior thyroid artery must be tied by an operation in the inferior carotid triangle. The operation is difficult. An incision three inches long is made along the anterior border of the lower part of the sterno-mastoid muscle, the muscle is drawn backward and the sheath of the carotid vessels drawn upward. It may be necessary to divide the sterno-hyoid and the sterno-thyroid. Behind

the sheath of the common carotid artery, the inferior thyroid is found as it arches upward and inward. Care should be taken not to injure the sympathetic trunk. The middle cervical ganglion lies directly on the artery.

Axillary.—The axillary artery is tied, in preference to the brachial, when injury or aneurysm require ligature high up. There are two operations which are practiced, either one of which is good. The arm should be fully abducted and the operation performed from the axilla, if possible. The surgeon should stand between the patient's arm and his body. An incision is made along the course of the vessel, which is at the junction of the anterior and middle third of the space between the two folds of the axilla. The coraco-brachialis muscle should be clearly defined, as it is the muscular guide to the artery. The muscle should be drawn outward, which exposes the median and external cutaneous nerves, which are drawn inward. This exposes the artery. The needle should be passed from the vein accompanying the artery, after the nerves have been thoroughly separated from it. The anastomosis about the shoulder is free.

Brachial.—The brachial artery requires ligature in wounds of the palmar arch or for aneurysm or artero-venous wounds at the bicipital space. The arm should be held away from the side and not supported on the table, but rather held by an assistant. The surgeon may stand between the arm and the trunk. The biceps muscle is the muscular guide. A two-inch incision is made along its border and the skin and fascia divided, when the biceps is drawn slightly outward and the median nerve exposed. As the nerve, which crosses the artery in the middle part of its course, is brought into view, it should be drawn inward. The artery should be separated from its *venae comites*, care being taken not to inclose any other structures within the ligature. Collateral circulation takes place through the free anastomosis of the profunda, *anastomotica magna*, and recurrent arteries about the elbow.

Ulnar.—The ulnar artery may be tied in the middle of the forearm or at the wrist. The muscular guide is the tendon of the flexor carpi ulnaris. An inch incision is made, the flexor carpi ulnaris drawn inward, and the artery exposed. The *venae comites* should be separated. The ulnar nerve will be found on the inner side of the artery, which should be avoided in passing the ligature. In the middle of the forearm, a line drawn from the inner condyle to the pisiform bone, will mark the line of incision. The incision should be made at the intermuscular septum between the flexor carpi ulnaris and the flexor sublimis digitorum muscles. The artery lies under cover of the flexor carpi ulnaris, and if one succeeds in finding this intermuscular septum, the artery is easily discovered and tied. It is said that the most common mistake which happens is, that the operator will separate portions of the flexor sublimis digitorum, or that he will get too far to the radial side between the flexor sublimis digitorum and the palmaris longus.

Radial.—The radial artery may be tied at three points, in the upper one-third of the arm, above the wrist, and at the back of the wrist. The supinator longus is the muscular guide. An incision is made along the inner border of this muscle, when it is raised up, exposing the artery. The radial nerve is on the outer side and separated by a small interval. The artery may be readily tied at this point.

Above the wrist, the artery lies between the tendons of the flexor carpi radialis and the supinator longus and is subcutaneous. An incision is made between these two tendons. The artery is readily exposed.

On the back of the wrist, the radial artery is ligated in what is known as the anatomical snuff-box, or inter-tendinous hollow, below the styloid process of the radius. The artery is here found directed towards the first interosseous space underneath the extensor tendons.

Abdominal Aorta.—Ligation of the abdominal aorta, according to Tillaux, has been done fourteen times. Death is reported in all cases, although a patient operated upon by Keene lived until the forty-eighth day. The operation is both difficult and dangerous. Patients usually die of sepsis. For a description of the operation, the student is referred to large works on operative surgery.

Common Iliac.—The common iliac arteries may be ligated by two methods, one by an extraperitoneal method, where the peritoneum is not opened, similar to operation for ligation of the external iliac, and by the trans-peritoneal operation, where the artery is ligated through the peritoneum. The operation is rather difficult and requires a thorough knowledge of the technic. With strictest asepsis the operation is not necessarily fatal. The method of procedure will be found discussed at length in more extensive texts.

Internal Iliac.—Occasionally, the internal iliac artery is ligated for hernia, hemorrhage, or aneurysm. The trunk is short, hence ligation is done just after the bifurcation of the common iliac.

Gluteal.—Ligation is necessary in case of gluteal aneurysm. The gluteal artery emerges from the pelvis through the great sacro-sciatic notch above the pyriformis muscle. A line drawn from the great trochanter to the posterior superior iliac spine at the junction of the upper one-third of this line with the middle one-third, will mark the point of incision. An incision is made along this line just mentioned, and the fibres of the gluteal muscles are separated and held apart. Through the space between the gluteus medius and minimus, the pyriformis muscle is located. The artery may now be ligated. Some believe that it is wiser to deal with the trunk of the internal iliac, inasmuch as the operation is difficult.

Sciatic and Pudic.—The sciatic and pudic arteries are rarely ever tied, but are best located opposite the sciatic spine.

External Iliac.—The external iliac artery is accessible in any part of its course. It has but two branches, the deep epigastric and deep circumflex iliac, and these come off in the lower portion. A line drawn from the bifurcation of the aorta to the middle of Poupart's ligament, will indicate the course of the artery. The following operation is one of the various operations described, which is generally utilized: An incision four inches in length extends from a point one and a half inches above the anterior superior spine, to one-half inch below the middle of Poupart's ligament. The muscles are successively divided until the fascia transversalis is reached. At this point, if the transversalis fascia is thick, it should be opened. Sometimes it is not well developed, when, unless care is taken, the peritoneum may be opened. The peritoneum and its contents are now stripped from the pelvic wall with the hand by careful dissection. The incision should be large enough and the peritoneum separated sufficiently far back to uncover the psoas muscle; the artery lies on the inner border of this muscle. It can be readily found enveloped in fascia, while lying over it is the genito crural nerve, the vein being on the inner side of the artery. The sheath is opened and the artery separated from the vein and the genito crural nerve. The aneurysm needle is passed from within out. This is Abernathy's method of operation. Collateral circulation is established through the internal mammary, superficial and deep epigastric, lumbar arteries, lower intercostals, also by means of the crucial anastomosis on the back of the leg; also, by the anastomosis of the ilio-lumbar and gluteal with the circumflex iliac and external circumflex artery, and with the anastomosis of the obturator artery.

Common Femoral.—This artery is rarely ever ligated, except in hip amputation. The superficial femoral is usually ligated because it permits of much better collateral circulation. The artery is located by a line drawn from the mid point of a line extending from the anterior superior spine to the symphysis, to the internal condyle of the femur. If the limb is flexed and abducted, the artery may be readily picked up at the apex of Scarpa's triangle or in Hunter's canal.

In Scarpa's triangle an incision is made over the direction of the artery, about a hand's breadth below Poupart's ligament. The incision should be about three or four inches long. The border of the sartorius muscle is the muscular guide. The middle cutaneous nerve presents, lying over the sheath of the artery. The muscle is drawn aside and the sheath may be opened and the artery exposed. The needle may be passed in either direction, especial care being taken not to enclose any other structures.

When possible, the artery should be ligated in Hunter's canal. A four-inch incision is made over the line of the artery and after the fascia lata is divided, the sartorius muscle is exposed. The outer border of the muscle is located and the muscle drawn inward. As it is drawn inward it discloses the aponeurotic covering of Hunter's canal. This

canal is opened, which exposes the femoral artery and vein and long saphenous nerve. The nerve to the vastus internus lies on the outer side of the artery. The long saphenous nerve crosses the artery from without inward, while the vein lies to the inner side and behind. The needle may be passed in either direction, but with great care. No mistake need be made in locating Hunter's canal, if it is borne in mind that it is directly beneath the sartorius muscle, and as the sartorius muscle is raised up in its sheath, the glistening surface of the aponeurotic covering of the canal may be seen.

Popliteal.—The popliteal artery may be ligated just after the femoral artery has passed through the opening in the adductor magnus, but the operation is more troublesome and has no advantage over the ligation of the femoral. The artery may also be tied in the lower part of its course where it lies on the popliteus muscle in the popliteal space. But this operation has no advantage over the ligation of the superficial femoral in Hunter's canal.

Posterior Tibial.—Ligature of the posterior tibial artery may be required in case of hemorrhage. It may be ligated in the calf, in the lower one-third of the leg, or just behind the internal malleolus. An incision should be made an inch behind the inner border of the tibia. The incision should be at least four inches long. The internal saphenous nerve is met with and should be pulled to one side. The artery lies just underneath the soleus muscle. The incision should expose the tibial origin of the soleus which is severed at the oblique line of the tibia. The muscle is pulled up and the artery exposed. If possible, the venae comites should be separated. The nerve should be distinguished from the artery, which is easily done, and the aneurysm-needle passed around the artery away from the nerve.

In the lower one-third of the leg, an incision is made midway between the border of the Achilles tendon and the inner border of the tibia. The artery is found lying on the flexor longus digitorum muscle. The nerve is on the outer side and behind. In passing the needle this nerve should be avoided.

Behind the malleolus the incision is made a finger's breadth behind the internal malleolus. The deep fascia is divided between the extensor longus digitorum and the flexor longus hallucis, and the artery is exposed. The sheaths of the tendons should not be opened.

Anterior Tibial.—The anterior tibial artery is located by a line drawn from a point midway between the outer tuberosity of the tibia and the head of the fibula, to a point midway between the two malleoli. It may be tied either in the upper, middle, or lower third of the leg. In the upper third of the leg the artery lies between the tibialis anticus and the extensor longus digitorum muscles, on the interosseous membrane. The anterior tibial nerve is on the outer side.

In the middle one-third of the leg it lies between the tibialis anticus

and the extensor proprius hallucis. The nerve generally lies on the artery.

In the lower one-third of the leg the artery lies between the tendons of the tibialis anticus and the extensor proprius hallucis. The nerve is on the outer side.

Dorsalis Pedis.—This artery extends from a point midway between the two malleoli and the interval between the first two metatarsal bones. An incision made along this line will uncover the artery which is found lying between the tendons of the extensor proprius hallucis and the extensor brevis digitorum. Sometimes it is said the artery is rather difficult to tie, and it will be best to cut the artery and then ligate the cut ends.

Peroneal.—The peroneal artery will be found lying on the inner side of the fibula on its postero-internal border. It is in an osseo-aponeurotic canal and is rather difficult to tie.

DISEASES OF VEINS.

Phlebitis is an inflammation of a vein. Two forms are recognized, (1) plastic and (2) infective.

Plastic Phlebitis usually results from a wound and often arises from the reparative inflammation extending into the vein. It may also result from injury. It is a localized inflammation of the vein, and is often attended by thrombosis. Continued pressure or irritation of the vein may set up a plastic phlebitis, thrombosis resulting. It is also said that inflammation of the perivascular tissues, as occurs in septic conditions, may induce plastic phlebitis within a vein.

Infective Phlebitis is a much more serious condition, inasmuch as the thrombus formed is infected and may become a means whereby the micro-organisms are disseminated through the body. This septic or infective phlebitis was the source of trouble among the older surgeons, as infection was introduced directly into the veins, and rapid sepsis resulted. Septic phlebitis never occurs now as the result of a surgical operation. In neglected wounds or in suppurating diseases, it may arise, forming a serious complication. It follows mastoid disease, the infection traveling through the bone into the lateral sinus. Localized phlebitis often arises around foul ulcers or in cases of gonorrhoea, but where the infection gets directly into the vein, as occurs in septic phlebitis, general edema will result.

Symptoms.—The vessels are swollen and hard, forming red and painful cords underneath the skin. Nodular enlargements corresponding to the valves may be felt. The skin is edematous and there are areas which are dusky and congested. When the deeper veins are involved, the diagnosis is more difficult. It is accompanied by a peculiar white edema of the tissues. In case the deep veins of the leg are involved, a condition called "milk leg" follows. In this condition per-

haps, lymphatic obstruction operates as a part of the cause of the condition. The onset of septic phlebitis is attended by a chill with rapid extension of the inflammation, unless but a small area is affected, and it is usually followed by sepsis and rapid invasion of the general system. Diffuse suppuration sometimes follows. Repetition of the chills and acceleration of the temperature would indicate pyemia.

Treatment.—The treatment of phlebitis is absolute rest and elevation of the part. In the case of a limb, it should be enveloped in lamb's wool or cotton and well bandaged. The limb should be kept hot by means of hot water bottles. The limb may be manipulated to assist the return circulation. Vigorous local manipulation should be avoided since coagulation may occur in the veins. Dislodging of the clot would be followed by embolism. The circulation to the affected part must be assisted by relieving any obstruction and encouraging the flow of blood through the agency of the vasomotors. Any spinal or other lesions affecting the nerves to the inflamed vessels should receive especial attention. The diet of the patient should be non-stimulating and nutritious. Septic phlebitis, with the formation of pus, should be treated the same as an abscess. As soon as pus formation is made evident by means of fluctuation, the abscess should be opened and freely drained. In some cases it is possible to ligate the vein above the septic area and scrape out the inflamed mass. This is very often attended by sepsis.

This method of treatment could only be used where a single trunk is involved; it is rarely ever feasible.

Varicose Veins, or Varix.

This disease is sometimes called phlebectasis. The vein becomes very prominently dilated and lengthened and more or less tortuous. It is said to occur in twenty per cent of adults, more frequently in men than in women. The locations where they are usually found are the internal and external saphenous veins (generally the internal); the spermatic veins which surround the spermatic cord (varicocele) and in the veins of the rectum, where a condition of hemorrhoids or piles is produced. Varicocele and hemorrhoids will be considered elsewhere. Other veins may be affected, as, for instance, the veins over the abdomen may be dilated in conditions of cirrhosis of the liver. Sometimes varicosities of the veins of the viscera happen, and rarely they occur in the deep veins of the extremities. Sometimes congenital varicose veins occur.

Pathology.—It need hardly be mentioned that the cause of varicose veins is an obstruction to the return circulation at some point. The cure of the condition depends upon the physician determining the point of obstruction. Changes take place within the vein-wall. It becomes thickened by the formation of inflammatory tissue and when the vein is cut it will remain distended. Pouch-like dilatations occur

along the course of the vein at the location of the valves. After some length of time, fibrous changes occurring in the veins, entirely displace the normal tissues of the intima and media. Superficial varicose veins are evident on inspection. They appear enlarged, thickened, distended, and tortuous.

Results.—The results of varicose veins in the leg, as these are the most common, consist of a general impairment of the circulation. In severe cases, edema of the limb is common. The tissues of the limb often become debilitated because of the bad circulation and at the least possible injury, ulcers result. These varicose ulcers are difficult to treat and sometimes seriously affect the general health. Where the skin is subject to irritation, eczema sometimes develops. This eczema oftentimes results in ulceration, and after the ulceration is established, the secretions flowing over the tissues may again cause eczema. Inflammations of the vein frequently occur in this ill-nourished and distended condition. This phlebitis may result in the formation of thrombus or it may result in the partial occlusion of the vein or the formation of an abscess. Where the injury to the vein results in the coagulation of the blood and the formation of thrombus, later the vein may be more or less absorbed, only a fibrous cord being left. Sometimes calcareous degeneration of the thrombus occurs, when a phlebolith results. Persons of rheumatic and gouty tendency who have varicose veins are very liable to phlebitis. Varicose veins are accelerated by the formation of what is known as the "vicious circulation." Sometimes blood from the internal saphenous vein empties into the external or short saphenous vein and thence into the deep veins, whereas the blood from the deep veins flows from the femoral vein into the saphenous, so that a certain amount of blood would, as it were, go round and round this vicious circuit. Whether this is true is questionable, but it is said to sometimes occur.

Treatment.—The treatment of varicose veins depends on recognizing the cause. The obstruction in the leg may be caused by enlarged lymphatic glands at the saphenous opening. Muscular contractions may produce tension of the fascia lata and cause impingement of the return circulation. Partial and complete dislocations of the hip will, in like manner, directly or indirectly interfere with the return circulation. Prolapsus of the abdominal viscera will produce obstructions in the pelvis. Pressure on the ascending cava where it passes through the diaphragm may be the cause. Where there is a general lack of tone, lesions affecting the vasomotor nerve supply to the vessels of the legs will be found. These lesions may be at the sacro-iliac joint, between the sacrum and lumbar spine, or in the lower dorsal or lumbar regions. Luxations of the lower ribs may operate similarly. A cure in any case depends upon removing the cause and securing the proper nerve supply by removing the lesions found, and also in stimulating the vasomotors to the veins affected.

Nevus.

Nevus is a condition of dilation of the veins, venules and arterioles and is classified as one of the tumors. (See Angioma.) The capillaries are dilated and this dilation may extend into the small veins and arteries, and large cavernous spaces may be formed. Considerable pigmentation of the tissues about may occur, since the blood may flow in cavernous spaces, and the circulation being weak at this point; it may be partially obstructed. The disease is very often congenital. It may wither and disappear after a time or it may enlarge and spread over a considerable area. Two varieties are usually described.

1. Capillary nevus, or mother's mark, occurs usually as a bright red or purplish colored mass, slightly elevated above the skin. It consists of a mass of capillaries lined with endothelium. They are small and often do not extend over a space of more than an inch or two in diameter, but they may, in some cases, cover the side of the head and face. Where a certain amount of pigmentation occurs, it is called the "port wine" stain. If they are injured, hemorrhage is usually very free, but is readily stopped by pressure.

2. Cavernous angioma is a condition where the veins are largely involved. They lie in the skin and subcutaneous tissues. They are soft to the touch, easily compressible, but return to their dilated condition so soon as the pressure is removed. They are often lobulated, and when the blood is pressed from them, they give evidence of sinuses beneath the skin. They are generally situated beneath the skin and show as a blue lobulated mass. In the mucous form, where the capillary and venous angiomata are mixed, it is usually of a dark red color. Venous nevi are really masses of venous sinuses lined with endothelium. They may be associated with injury, may occur spontaneously, because of local weakness and obstructions, and may be congenital.

Treatment.—The treatment of nevus, where it can be accomplished, especially the venous form, is (1) excision. The veins are ligated, separated from the subcutaneous tissues and the skin, and removed. (2) Subcutaneous ligation may be used with advantage in some cases, and if excision cannot be done, it should be tried. (3) Injection of coagulating fluids into the tumor, such as perchloride of iron or a strong solution of carbolic acid, is no longer practiced. (4) Electrolysis. Where excision and subcutaneous ligation are impossible, electrolysis forms an excellent method of treatment of nevus. This treatment is especially valuable where the nevus occurs upon the face or where it is necessary to avoid cicatrization. It consists in the passing of a strong current of electricity through the mass. This produces chemical and physical changes and brings about coagulation and organization of the tissues. Both poles of the battery may be introduced into the tumor, but this is not the wisest plan. It is better to employ a one or two needled positive electrode and introduce it into the tumor while the negative pole is applied to a different part of the body. The needle

should be made of steel, inasmuch as the treatment corrodes the needle, which has an advantageous effect upon the tumor. The use of the negative pole in the tumor is more liable to cause scar. A current equal to about two-hundred milliamperes should be passed through the tumor for about fifteen minutes. Should both poles be applied to the tumor, a current of only about half this strength is necessary. General anesthesia is required. The immediate effect on the tumor is to cause it to become hard through the coagulation of the blood. In some cases the treatment is not successful. It is best to deal with the periphery of the nevus first. Some scarring will be inevitable. It is wise not to do too much at one sitting. If the nevus be treated at several sittings, there will be less scar formation. The nevus should be treated sufficiently long to permit of complete cicatrization.

Embolism.

An embolus is any floating object in the blood. It may be composed of the following materials:

1. Thrombi. (2) Parasites. (3) Fat. (4) Air. (5) Glandular Cells.

The method by which thrombi become emboli can best be seen in forms of valvular heart disease or endocarditis. In valvular heart disease the valves become roughened and clots are readily formed, when, because of the action of the heart, these clots become detached and are whirled away along the blood-stream and finally plug up some artery. This is the most frequent origin of emboli. Emboli may contain parasites and wherever they lodge, an abscess results. In case of fracture, especially of long bones, particles of fat may be dislodged, and finally entering the veins, are carried back to the heart. This will cause dyspnea by plugging up the branches of the pulmonary artery. Air embolism sometimes occurs where there is a wound of a large vein and where the intravenous pressure is negative, or it sometimes happens after giving a hypodermic injection of a drug, where the syringe contains some quantity of air. Embolism by other cells sometimes occurs in cases of cancer and sarcoma. The cells enter the circulation and are carried elsewhere, and a secondary tumor results.

Effects of Embolism.—The effect of embolism is to cut off the circulation to the part. If it occurs in the brain, paralysis results. If it happens in other organs, other symptoms. These effects may depend somewhat upon the nature of the clot. They may be classified as follows:

1. Changes in the clot. Subsequent changes in the clot may occur. Becoming organized, as in case of thrombi, the artery is permanently obliterated. Collateral circulation may be established and the function of the part restored.

2. Anemia. Where collateral circulation is fairly good, the part may give evidence only of anemia. This will be recovered from in due time.

3. Necrosis. In terminal arteries, necrosis will occur, as in case of

gastric ulcer. In terminal arteries of the brain, necrosis of a portion of the brain very often happens. This necrosed area becomes liquefied, afterwards forming either an abscess or cyst, depending upon whether the clot is infective.

4. Infarction. Where the embolism is of an organ like the kidney or spleen, infarcts are formed. This infarct consists in the plugging of a terminal artery in some such organ as mentioned, and a subsequent engorgement or swelling in the area to which the artery is distributed. Inflammatory changes and fibrous tissue changes very often take place in these infarcted areas. There are two kinds of infarcts—the white, in which there is no obstruction to the return circulation, and red infarcts, where there is more or less obstruction to the return circulation, or where there is at least some collateral circulation.

Evidences of Embolism.—The evidences of embolism are similar to those of thrombosis, with the exception that they come on more suddenly. The effect on the brain is sudden and complete paralysis of the area affected. Embolism of the *arteria centralis retinae* and its branches would destroy sight in the eye affected. It at once destroys the function of the area to which the artery, which is plugged, is distributed. In the organs where infarction takes place, there will be evidences of congestion and edema. Should the blood supply be entirely cut off, necrosis of a mass of tissue will occur. If the embolus is infective an abscess results. In any case the symptoms will be obscure and diagnosis difficult, and it can only be made, in many cases, by eliminating other conditions.

Thrombosis.

Thrombosis is the formation of a clot in a living blood-vessel.

Causes.—The causes of thrombosis may be classified as follows:

1. Disease or injury to the vessel wall. Any disease or injury to the vessel wall, whereby it becomes roughened or thickened or a portion is removed, may furnish more favorable conditions for coagulation. Atheroma, sclero-endarteritis, etc., are conditions which bring about thrombosis.

2. Certain changes in the blood. Changes in the blood, whereby it becomes more coagulable, favor thrombosis. These changes are, perhaps, problematical and theoretical, but that the blood is more coagulable under some circumstances than in others, is likely true.

3. Foreign bodies or the presence of micro-organisms. These foreign bodies furnish a point upon which the coagula may be deposited or to which the leukocytes may cling, thereby assisting the formation of a clot.

4. Retardation of the blood stream. Retardation or slowing of the blood stream may occur under several conditions. It occurs after (a) ligation of the artery in operations for thrombosis, or from injury to the artery or vein, from aneurysm, or in any operation where the artery is tied.

(b) From tight bandage. Pressure of a tight bandage may lead to such obstruction to the circulation that coagulation will occur.

(c) Diminished force and frequency of the heart-beat, lessening the vis a tergo, perhaps assist in the formation of the clot.

(d) The pressure of a tumor or luxated bones or other objects upon the vessel above, may lead to coagulation and the formation of thrombi. This occurs, perhaps, in cases of phlegmasia alba dolens or milk leg. When the clot is formed, it may extend in both directions from the point of origin, but it usually extends in the direction of the blood current. If it entirely fills up a branch of the artery it will extend back only so far as the main trunk. At this point it may stick out and form a projection into the blood stream of the larger artery. It will extend in the direction of the blood stream as far as where branches are given off, or where the blood flow is influenced by collateral circulation. The thrombi may be occluding where they entirely fill up the vessels or they may be only partial. The effects they produce and the symptoms of thrombosis will depend upon the subsequent changes which take place in the thrombus, or upon whether it is *occluding*.

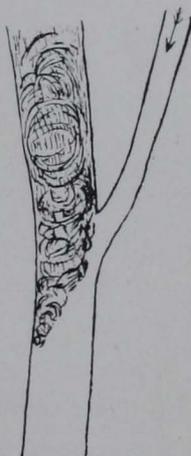
Changes in Thrombosis.—1. Organization. A thrombus may become organized; this takes place in the following manner: As soon as a clot forms in any vessel, it becomes infiltrated with leukocytes and proliferated endothelial cells and connective-tissue cells—in other words, round cell infiltration occurs. Subsequently the clot becomes displaced by means of this new formation. Small blood vessels may extend from the vasa vasorum through the vessel wall out into the clot. The artery becomes organized and forms a hard fibrous cord.

2. Softening. Softening of the clot may occur because of fatty degeneration of its elements. Fatty degeneration may be because of the limited nutrition of the infiltrated tissue cells or the softening may be the result of bacteria. The clot may become softened and a portion of it dislodged and carried into the general circulation, embolism resulting. It may break down, the elements become liquefied and a small cyst result, or, on the other hand, fatty degeneration and liquefaction and absorption of the elements may occur.

3. Calcification. Sometimes the fatty material which is formed as the result of fatty degeneration of the clot, will become displaced by means of calcareous material, when the remains of the thrombus and the artery will be a calcified mass.

4. Absorption and tunnelling of the clot may sometimes occur. This is accomplished by means of the clot apparently opening up because of the blood pressure or the liquefying effects of the blood, or perhaps be-

FIG. 33.



Venous thrombus.

cause of fatty degeneration. The clot becomes tunnelled out and a sinuous or tortuous tract is made through the clot and it becomes pervious to the extent that it will permit of regular circulation taking place through it.

Effects of Thrombosis.—The effects of thrombosis depend upon whether it occurs in an artery or vein, or whether it is in a terminal artery, or upon the extent to which the circulation is cut off from the tissues to which the vessel is distributed.

1. Swelling and edema. The swelling and edema are usually great. It will depend upon whether the obstruction is in the vein or artery. If the obstruction is in the vein, the swelling will be enormous. If the clot becomes organized in the vein and the collateral circulation is poorly established, this edema may remain and become hard (solid edema). This sometimes occurs in phlegmasia alba dolens.

2. Gangrene. It is not unusual for gangrene to result from obstruction to the return circulation or from the formation of a thrombus in an artery or vein. The gangrene following is of a moist variety, especially where the thrombus is in the vein. The extent of the gangrene will depend upon the extent to which the circulation is cut off.

3. Phlebitis. Inflammation of the vein walls will very likely occur, especially if the clot is infected or if the patient is in a debilitated condition. It may take on a suppurative form. If it does, it more than likely arises from an infected clot.

4. Embolism. Embolism consists in the plugging up of an artery by means of a floating clot or other material which has become detached and loose in the blood. If the material forming the embolus is not infective, the results are not so serious, but if it is infective, pyemia will likely result.

Symptoms of Thrombosis.—The symptoms of thrombosis depend upon the location of the clot. In case it occurs in a vein, it will be attended by marked edema and dilatation of the veins, together with phlebitis. Blood extravasations are not uncommon. The pain is severe and the part to which the artery is distributed, or from which the vein comes, will lose its function. Thrombosis of one of the cerebral arteries would be attended by paralytic or mental symptoms. If it should occur in the lower limb, paralysis and edema of the member will follow, together with more or less pain. In case the vein is affected the symptoms of phlebitis will supervene.

Treatment.—The treatment depends upon the conditions present. In general, it is directed toward securing resorption of the clot and stimulating collateral circulation. Vigorous manipulation to dislodge the clot is not advisable. Often the clot can be absorbed if the case is seen early. When gangrene results, operation is necessary. In paralysis, the result of thrombosis and embolism, an effort should be made to establish collateral circulation. In this, nature can be assisted. If the part

can be prevented from dying, the integrity of the tissues will be restored in time.

INJURIES TO VEINS.

Injury to veins should be treated in much the same manner as injury to arteries. It demands prompt methods to arrest the hemorrhage, and later, the bleeding points may be ligated. In all cases the proximal and distal ends of the veins should be ligated, as hemorrhage may occur from either end. Especially is this true of the external jugular, inasmuch as the valves are imperfect and do not entirely close the vessel. Operations on veins are done with the same precautions as are taken in the ligation of arteries. (See Ligation of Arteries.)

DISEASES AND INJURIES OF THE LYMPHATICS.

Lymphangitis.

There are two forms of lymphangitis, acute and chronic.

Acute Lymphangitis is a rapid invasion of the lymphatics by septic material or the products absorbed from poisoned wounds.

Cause.—The cause is micro-organisms or other toxic material associated with obstruction to the lymph stream.

Pathology.—The wall of the lymphatic is infiltrated and inflamed as in an ordinary acute inflammation. The tissues round about are more or less involved. It is said by some that the lymph within the vessels coagulates and forms a pink clot.

Symptoms.—The symptoms of an acute lymphangitis are fine red lines, edematous swelling and a violent inflammation closely resembling erysipelas. There seems to be two forms, one in which the larger lymphatics are involved, a tubular form, and the other in which the smaller lymphatics are involved. Where the small lymphatics only are involved, it may closely resemble erysipelas. The disease may be attended by chill, vomiting, and sweats. The pulse is rapid and the fever ranges from 102 degrees to 104 degrees F. The diagnosis is sometimes difficult, but it is not so essential. Erysipelas itself is a lymphangitis due to a special micro-organism. It has more of a rose-red color, the skin is more brawny, and the onset of the disease more marked than in acute lymphangitis.

Treatment.—It is essentially that of erysipelas. (See treatment of Erysipelas.)

Chronic Lymphangitis.—A chronic inflammation of the lymphatics resembles a chronic inflammation in any of the connective tissues. It follows the acute form where recovery is not entire, or it happens in cases of syphilis and tuberculosis. There are people who seem to have a tendency to the proliferation of connective tissue elements. In these subjects, chronic lymphangitis often develops. There are enlargements of the lymphatic glands and thickening of the connective tissues generally.

Treatment.—The treatment is the same as the acute form. Remove the obstruction to the lymphatic circulation.

Lymphangiectasis or Lymphangioma.

This is a condition of chronic dilatation of the lymphatic vessels. It is sometimes congenital and other times acquired. It may be localized to small areas or involve a considerable part of a member. Chronic distension of the lymphatics is oftentimes accompanied by overgrowth of the connective tissue elements of the part, leading to chronic hypertrophy, as seen in macroglossia. Distension of the lymphatics may be shown by small vesicles which persist and which are not accompanied by evidences of inflammation. When these vesicles or lymph spaces are opened, there is a considerable flow of fluid (lymphorrhœa). They are found most frequently on the inner side of the thigh and the genitalia of the male.

Treatment.—Remove the fascial obstruction to the lymphatic circulation. This will drain the sodden tissues and give relief.

Lymphatic Obstruction.

Lymphatic obstruction may take place in any of the large lymphatics, as the thoracic duct or any of its branches. The obstruction may be due to muscular contraction, contraction of the fascia, abnormal position of the bony structures, and to chronic lymphatic obstruction arising from the deposit of tuberculous material, as occurs in long standing inflammations of the fascia or connective tissues generally. Repeated attacks of eczema may cause enlargement of the lymphatic glands, which operates as an obstruction to the lymphatic circulation and will sometimes finally result in a thickening of a member. This lymphatic obstruction and enlargement of the part is called elephantiasis.

Elephantiasis.

There are two forms of elephantiasis: (1) Elephantiasis Arabum and (2) Pseudo-elephantiasis. It may affect the foot, leg, genitalia, etc., where it is known as elephantiasis pedis, elephantiasis cruris, elephantiasis labium, etc. The phenomena of elephantiasis consist of (1) edema. This edema is lymphatic in origin and solid. The fluid cannot be pressed out of the tissues and the part appears to be permanently thickened. (2) Hyperplasia. Hyperplasia of the connective tissues takes place. The subcutaneous connective tissues become infiltrated and thickened and increased in amount. The skin becomes coarse and warty in appearance and ulcers are common. Where injuries or ulcerations occur in the enlarged part, the lymph will seep out (lymph fistula). This continual discharge of lymph is called lymphorrhœa.

Pseudo-elephantiasis arises from tuberculous conditions and ulcers. It is sometimes called Barbados leg. It is a disease of the tropics and need not be discussed here. It affects the leg, scrotum, vulva, face, and breast. The disease may persist for years.

Lymphadenitis or Adenitis of the Lymphatic Glands.

Cause.—Inflammation of the lymphatic glands is produced by the absorption of toxic materials and obstruction to the return circulation. This material is carried back through the lymph channel into the lymphatic glands where tissue changes are produced. This inflammation in the lymphatic glands operates as an obstruction to the flow of lymph. As soon as the source of the irritating products and the obstructions are removed, the swelling and inflammation of the gland disappear. If pyogenic micro-organisms get in, suppuration is very likely to follow. Suppurative adenitis is a slow process and may be prolonged over a considerable period. Some writers look upon the lymphatic glands as filters whereby poisonous products are kept from entering the general circulation. This perhaps accounts for the fact that when a considerable amount of poisonous material finally gets into these glands, suppuration is very apt to occur. Occasionally, acute lymphangitis occurs. In these cases it is believed that muscular injury, irregularities in the circulation, and bony lesions, etc., may be set down as the cause.

Pathology.—The pathology of the disease is simply that of an inflammation in any of the tissues. If suppuration occurs, it is usually localized, rarely diffuse. If it becomes diffuse, it may persist for a considerable length of time.

Symptoms.—The evidences of acute lymphangitis are the symptoms of inflammation, together with the enlargements of the glands. They are extremely painful and hard, and the tissues about are sometimes edematous. As soon as suppuration is evident, the lymphatic gland should be freely opened and drained. Sometimes the suppurative process may extend into the neighboring glands and each one in succession breaks down and ulcerates. The absorption of toxins and disturbance of the digestion and secretions will follow and the patient becomes debilitated, and a chronic abscess results, if the disease is not properly treated at once. Any obstruction to the nerve or blood supply, or the lymph stream, should be relieved at once and any anatomical lesions accounting for the condition, should be corrected. As soon as suppuration is evident, the abscess should be opened and freely drained. Not only should there be free drainage, but the abscess should be frequently dressed, each time being washed with an antiseptic solution. Before suppuration takes place, hot fomentations are valuable. The glands most frequently involved are the axillary, inguinal, and cervical. Where suppuration occurs, they should be treated as acute abscesses. It is worthy of note that the osteopathic treatment, which will be indicated in each individual case, is of the utmost importance. Next to this should be cleanliness, proper diet, and hygiene.

Chronic Lymphadenitis.

Chronic lymphadenitis is a chronic inflammation of the lymphatic glands and may result from acute inflammation or from constitutional conditions, but, in all events, the chief underlying cause is anatomical

derangement. The disease is most common in the neck in scrofulous children. Sometimes the disease can be traced to exciting causes, such as carious teeth, chronically inflamed tonsils, sore mouth, and is said to be produced in some cases by lice. In every case syphilis and tuberculosis should be eliminated. The glands usually enlarge slowly and become infiltrated with round cells, as in chronic inflammation of other tissues. The enlargement is first fleshy in nature and usually not painful. The person may improve in health and the enlargement disappear, or the inflammation may continue for some length of time. The inflammatory reaction becomes apparent, slowly accelerated and may or may not be painful. Finally the gland undergoes caseation, or it may even break down and ulcerate. Other times, the liquid elements of the caseous mass may be absorbed, leaving a hard mass, which finally atrophies and disappears. It is claimed by some that general tuberculosis may be derived from these chronically enlarged glands. The glands, which are at first singly enlarged and movable, often become adhered into a mass. Evidence of suppuration will be shown by the fact that the skin over the gland becomes red and adherent. After a lymphatic gland breaks down and suppurates, it leaves a purplish, foul, undermined, and indolent ulcer. After awhile this may heal. They leave a peculiar, puckered, white scar. After suppuration has occurred and fluctuation is distinctly felt, the abscess cavity should be opened and well drained. If the opening is large enough for the finger to be introduced, all loculi of the cavity should be dug out. A Volkmann's spoon is an excellent instrument with which to scrape out the dead parts of the gland. Strictest asepsis should be maintained to prevent scarring. The scars are peculiar in these cases, in that they retain their pink color much longer than ordinary scars. In treating acute and chronic lymphangitis, painting the glands with belladonna and glycerin, the application of the tincture of iodine, or the oleate of mercury, or other such drugs, is of no value. The treatment should be first directed towards restoring the circulation and relieving the obstruction to the return circulation, not only the lymphatic, but the venous as well. Besides the *cause* must be removed, whether it is carious teeth, anatomical lesions, or a sore. Some surgeons advise a radical treatment for enlarged lymphatic glands, but this is unwise. This treatment is to enucleate the gland as soon as it enlarges. If proper attention is paid to the *cause* of the disease, the treatment will be plain.

Lymphadenoma.

A non-inflammatory enlargement of lymphatic glands may occur sometimes; this is called a condition of lymphadenoma. Two forms are described by various writers, (1) benign or the simple form, which consists in the enlargement of a single lymphatic gland or the lymphatic glands of a small area, viz., the groin, neck, or axilla. The cause of the disease is due to lymphatic obstruction or to errors of the nerve and

blood supply. (2) Malignant lymphadenoma, or Hodgkin's disease, or pseudo-leukemia, is usually met with in adults and consists in an overgrowth of all the lymphoid tissues of the body—spleen, lymphatic glands, and the lymphoid tissues in the bowels. The proportion of white corpuscles is much greater than should be, but not so great as exists in true leukemia. The subject has one white, to fifty or seventy-five red, corpuscles. The disease is said to be incurable.

Lymphosarcoma.

This is a condition of sarcoma of the lymphatic glands. (See Sarcomata.) The disease occurs more often in the tonsil than any place in the body. It grows rapidly and is painless. It seriously affects the health and rapidly becomes fatal. The disease usually occurs in adults. The dissemination of the growth to the viscera results fatally.

Secondary growths of the lymphatic glands and *tubercular enlargements* of the lymphatic glands or *syphilis* of the lymphatic glands, are discussed elsewhere in the text.

DISEASES OF THE SKIN AND ITS APPENDAGES.

Dermatitis.

One of the most common inflammations of the skin is the toxic form, the result of poison sumach. There are three forms of the poison sumach more especially toxic, the poison oak, poison ash, and poison ivy. Contact with the plant is not always necessary to bring on the inflammation. The symptoms are a papillary or vesicular inflammation of the skin. Edema may result. In bad cases there is fever.

Treatment.—Apply sweet spirits of nitre to moisten the surface of the skin. Oxid of zinc ointment containing ten drops of carbolic acid to the ounce of ointment is an excellent application. Extract of witch hazel applied several times daily is of great service many times. A 1:5000 solution of bichloride of mercury will relieve some cases.

Furuncle.

A furuncle, or boil, is a circumscribed inflammation of the true skin and the connective tissues beneath it. The cause of a boil is infection of a hair follicle by the pus germs, generally the staphylococcus pyogenes aureus, sometimes the albus. Conditions making inoculation possible are the same as those operating in other infections. They are common in disorders of digestion, in constipation, diabetes, Bright's disease, and conditions of general debility.

Symptoms.—The symptoms of a boil are too well known to require description. Sometimes boils apparently come in crops or they may be scattered over the body. In such instances the pus is usually expressed by the hand and gets onto the body in other locations and infection occurs.

Treatment.—As soon as pus is evident, the boil may be lanced or allowed to rupture itself. The cavity must be thoroughly cleansed with an antiseptic solution, as peroxid of hydrogen. Where the boils come in crops, scrubbing the skin with soap and water and afterwards thoroughly washing it with an antiseptic solution, or fomentations of a weak solution of bichloride of mercury, or a saturated solution of boracic acid, is of great service.

Carbuncle.

A carbuncle is really a condition similar to a boil, but which is attended by extensive infiltration of the skin in the neighborhood of the pus formation. The cause is the staphylococcus pyogenes aureus, coupled with certain conditions of the body or a devitalized condition locally. It differs from a boil in that the constitutional symptoms are severer and the base is hard, indurated, and boggy. Instead of the pus pointing at one place, several pustules will form with a bloody serum contained in them. It is not unusual that a considerable mass of tissue will necrose, pus forming in below this, will burrow out through it. Where the patient is debilitated and the absorption of pus is very great, general sepsis may follow, when it may result in phlebitis or lymphangitis. The most usual location for carbuncles is the neck, back, and buttock.

Treatment.—The treatment is to relieve local lesions and whatever general ailment the patient may have. The carbuncle should be freely incised and cauterized with pure carbolic acid. It should then be treated as a simple sore by washing with antiseptics and sprinkling with Senn's powder (one-third salicylic acid to two-thirds boric acid). Sometimes a hot saturated solution of boracic acid accomplishes much. This treatment should be kept up until the sloughs are separated. The sore should then be dressed with dry antiseptic gauzes.

Clavus or Corn.

A corn is a thickening of the epidermis, due to inflammation of the skin, brought about by irregular pressure of ill-fitting boots. The treatment is to remove the pressure by the use of plasters and then subsequently to remove the corn by scraping. In old persons the corn should not be cut, but should be soaked in hot water and scraped, care being taken not to injure the skin. In painful feet, the result of corns, direct the patient to soak the feet in hot water and afterwards wrap them in cloths saturated with a mixture of equal parts of linseed oil and lime water. Suitable plasters to remove the pressure from the corn, will relieve the inflammation, when the corn can be removed. The following formula will be found useful in removing corns: Paint the corn each night with a mixture of salicylic acid, one and one-half drams, extract of cannabis indica ten grains, and flexible collodion one dram.

Chilblains.

Chilblains are circumscribed congestions and inflammations of the skin, the result of excessive cold. They are more common in young persons. They consist of localized reddish or bluish-red erythematous areas. They give rise to intolerable itching and burning. In some cases the skin may be a purplish-red and so congested as to cause rupture—broken chilblain.

Treatment.—The application of equal parts of spirits of turpentine and olive oil, or the oxid of zinc ointment, or the tincture of cantharides and soap liniment in the proportion of one to six, will give relief.

Onychia.

Onychia is an inflammation of the nail and seems to be due always to the infection of the matrix with pyogenic organisms. The inflammation usually starts at the side or base. The common form is paronychia or unguis whitlow. Pus forms beneath the nail and the affection is extremely persistent and painful.

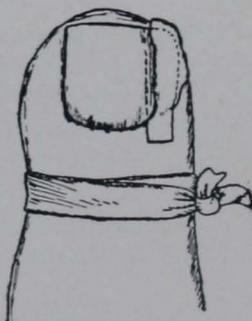
Treatment.—The treatment consists in removing the nail with fine scissors and cleansing the sore thoroughly with antiseptics. The patient is usually run down in health. Strictest antisepsis and care of the nail is necessary. When suppuration is taking place, hot lotions of 1:50 carbolic solution are most comforting. All parts of the diseased nail should be trimmed away with fine scissors and all exuberant granulations touched with lunar caustic.

Ingrowing Nail.

Ingrowing nail is an ulcerative condition of the side of the toe (generally the great toe) produced by the curling up of, and pressure on, the nail, caused by pressure of ill-fitting boots and neglect of the feet. Extensive inflammation and thickening of the tissues alongside of the nail may result, so that the flesh will, in some cases, extend out over half the nail.

Treatment.—The treatment is to take the condition in hand early and prevent pressure by correcting the footwear. Then insert a piece of surgeon's cotton underneath the edge of the nail to prevent the sharp edge from cutting into the flesh, also, the middle of the nail should be scraped thin so as to permit it to bend; also, in trimming the nail, it should be cut straight across and the corners allowed to grow out. These should be turned up. The disease seems to be produced by the nail being thick and the corners having been cut off on the sides. As the nail grows out the flesh is pushed by the boot against the sharp edge of the nail, which causes the inflammation.

FIG. 34.



Method of operation for ingrown toe-nail. Tie a fillet around the toe and excise part of the nail.

Of the various operations for relief of ingrowing toenail, there is but one that gives permanent relief. The redundant tissues on the side of the toe should be cut off and one-fourth of the nail should be removed, care being taken to destroy the matrix so the nail will not return. After the operation the wound should be treated antiseptically and allowed to heal.

Molluscum Contagiosum.

This is an affection which shows itself by small, hemispherical nodules, about the size of a split pea. They are yellowish-white in color and umbilicated. These masses undergo hyaline or waxy degeneration. The depression in the center is usually occupied by dried material. They are common on the face, especially of a child, and may appear upon the breast of the mother. The nature of the affection is unknown. The origin seems to be in a hair follicle.

Treatment.—The treatment is to incise the mass, express out the contents and touch the capsule with a stick of nitrate of silver.

DISEASES AND INJURIES OF NERVES.

Injuries to the nerves consist of:

- | | |
|----------------|-----------------|
| 1. Contusions. | 4. Compression. |
| 2. Strains. | 5. Puncture. |
| 3. Rupture. | 6. Division. |

Contusions.

Contusions may be transitory in their effect, but in persons subject to gout, syphilis, rheumatism, or in neurotic individuals, neuritis may result. Simple contusions cause a tingling sensation as of a pin pricking the skin. This may wear off in a few hours. In severe cases there may be complete loss of motion and sensation.

Treatment.—The treatment consists in securing the proper nerve and blood supply to the affected nerve trunk. Massage and friction will be found serviceable.

Strains.

Strains are produced by extraordinary muscular efforts during times of excitement, and the results are similar to contusions. The treatment is likewise similar.

Rupture.

Rupture of a nerve rarely occurs except in connection with fractures where there is considerable laceration of the soft parts, or in connection with dislocations. Entire division of a nerve is very rare. All of the axis cylinders may be ruptured, with the sheath of the nerve still intact. The symptoms of the affection are immediate paralysis of motion and sensation. In case the rupture is complete, the paralysis

of motion and sensation may be permanent, but usually a considerable amount of repair will take place; sometimes it is complete.

Treatment.—The treatment consists in relieving the congestion and securing the proper blood supply to the injured nerve. Where the paralysis exists for some length of time, the part should be thoroughly manipulated to prevent atrophy, until regeneration of the nerve takes place. Even in old standing cases much improvement may be obtained.

Compression.

Compression of the nerve may result in partial or complete loss of function. The pressure may serve as an irritation and cause the inflammation and a neuralgic condition. Pressure may be exercised upon a nerve in the following conditions:

- | | |
|---|--|
| 1. Aneurysm. | 5. Pressure of a crutch, causing crutch-paralysis. |
| 2. Tumor. | 6. Pressure of a splint. |
| 3. Fracture. | 7. Chronic osteitis. |
| 4. Callus, where it envelops a nerve some weeks after the fracture. | 8. Syphilitic diseases of bones. |
| | 9. Displacement of bones. |

Displacement of bones consists in partial or complete dislocations. Partial dislocations, the result of injury or muscular contractions, are more frequently the cause of compression than all other agencies. These should be looked for in any given case. When the compression can be readily removed, recovery will be complete. If secondary changes have taken place in the nerve and muscles, the prognosis is not so favorable. Recovery will be slow.

Puncture.

Puncture of a nerve is usually associated with inflammation and followed by neuralgic pains. Sometimes the pain is very intense. Especially is this true in neurotic individuals. The pain will radiate along up the nerve trunk and cause muscular spasms.

Division.

The immediate effects of division of a nerve are:

1. Paralysis of motion, providing the nerve contains motor filaments.
2. Paralysis of sensation in the part to which the nerve is distributed. The area of sensation destroyed becomes smaller through the development of collateral nerve distribution.
3. Vasomotor paralysis will be evident by congestion of the part at first, followed later by the part becoming colder and not sufficiently supplied with blood.
4. The secretions may be arrested because of secretory fibres having been destroyed.
5. Trophic changes may take place in the tissues, as ulcerations, degenerations, etc., because of paralysis of the trophic nerves.

Secondary Effects.—The secondary effects consist in (1) inflammation and (2) degeneration of the nerve trunk and (3) the reparative efforts of nature. Immediately upon division of a nerve, the space between the divided ends becomes filled with blood. After several days this is absorbed. Round-celled infiltration takes place, so that the spaces finally become filled up with granulation tissue. If there is not approximation of the nerve ends, the two stumps become united by means of cicatricial tissue. From the proximal extremity of the nerve, the axis cylinders will grow out through the connective tissue, and some of the fibres will seek out the axis cylinders of the distal end of the nerve, and will grow down through the myelin sheaths. This results in the partial restoration of the nerve-function. It is said that such outgrowing of the nerve trunks may take place through one and a half inches of cicatricial tissue. Sometimes such regeneration does not occur. Even a small scar may result in the complete loss of the nerve-function. In case of amputation of a limb, the divided end of the nerve sometimes develops a tumefaction (amputation neuroma). This consists of a thickening of the connective tissues of the nerve, together with the outgrowth of the axis cylinders of the trunk of the nerve. These axis cylinders coil up and sometimes form a bulbous extremity. These bulbs may be the cause of severe neuralgias, and may necessitate the removal of the end of the nerve trunk. After division of the nerve, in the peripheral extremity, Wallerian degeneration occurs. This is set up about the fourth day. It is said to be caused by a separation of the nerve trunk from its source of nutrition, the nerve cell. The changes which occur are such as are described under "Repair of Nerves." The changes which take place in muscles consist of more or less complete paralysis of motion. This paralysis is later followed by more or less slowly developing atrophy, and finally, the muscle undergoes degeneration. Deformity may result because of the paralysis, atrophy, and degeneration; especially is this true where the opposing muscles are disturbed. Certain electrical changes take place in the muscle. These electrical changes are summed up in the reactions of degeneration. As long as the reactions of degeneration are present, there is hope for recovery of the muscle, providing the nerve can be restored. This is of little practical use inasmuch as the history of the case, together with the anatomical conditions present, will enable the physician to determine the amount of recovery which may be expected. The sensation which has been destroyed as the result of the nerve division, will be more or less restored. The area of anesthesia will be lessened as anastomosis and collateral nerve supply is established. The blood supply to the part is lessened. The part looks bluish and may appear congested. Sometimes the skin has a peculiar, shiny appearance, while at other times it is rough and covered with scales, or even edematous. Wounds heal badly in a paralytic limb. Exposure to heat and cold may cause chilblains or vesication. Slight irritants excite ulceration, and these ulcers persist for a considerable length of time. In paralysis of

the fifth nerve, corneal ulceration is common, whereas in hemiplegia, perforating ulcers arise on the bottom of the foot. The appendages of the skin may become involved, the hair falling out, or the nails become brittle and rough. The sebaceous glands may become functionless or may secrete an over abundance of sebaceous material. Atrophy of some of the smaller bones, as the phalanges, and ankylosis of the terminal joints, may occur in old cases. When the paralysis occurs in young people, the development of the member paralyzed is arrested. Occasionally the division of a nerve is attended by certain changes in the cortical area. This may result in epileptiform seizures or in severe cases of dementia. This is not so common unless a foreign body is in relation with the stump of the nerve. Regeneration of the nerve will take place according to the method described under "Regeneration of Nerve Tissue."

Treatment.—In case of division of a nerve, the treatment is nerve suture. The needle best suited for the purpose is a round one, not having cutting edges. A fine Hagedorn needle may be used. The operation of uniting the nerve ends should be done under the strictest asepsis. The suture, which should be of catgut, must be aseptic and only one or two applied, sufficient to hold the ends of the nerve in position.

Secondary nerve suture has, of late years, given some promise. Even where a considerable cicatrix has formed between the ends of the nerve, it can be removed, the nerve ends approximated, and a good result obtained.

Nerve grafting has been done successfully. It consists in removing a piece of nerve from a lower animal (preferably from the spinal cord), and grafting it in between the divided ends of the nerve. This operation has been done successfully in several instances. It requires the strictest asepsis and a thorough acquaintance with operative technic. After the injury, the parts should be manipulated and massaged in order to encourage the circulation to the injured part and prevent degeneration of the muscles. Ankylosis and contractions of any muscles or ligaments should be prevented. If sepsis has complicated the original wound, the prognosis of the case is rather unfavorable.

Neuritis.

Neuritis, or inflammation of a nerve, is not a common condition, but may occur from subluxations, injury, gout, or rheumatism. It sometimes attends necrosis of bone, carious teeth, etc.

The *symptoms* vary according to whether the inflammation is acute or chronic, and according to the nerve affected. The inflammatory condition may be sufficient to lead to degeneration of the nerve. Usually it results in the formation of fibrous tissue, the slow contraction of which so impinges upon the nerve that persistent neuralgic pains result.

The *causes* are due to injury, gout, rheumatism, and subluxations.

The *treatment* consists in relieving the congestion, improving the circulation to the nerve, and removing the cause. If it is rheumatism,

the rheumatism should be treated; if it is gout, the gout should be treated; or if it is a dislocated bone, the luxation should be reduced.

Neuralgia.

Neuralgia means "nerve pain." The term is applied to persistent pain in a part along the course of a certain nerve. The pain is usually paroxysmal, intermittent, darting, and stabbing in character. It is most common in the trigeminus or fifth nerve. The attacks may last a few minutes, or several days, or even longer. It may be periodical. The pains may extend over a certain part of the nerve, or all of it. Trophic changes will take place in the skin. Sensation and motion may be more or less affected. Frequently the circulation is impaired. It may be brought on apparently by a draft of air. Pressure on certain points may relieve or increase the pain. Muscles frequently become contracted and there may be excessive secretions. Over the area of the distribution of the nerve, an herpetic eruption may break out. Neuralgic pains may occur in any mixed or sensory nerve or in any of the organs, such as the breast, ovary, or testis.

Causes and Treatment.—Osteopathy in this affection does what medicine and surgery have failed to do—accomplishes a cure. The cause of this troublesome affection is pressure on a nerve by contractions of the muscles and connective tissues, but more especially by bony displacements. As for instance, trifacial neuralgia is produced by luxation of the atlas affecting the medulla and sympathetic nerves. Intercostal neuralgia is produced by a luxated rib or contractions of the intercostal muscles which hold the ribs in abnormal position. Operative interference is never warranted in view of the results obtained by osteopathic treatment. These operations consist of nerve section and nerve stretching.

DISEASES AND INJURIES OF BONES AND JOINTS.

Diseases of Bones.

Inflammation of Bone.—Inflammation of bone has for its causes the same agencies which produce inflammation of any other tissue. The reaction to injury in bone is quite similar to the reaction in other tissues. Only the soft tissue of the bone is affected. The inflammation usually begins in the periosteum or endosteum and then extends along the Haversian canals, lymphatics, and blood stream into the bone itself.

The results of inflammation of bone are suppuration, caries, necrosis, and sclerosis, which are similar to the terminations of inflammation in other tissues. When the inflammation occurs chiefly in the periosteum, it is a periostitis; if the chief changes take place within the bone itself, it is an osteitis; or within the medulla of the bone, osteomyelitis. The inflammation may be simple or septic. Simple inflammations attend fractures and bruises of the bone and are reparative in nature and terminate in resolution, whereas the septic variety

very often terminates in destructive changes. The septic variety is brought about by the absorption of micro-organisms. These are carried through the body and finally lodge in the connective tissue spaces of the bone, setting up inflammation.

Periostitis.

Periostitis, or inflammation of the periosteum, occurs in three forms, (1) acute simple periostitis, (2) acute infective periostitis, and (3) chronic periostitis.

Acute Simple Periostitis.

This is usually the result of injury and occurs in the exposed parts of the body. Its pathology is that of simple inflammation. It terminates in resolution.

Treatment.—The treatment consists in rest, elevation of the part, and the application of cold. Manipulation to assist the return circulation and to secure a good, free flow of arterial blood, will be found of great advantage. Pus formation is rare. The disease usually terminates in resolution. Should evidence of suppuration appear, hot boracic acid fomentations should be applied, and as soon as the pus is formed, a free incision should be made and the pus evacuated. Rigid antisepsis should be employed to prevent ulceration of the bone.

Acute Infective Periostitis

Is sometimes called diffuse periostitis. It is of a grave nature and leads to death of a considerable portion of bone, or the disease may terminate fatally in pyemia or septicemia.

Pathology.—The disease usually occurs in young people who are debilitated. It often follows an injury, although the injury may be slight. The most probable causes are constitutional conditions and certain bony lesions affecting the nutrition, which render infection possible. The disease is often the sequel of a continued fever. The exciting cause of the affection is, perhaps, the staphylococci or streptococci which have gained entrance into the system at some point made weak by a deficient nerve and blood supply, the result of subluxations or muscular contractions. The disease begins as a rapidly spreading inflammation, which quickly extends into the bone and reaches the medulla. The pus is formed beneath the periosteum in the cancellous part of the bone, also in the medulla. In some cases the entire shaft of the bone may be destroyed. The epiphysis of the bone escapes injury, as the blood supply to this part is through another source and is perhaps better. There is no direct connection between the blood-vessels which supply the epiphysis and those which supply the diaphysis until after ossification is complete, and for this reason, neither the epiphysis nor the joint become affected. It is possible

for the inflammation to spread to the joint, only through the connection between the capsule of the joint and the periosteum.

Symptoms.—The onset of the disease is usually announced by a chill and an inflammatory fever, which is sometimes attended by delirium. The shafts of the long bones, such as the humerus, femur, and tibia, are more frequently affected. This disease may be overlooked. It begins as a pain, deep-seated, intense, and agonizing. The limb can not be handled, which makes it probable that the periosteum is affected. The soft-parts over the bone become swollen, edematous, and dusky red (indicating a deep-seated inflammation). It can not always be differentiated from an abscess, except by incision. If the joints become involved, the symptoms are more urgent. After suppuration occurs and the pus burrows towards the surface, it will be found, after rupture or opening of the abscess, that a considerable mass of the bone has died. If the joint becomes involved, bony ankylosis will frequently result. As soon as the diagnosis is made, an incision should be made through the periosteum, free drainage established, and the wound washed with corrosive sublimate solution (1:2000). Should this not serve to arrest the process, and if small particles of pus seem to come through the nutrient foramina, an opening should be made, by means of a bone chisel or trephine, into the middle of the bone, where, some surgeons believe, is the primary seat of the trouble. The wound should be washed out twice daily with a 1:2000 corrosive sublimate solution. At least a gallon of antiseptic solution should be thrown into all parts of the abscess each time. The limb should be kept quiet. Liquid nourishment should be given regularly at stated intervals. Should a joint become involved, suppuration occurring, it should be laid open and freely irrigated with some antiseptic solution. If there is evidence of general sepsis intervening, amputation should be considered. An early incision can not be too strongly emphasized, since by this means the shaft of the bone may be saved. Should necrosis of bone occur, the dead bone must be removed as soon as it becomes loose. If the shaft of the bone dies, a short longitudinal incision should be made, the shaft divided and pulled loose from either epiphysis. If this is done early, it will save deformity, suppuration, and sepsis. Furthermore, by applying an extension apparatus, new bone will be formed in place of the old shaft, providing pus has not been present a sufficient length of time to destroy the vitality of the periosteum.

Chronic Periostitis.

It is associated with changes in the connective tissues about the bone. It is usually limited and is almost always due to syphilis, tuberculosis, or rheumatism. When it is caused by trauma, it arises from a long continued irritation, or perhaps from the extension of an ulcer into bone. As in acute periostitis, it may result from continued fevers, such as typhoid.

Pathology.—The pathology is similar to that of acute periostitis, except the tissue changes are not so rapid. Round cell infiltration takes place in the periosteum, extending finally into the bone. The inflammatory material will, with proper treatment, be absorbed or may become ossified, or a condition of fibrosis may occur. In another case it may break down, forming pus, caries resulting. The ossifying variety of the disease forms a hard node of bone. Suppurating chronic periostitis of the long bones is usually due to tuberculosis or typhoid fever, whereas, that occurring in the skull is often the result of syphilis.

Symptoms.—Dull, deep-seated, boring pains, which are worse at night than by day. Upon examination it will be found that the bone is thickened, presenting hard, irregular nodules along its surface. On the head, the tumor is usually soft and fluctuating and looks like a sebaceous cyst, but there is always a history of syphilis.

Treatment.—The treatment is to lay open the soft mass and clean out the abscess. If the case is syphilitic, the general condition should be treated. Where a mass of bone dies, it should be removed. If the inflammation extends into the medullary cavity, the bone should be trephined.

Osteomyelitis.

There are three forms of osteomyelitis, (1) Acute simple osteomyelitis, (2) Acute diffuse osteomyelitis, and (3) Chronic osteomyelitis.

Acute Simple Osteomyelitis is a localized inflammation of the medulla of the bone and is believed to be of traumatic origin. It arises from fractures or from sawing of the bone in an amputation. There may be a localized necrosis, when the sequestrum is small and conical, because of the spread of the inflammation along up the medullary canal.

The *treatment* is to keep the wound aseptic and to remove the sequestrum, if one forms.

Acute Diffuse or Infective Osteomyelitis is a more grave affliction. It is said to be often spontaneous in its origin, while in some cases there may be a distinct history of trauma. It occurs in debilitated and strumous subjects, especially in children.

Cause.—The cause of the disease is the streptococci and the staphylococci, which have gained entrance into the system, because of the lessened resistance of the tissues at some point, or because of the presence of ulcers. It follows, or attends, attacks of acute infectious diseases or suppurating wounds. It sometimes follows abrasions where more or less sepsis complicates the condition.

Pathology.—The disease is grave. It usually begins with a chill, the fever rises rather rapidly, and delirium is common. In children, after wounds, the disease comes on suddenly and at night. Where there is no evidence of injury, the patient may give a history of becoming chilled after being apparently over-heated. Locally, there are vio-

lent aching pains and acute tenderness over the seat of the inflammation. The entire medulla of the bone becomes infiltrated and there is rapid diffusion of the pus germs. The toxins absorbed give symptoms of sapremia, septicemia, or pyemia. It is not unusual that infective osteomyelitis is the gravest of the staphylococci infections. The disease can probably be prevented in many instances, but in others not. The entire diaphysis of the bone may be destroyed and sometimes the neighboring joints are involved. In some cases, only a central mass of bone is destroyed.

Symptoms.—The symptoms are similar to those of periostitis, except that the local signs are not evidenced so soon. The systemic disturbances are usually greater and more sudden, but as soon as the inflammation extends through the bone to the periosteum, the local symptoms are the same, and perhaps the two diseases can not be differentiated. High fever, rigors, and edematous swelling of the limb are present. In cases of fractures or amputation, the periosteum recedes, leaving the dead end of the bone protruding. The granulations about the dead bone are fungating in character.

Treatment.—In osteomyelitis, not the result of wounds, an early free incision seems to be the best treatment. Even before pus is formed, the medulla of the bone should be exposed. In cases, the result of operation or injury, the wound should be thoroughly cleansed with an antiseptic solution. Some operators scrape out the medulla of the bone and follow this curetting process with antiseptic washes. The treatment is similar to that of sapremia or septicemia. Should general sepsis supervene, a high amputation is necessary. When septicemia and pyemia seem to have been established, amputation will be of no use.

Chronic Osteomyelitis can not be differentiated from chronic periostitis. It may end, as other chronic inflammations, in the formation of fibrous tissue in the medullary canal, or it may end in the formation of pus. The disease is believed to be tubercular. The abscess following is called Brodie's abscess. The disease may be the result of syphilis or typhoid fever. The medulla of the bone and the tissues within the Haversian canals, seem to be equally affected. The cancellous part of the bone suffers most. It is difficult to differentiate this disease from osteitis until after the diseased tissues have been exposed by operation.

Osteitis.

Osteitis means inflammation of the bone tissues, but this is said to occur rarely, if ever, without involving the medulla or periosteum, hence it is difficult to differentiate between it, periostitis and osteomyelitis.

Cause.—The cause seems to be the same as in other disease of bone.

Pathology.—The pathology is likewise about the same. There is usually a history of injury, together with lesions affecting the tissues locally, or certain constitutional conditions. The tissue changes

occurring in osteitis, are similar to those occurring in inflammations of other tissues. The Haversian canals and other spaces in the bone become infiltrated with proliferated bone cells. There are certain large bone corpuscles formed which bring about a rarification, or thinning, of the bone. By this process all of the bony spaces are enlarged and by destroying the septa between the spaces, larger spaces are formed. The periosteum will become more or less inflamed and perhaps separated by exudations from the bone itself. When the periosteum becomes separated, the nutrition is cut off to a portion of the bone mass. Death of this mass occurs (necrosis). In some cases, resolution of the inflammation may take place, while in other cases, fibrous tissue and bone formation will result, the bone becoming permanently thickened and hardened (sclerosis). In other cases suppuration may follow and abscess of the bone occur. This abscess of the bone is attended with molecular death or caries. Sometimes caseation may take place in the abscess. It is said that osteitis will sometimes occur in connection with periostitis, as the result of strains or traumatism, or will follow any of the acute infectious diseases. Periostitis, and sometimes osteitis, will occur at the attachment of the patellar tendon to the tubercle on the front of the tibia in football players, causing a football knee.

Osteitis may terminate in destruction and absorption of part of the bone, the process being similar to abscess formation with absorption of pus. This is called "rarefied osteitis."

Symptoms.—Osteitis can not be differentiated from periostitis. The signs vary according to the intensity of the inflammation. Pains are deep-seated and boring, and they are worse at night, and increase on moving about. The edema is slight, with little redness. If the periosteum is involved, the redness will be considerable. There may be no swelling at first, although subsequently, the limb may become considerably enlarged. The deep-seated character of the pain, the fact that it has continued for a long time, and that pressure relieves the pain, together with the absence of much redness and swelling, indicate osteitis. Pain of a more superficial character, and which is increased upon pressure, would indicate that the periosteum and superficial tissues are affected. In the chronic form of the disease, the diagnosis can not always be made.

Treatment.—The treatment should be directed towards increasing the arterial blood flow, relieving the return circulation, and any general or systemic ailment which may be present. Relief may not be obtained until the bone is laid bare and a piece chiseled out. This will let out the engorged blood and pus. If gout, rheumatism, or tuberculosis exist, special treatment will be required.

Abscess of Bone.

Abscess of bone is always chronic. Acute inflammation of bone causes necrosis rather than abscess formation. After enteric fever, an area of suppuration may slowly form at the end of one of the long

bones. This is said to be due to the action of the typhoid bacilli. It may occur after tuberculosis, the end of the bone being the point of least resistance. The disease is more commonly found in the tibia than any other bone. Often great thickening of the bone covering the abscess occurs. The pus may burrow into the joint, inasmuch as there is no periosteum there to form a shell of bone to act as a barrier. Inasmuch as this abscess of the bone may be the result of any chronic inflammation of the bone, it may be located within the medullary canal, within the bone itself, or beneath the periosteum. The process by which pus is formed in bone, is similar to that occurring in suppuration in the soft tissues. After the central portion of the inflamed area dies, caries of the surrounding bone follows until a distinct abscess cavity is formed. This is lined with a thick, tough, pyogenic membrane. The abscess may be latent in the bone for years. After the abscess cavity forms, it may burrow through the periosteum to the surface and discharge most of its contents. The opening through the outside shell of bone may close up and the abscess remain quiescent for a considerable period of time, and when the system again becomes debilitated, or because of injury or exposure, the abscess takes on renewed activity and pus is again formed. At the second formation of pus it may burrow through a new sinus, making an additional opening.

Symptoms.—The symptoms are somewhat obscure and frequently lead to the diagnosis of chronic rheumatism. The pain is rather a dull ache and is described by the patient as giving a sensation like boring into the bone with a gimlet. The pain is said to be worse at night. Previous to the discharge of pus through the small sinuses leading down to the cavity, the pain will be intense; afterwards the patient may be able to get up and about and suffer no very great inconvenience. As the abscess approaches the surface, there will be edema and other evidences of pus formation. The enlargement of the bone, the redness of the skin, and the character of the pain, will be sufficient to make the diagnosis. It may be impossible to distinguish whether it is a case of osteitis, periostitis, or osteomyelitis, but it does not matter with which of these ailments we have to deal, the treatment is practically the same. Where there is doubt, exposure of the limb to the x-rays will indicate the nature of the affection. In a case operated upon by the author in the clinics of the American School of Osteopathy, an abscess in the lower part of the tibia was opened. The history of the case extended over a period of seventeen years. There were two openings leading through the thick, hard shell of bone which surrounded the abscess cavity. The cavity itself was perhaps the size of a walnut. The tibia was several times its natural size. A button of bone was taken out by a trephine and the abscess cavity well curetted out and then packed with gauze and afterwards treated antiseptically. Appropriate osteopathic treatment afterwards, to restore the general health, resulted in complete recovery.

Caries.

Caries in bone is a process similar to ulceration in the soft-parts. It means a limited molecular death of the bone substance. The general tendency is to inflammatory exudates which are prone to suppurate and afterwards, perhaps, to caseate.

Cause.—The cause of the disease is deficient nutrition from abnormal blood supply and obstruction to the return circulation. Syphilis and a general debilitated state of the system are also causes. Conditions of caries usually give a history of an injury and a period of failing health. Like abscess, caries is one of the terminations of chronic inflammations of bone. The process may be tubercular.

Pathology.—The pathological changes taking place are similar to those of abscess formation, except that the condition is more chronic and takes place slowly. The bone and periosteum become infiltrated with granulation-tissue cells, the circulation becomes more or less arrested at a certain point and coagulation necrosis of a small mass results. This mass may break down and form pus, or it may undergo caseation and absorption. Liquefaction necrosis may occur. Sometimes the adjacent trabeculae of bone become absorbed because of the destructive process, and a considerable cavity in the bone results. It is said that the granulation-tissue cells may form distinct masses sometimes. These masses will increase or extend through the soft tissues. This is called *fungating caries*. There are cases where these granulation tissue cells seem to break down and afterwards dry up, or the fluids are absorbed, but the bone has already been destroyed by their action, so that there is no pus formation and little evidence of inflammatory tissue. This is a condition of *dry caries* (*caries sicca*). Should a considerable mass die so as to form a sequestrum of bone, and afterwards the caries follow, as in other instances, the condition is called *caries necrotica*. In some instances, it is claimed the tubercle bacilli and giant cells have been found in among the granulation tissue. This has led to the claim that all these cases are tubercular. Caries occurs in cancellous bone, and more often in the vertebrae than in any other part of the body, whereas necrosis happens in compact bone and more often in the long bones. The tuberculous variety more frequently undergoes caseation and is attended by a crumbling away of the bone, with but little tendency to repair, and the destructive process is more widespread. There seems to be no method of determining whether or not these cases are tubercular. It matters little, since the treatment is the same in all cases.

Symptoms.—The symptoms are pain, more or less swelling (sometimes not evident), contraction and rigidity of muscles about the inflamed area, redness, and other evidences of inflammation when the process becomes superficial. If pus forms, it will burrow along the direction of least resistance until rupturing. The discharge is a peculiar, foul-smelling material which contains a considerable number of bone

cells. Around the opening of the sinus there is a mass of granulation tissue which is more or less exuberant and puckered. At the point where caries occurs, the bone is found to be friable, rough, and yielding.

Treatment.—The surgical treatment is to enlarge the sinus and cleanse the cavity. If it is possible to reach the carious bone, it should be scraped out and a healthy ulcerating surface produced. Afterwards, antiseptics, as boroglyceride solution, may be applied.

Necrosis.

Necrosis is the death of bone en masse, and with reference to bone, it means the same as gangrene of the soft-parts. Necrosis of bone is rather frequent and is more common, as before mentioned, in compact than in cancellous bone. It more frequently follows acute inflammation. Necrosis is always due to an arrest of the nutrition to a mass of bone, therefore, any inflammatory process which would interfere with the nutrition to compact bone, will result in its death.

Cause.—The cause in all cases is arrest of nutrition, that is, the blood supply is cut off. This may be due to inflammation, injury, tissue-contractions, or luxations. The cause of the inflammation may be injury or constitutional disease, or, perhaps, acute, specific febrile processes. Fracture of bone and injury of the nutrient artery may result in death of the bone, or necrosis. Injury of the main artery to the part, or the main nerve, or vein, or extensive laceration of the soft parts, or phosphorous or mercurial poisoning, may result in death of the bone.

Pathology.—The pathological changes, which occur in the death of bone, consist, for the most part, in depriving the bone of its membrane (periosteum), and in plugging up the blood-vessels which enter the bone through the Haversian canals. If undue inflammation occurs, it will interfere with the nutrition and result in death. In necrosis, from various causes, different parts of the bone will be affected. In simple periostitis, the outer lamellae of the bone are usually affected, whereas, in osteomyelitis, the layers of bone surrounding the medulla are mostly affected. If, in acute osteomyelitis, the entire bone is affected, the whole diaphysis will die. If the necrosis is due to osteitis or simple periostitis, it is very often attended with, and followed by, caries. A piece of dead bone is called a sequestrum. This piece of bone is devoid of periosteum, and is usually white, hard and bloodless. Sometimes, after it has been exposed for a length of time to decomposing discharges, it may turn black. The resonance of dead bone and live bone is different. If the bone has been inflamed, the surface of the sequestrum will be rough and irregular. Usually, the surface next the periosteum is smooth and the margins are ragged and serrated. In inflammations, where caries has occurred, the sequestrum will be porous and friable, but where there is more or less fibrosis, the mass will be found hard and unyielding. After a piece of bone has died it

may, of itself, act as a source of inflammation, as it becomes a foreign body and is therefore irritating. Nature endeavors to get rid of it by an ulcerating process. In some cases, the ulcerating process may continue for some considerable length of time and the mass of bone may be discharged (exfoliation). Often there is caries of the bone around a sequestrum, forming a cavity. After the discharge of a piece of bone or after its removal by surgical methods, the cavity fills up with fibrous tissue, which undergoes ossification. It may happen that, as the mass of bone dies and becomes separated, the periosteum, not being destroyed, forms new bone around the outside of it, so that the sequestrum lies in a mass of pus walled in by bone on all sides. The sequestrum is then said to be invaginated. Sometimes this cavity containing a sequestrum and pus, surrounded by a shell of bone, is called an involucrum. Occasionally, the pus may burrow through this shell of bone and discharge on the surface. The opening of the sinus has a drawn appearance and is called a cloaca.

Diagnosis.—The diagnosis between caries and necrosis can not always be made, nor is it essential. The pus is usually foul smelling, and the appearance of the opening of the sinus is characteristic. A probe may be introduced to the bottom of the sinus and the roughened or loose bone detected. There are cases of necrosis without the formation of pus. These somewhat resemble new growths. This form of the disease can not be diagnosed unless an incision is made. The dead bone exfoliated in carious conditions is soft and crumbles, whereas that derived from conditions of necrosis is thick and hard. The skin over necrosis is more edematous and inflamed. The discharge in caries may be thin and more or less watery, whereas in the case of necrosis, it is thick and purulent. In case of necrosis, there may be great thickening of bone, while in caries, there may not be. In abscess of the bone there likewise may be found great thickening of the bone and a discharge of pus. The diagnosis can be correctly made only by exploratory incision.

Treatment.—The treatment in diseased bone is to extirpate the diseased area when it is possible. In case of necrosis, as soon as the diseased bone is found, it should be removed. The inflammation should be treated as any acute inflammation. In chronic conditions, an operation, uncovering the sequestrum and removing it will be found necessary. The presence of several cloacae and a thickened condition of the bone will be sufficient to warrant a diagnosis of involucrum. A bone chisel or trephine should be brought into use, the abscess cavity opened and the sequestrum removed, and all of the dead or diseased bone scraped out. The abscess cavity may then be cleansed thoroughly and a boroglyceride solution applied once or twice daily. In case the abscess cavity is large, and severe hemorrhage follows the operation, the cavity from which the diseased bone has been removed should be packed with borated gauze. Cleanliness, together with supporting

treatment and a correction of any local lesions, malposition of the limbs, bones, muscles, and contractions of fascia, will effect a cure.

Atrophy of Bone.

Atrophy of bone is often an accompaniment of old age. It results because of pressure or non-use. It may occur about joints, because of disease or non-use, or in the stumps of amputated limbs. This atrophy may be attended by a friable condition of the bone, or the bone may become considerably smaller, rendering it more liable to fracture. Fatty degeneration, more or less, attends atrophy of the bone.

Hypertrophy of Bone.

Hypertrophy, as the term indicates, is an overgrowth of the osseous structures. The general causes of hypertrophy operate. It is the result of an increased blood supply, excessive use, etc. In case of the removal of the radius, the companion bone, the ulna, will become enlarged and hypertrophied. In such cases it depends upon an increased demand upon the bone. The term "hypertrophy" should not be applied to fibroid thickening, the result of inflammation.

Syphilis of Bone.

In tertiary syphilis, certain pathological changes take place in the bones. The nature of these changes are gummatous formations occurring usually in the periosteum. They are nodes of inflammatory thickening or infiltration. These extend into the bone itself. Ofttimes they lead to caries, necrosis, or sclerosis. Ulceration and destruction of bone may occur because of this low-grade inflammation set up, and because of the general condition of malnutrition existing in syphilis.

Tuberculosis of Bone.

Tubercular disease of bone refers to that variety of osteitis set up by the deposit of the tubercle bacillus.

Pathology.—The pathology of the affection is the pathology of the deposit of the tubercle anywhere, except that it occurs in bone. The deposit of the tubercle always takes place at a point in the bone where there is the least blood supply and where the bone is the weakest. It develops after an injury has set up an inflammation. In the largest per cent of the cases, tuberculosis of other organs does not occur. Patients suffering from Pott's disease of the spine, which results in the formation of psoas or lumbar abscess, may live out a long life, after apparently extensive destruction of the tissues. There seems to be no way by which we can determine whether or not a given case is tubercular, therefore the same treatment should be applied in all cases, viz., to increase the general nutrition, relieve any constitutional conditions, support the patient by proper diet, hygiene, and habits, and above all, correct any lesions which may be found, which might be the cause of the ailment by interfering with the circulation and nutrition of parts of the bone.

Mollities Ossium, or Osteomalacia.

Mollities Ossium is a disease in which the earthy salts are absorbed, leaving the bone soft so that it will bend. There may be numerous bones involved. Usually it comes on late in life, and is said to be more frequent in women than in men. It may occur during pregnancy. The medullary structures of the bone increase in size and become more fatty.

Cause.—The cause of the disease is unknown. Some writers maintain that it is produced by the development of lactic acid in the system, but this is only theory. In some cases the medulla of the bone seems to be filled with material much resembling spleen pulp.

Symptoms.—The symptoms of the disease are those of rheumatism. There is a general weakness and obscure pains. This is followed by a sudden fracture or perhaps a bending and distortion of the bones. The long bones become misshapen, as do the pelvis and thorax. The urine is said to contain albumen, phosphates, and lactic acid. Death usually comes on from exhaustion. If it occurs during pregnancy, the patient may die during parturition.

Treatment.—Inasmuch as the cause of the disease is unknown, the treatment is likewise not definite. It is reasonable to suppose, when we consider the many affections in which Osteopathic treatment has been eminently successful, where other methods failed, that in these cases there will be found lesions accounting for the conditions present. Where this is true, the removal of these lesions and the abatement of the symptoms would indicate to the physician that he had found the source of the trouble. At all events, whatever lesions are found, they should be removed with the hope that a specific treatment may be found.

Acromegaly.

In this disease there is general, symmetrical enlargement of the bones and connective tissues of the hands, feet, head, and face. The nasal and inferior maxillary bones are the most affected. Prognathism of the lower jaw and prominence and thickening of the nose and supra-orbital ridges are marked symptoms. The larynx, bones of the shoulder-girdle, ribs, and vertebrae may also become affected. The cause of the disease is obscure. It can, most likely, be attributed to some lesion of the nervous system.

Virchow's Disease, or Leontiasis Ossium.

This disease consists of hypertrophy of the facial and cranial bones. It is symmetrical and usually involves the superior maxillary bone. The hypertrophy is progressive, symmetrical, and causes persistent headaches. Great deformity results. Where the disease has continued for some length of time, the removal of a mass of bone may give some relief.

Tumors of Bone.

The tumors of bone are:

1. Osteomata. 2. Enchondromata. 3. Fibromata. 4. Sarcomata.
5. Carcinomata.

Osteomata.—These tumors are reproductions of true bone. They are circumscribed and diffuse. The diagnosis of the tumor can be made by eliminating the other forms.

The *treatment* consists in removing the tumor by means of a chisel.

Enchondromata.—These are reproductions of cartilage in connection with bone. They occur more frequently in the bones of the fingers or at the end of the long bones. They are multiple and often congenital. Sometimes, in developing within a bone, they expand it into a thin shell, maybe rupturing it. They are thought to arise from periosteum. They may grow in any direction in the bone, or out towards the surface. They rarely ossify, but calcification or mucoid softening may occur.

Diagnosis.—They may be diagnosed by great hardness and their even attachment to the bone, slow growth, and no glandular enlargements attending.

Fibromata.—These sometimes occur in connection with the bones at the base of the skull or lower jaw. They are said to constitute the nasal polypi and epulis, and rise from the periosteum of the bones of the naso-pharynx.

The *treatment* is to remove the tumor.

Sarcomata.—Sarcomata of bone are common. They are of the myeloid variety, occasionally the round and mix-celled. They are derived from the deeper layers of the periosteum and may surround the bone or extend to the bony tissues.

Symptoms.—The symptoms of sarcoma are the symptoms of a sarcoma anywhere on the body. They grow slowly and occasion considerable pain, but do not affect the lymphatic glands. Some forms of sarcomata may grow rapidly. The pain may not be severe, or it may be absent. The tumor occurs more frequently in young people and is attended by great loss of weight and strength. In some cases the tumor is pulsating and there is considerable redness and edema of the soft-parts. If possible, the tumor should be removed. Some forms of the tumor are very malignant.

Carcinomata.—Cancer of bone never occurs primarily. It may spread to the bone from any of the organs or from any of the surfaces of the body. Amputation seems to be the only relief.

INJURIES OF BONES.

Fractures—A fracture is a broken bone, or a sudden and forcible solution of the continuity of bone.

Causes.—A. Predisposing.

- | | |
|---------|---------------------------------|
| 1. Age. | 3. Occupation. |
| 2. Sex. | 4. Certain diseased conditions. |

Age.—Fractures are more common after the age of forty-five, because of the fragile condition of the bones, and less common in small children on account of the elasticity of the bones and because the subject is less liable to injury. Fractures increase in frequency from six years upward, being more frequent in very old people.

Sex.—The male sex is more liable to fracture, because of greater exposure to violence and injury.

Occupation.—Laborers, because of the greater risks they are compelled to take in life, are more liable to fractures.

Certain diseased conditions, which render fractures more likely, may be enumerated as follows: Atrophy, either senile or from pressure or disuse; rickets; fatty degeneration; fragilitas ossium; osteomalacia; nervous disorders; tuberculosis and syphilis; caries and necrosis; malignant growths, and in fact, any condition which impairs the strength of the bone renders it more liable to fracture.

B. Exciting causes.

- | | |
|-----------------------|-----------------------|
| 1. External violence. | 2. Internal violence. |
| a. Direct. | |
| b. Indirect. | |

Direct Violence.—By direct violence we mean violence applied to the spot where the fracture occurs. It is evident that in cases of this kind there will be more or less contusion of the soft-parts at the site of fracture. The fragments are more liable to be comminuted and the injury to the soft-parts is likely to be greater in fractures from direct than from indirect violence.

Indirect Violence.—Fractures from indirect violence take place where the force is transmitted through the axis of the bone or through other structures, as for instance, intra-capsular fracture of the femur takes place in twisting the leg from catching the toe; fracture of the clavicle may occur from falling on the hand; fractures of certain vertebrae or the base of the skull may be produced by falls upon the buttocks; fractures on the back part of the skull may take place because of injury upon the front of the skull (fractures by *contre coup*).

Internal Violence.—Internal violence consists of muscular action. Fractures from muscular action may take place in the long bones in diseased conditions, as in the case of spastic paralysis. Under ordinary circumstances, they are more common in the patella.

Varieties of Fracture.

All fractures are divided into simple and compound, depending upon whether there is an open wound leading to the site of fracture.

1. **Simple Fracture** is one in which air is not admitted to the site of fracture.

2. **Compound Fracture** is one in which air is admitted to the site of fracture or the wound leads to the surface. A flesh-wound attending a

fracture does not necessarily mean that the fracture is compound. The wound may not lead to the site of fracture.

All fractures may also be divided into complete and incomplete.

3. **Complete Fracture** is one in which the bone is separated into two or more fragments.

4. **Incomplete Fracture** is one in which the bone is not separated into fragments, but is only partially fractured. The most common form of incomplete fracture is green-stick fracture, where the bone is partially bent and partially broken.

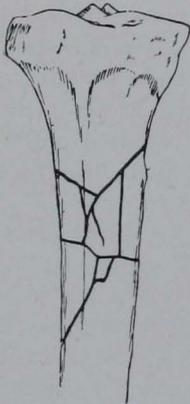
Other forms of fracture may be described as:—

5. **Multiple Fracture**, a condition where there is a fracture at more than one point in the bone.

6. **Comminuted Fracture**, where the bone is fractured at two points and these lines of fracture unite.

7. **Impacted Fracture**, a condition where one

FIG. 35.



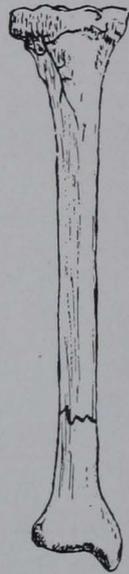
Comminuted fracture of upper extremity of tibia.

FIG. 36.



An impacted fracture of the upper extremity of the femur.

FIG. 37.



Transverse fracture of the tibia.

fragment telescopes the other, or the ends of the bones are driven into each other.

8. **Fissured Fracture**, a condition where the bone is simply fissured, not entirely broken off, and there is no displacement. This variety occurs most frequently in flat bones.

9. **Depressed Fracture** occurs in bones of the skull most frequently. One edge of the broken bone is driven below its opposing edge.

10. **Punctured Fracture** is one which is produced by a pointed instrument without displacement of the fragments.

11. **Splintered Fracture** is a condition where the ends of the bones are splintered and separated into numerous fragments.

Other forms, described according to the line of fracture, may be:

12. **Transverse**, where the line of fracture is transverse to the long axis of the bone.

13. **Oblique**, where the line of fracture extends obliquely to the shaft of the bone.

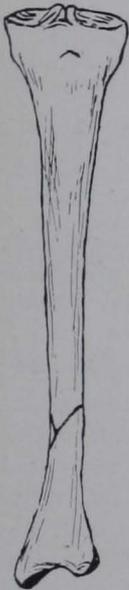
14. **Longitudinal**, where the line of fracture extends lengthwise in the bone.

15. **Spiral**, where the line of fracture extends spirally around the bone.

16. **Y or T Fractures** are those occurring at the end of bones, as in the lower end of the humerus or femur, the line of fracture resembling the letter Y or T.

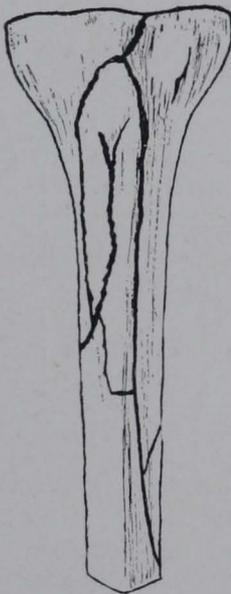
17. **Stellate Fracture** is one occurring in the skull where several lines of fracture radiate from a single point.

FIG. 38.



Example of oblique fracture of the tibia.

FIG. 39.



Longitudinal fracture of the tibia.

18. **Epiphyseal Fracture** is one extending through the epiphyseal cartilage which unites the epiphysis and diaphysis. It consists in the separation of the epiphysis from the diaphysis.

19. **Complicated Fracture** is one which is associated with extensive injury to the soft parts, or is attended by rupture of the main artery of the part, or by concomitant dislo-

FIG. 40.



Y fracture of the lower extremity of the humerus.

cation or other severe injury which interferes with treatment and union of the fracture.

20. **Ununited Fracture** is one in which union has not taken place within a reasonable length of time after the injury.

Signs of Fracture.—The signs of fracture are, in general, those of local injury and may be enumerated as:

- | | |
|----------------------------|------------------------------|
| 1. Pain. | 6. Crepitus. |
| 2. Swelling. | 7. Shortening. |
| 3. Deformity. | 8. Sensation of sudden snap. |
| 4. Impaired function. | 9. History of the accident. |
| 5. Preternatural mobility. | |

The **pain** of a fracture is not diagnostic. It may be severe, or slight. Sometimes it is so severe as to cause great shock; especially is this true where a large nerve, such as the sciatic, is pressed upon by the jagged end of the bone.

The **swelling** may be slight, or it may be severe, depending largely upon the amount of injury to the soft-parts, and the amount of effusion of blood amongst the tissues.

The **deformity** varies. It may be simply an enormous swelling or it may be angular, such as to indicate at a glance that there is a broken bone. Deformity, crepitus, shortening, and other signs will depend largely upon the displacement of the fragments. The displacement of the fragments depends upon three things, viz.:

- | | |
|--|------------------------|
| 1. Continuation of the fracturing force. | 2. Muscular action. |
| | 3. Weight of the limb. |

Sometimes, because of these agencies acting, the deformity will depend upon the amount of the swelling, the degree and nature of the displacement of the fragments.

Impairment of the Function will depend largely upon the nature of the fracture. Sometimes the function will be only slightly impaired, at other times the function may be entirely lost.

Preternatural Mobility means mobility at a point where there should be none. The mobility may sometimes be increased and at other times diminished. In case of fracture of the shaft of a bone, there is mobility at an abnormal location. In case of fracture at the end of a bone, the mobility may be decreased. Preternatural mobility may be absent in fissured fractures, in incomplete or green-stick fractures, or in impacted fractures. When it can be obtained, preternatural mobility is proof positive of fracture.

Crepitus is the sensation imparted to the surgeon's hands by the scraping together of the roughened ends of the broken bone. This scraping together of the ends of the bone may be sufficient that a grating sound can be heard, but the crepitus refers to the sensation which is obtained by touch. There are two kinds of crepitus, false and true. *False crepitus* is obtained at joints where there are roughened tendon-sheaths or articular cartilages, or where fibrous adhesions have been formed between the ends of the bones, so that motion of the joint causes grating. In some cases this so closely resembles crepitus as to make the sign of but little value. True crepitus is of great importance. It is sufficient evidence upon which to base the diagnosis where there is proof that it came from the bone, and not from other structures.

Shortening varies according to the fracture and according to the condition of the member. It is produced by muscular contraction, the muscles normally being slightly contracted, and when the bone is

broken the ends are pulled past each other. Sometimes the weight of the member, with no other agencies acting, may overcome this muscular contraction, when the shortening may not be so great.

Sensation of Sudden Snap and History of the Accident.—A history of the accident, and the fact that the patient felt a cracking of the bone, may be of some value. Subjective symptoms are often of not much value.

Diagnosis of Fracture.—The diagnosis of fracture is made by weighing the symptoms and evidences obtained. Sometimes the fracture will be extremely difficult to make out. The diagnosis may be clouded under the following circumstances:

1. When the fracture occurs in the neighborhood of a joint.
2. When there is much fluid effusion and extravasation of blood and serum about the site of fracture, so as to render it impossible to make suitable examination.
3. In conditions where there is no displacement of the bones, or where the fragments are held together by a companion bone.
4. Subperiosteal fractures or fissured fractures of the skull.

The signs of fracture may be so meager and difficult to obtain that a diagnosis is impossible. Where it is possible, in doubtful cases, the injured member should be exposed to the x-rays. The diagnosis can be made by successfully obtaining the various signs of fracture. Crepitus can be obtained by making extension and counter-extension where the fracture occurs in a long bone, thus bringing the ends of the bone in apposition. Crepitus may be gotten by grasping the limb above the site of fracture and rotating the limb below. Sometimes effort at muscular action by the patient will develop crepitus. Where crepitus can not be obtained without the use of force, other signs must be looked for. Shortening is an important sign in many fractures and is obtained by measuring, after placing the body in a normal position. Measurements should be taken from fixed points. In case of fracture of the humerus, the shortening is determined by measuring from the acromion process to the external condyle. Preternatural mobility is one of the most important of the signs and is obtained, in some instances, by grasping the limb above and below the fracture, and an effort at motion will determine whether there is mobility at a point where there should be none.

How Fractures Heal.—As a rule, a broken bone heals, under favorable circumstances, much better than any other tissue. The way in which union takes place is of the greatest importance, and should be thoroughly understood in order to appreciate the importance of the methods of treatment. As soon as the fracture occurs, extravasation of blood takes place in the soft parts and between the ends of the broken bones. This extravasation may be great or it may be small. Sometimes it is so great as to form a complication of the fracture, but under average circumstances the hemorrhage into the site of fracture will cease when

the pressure becomes equal to that within the blood-vessels. The tissue changes and inflammation which follow will be sufficient only to repair the injury in case of simple fracture. In case of compound fracture, the inflammation will likely be greater because of the introduction of a certain amount of septic material. The periosteum, Haversian canals, medulla of the bone, and soft tissues about, all become infiltrated with leukocytes and round cells. These new cells are derived from the endothelial cells in the Haversian canals, from the endosteum (membrane lining the medullary cavity) and periosteum. The blood which has extravasated between the ends of the bones, becomes absorbed within four or five days in ordinary fractures. In case of green-stick fracture, perhaps earlier, while if there is extensive injury to the soft parts, the absorption might not be completed before the sixth or eighth day. In young persons the reaction of the tissues to injury is quicker and greater than in old people, so that the absorption takes place more quickly. The formation of granulation tissues at the site of fracture takes place just as soon as the clot is sufficiently absorbed. When the diffused blood disappears, its place is occupied by granulation-tissue cells which comprise the soft callus. The formation of this soft callus begins, in children, as early as the third or fourth day; in very old people as late as the tenth or twelfth day, but ordinarily it begins by the fifth or sixth day, so that the fracture should be *set* before that time. This soft callus becomes penetrated by delicate capillary loops which are derived from the vessels in the Haversian canals and periosteum. The soft callus which fills up the spaces between the ends of the bones is the permanent or definitive callus. Within the medullary cavity the endosteal callus is formed, whereas on the outside of the bone and derived from the periosteum is formed the periosteal, or ensheathing callus. This new tissue becomes firm and hard and highly organized until it is converted into a fibrous or cartilagenous mass. Over the ensheathing callus new periosteum forms because of a growing out of the periosteum from either side of the fracture. All this has occurred, under average circumstances, by the fourteenth day after the fracture. At this time ossification of the callus begins, usually at the point where the ensheathing callus meets the periosteum. The ossifying process extends over either edge of the ensheathing callus until it meets in the middle line and also extends down in through the definitive callus into the endosteal callus. Ossification in the definitive callus begins at the edges next to the healthy bone, while ossification of the endosteal callus starts where it is in contact with the endosteum and takes place in the same manner as ossification from the periosteal callus. When ossification is complete, the endosteal and periosteal callus become absorbed and disappear, leaving the permanent callus sufficiently strong to maintain the integrity of the bone. The new callus is vascular in the beginning, but becomes solid by the process of ossification. The large vascular spaces are filled up by layers of bone successively

built in. In cases where the fragments overlap, the space is filled up by the ensheathing callus, and under such circumstances the ensheathing callus will not be absorbed. When the fragments are in good apposition and kept at rest, all the ensheathing and endosteal callus will disappear. Where there is much motion, or not good apposition, none of the ensheathing callus may be absorbed and a large knot will always remain as an evidence of fracture. It is the rule in children, for a considerable amount of ensheathing callus to be developed because of the energy of the tissues.

Treatment.—The indications in the treatment of fractures are:

1. Reduction.
2. Maintaining apposition.
3. Restoration of function.
4. Attention to the general health.

Reduction of fracture consists in bringing the ends of the bones in apposition in as nearly normal position as possible.

Temporary Methods.—When a fracture is first seen, the member should be put in the best position possible to prevent injury. Effort at reduction should not be made until the proper materials for splints and bandages are at hand. In case of a fractured femur, the limb may be tied to the opposite one, or it may be bound to an umbrella or stick, so that further manipulation of the member will not injure the soft-parts. Where the patient is already in bed, sand-bags or pillows may be propped about the limb. Before efforts at reduction are made, the clothing, shoes, etc., should be cut off and the limb exposed, so that a careful examination can be made to determine the nature of the fracture and amount of displacement. The conditions preventing reduction are:

1. Swelling. The swelling may be such as to interfere with the setting of the fracture or the application of the proper dressings. Under such circumstances anti-inflammatory measures, such as cold and rest, should be employed for the first twenty-four or thirty-six hours, the part having been kept immovable during this time. When the swelling has sufficiently subsided, efforts at reduction may be made.

2. Contraction of muscles may be such as to interfere with the reduction. When this occurs, a pulley and weight should be secured, so when reduction is once made, the fragments may be kept in position by means of extension and counter-extension.

3. Interposition of fascia, muscle, tendon, etc. The interposition of some of the soft structures, as a piece of periosteum, tendon, muscle, etc., may prevent the surgeon from securing apposition of the fragments. It is necessary to get rid of this interposing tissue or union will not take place.

4. Impaction of fragments will also prevent reduction; in fact, in cases of impacted fracture, reduction should not be made. The fractured bones should be allowed to heal in that position. Before efforts are made at reduction of a fracture, a suitable splint, such as the surgeon believes to be the best for the condition at hand, should be selected,

and all materials prepared before a reduction of the fracture is attempted. The nature of the dressing will depend largely upon the choice of the surgeon, inasmuch as there are many suitable dressings that are known and tried, and if properly applied will bring about good results.

Methods of Reduction of Fracture.—The reduction is usually accomplished by extension and counter-extension. This overcomes muscular contraction, when the pressure of the soft-parts will push the ends of the bone in the proper position. This is not always true. In case of fracture of the upper extremity of the femur, extension and counter-extension will not bring about relaxation of the contracted muscles. In this case the psoas and iliacus muscles tip the lower end of the upper fragment forward and prevent the operator from securing the desired apposition of the fragments. In such cases it is necessary to partially flex the thigh upon the abdomen. In case of fracture of the lower extremity of the femur, contraction of the muscles of the calf turns the lower fragment backward, preventing apposition, and no amount of extension and counter-extension will secure apposition. Here, by flexing the leg at the knee, the limb may be properly manipulated and apposition secured. In general, to secure reduction, extension and counter-extension, rotation and flexion, and manipulation should be made to mould the parts in position, and when once the bones are gotten in good apposition, every effort should be made to maintain them in such position.

Position of the Limb.—The limb must be put in such position as to secure the greatest muscular relaxation and greatest ease to the patient. Opposing muscles rarely act with equal force and it is necessary to determine the muscles which are contracted. The limb must be placed in such position as to secure relaxation of the contracted muscles.

Position of the Fragments.—When the fragments are impacted, they should be allowed to remain in this condition. The reasons are, that because of the injury to the ends of the fragments, one being driven into the other, the effort at union will not be sufficient and therefore a bad result may be obtained; whereas, if the impaction is allowed to remain, good union may be obtained, but there may be some deformity. It is better to have the slight deformity attending an impacted fracture than lose the use of the member, which might occur providing the impaction is broken up.

Maintaining Apposition.—In the treatment of fracture it is necessary to maintain apposition in order that nature may, by the reparative process, heal the injury. This apposition must be maintained at all times until union is complete, when the apparatus used for the purpose may be dispensed with. To maintain the fragments in apposition, it is necessary to use splints, bandages, strappings, etc., such means as are known to be reliable. These splints, bandages, and strappings vary according to the location of the fracture and its nature.

Rules for Applying Splints.— Rules for applying splints may be best considered under the following heads:

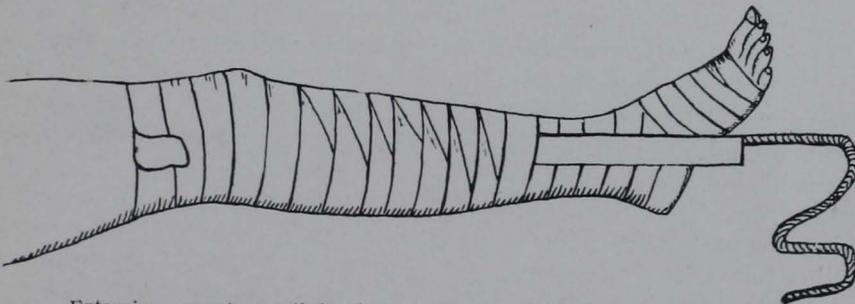
1. The splint must be well padded. The padding is best made by means of aseptic lamb's-wool, borated lint, or surgeon's cotton. The splint should be thoroughly padded to give the member a nice, soft, easy bed in which to rest.

2. The splint should not press upon bony points. This should be observed for fear a pressure-sore might result. Also unequal pressure would result in displacing the fragments.

3. The bandage must not be applied too tightly, so that constriction of the limb will take place. It may be possible, in the application of the bandage, that it will so obstruct the return circulation that gangrene will result, or it may so interfere with the nutrition of the limb as to cause non-union.

4. Splints, in general, must render immovable the joints above and below the fracture. Inasmuch as the muscles which move the member

FIG. 41.



Extension apparatus applied, suitable for fractures of the femur. It consists of a long strip of adhesive plaster extending up on either side of the leg. The adhesive plaster is held in place by a roller bandage.

have their origins from above the joint, and their insertion is frequently beyond the joint below, it is necessary to render both immovable in order to secure immobility of the fragments.

5. The splint must not cover the wound, in case of compound fracture. This is necessary, inasmuch as the wound must be treated. In case of severe simple fracture, the site of fracture should be left exposed in order to observe any changes which may take place.

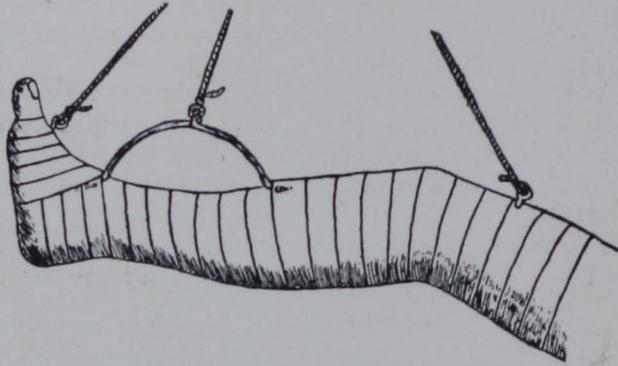
6. The patient must be seen within twenty-four hours after applying the first dressing. This is necessary, inasmuch as the swelling which follows fracture, may be such as to operate as an obstruction to the return circulation. The bandage may become too tight.

7. Should the circulation not be disturbed and the fragments held in apposition, the dressing should be left alone. This rule should be followed conscientiously. It is not necessary to look at the site of fracture every day, but it is necessary to see that the dressings accomplish the desired purpose.

8. Where the splints will not maintain apposition, an extension

apparatus must be applied to overcome muscular contraction. This is preferably done by a weight and pulley, the extension being made on the lower fragment. On the lower extremity in strong men, the weight should be five to ten pounds; in persons less strong the weight should be less.

FIG. 42.

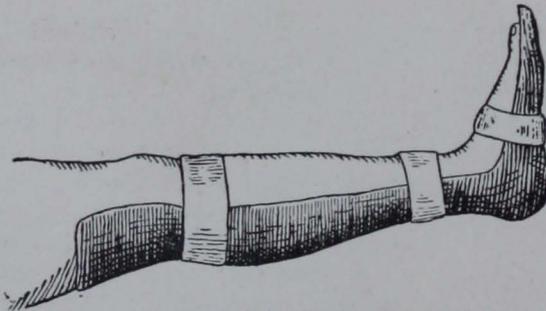


A plaster cast which encloses a rod by which the member may be suspended.

Dressings.—There are many forms of dressings. Some surgeons prefer one kind and some another. Some have secured better results with one kind of dressing and, perhaps, are more adept at applying that dressing. Dr. A. T. Still prefers a starch-paste dressing made with starch-paste, pasteboard, and a many-tailed bandage.

Other forms of dressing consist of splints made of thin board, pasteboard, gutta percha, or a plaster-of-Paris dressing. At pres-

FIG. 43.



A plaster trough applied to the lower leg. It is an excellent dressing for fractures of the tibia or fibula.

ent the plaster-of-Paris dressing is the most popular. It has many advantages, viz., great strength and durability. A plaster-of-Paris dressing is often applied at once, in case of fracture, where there is not much injury to the soft parts, or much swelling, or where the case is in a hospital and can be watched

by an intelligent attendant. In private practice this is not best, inasmuch as it may obstruct the return circulation. It is best to put on a temporary dressing until the swelling reaches its maximum intensity, when the gypsum splint may be applied.

Restoration of Function.—Restoration of function is accomplished, in the greater part, by manipulation. This manipulation assists the return circulation, prevents adhesion among the soft-parts and maintains the integrity of the joint. This manipulation should be begun at the end of the second week in almost all cases. Some fractures in old people may form exceptions to the rule. The former method of treating fracture by not manipulating them until after four or five weeks has been found to be bad, inasmuch as by manipulation you can assist the circulation and secure union in many cases where otherwise non-union would occur. Where the fracture is in the neighborhood of a joint, or involves the joint, just as soon as the inflammation and swelling disappear, which will be in four or five days, manipulation to assist the return circulation, to prevent the formation of adhesions, will be found of the greatest advantage. This manipulation should be gentle and not vigorous and destructive, but should be regularly kept up. The manipulation consists in pronating and supinating, extending and counter-extending, rotating and circumducting the member, and in loosening up the soft-parts in the neighborhood of the fracture in a mild way.

Attention to the General Health.—This can best be subserved by placing the person upon a suitable bed. In general, the bed should be smooth. Where there is a tendency to bed-sores, a water-bed or air-cushion should be provided, while the skin should be treated with lotions of alcohol and an ointment of benzoated oxid of zinc. If available, a fracture bed may be supplied. The patient should be placed upon a suitable diet, consisting of substantial food which will sustain the strength. The bowels should be kept acting daily. Old people should not be kept in bed too long, as edema of the lung is liable to arise.

Time Within Which a Fracture Should Heal.—Complete union

FIG. 44.



The ambulatory method of treating fractures of the leg.

takes place in fractures, in the average case, in from four to six weeks. In a child, good union may take place within three weeks, whereas, in an old person, it may be considerably longer. If union has not taken place in eight weeks, it may be considered a condition of delayed union, but delayed union is liable to occur under many circumstances.

Ununited Fracture.—An ununited fracture is a condition in which, within a reasonable time, the fractured ends of the bones are not united with sufficiently strong callus to enable the restoration of the function of the member. There are various conditions of ununited fracture, which may be classified as follows:

1. **Delayed Union.** This is a condition where, because of debility or disease, or because of the treatment, the union is delayed beyond the time when it should have taken place.

2. **Fibrous Union.** Fibrous union is a condition which may occur, even under favorable circumstances, as in fractures of the patella, intracapsular fractures of the neck of the femur in old people, or fractures of the anatomical neck of the humerus, where the parts of the bone at the site of fracture are poorly supplied with blood. It occurs at other locations, where the parts are not kept strictly immovable.

3. **False Joint (Pseudo-arthritis).** A condition of false joint occurs where the fracture has not been kept immovable, and the ends of the bones become worn off; a thin covering of cartilage forms, and a capsule is developed.

4. **No Effort at Union Whatever.** There are conditions of malnutrition, where there is no effort at union whatever. The causes of non-union or ununited fracture are local and general. The *local* causes may be enumerated in this manner:

(a) Failure to maintain immobility, which may be because of improper dressings, or because the patient did not properly follow the instructions of the physician.

(b) Failure to secure apposition, not from the bungling work of the operator, but from (1) muscular contractions which will cause overlapping of the fragments; (2) interposition of muscle, tendon, fascia, periosteum, etc.; (3) the loss of a piece of bone. Where there is comminution, a piece of the bone may be destroyed. This loose piece of bone may act as a foreign body, preventing apposition.

(c) Defective nutrition to the injured bone may be brought about by the following conditions: (1) injury to the nutrient artery of the bone; (2) injury to the main artery of the limb; (3) defective nerve influence, because of injury or rupture of the main nerve to the limb, or because of injury to the spine, so that the trophic and vasomotor impulses to the injured area are either interfered with or destroyed; (4) poor blood supply to the site of fracture. This occurs in case of fracture through the ends of the bone, as in the upper extremity of the humerus or femur. (5) Necrosis of a fragment of bone may occur,

where it has been detached from the soft tissues and from the shaft of the bone, its source of nutrition being thereby cut off.

The *general* causes of non-union are the following: Old age, general debility, malnutrition, or sudden alteration of the patient's habits. If the patient has been addicted to the use of stimulants, the sudden withdrawal of them, may markedly interfere with the nutrition. General diseases, as Bright's disease, diabetes, syphilis, gout, tuberculosis, rickets, and scurvy, certain forms of paralysis, such as tabes dorsalis, or paralysis agitans, will interfere with the general nutrition of the body to that extent that there will be little or no effort at union.

Disunited Fracture.—A disunited fracture is a condition where the fracture has once healed and, because of acute fevers or some general disease, the callus is absorbed, and the fracture left ununited.

Treatment of Delayed Union.—The treatment of delayed union should be taken up methodically. The first thing to determine is the cause, and this should be corrected. In general, the following procedure should be strictly adhered to:

1. Reapply and fix a dressing, correct in every detail, which will maintain the fragments in apposition and immovable. The general health should then be corrected. If there are any local or spinal lesions, or any condition which would interfere with the nutrition to a certain area, these conditions must be relieved. At this same time, thorough manipulation of the soft-parts, and of the member should be kept up, to secure a good blood supply to the site of the fracture. If this fails, the following should be tried:

2. Friction of the fragments should be made under anesthesia. When the muscles are thoroughly relaxed, the two fragments should be grasped and raked together vigorously and thoroughly, in order to excite the reparative process. Then a fixed dressing should be applied and the parts kept in apposition, until the fracture has had an opportunity to heal. In the meantime, any constitutional defect should be corrected. Any lesion interfering with the circulation, general nutrition, or the secretion of any organs, such as the kidneys, liver, etc., should be treated and removed. If this method fails, the following should be tried:

3. Operative Procedure. The operative procedure, to unite an old fracture, consists in drilling through the ends of the fragments with a bone drill, and fastening the fragments together by means of aseptic ivory pegs or steel nails, or the ends of the bones may be wired together. Where the bones are subcutaneous, as in the case of the tibia, instead of friction, the bone drill may be introduced through the skin, and a hole bored through the ends of the fractured bone to excite inflammation and union. Senn's bone-ferrules may be used. These are serviceable in the treatment of non-union, especially in case of the humerus or femur.

Vicious Union.—Vicious union is a condition which sometimes occurs in improperly adjusted fractures, or where the condition has

had had treatment. An enormous amount of callus will be thrown out, which will involve a nerve or a companion bone and interfere with the use of the member.

Complications of Fractures.—Fractures may be complicated by the following conditions, which must receive appropriate treatment:

1. General conditions, such as shock, delirium, retention of urine, etc., brought about by the effects of the injury upon the general system.

2. Infection. Infections, such as erysipelas, tetanus, sepsis, etc., may complicate fracture and interfere with union. Sepsis is rare, except in compound fractures, but erysipelas and tetanus may occur in simple fractures. These infections will likely bring about non-union and death, unless they are successfully combated.

3. Dislocations. When a concomitant dislocation occurs, the healing of the fracture may be markedly interfered with, inasmuch as it will be more difficult to secure apposition of the fragments and maintain immobility.

4. Injury to Other Structures. Injury to a joint, main artery to the limb, or the nutrient artery to the bone, or to the nerve to the part, may form a serious complication and prevent union, or, in some cases, even demand amputation. Extensive extravasation of blood may form a serious complication in the healing of a fracture.

5. Fat Embolism. Fat embolism may occur in case of fracture of the long bones. This fat embolism is serious, but may be recovered from. The fat gets into the deep veins, and, after passing through the heart, will not circulate through the capillaries of the lung, causing obstruction in the branches of the pulmonary artery.

6. Gangrene from tight bandage. Dr. A. T. Still advises the use of his dressing, because the nutrition to the part below is not interfered with, and the tightness of the bandage can be readily regulated. A fixed dressing, as of plaster-of-Paris, may bring about gangrene of the extremity, if it interferes with the return circulation.

7. Bed-sores and Pressure-sores. Unless guarded against, bed-sores and pressure-sores may form such a serious complication of the fracture, as to interfere with the general health of the patient and bring about non-union. The attendant should be cautioned to watch for any indication of such sore.

8. Hypostatic pneumonia is a serious complication, in case of old people, and should be avoided, if possible. If an old person is kept in bed too long, the circulation being weak, the fluids settle in the lower and back part of the lung, hypostatic pneumonia resulting. When once set up, it is fatal.

9. Paralysis may occur under at least two conditions. Crutch paralysis, because of the pressure of the crutch, or the nerve may become involved in the callus, where the nerve is in relation with the bone, as the musculo-spiral in the upper arm.

10. Suppuration may occur, where the circulation is cut off, or arrested to a certain portion of the tissues at the site of fracture, or

it may occur because of infection. This will interfere with the formation of the callus.

The combating of these conditions of fracture can best be accomplished by a strict watch of the case and by relieving the conditions, as they arise, by approved methods. An old person should be propped up in bed, pressure should be kept from pressure-sores, and the bandage must be properly applied. If an injury to the other structures, such as the artery, nerve, or extravasation of blood, it may demand amputation. Suppuration can be prevented by aseptic treatment. Infections may be prevented, and if they arise, should at once be combated by appropriate methods. Shock, delirium, and the retention of urine, should be relieved by proper manipulation. If the shock is from loss of blood, the patient's health should be restored by appropriate treatment.

Epiphyseal Fracture.—Forcible removal of the epiphysis from the diaphysis, consists of a fracture through the film of cartilage which unites them. Obviously this fracture occurs before the age of twenty or twenty-one. The signs of the fracture are not so pronounced as those of ordinary fracture. Crepitus is moist, and being so near the joint, it may be difficult to obtain. Inasmuch as the bone grows long from the epiphyseal cartilage, permanent shortening will result, because of this injury. It is easy enough to get union, but the patient should be made to understand that deformity will result. The treatment is the same as in other kinds of fractures.

Compound Fracture.

Compound fractures are those which are attended by a wound of the soft parts which lead to the site of fracture.

How Produced.—1. By the fracturing force. The fracturing force may, in addition to breaking the bone, destroy the soft-parts down to the site of the fracture. This wound, produced by the fracturing force, may be incised, contused, lacerated, or punctured, as the case may be, therefore a bullet might produce a compound fracture, being made compound by the fracturing agent.

2. Muscular action of the patient. Sometimes in the effort of the patient to move about or perform some physical act, the sharp end of one of the fragments may be forced through the skin.

3. Later, fractures may become compound by sloughing of the soft-parts down to the site of fracture. This is unusual.

Dangers in Compound Fractures.—(1) Hemorrhage, (2) shock, and (3) sepsis.

Hemorrhage may be arrested by ligation of the ends of the artery or by proper dressing. The shock may be relieved by appropriate means. Sepsis may be guarded against by means of cleanliness.

Union in Compound Fracture.—Union in compound fracture, takes place in the same manner as in simple fracture, but is longer delayed,

and accompanied by the formation of more callus. This callus sometimes involves the soft parts to a considerable extent.

The *treatment of compound fracture* consists in the following:

1. The wound should be rendered aseptic. All foreign bodies should be removed, loose fragments of bone, if detached, should be removed.
2. The fracture should be set and the wound dressed with suitable antiseptic dressings. Splints should be applied which must maintain immobility and at the same time allow the wound to be free from pressure, and so it can be readily exposed.
3. The wound should be treated, from day to day, in an antiseptic manner, to prevent sepsis and other complications.

Indications for Amputation.—One of the most troublesome questions arising from compound fractures, or even from a bad simple fracture, is whether or not the member can be saved. The older surgeons held that the following conditions demanded amputation:

1. Extensive injury to the soft-parts.
2. Where there is great comminution of bone.
3. Where there is involvement of a large joint.
4. Rupture of the main artery of the limb.
5. Old Age. In case the patient is very old, and his strength believed not sufficient to heal the fracture, the member might be amputated with advantage. The procedure adopted by the surgeon, in any case, will be that which, in his judgment, is best. Where he is doubtful about what should be done, a consultation should be held. The patient should be apprised of the condition, and under no circumstances should amputation be performed without the consent of the patient or his next friend. If the patient is unconscious, it is the duty of the physician to do that which he believes best. With modern aseptic and antiseptic methods, wounds of the soft parts should be rendered aseptic and, if the circulation to the part below is not too seriously interfered with, gangrene may be avoided. Should the case be doubtful, it should be put in suitable dressing and closely watched. Should evidence of gangrene appear, amputation must be performed at once. Every attempt must be made to save the member, but the patient's life must not be sacrificed in so doing.

SPECIAL FRACTURES.

Fractures of the Nasal Bones.

Fracture of the nasal bone is produced by direct violence. The injury is severe. The line of fracture is usually transverse, but may be longitudinal and comminuted, also may be complicated by emphysema of the tissues. The fracture may extend into the cribriform plate of the ethmoid. The diagnosis is readily made by evidences of severe injury and crepitus. There is often considerable deformity. Union takes place quickly, and is, as a rule, good.

Treatment.—The bones may be manipulated into position with the fingers externally, or by covered probe or director internally. If the

bones will not remain in position of themselves, a tampon, made by wrapping a section of a linen catheter with gauze, may be introduced. This will assist in holding the fragments in position until the soft callus is formed, which will be in five or six days. Should the treatment not be successful in maintaining the bones in proper position, a Mason's pin may be used. Should the fracture be compound, the wound must be treated as an ordinary wound by antiseptic methods.

Fracture of the Lachrymal Bone.

Fractures of the lachrymal bones are produced by direct violence and attended by severe injury of the soft-parts. The chief trouble is, that the fracture may result in obstruction of the nasal duct, and in treatment, this should be looked after.

Fracture of the Superior Maxillary Bone.

The superior maxilla is rarely fractured. The break is the result of direct violence. The diagnosis is readily made by mobility and crepitus. Deformity, the result of this fracture, is usually very great and is exaggerated upon the production of callus. The fracture through the alveolar process will result in inability to chew. This fracture may be produced in extracting teeth. Fracture of the nasal process may interfere with the nasal duct. If the antrum is fractured, emphysema of the soft-parts may occur, or it may result in considerable depression in the cheek. The infra-orbital nerve may be involved, frequently causing great pain. To manipulate the bone into position, put a finger of one hand in the mouth and apply the other hand externally, when the fragments may be approximated. Where the malar bone is driven into the antrum, the antrum should be opened and the bone lifted out. Loose teeth should be extracted. If the fracture is compound, the wound should be kept aseptic. The mouth should be frequently washed to keep it clean and the patient supported by liquid diet. Where the teeth are irregular and out of line, they should be put in regular position and held together by thongs.

Fracture of the Malar Bone.

The malar bone is rarely fractured. Where fracture occurs it is the result of direct violence. If the bones are in abnormal position, they should be put immediately in correct position. If chewing exaggerates the deformity the fragments should be wired. Fractures of the zygomatic arch may be similarly treated.

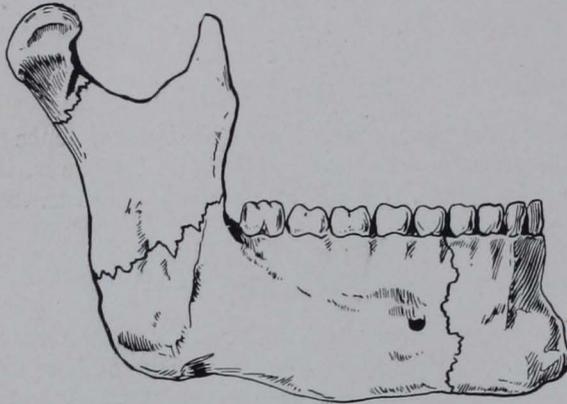
Fractures of the Inferior Maxillary Bone.

Fracture of the lower jaw usually occurs at, or near, the symphysis, but may occur anywhere on the body or ramus. The coronoid process may be broken off or the line of fracture may extend through the neck.

The fracture is very liable to be compound in the mouth. The fracture may be bilateral. The cause of the fracture is usually direct violence.

Diagnosis.—Laceration of the gums, blood-stained saliva, and the irregular line of the teeth, together with pain and crepitus, will be sufficient upon which to base the diagnosis.

FIG. 45.



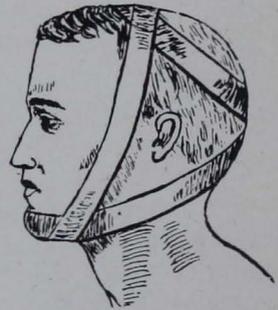
Illustrating the locations of fractures of the inferior maxilla.

Where the fracture is through the neck or the coronoid process, the signs are more obscure. When the fracture occurs far back, the anterior fragment is pulled down, while the posterior fragment is pulled up and may override the anterior. This is caused by the opposing action of the supra-hyoid muscles

and the muscles of mastication.

Treatment.—A splint of gutta-percha, leather or perforated tin is made to fit over the chin. A Barton's bandage is then applied which holds the jaws together. The patient should be instructed to avoid talking and chewing. The diet should be liquid and should be passed between the teeth or the gap beyond the last molar. Where the fracture is compound within the mouth, suppuration may occur. It is necessary to exercise the strictest cleanliness; after taking food, the mouth should be rinsed with an antiseptic lotion—a saturated solution of boric acid or Listerine. Union will take place in four or five weeks. Where there is much displacement and the patient is unruly, the fragments may be held in apposition by means of thongs passed between the teeth. Where this method fails, wiring of the fragments may be advised. Where the suppurative process is active, the site of fracture should be cleansed and maintained aseptic until the inflammation subsides, when apposition of the fragments can be secured.

FIG. 46.



Barton's bandage applied in fracture of the inferior maxilla.

Fracture of the Hyoid Bone.

Fracture of the hyoid bone is rare and is produced by compression of the throat. The fragments are pulled apart by the supra—and infra-

hyoid muscles. The bones may be manipulated into position, and the neck strapped with adhesive plaster to keep the bones in apposition, while the person should avoid talking or using the throat as much as possible.

Fracture of the Ribs.

Fractures of the ribs are fairly common. They arise in two different ways, by direct violence, as a blow upon them, or by compression of the chest. The fifth to the eighth ribs are those usually injured. There may be contusion and laceration of the viscera, caused by driving the sharp end of the fractured bone into the underlying structures. The fracture may be compound from within.

Signs.—The signs are evident. There is localized pain, which is stabbing in character, and is increased on effort at breathing or coughing. If there is much displacement of the fragments, there will be considerable local extravasation of blood and swelling. Crepitus may be obtained. Emphysema of the tissues is an indication of perforation of the lung. If the patient is fleshy, the diagnosis may be difficult. Emphysema of the tissues over the thorax without external wound, is evidence of fracture.

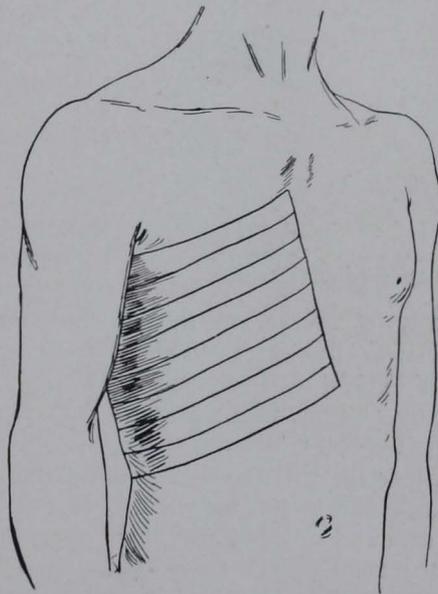
Treatment.—The treatment of fractured ribs is to strap the side with adhesive plaster. The strips of plaster should be two inches wide and extend from the spine to the middle of the sternum, around the portion of the rib broken. The ribs above and below should be immobilized, so that several strips, each overlapping the other, are necessary.

The strips must be applied at the end of a forced expiration. A figure-of-8 bandage may then be applied over the plaster. When the lower ribs are broken, tight bandages around the chest are, as a rule, contra-indicated; troublesome hiccough may result. Union takes place within two or three weeks. The mobility between the ends of the floating ribs is so great that only fibrous union is obtained.

Fracture of the Costal Cartilages.

The costal cartilages are liable to fracture. The treatment is the same as in fracture of the ribs.

FIG. 47.

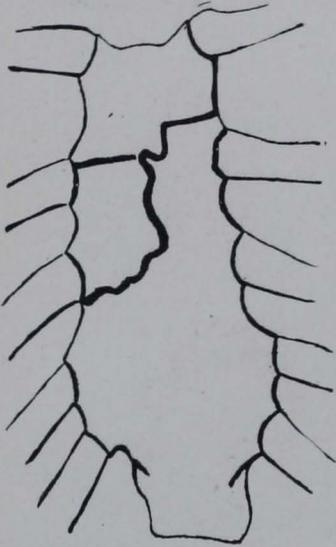


Method strapping side with adhesive plaster in fracture of the ribs.

Fracture of the Sternum.

Fracture of the sternum is produced by direct violence. The line of fracture is usually transverse. The fragments generally remain in situ. Where there is displacement of the fragments, great dyspnea may result.

FIG. 48.



Fracture of the sternum.

Treatment.—The patient should be kept in bed with a small pillow between the shoulders and the chest strapped, as in case of fracture of the ribs.

Fractures of the Clavicle.

The clavicle is one of the most frequently fractured bones. The only other bone so often fractured is the radius. The clavicle is broken by direct and indirect violence, by blows directly upon the clavicle, and by falls upon the shoulder or arm. The injury is common in children and the fracture may be greenstick. The bone may be broken in three different locations, at the sternal extremity (least often), in the middle third (most often) and in the outer third.

Sternal End.—This fracture is rare, usually transverse, and the displacement slight.

Middle One-third.—This is the common site for fractures of this bone. The line of fracture is usually oblique. The deformity is characteristic, the shoulder falls downward and inward, due to the weight of the arm and the action of the chest muscles. The outer extremity of the inner fragment projects prominently against the skin and appears to be drawn up, but is not. It is held in position by the sternomastoid muscle, and by the rhomboid ligament. The falling of the shoulder stretches the skin over the sharp outer end of the inner fragment. The head is inclined to the affected side and the arm is useless. There is a history of a fall.

FIG. 49.



Fracture of the clavicle, showing how deformity takes place.

Outer One-third.—This fracture is produced by direct violence, falls upon the shoulder, or a blow upon the acromion. The deformity is not great, the clavicle being held in relation with the scapula by means of the coraco-clavicular ligament.

Signs of Fracture of the Clavicle.—The deformity is characteristic. Pain, crepitus, deformity, evidences of injury, and history of accident.

Treatment.—Fracture of the clavicle is best treated by one of the following methods:

1. A posterior figure-of-8 bandage serves the purpose of drawing the shoulders backward, and a sling will sustain the weight of the arm. Sufficient padding should be put in the axilla so as to prevent the arm from falling against the chest. Velpeau's bandage, as far as appearance is concerned, makes an excellent dressing, but it is believed that it exaggerates the deformity.

FIG. 50.



Sayre's Dressing. Method of applying the first strip of adhesive plaster, which extends around the body.

FIG. 51.



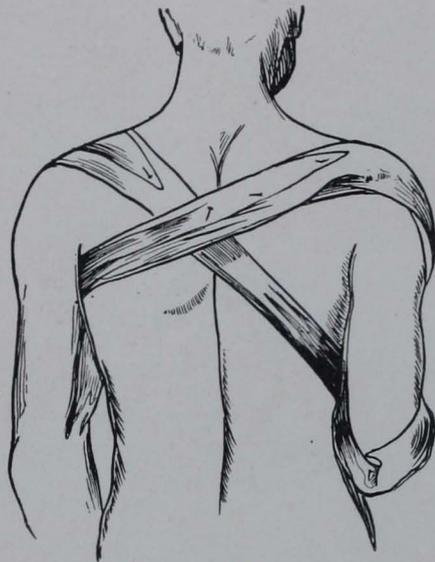
Sayre's Dressing. Method of applying the second strip of adhesive plaster, which extends over the shoulder and under the elbow.

2. Sayre's dressing is very successful, especially in children, as it serves the purpose of holding the arm immovable. Two strips of adhesive plaster, two to four inches wide, are necessary. A suitable pad should be placed in the axilla. A strip of adhesive plaster of sufficient length is fastened around the arm at the insertion of the deltoid. It is then carried entirely around the body, and fastened on the back. Another strip is started on the scapula of the sound side, passed across the back, down the back of the arm, over the elbow, and up over the shoulder of the sound side. Where the plaster passes over the elbow a slit should be made to prevent pressure on the olecranon. This second plaster

should be drawn sufficiently tight to raise up the arm. The hand should be placed across the chest on the shoulder of the sound side, so that the plaster extends along up the forearm and over the hand. In children this serves the purpose of maintaining immobility of the entire arm.

3. Moore's dressing consists of a figure-of-8 bandage around the elbow, and over the arm and shoulder, to the shoulder of the opposite side.

FIG. 52.



Moore's dressing for fracture of the clavicle. The arm is carried in a sling.

4. Where even the slightest deformity is undesirable, the patient should lie on a smooth bed, with a small pad between the scapulae, for at least three weeks. A small sand-bag can be placed over the shoulder and the arm may be strapped to the side, the patient being cautioned to avoid all unnecessary motion. A considerable callus is the rule in these fractures. When the fracture is properly attended to, a good result can be obtained. In fractures where there is violent injury, the outer fragment may be driven downward until it perforates the apex of the lung. Emphysema of the tissues will follow and complicate the condition.

forates the apex of the lung. Emphysema of the tissues will follow and complicate the condition.

Fractures of the Scapula.

The scapula may be fractured in the following locations:

- | | |
|----------------------|--------------------|
| 1. Acromion process. | 4. Neck |
| 2. Coracoid process. | 5. Glenoid cavity. |
| 3. Body. | |

The *acromion process* may be broken by direct violence. The arm and hand are helpless and there is evidence of local injury. The bone is subcutaneous, and if seen early, there will be no difficulty in making out the condition. *Treatment.*—It may be strapped in position and the arm carried in a sling.

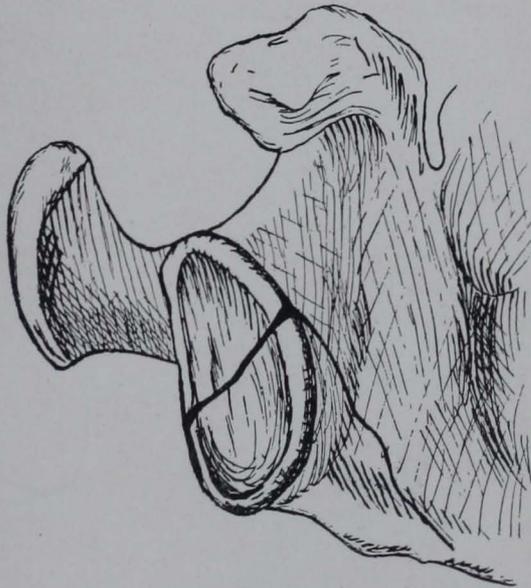
The *coracoid process* is rarely broken and then only from direct violence. There is little displacement. The arm should be raised and put in a sling and the fragment of bone drawn up as far as possible.

The *body* of the scapula is rarely broken and then only from direct violence. The fracture may be longitudinal or transverse. It is a result of injury to the spine of the scapula. The diagnosis can be made

by obtaining crepitus and preternatural mobility. The fragments may be held together by strapping and by supporting the arm.

Fracture of the *neck* of the scapula is produced by great violence to the shoulder. It may occur in two locations, through the neck, or through the suprascapular notch back of the coracoid process. The deformity resulting resembles a dislocation of the humerus downward. These conditions are readily differentiated, since when the shoulder is pushed up, as the arm is lifted, crepitus is obtained. On allowing the arm to hang by the side, the deformity returns. The arm should be bandaged to the side and kept immovable.

FIG. 53.



Fracture through the glenoid cavity of the scapula.

Fracture of the *glenoid cavity* is extremely rare. The prognosis of the injury is good. It should be treated as a fracture of the neck of the scapula.

Fractures of the Humerus.

These are divided into:—

1. Fractures of the upper extremity.
2. Fractures of the shaft.
3. Fractures of the lower extremity.

Fractures of the upper extremity are:—

- A. Fractures of the anatomical neck (Intracapsular).
- B. Fractures of the surgical neck (Extracapsular).
- C. Fracture of the greater tuberosity.
- D. Fracture of the epiphysis.

Fractures of the anatomical neck are:—

- a. Non-impacted.
- b. Impacted.

A **non-impacted** fracture of the anatomical neck is extremely rare, but is more frequent than the impacted form. The line of fracture is partly within and partly without the capsule of the joint. The signs of the fracture are obscure, and consist of pain, swelling, loss of function, deformity (loss of rotundity of shoulder), crepitus, and absence

of the signs of dislocation and other injury. The fracture occurs in old people. The prognosis is not very good, inasmuch as only fibrous union may be obtained; furthermore, the upper fragment may become turned in its position so that the fractured ends of the bone can not be brought into position. Perhaps this can only be made out by an x-ray examination. Should such a condition occur, an operation will be necessary to remove the upper fragment. Where there is not much displacement of the fragments, and the patient has good general health, the prognosis is fairly good.

In **impacted** fracture of the neck of the humerus, the head is driven into the lower fragment. The cause is from direct violence. The signs are even more obscure than in the non-impacted variety of fracture. There is shortening, which is determined by measuring from the acromion process to the external condyle, and a slight prominence of the acromion process. There is loss

FIG. 54.



Impacted fracture of the anatomical neck of the humerus.

FIG. 55.



Fracture of the surgical neck of the humerus. S, scapula; D, deltoid; P. M., pectoralis major; L. D., latissimus dorsi.

of rotundity of the shoulder, and later the head of the bone can not be felt in an abnormal position, and there is no crepitus. There is absence of the signs of dislocation. The signs of this fracture are chiefly negative.

Treatment.—A shoulder-cap, extending down as far as the insertion of the deltoid, should be made of a starch-paste dressing, leather, or gutta-percha. The axilla should be well padded and the shoulder enveloped in cotton, and a figure-of-8 bandage applied from the fingers up, to prevent edema. Obstruction to the circulation is produced by

the callus compressing the deep veins in the axilla. Manipulation of the soft-parts should be begun early, within ten days, and kept up regularly, in order to prevent a stiff joint.

Fracture of the Surgical Neck.—This fracture may be impacted or non-impacted, but the impacted form is extremely rare, and when it occurs, the lower fragment is driven into the upper one. The non-impacted form, which is the most common, is caused by direct violence.

Displacement.—The upper fragment is rotated out by the muscles which are attached to the greater tuberosity, while the deltoid, biceps, and triceps, together with the pectoral muscles, draw the lower fragment upward and forward, so that the roughened end of the lower fragment makes a prominence against the anterior fold of the axilla. The arm is helpless and is supported by the hand of the opposite side.

Signs.—There is marked pain, swelling, and some shortening. The roughened upper end of the lower fragment makes a prominence against the anterior fold of the axilla. Preternatural mobility is very evident as the operator grasps the head of the humerus. The arm may be rotated while the upper fragment remains stationary. There is increased mobility upon manipulation by the surgeon, also loss of function. Upon extension of the arm and approximation of the fragments, crepitus is obtained.

Union.—In fracture of the surgical neck, union is bony, and the result good. The only complication arising may be paralysis of the deltoid, because of the involvement of the circumflex nerve in the callus. Where fracture is not attended by other injury, a good result can be assured.

Treatment.—The treatment consists in reducing the fracture by extension and counter-extension. A firm pad should then be placed in the axilla. A shoulder-cap, covering the outer, anterior, and posterior surfaces of the shoulder and upper arm, extending down below the insertion of the deltoid, should be applied. Previous to the application of the shoulder-cap, a moderate film of surgeon's cotton may be placed over the shoulder. A figure-of-8 bandage should be applied from the hand up and carried entirely over the shoulder. The arm is put in a sling, and in a muscular person a one or two pound weight is hung on the elbow to overcome muscular contraction. This is unnecessary in weak people.

Fracture of the Greater Tuberosity is rare, and is the result of direct violence. There is evidence of great local injury; sometimes the bone may be split.

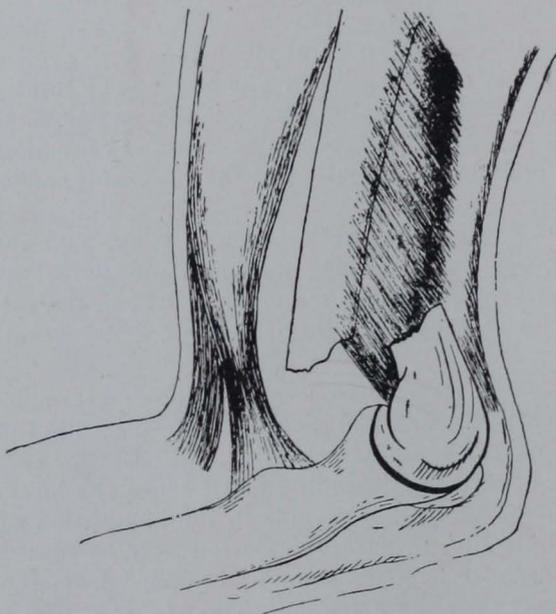
Treatment.—The treatment must be modified according to the requirements of the condition. If the tuberosity is drawn away from the bone, it should be brought back and held there by adhesive strips. The arm should be bandaged from the hand up and carried in a sling.

Epiphyseal Fracture of the upper extremity of the humerus is rare. It happens before the age of twenty and resembles a fracture of the sur-

gical neck. The upper fragment carries with it the greater tuberosity. The *signs* of the fracture are the same as the signs of fracture of the surgical neck, with the exception that crepitus is moist, and the projection made against the anterior fold of the axilla is from a smooth, rather than a roughened, end of the bone. The *treatment* is the same as treatment of the surgical neck.

Fractures of the Shaft.—The shaft of the humerus is broken by direct violence, while, in some rare cases, it may be by indirect violence. In case of softening of the bone, muscular contraction has been said to produce the fracture. The displacement of the fragments will depend upon the location of the fracture. Where the line of fracture is above the insertion of the deltoid, the upper fragment

FIG. 56.



Oblique fracture of the lower extremity of the shaft of the humerus, showing the displacement of the fragments.

is rotated outward by means of the muscles attached to the greater tuberosity, while the deltoid, biceps, and triceps, pull the lower fragment upward and lift it outward. The upper fragment is drawn inward towards the chest by the muscles attached to the bicipital ridges. Where the fracture occurs below the insertion of the deltoid, the upper fragment is drawn outward and forward by the action of the pectoralis major and deltoid, and shortening is produced by the biceps and triceps.

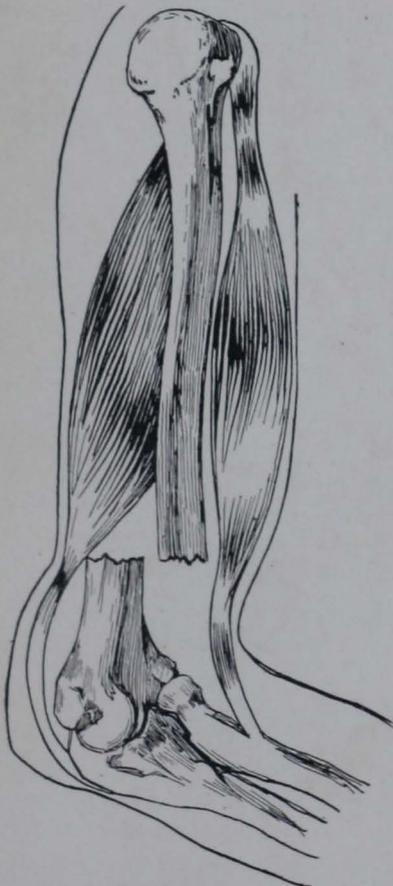
Signs.—The signs of the fracture are very evident and may be enumerated as pain, swelling, preternatural mobility, crepitus, deformity, and loss of function.

Union.—Good union may be obtained in treatment of fracture of the shaft of the humerus, but it must be borne in mind that non-union more often happens in this fracture than in any other. The chief reason seems to be that the fragments are not maintained immovable and in apposition. Complications may arise which consist of paralysis of the extensor muscles because of the involvement of the musculospiral nerve in the callus.

Treatment.—The treatment of fracture of the shaft of the humerus is simple, but whatever method is used, it should be attended to thoroughly. The splints used are the following:

1. A posterior trough, which is perhaps the best splint to use, is made of perforated metal, or of pasteboard and starch-paste, and extends from the shoulder to the hand. It should be well padded, so as to make a nice bed for the arm.

FIG. 57.



Transverse fracture of the humerus, showing little displacement of the fragments.

- | | |
|----------------------|----------------------|
| A. Transverse. | D. External condyle. |
| B. T- or Y-shaped. | E. Epiphyseal. |
| C. Internal condyle. | |

2. An internal angular splint, which should extend from the shoulder to beyond the wrist, so as to immobilize the hand. This may be reinforced by three simple splints, one on the front of the arm, one on the outer side, and one on the posterior surface. These should extend from the axilla to the elbow. The arm should be well enveloped in cotton and the splints, which are made of heavy pasteboard or thin boards, are then applied. A figure-of-8 bandage should be applied from the hand entirely over the arm and enveloping the shoulder. The splint should maintain extension and counter-extension. The dressing devised by Dr. A. T. Still is the most suitable dressing after the preparation has dried. Extension and counter-extension may be made after twenty-four hours and the bandage readjusted.

3. A plaster-of-Paris dressing is advocated by some physicians, but it is not satisfactory.

Fractures of the Lower Extremity of the humerus consist of the following:

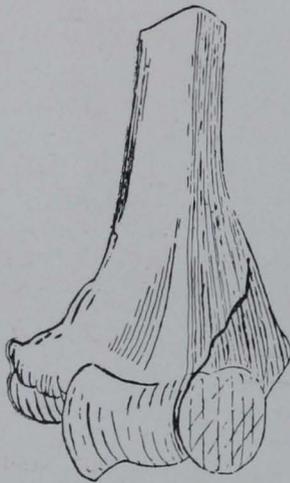
A transverse fracture of the lower extremity of the humerus may occur in two locations, one above the condyle, and the other below. Transverse fracture below the condyles, taking off a portion of the lower epiphysis, is an extremely rare condition. Transverse fracture above the condyles is the common fracture.

Cause.—Direct violence, as falls on the elbow.

Displacement of Fragments.—The triceps, acting upon the olecranon, draws the forearm backward; the biceps, brachialis anticus, triceps, and other muscles, draw the forearm upward, while the lower end of the upper fragment is carried forward and makes a prominence above the crease at the bend of the elbow.

Signs.—Deformity in this fracture resembles the deformity in dislocations of both bones of the forearm backward. A diagnosis can be made by careful examination. In fracture, the relation of the condyles and the olecranon is unchanged, whereas in dislocations, the relation of these bony points is changed. In case of fracture, upon reduction of the deformity, crepitus is obtained, while in dislocations, no crepitus is obtained. In case of fracture, the deformity will return after reduction;

FIG. 58.



Fracture of the outer condyle of the humerus.

FIG. 59.



Fracture of the internal condyle of the humerus.

in dislocations the deformity will not return. In fracture there is shortening, the distance from the external condyle to the acromion process is shorter on the injured side, while in dislocation, there is no shortening. In fracture, the lower end of the upper fragment makes a prominence above the crease at the bend of the elbow, while in dislocation, the prominence is below the crease at the end of the elbow.

In **T-shaped fracture** there is not only a transverse fracture, but the line of fracture extends into the joint. The signs are similar to those of transverse fracture, with the exception that upon motion of the condyles of the humerus, crepitus is obtained. Where the case is seen early, crepitus may be obtained by compressing the condyles. Where great fluid effusion has taken place in the joint, this sign may be absent.

Fracture of the condyles is the result of direct violence. The line of fracture may, or may not, invade the joint. In case the internal

condyle is fractured, the fragment is drawn downward by the pronator radii teres and the flexor muscles of the arm, whereas in fracture of the external condyle, it is drawn downward underneath the fibres of the supinator longus. The loose fragment is readily manipulated, and when drawn into position, crepitus can be obtained.

Epiphyseal fracture is the same as transverse fracture, with the exception that moist crepitus is obtained. The fracture occurs in young persons.

Diagnosis.—The diagnosis in all these fractures is difficult; furthermore, great swelling is the rule. The best treatment, where the case is not seen early, and before the swelling is intense, is to place the arm on a pillow, keep it in an immovable position, and apply cold to combat the swelling, after which, a correct diagnosis can be made. Furthermore, the bones may be manipulated in the proper position and a permanent dressing better applied. Where the diagnosis is uncertain, an x-ray examination should be made, if possible. It is of the greatest importance to correctly determine the condition. The prognosis should be guarded. Fractures extending into the elbow-joint are always serious, and it is difficult to obtain good union without deformity, or without interference in some of the functions.

Union.—Union takes place with more or less deformity. In epiphyseal fractures, or fractures within the capsule of the joint, the union is fibrous. In transverse fractures, and in fractures of the condyles, the union is bony.

Treatment.—As before mentioned, where there is much swelling, the arm should be placed upon a rubber cushion and cold applied. When the swelling has been reduced sufficiently, the diagnosis may be made, and a suitable dressing applied. A posterior trough, or an external or internal angular splint, may be applied. The internal angular splint is preferable in all cases, with the exception of fractures of the internal condyle. Manipulation should be made early in all cases, with the exception of transverse fracture, where the line of fracture does not invade the joint. In all cases where the fracture invades the joint, manipulation should be begun at the end of the first week. In case it does not invade the joint, it may be delayed until the end of

FIG. 60.



Method of dressing the arm in acute flexion for T-fractures or for fracture of the internal and external condyles of the humerus.

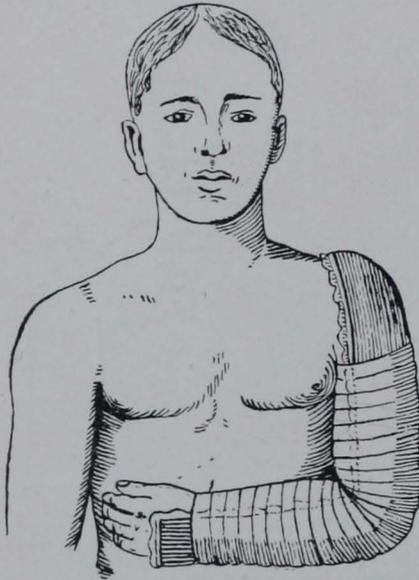
the second week. The success in the treatment of these fractures will depend upon the proper management of the case.

Fractures of the Forearm—Both Bones.

Fracture of both bones of the forearm is the result of direct violence, when both bones are broken at the same level. Where the bones are not broken at the same level, it is the result of indirect violence, the bones breaking at the weakest point. In the latter condition, the radius breaks in the upper one-third, while the ulna breaks in the lower one-third.

Displacement.—The upper fragment of the radius is drawn toward the upper fragment of the ulna by the pronator radii teres, while the lower fragment of the ulna is drawn toward the lower fragment of the radius by the pronator quadratus, and in this manner the interosseous space is more or less obliterated.

FIG. 61.



Posterior trough, suitable for fractures of the humerus and both bones of the forearm.

Signs.—Deformity, crepitus, history of accident, pain, swelling, preternatural mobility, etc. The signs are very evident.

Treatment.—Flex the elbow to a right angle and place the forearm midway between pronation and supination. In this position, the thumb is directed upward. A well-padded internal and external splint should be applied. The internal splint should extend from the axilla to the tips of the fingers, while the external splint need only extend from the

elbow to beyond the wrist. Both splints should be broader than the forearm, so that the bandage may not compress the bones towards each other, thus lessening the interosseous space. Manipulation of the hand, fingers, and muscles of the forearm should be begun within two weeks. If either the elbow-joint or wrist joint is involved, manipulation should be begun earlier. Pronation and supination may be lost if this manipulation is not begun early, and kept up regularly. The patient should be seen within twenty-four hours after the accident, because of the liability to constriction of the return circulation by the bandage. Here, again, the dressing advised by Dr. Still will be found to be of the greatest advantage. The fracture may be green-stick, in a child.

Fractures of the Radius.—Fractures of the radius are of the (1) neck, (2) shaft, and (3) lower extremity.

Fracture of the *neck* of the radius is the result of direct, or indirect, violence. The diagnosis is sometimes difficult. The signs are crepitus, obtained by extension and manipulation; preternatural mobility, obtained by grasping the head of the bone and pronating and supinating the arm. The head does not move. Occasionally, in young persons, the upper epiphysis may be separated. This condition is difficult to diagnose. It gives moist crepitus, and evidence of a foreign body in the joint.

Treatment.—The treatment of fracture of the neck of the radius consists in flexing the arm at right angles, to relax the biceps, when a posterior angular trough, or internal angular splint, may be used. Mild manipulation should be begun at the end of the second week.

The *shaft* of the radius is broken by direct, or indirect, violence, such as blows upon the arm, or falls upon the palm. Displacement of the fragments varies, depending upon whether the fracture is above or below the insertion of the pronator radii teres. Should it be above, the upper fragment will be flexed and supinated, while the lower fragment will be pronated and drawn towards the ulna. When the fracture is below the insertion of the pronator radii teres, the upper fragment is flexed and drawn inward, while the lower fragment is approximated to the ulna.

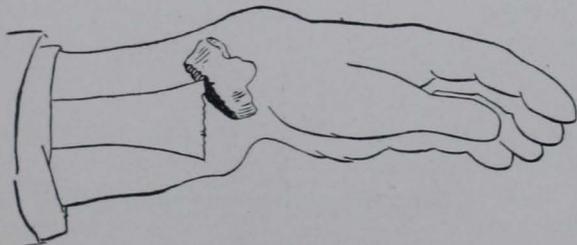
Treatment.—The forearm should be placed midway between pronation and supination, and flexed at right angles at the elbow. A posterior, or internal, angular splint may be used, with sufficient interosseous pad to prevent the approximation of the bones. The splints should be carried from below the wrist to above the middle of the arm. Manipulation should be begun at the end of the second week.



FIG. 62.

Fracture of the lower extremity of the shaft of the radius showing deformity.

FIG. 63.



Colles's fracture, showing displacement of the fragments.

Fracture of the *lower extremity* of the radius is called **Colles's fracture**. This injury occurs most frequently in elderly women, and is produced by falls upon the outstretched palm, while the hand is completely pronated and ex-

tended. The fracture may be an inch from the wrist-joint, but is usually less. The deformity is characteristic, and is described as

“silver-fork,” because of the position of the hand resembling a dinner fork.

Displacement.—The lower fragment of the bone is carried backward and upward, because of the direction of the application of the violence.

FIG. 64.



Silver-fork deformity in Colles's fracture.

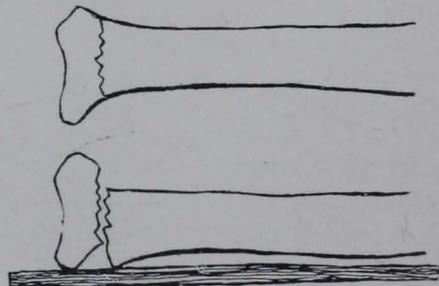
Often there is some impaction of the fragments. This impaction, together with the action of the extensor carpi radialis longior and brevior muscles, maintain the deformity. Because the main violence is directed on the ball of the thumb, the outer side of the lower fragment is displaced more than the inner side. This causes a prominence of the styloid process of the ulna, which will be found in this injury on a lower level than the styloid process of the radius. The upper fragment is pronated and approximated to the ulna. These forces acting, likely produce the characteristic deformity.

Signs.—The characteristic deformity is a prominence on the back of the wrist, while there is a corresponding depression on the front of the wrist. The styloid process of the radius is on a higher level than that of the ulna. In case the fracture is not impacted, there is crepitus. The history of the accident and the age of the patient may be considered. It may be confounded with dislocation of the wrist, but this dislocation is rare, and the deformity different. The styloid process of the radius is on a lower level than that of the ulna, while there is no crepitus. If the deformity is reduced, it will not return.

Treatment.—The treatment of Colles's fracture is, first, to set the fracture, providing it is not impacted. Where there is impaction, without much deformity, the member should be treated in that position. There are numerous splints which are of excellent service in the treatment of this fracture. The chief objection to all of them seems to be that a stiff joint is liable to result. Levis's splint is, perhaps, the most popular. A splint similar to Levis's may be made of Dr. Still's dressing.

Bond's splint is an excellent dressing. This splint has a pad which fits over the lower end of the upper fragment, and a dorsal pad which fits

FIG. 65.



Deformity liable to result in the treatment of Colles's fracture with a straight splint.

over the lower fragment. It tends to correct the deformity. The fingers and thumb are allowed to be free. Passive motion should be begun in four or five days, and kept up until cured.

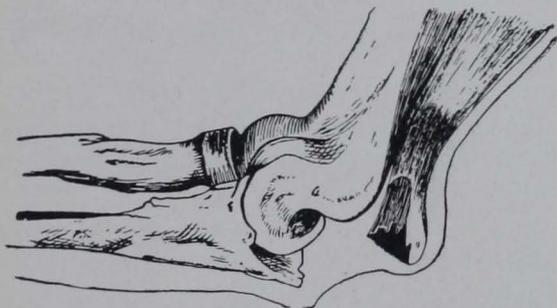
Fracture of the Ulna.

Fractures of the ulna consist of fractures of the:

- | | |
|----------------------|---------------------|
| 1. Olecranon. | 3. Shaft. |
| 2. Coronoid Process. | 4. Styloid Process. |

Fractures of the *olecranon* are produced by direct violence, as by falls upon the elbow, and by muscular contraction, in conditions of disease of the bone.

FIG. 66.



Fracture of the olecranon process, showing upper fragment pulled up by the triceps muscle.

neath the skin, an inch or more above the joint. The diagnosis is easy, inasmuch as it cannot be mistaken for any other injury.

Union.—The union is sometimes fibrous, but in young and middle-aged people, in good health, the union is good.

Treatment.—The arm is best treated in complete extension and by strapping the olecranon in its normal position by means of adhesive strips. Some surgeons advise the use of a right-angle splint and strapping the bone in position. In case of non-union, the olecranon may be wired in position. The arm should be kept in an extended position for three weeks, when slight flexion should be made. Manipulation should be instituted late.

Fractures of the *coronoid process* occur most frequently at the time of dislocation of the ulna. It is said that contraction of the brachialis anticus may produce this fracture. The fracture is attended by considerable injury. Where it complicates a dislocation, a bad result is liable to follow. It is best treated in flexion, with an internal angular splint. Manipulation should be begun early, in order to prevent a stiff joint.

Fractures of the *shaft* are caused by direct violence. The line of fracture may be transverse, or oblique. The upper fragment is held in position while the lower fragment is approximated to the radius by the pronator radii teres. The diagnosis is easy, inas-

Nature of the Injury.—Usually there is considerable contusion of the tissues over the olecranon, while the loosened fragment is drawn upward by the tendon of the triceps and can be readily felt be-

much as the posterior border of the ulna is subcutaneous. A finger run along the posterior border would discover an offset in the bone. Union is good.

Treatment.—It is best treated in a manner similar to fractures of the shaft of the humerus. A splint, the length of the forearm and hand, slightly wider than the forearm, applied to the inner side, will be sufficient. The splint should be well padded, and held in position by a figure-of-8 bandage. If extension and counter-extension are kept up while the splint is applied, the bones will be held in apposition.

Fractures of the Carpus.

Fractures of the carpus are produced by severe, direct violence, and very often the fracture is compound.

The *diagnosis* is readily made by crepitus. The injury is more serious than is indicated at first glance. Because of the limited blood supply to the carpal bones, one of the fragments may die, and suppuration and abscess result. Should this occur, it will produce ankylosis.

Treatment.—The bone should be manipulated into position, and held by a well padded anterior splint, extending beyond the middle of the forearm.

Fractures of the Metacarpus.

Fracture of the metacarpal bones is produced by direct violence. The signs are evident, and consist of deformity and crepitus.

Treatment.—The bones may be readily manipulated into position, while an anterior splint, extending beyond the wrist, should be applied. In fractures of both the carpus and metacarpus, manipulation should be begun early, in order to prevent fibrous adhesions of tendons and the involvement of the joints.

Fractures of the Phalanges.

Fracture of one of the phalanges may take place because of direct violence. The diagnosis is easy. It is best treated by a palmar splint immobilizing the metacarpo-phalangeal, as well as the phalangeal joints. The hand should be carried in a sling during the first two weeks.

Fractures of the Pelvis.

Fractures of the pelvis are caused by heavy, direct violence, such as the wheels of a loaded wagon passing over the body, or by falls from a considerable distance. The nature of the injury depends upon the line of fracture. If the line of fracture extends through the crest of the ilium, it may not involve any of the pelvic viscera, but it may extend through the ramus or body of the pubes and ischium, thus separating the two sides of the pelvis. Such fractures of the true

pelvis are usually attended by lacerations of the pelvic viscera, of the rectum, vagina, urethra, and bladder.

Signs.—The signs will vary, depending upon the viscera injured. There is severe contusion of the soft-parts. Crepitus is obtained by pressing upon the ilia, or upon the pelvis antero-posteriorly. Bloody urine will indicate that the fracture extends into the bladder, or blood may be voided from the bowel. A history of the accident may lead to a suspicion of fracture. If any of the viscera are involved, the prognosis of the fracture is grave. Infection, abscess formation, and non-union, will bring about exhaustion and death. Where there is laceration of the viscera, the patient may be kept quiet with sand-bags at the side, and with proper care and attention, may recover. The acetabulum may be fractured because of blows upon the hip. This injury is rare, and the diagnosis can be made by eliminating fractures and dislocations of the hip, and by the presence of pain and crepitus. In fractures of the pelvis, little dressing, beyond keeping the patient quiet, will be required. A flannel roller may be applied around the pelvis and the patient not allowed to move.

Fractures of the Femur.

Fractures of the femur are divided into:—

- I. Fracture of the upper extremity. III. Fractures of the lower extremity.
II. Fracture of the shaft.

Fractures of the upper extremity are divided into:—

- A. Intracapsular. C. Fractures of the greater tuberosity.
B. Extracapsular. D. Epiphyseal.

Intracapsular fractures are divided into:

1. Impacted. 2. Non-Impacted.

The **non-impacted** fracture is the most common.

Cause.—The causes of non-impacted fracture of the neck of the femur are:

1. The fragile condition of the bone.
2. Fatty degeneration of the neck.
3. Indirect violence.

The fracture happens in old people, and is produced by slipping on cobble-stones, etc., or catching the toe. The limb is wrenched, and the neck of the bone easily breaks off

Nature of the Injury.—The fracture may be transverse, or oblique, and the displacement will depend somewhat upon the line of fracture. In some cases, the fracture is subperiosteal. In other cases, where the periosteum is torn, or lacerated, greater displacement of the fragments takes place.

FIG. 67.



Non-impacted intra-capsular fracture of the neck of the femur.

Signs.—1. Shortening—three-fourths of an inch, to one inch.

2. Eversion of the foot, which is produced by the weight of the limb as it lies in a helpless condition.

3. Lessened arc of rotation of the great trochanter. This sign is obtained by grasping the great trochanter and rotating the limb outward and inward.

4. Crepitus.

5. The great trochanter is nearer the anterior superior spine. This may be determined by accurate measurements. These measurements may be made in one of two ways. First, by Nelaton's line, which is a line drawn from the anterior superior spine of the ilium to the most prominent part of the tuberosity of the ischium. Under normal conditions it crosses the upper edge of the great trochanter.

It may also be made by Bryant's line, which consists of a line drawn around the body at the level of the anterior superior spines. A second line is drawn upward from the great trochanter to this line. This second line is shorter on the injured side than on the sound side, in case of displacement of the great trochanter upward.

6. A history of the accident.

7. Age of the patient. The fracture happens in old people, and from slight injury, by catching the foot, or in slipping. It should be noted that there is no injury to the tissues over the trochanter.

Allis's Sign.—This is the relaxation of the fascia lata. The relaxation is caused by shortening, lessening the tension on the ilio-tibial band.

Impacted Intracapsular Fracture of the neck of the femur is rare.

Signs.—

1. No crepitus.
2. Very slight shortening.
3. Absence of the signs of other injury or dislocation.
4. History of the accident and age of the patient.
5. Eversion of the limb.

Occasionally in these fractures the limb is not helpless, and the patient may even attempt to walk.

FIG. 68.



Method of determining Allis's sign in fracture of the neck of the femur.

The diagnosis is sometimes very difficult, inasmuch as the signs are chiefly negative.

Extracapsular Fracture of the neck of the femur occurs in young, or middle-aged people, and is either impacted, or non-impacted, but is usually impacted. It is caused by direct violence, as heavy falls on, or severe injury over, the trochanter. In the impacted variety, the upper fragment is driven into the lower one.

Nature of the Injury.—The injury is brought about by severe direct violence, therefore there is evidence of bruising of the skin and soft tissues. The trochanter is considerably thickened. There is shortening of at least one inch, and is greater than in the intracapsular fracture. There is a lessened arc of rotation of the trochanter, no crepitus, eversion of the foot, while the trochanter is displaced above Nelaton's line.

In the **non-impacted** extracapsular fracture of the neck of the femur, it is believed that the impaction is broken up by the extension of the fracturing force, or by the efforts of the patient to move, or by subsequent manipulation. The cause of the injury is, great direct violence over the trochanter.

Nature of the Injury.—The injury is very severe. There is intense contusion of the skin and soft-parts. The line of fracture may even extend through the base of the great trochanter, or may extend through the line of union of the neck with the great trochanter.

Signs.—1. Crepitus, which is pronounced, and is evidenced by grasping the trochanter.

2. Shortening (one or two inches).
3. Evidence of great injury to the soft-parts over the trochanter.
4. History of the accident, and age of the patient.
5. Eversion of the limb.

Treatment.—**Non-impacted Intracapsular Fracture.**—As this fracture occurs in old people, long confinement in the recumbent posture is liable to result in hypostatic congestion of the lungs, and in bed-sores, either of which may destroy life; therefore, it is best to keep the patient in bed the shortest time possible. The patient may be put to bed, and an extension apparatus applied, with sand-bags along the side of the femur, and the limb kept immovable until the preliminary soreness disappears. At the end of the first week, and not later than the second week, the patient should be allowed to sit up, or, if possible, to get up and about on crutches. Where it is deemed advisable, and the condition of the patient's health will permit it, a fixed-dressing should be applied, which will immobilize the hip and knee. In the majority of cases, this dressing can not be used. Fibrous union is the rule. Sometimes, because of the limited blood supply, and the enfeebled condition of the patient, no union takes place, and the end of the bone may become worn off. Sometimes the limb is left helpless. In order to secure a good result, confinement in bed for six or eight weeks is usually neces-

sary, and where the patient is young, this may be permitted. A stiff apparatus applied over the hip is necessary, even after a considerable length of time in bed. This stiff dressing over the hip may be in the nature of a leather casing, or a pasteboard and starch-paste dressing, and so constructed as to fit closely over the hip and thigh.

In the **impacted** form, a similar treatment should be followed, except that the extension apparatus is unnecessary. No attempt should be made to break up the impaction. Generally a good result can be obtained, but the hip should be rendered immovable by some fixed dressing. A plaster dressing in old people is bad.

Extracapsular Fracture.—In the **impacted** variety, it is only necessary to keep the limb at rest. No extension apparatus is necessary. Sand-bags should be placed along the side of the hip, and the limb kept at rest until the soreness and swelling have disappeared, and then the patient may get up and go about on crutches. Subsequent manipulation may obtain a good result.

In the **non-impacted** variety, an extension apparatus will be necessary. An eight or ten pound weight, sufficient to overcome the muscular contractions, should be applied, and the patient kept quiet in bed, and the limb kept immovable, by sand-bags, until the preliminary swelling and inflammation have subsided, when a plaster dressing, encasing the leg and pelvis, may be applied. This plaster dressing is kept on for two weeks, when the patient is gotten up on crutches. The plaster dressing should be removed at the end of four weeks. Some surgeons advise, in the impacted variety, if the person is in good general health, to pull the impaction apart and apply a plaster dressing, but this method of procedure is questionable. Deformity, following this fracture, is the rule. While the extension apparatus is used, the foot of the bed should be raised from four to six inches, so that the weight of the patient will operate as a counter-extending force.

Fractures of the **greater tuberosity** are very rare, and are accompanied by extensive local injury. The diagnosis is usually not difficult. The broken fragments should be strapped into position, and the patient kept at rest in bed until fibrous union, at least, has taken place.

Epiphyseal fracture is also rare, and occurs in young people.

Signs.—The signs are the same as non-impacted extracapsular fracture, with the exception that there is moist crepitus. A history of the case, and the age of the patient, indicate the nature of the injury.

Fractures of the Shaft.

Fractures of the shaft of the femur are best considered in fractures of the upper, middle, and lower one-third. The *cause* is usually direct violence, but may be due to indirect violence, especially when occurring in the upper one-third of the shaft. The line of fracture is usually oblique. Muscular contracture may produce the fracture, in conditions

of softening of the bone, or in fragile conditions of the bone attending paralysis agitans.

Upper One-third.—Displacement of the Fragments.—In the upper one-third, the

FIG. 69.



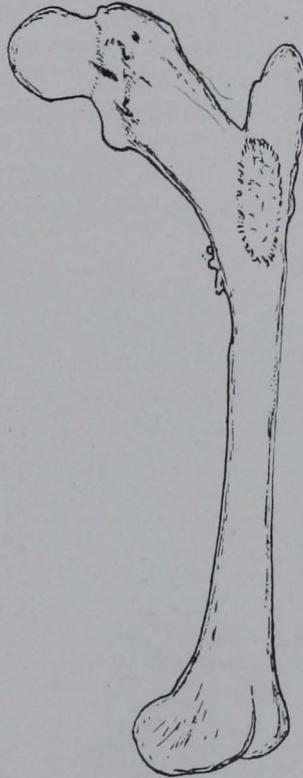
Fracture of the upper extremity of the shaft of the femur, showing displacement of the upper fragment by the psoas and iliacus.

upper fragment is tilted forward by the action of the iliacus and psoas muscles, while the quadriceps extensors, biceps, semitendinosus, semimembranosus and the adductors draw the lower fragment upward, so there is marked shortening, the upper end of the lower fragment slipping past the upper fragment. Extension made upon the limb in an extended position, will not bring about apposition of the fragments. The limb must be treated in a semi-flexed position, in order to relax the psoas and iliacus muscles.

In fractures of the **middle one-third**, a similar displacement of the fragments may occur, but it is not so pronounced.

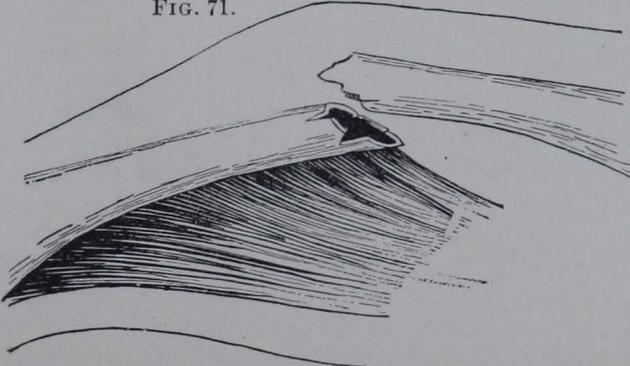
In fracture of the **lower one-third** of the femur, the upper end of the lower fragment is usually turned back-

FIG. 70.



Union with angular deformity in fracture of the upper one-third of the shaft of the femur.

FIG. 71.



Deformity in fracture of the middle of the shaft of the femur.

ward, because of the action of the calf muscles on the upper and back part of the condyles, whereas, the upper fragment is usually tilted more or less forward, and there is marked shortening. This deformity may not occur where the fracture is caused by direct violence and the line of fracture is transverse. In fractures of the middle one-third of the shaft, extension will bring about apposition of the fragments, and the limb may be treated in a fixed dressing in an extended position, but in fractures of the upper and lower one-third, the thigh should be flexed on the abdomen, and the leg partially flexed on the thigh. In fractures of the upper extremity, union with angular deformity may occur, when good apposition has not been obtained and the fragments are not kept immovable.

FIG. 72.



Fracture of the lower extremity of the shaft of the femur, showing the deformity produced by the action of the calf muscles.

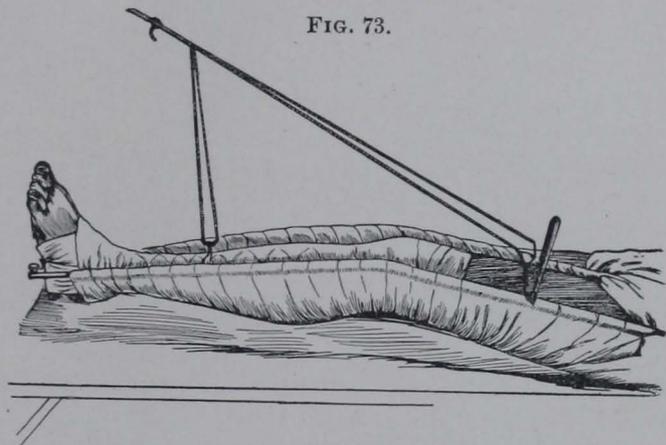
Signs.—The signs in fracture of the shaft of the femur are so obvious that a diagnosis is easy. The limb below the fracture is helpless, and any effort at motion causes great pain. There is shortening to the extent of two or three inches. Preternatural mobility and crepitus, with deformity, will be sufficient to enable the operator to determine the injury. The foot is everted and helpless. Sometimes this fracture is attended by great shock and intense pain, because of injury to the sciatic nerve. Fat embolism forms a rare complication.

Dressing.—Numerous dressings, splints, extension apparatus, and other forms of dressings, have been devised for these fractures. Whatever is used, the operator must keep in mind the condition of the limb to be treated. Dr. Still advises the use of a dressing made of starch-paste, pasteboard, and a many-tailed bandage, which is applied to the thigh and leg. Each day the physician visits the case, to see that the bones are kept in good apposition, and the dressing does not interfere with the return circulation. He has never had a failure with this method of treatment. For fractures of the upper and lower thirds of the femur, Hodgen's dressing is of great value. This

dressing consists of a cradle made of muslin, fastened to two iron bars, which are bent at the knee. Two cross pieces, which can be readily detached, hold the two bars a certain distance apart. Fastened to these bars is a suspension apparatus, which is attached to a hook in the ceiling. By this means the limb is swung in the cradle, which will accommodate itself to the shape of the thigh, and by regulating the suspension appa-

ratus, any degree of extension can be obtained. For hospital use, this dressing has no superior. The splint in most common use, both in the hospital and private practice, is the double inclined plane. This, in case of fracture of the upper one-third of the femur, relaxes the psoas and iliacus muscles; in case of the lower one-third, it relaxes the calf muscles. Extension is made

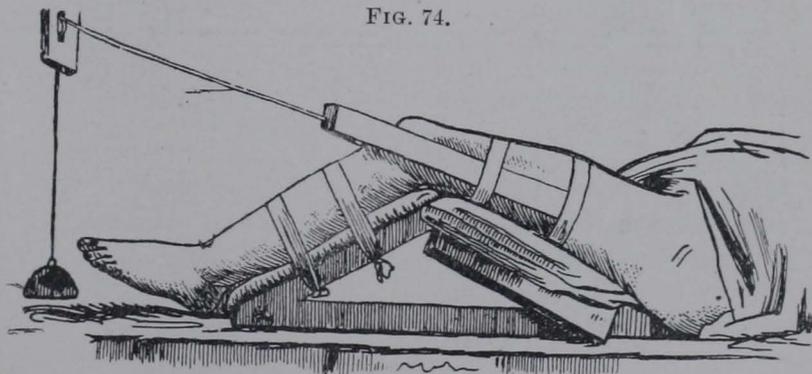
FIG. 73.



Hodgen's dressing for fractures of the shaft of the femur.

in the direction of the lower fragment. The difficulty in the treatment of this fracture in small children is to maintain immobility. Perhaps the dressing which yields the best result is a vertical suspension of the limbs in a plaster dressing. This enables the attendant to easily reach the excretories, so that cleanliness can be

FIG. 74.

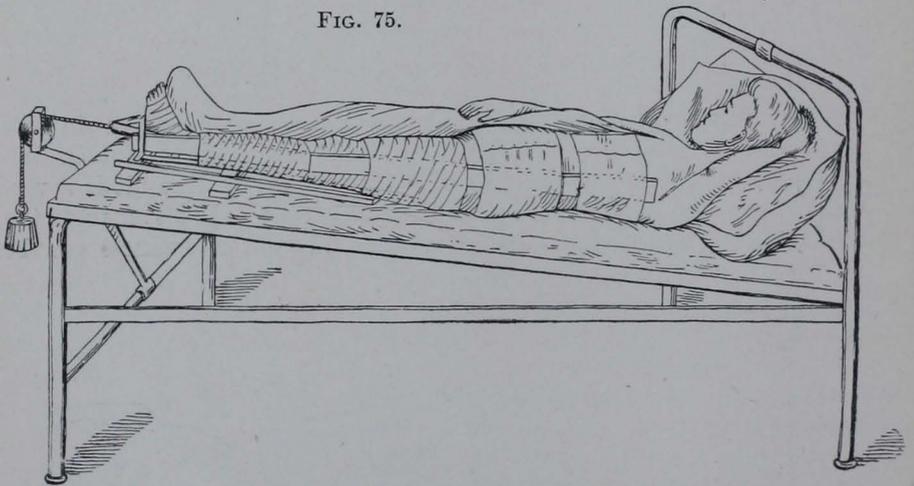


Double inclined plane and extension apparatus for fracture of the upper extremity of the shaft of the femur.

maintained. Fracture of the middle third of the shaft can be treated successfully with a plaster-of-Paris dressing, which is applied from the foot up the thigh and around the pelvis, in the form of a spica bandage, as high as the tenth rib. It does not matter how successfully this dress-

ing is applied, it will soon become loose, so if a good cast is originally put on, and along the site of fracture, the bandage, reinforced by two or three narrow wooden strips, the plaster may be incised, and a roller bandage applied over all, and the splint drawn snugly to the thigh. If this splint is used, the patient should be gotten up at the end of two weeks and made to go about on crutches. The reason for this is that considerable atrophy of the muscles will take place, unless some such method is used. In hospitals, a plaster-of-Paris bandage is applied immediately. This is not wise in private practice. The best method would be to put on an extension apparatus, keep the limb immovable between sand-bags until the preliminary swelling has disappeared, and then the plaster bandage can be put on, and in ten days, or two weeks, the patient may get about on crutches. In fractures of any part of the thigh, the hip-, knee-, and ankle-joints should be rendered immovable. The knee and ankle may easily be rendered immovable, but the hip-joint only with great difficulty. The reason is, that it is necessary for the bowels to move daily, and the inserting of the bed-pan, and care of the patient, will cause more or less motion at the hip-joint. Where it can be obtained, a fracture-bed will be found of great service. If a

FIG. 75.



Long splint, fracture bed and extension apparatus used in fractures of the femur.

fracture-bed can be secured, only an extension apparatus will be required. The function of the fracture-bed is to raise the patient, by means of canvas stretched on a frame. A hole through the sheet and canvas, in the neighborhood of the buttocks, will allow the contents of the bowel to be evacuated without motion of the body.

Fractures of the Lower Extremity.

Fractures of the lower extremity of the femur are:—

- A. Transverse.
- B. Y or T.
- C. Internal or external condyle.

Transvers.—The diagnosis of a transverse fracture is fairly easy, when it is produced by direct violence. There may not be much displacement. Where it is produced both by direct and indirect violence, there may be considerable displacement. The upper end of the lower fragment may be turned directly backward. When this occurs, some difficulty may be experienced in setting the fracture. Cases are on record where it was necessary to tenotomize the tendo Achilles in order to effect relaxation of the calf muscles, so as to permit of manipulating the lower fragment into position. When once in proper position, the limb should be treated in a semi-flexed position by a double inclined splint. The diagnosis is made by means of preternatural mobility, deformity, crepitus, history of the accident, and the nature of the injury. Generally a good result is obtained in the treatment of the fracture. The fracture may be kept immovable for three weeks in a young person, and in older persons four weeks, when they may be gotten up on crutches. Care should be taken in the preliminary use of the limb, that the soft callus is not broken up. There is no danger of ankylosis at the knee, inasmuch as the line of fracture does not invade the joint.

T or Y fracture is an extremely serious injury. It is produced by direct and indirect violence, and the violence is usually of such nature that it produces contusion and injury of the soft-parts, as well as the fracture. This adds to the gravity of the case. Inasmuch as the fracture invades the joint, effusion of blood will take place within the joint cavity, and the swelling will be intense. Where the case is not seen early, it had best be treated by antiphlogistic measures until the swelling disappears, when an accurate diagnosis can be made. Where it is possible, the limb should be exposed to the x-rays, in order to determine the exact nature of the fracture, then a fairly accurate prognosis may be made. Bony union takes place between the condyles and the shaft of the bone. Only fibrous union will take place between the two condyles. The space between the condyles is widened, and they will no longer fit the articular surfaces of the tibia, nor will the patella fit in between the condyles, so that the joint will be permanently enlarged, and other deformity may result. The *diagnosis* of the fracture is easily made. Crepitus is marked. There is effusion in the joint. Motion of the patella will occasion crepitus. More or less evidence of dislocation will be present. These, together with the history of the accident, and evidences of severe injury of the knee, will be sufficient to make the diagnosis.

Treatment.—The limb should be kept immovable for a period of ten days or two weeks. The parts adjacent to the injury may be manipulated, to assist the return circulation. The patient should be kept in the best possible condition and every effort made to get rid of the inflammation. At the end of two weeks, slight manipulation of the joint may be begun. This manipulation will prevent the formation of adhesions. Where there is not much contusion of the parts, the

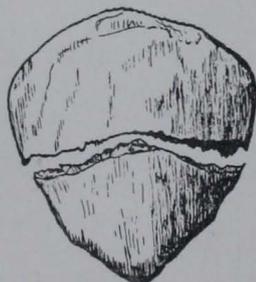
joint may be manipulated as early as the twelfth day. This manipulation is kept up lightly for two weeks, when the person may be gotten about on crutches, and a leather knee-boot constructed, which can be laced up closely to the limb, and which will hold the fragments in position. This splint may be removed daily, to permit of manipulation of the joint. If this treatment is followed out with care, the integrity of the joint will be maintained and a fairly good result obtained.

Fracture of Either Condyle is produced by direct and indirect violence, either or both. The signs of fractures are the mobility of the condyle and crepitus, together with evidence of injury. Usually a good result will be obtained. Even if the union is but fibrous at first, it will become bony, especially if the fracture occurs in a young person. Such a fracture happening in an old person, is more grave, and the integrity of the joint will be permanently lost. Deformity is the rule in this kind of a fracture, inasmuch as more or less callus must form between the condyle and the end of the bone. This slice of callus so inserted, as it were, elongates the condyle, and in case of fracture of the inner condyle, the person will have knock-knee, whereas, if it happens in the external condyle, by lengthening it, a bowed condition of the leg will result. This fracture should be treated with a double inclined plane and motion begun early (within two weeks) and kept up until the freedom of the motion of the joint is not impaired.

Epiphyseal Fracture of the lower extremity of the femur is extremely rare. Moist crepitus, history of the accident, age of the patient, evidence of a foreign body in the joint, and other signs of fracture, will enable the physician to make the diagnosis.

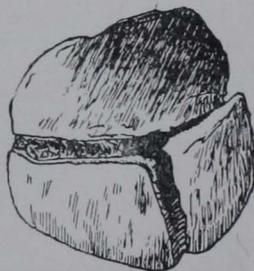
Treatment.—The treatment is the same as in the other forms of fracture. The family should be notified that considerable deformity results from this fracture. Destruction of the lower epiphysis will result in marked shortening of the limb, since the limb will no longer grow from this joint.

FIG. 76.



Transverse fracture of the patella.

FIG. 77.



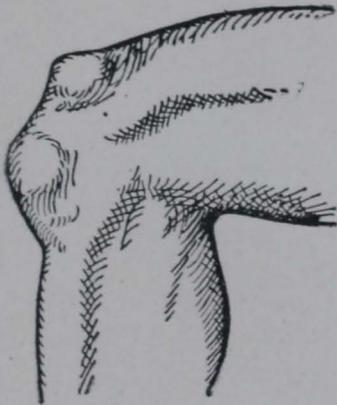
Fracture of the patella with separation of the bone into three fragments.

Fractures of the Patella.

The patella is fractured by direct violence. The line of fracture may be vertical or transverse, but is usually transverse. The trans-

verse fracture is said to occur sometimes from muscular contraction, by vigorous and forced action of the quadriceps extensors. The diagnosis of the transverse fracture is easy. The upper fragment is pulled

FIG. 78.



Fracture of the patella, showing displacement of the upper fragment.

FIG. 79.



Fracture of the patella, showing the nature of the injury.

up above the knee, by the action of the quadriceps muscles, while the lower fragment remains in situ. There is a gap between the fragments. In the vertical fracture, the diagnosis is equally easy. It is so rare that it scarcely merits description.

Treatment.—The treatment in case of a transverse fracture of the patella is not followed by a very good result. Fibrous union is the rule, although bony union may occur. The blood supply to the bone is insufficient to secure strong union. In elderly people, it is perhaps best to wire the bones together at the outset. Under aseptic conditions this operation may be done without impairing the integrity of the joint. In young or middle-aged healthy people, the limb may be dressed in extension, while the upper fragment is drawn downward by means of adhesive strips. The limb should be kept in an extended position for at least six weeks, and then manipulation and passive motion should be begun, but only mildly. The reason for not permitting motion of the limb earlier is that the callus, which is yet only fibrous, will stretch and allow the fragments to be pulled apart. This will lengthen the distance between the origin and insertion of the quadriceps extensor muscles and thereby impair their usefulness, and deformity will result. Should fibrous union occur an operation may be advised. A slice of callus may be sawed out and the ends of the bones united. It may be treated by means of McBurney's hooks, but this treatment is not often used.

Compound Fracture of the Femur and Patella should be treated in the same manner as a simple fracture, with the exception that the wound

should be cleansed and aseptized at once and thereafter dressed antiseptically. Should a plaster bandage be applied, a window may be cut in the plaster over the site of the wound, so as to permit of daily treatment and cleansing of the wound and provision for drainage.

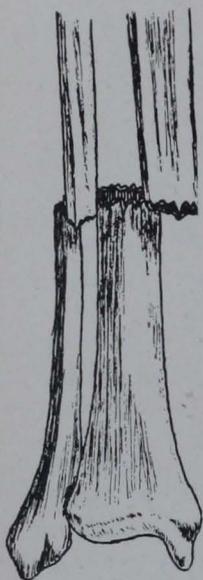
Fracture of the Lower Leg.

Fractures of the lower leg may be divided into:

- I. Fractures of the tibia and fibula.
- II. Fractures of the tibia.
- III. Fractures of the fibula.

Fracture of Both Bones is most common, with the exception, perhaps, of fractures of the lower extremity of the fibula. The cause is direct and indirect violence. If both bones are fractured at the same level,

FIG. 80.



Transverse fracture of both bones of the leg as results from direct violence.

and the line of fracture is transverse, the cause is direct violence. If the bones break at their weakest point, because of falls on the foot, and more or less force distributed to the leg at the same time, the line of fracture will be oblique. In the latter case, the tibia breaks in its lower third, while the fibula breaks in its upper third. In the transverse fracture, which is the result of direct violence, there is not much deformity. The diagnosis is easy. The tibia is subcutaneous and fracture can readily be determined in it. It may not be so easy to determine whether the fibula is broken, but in case only the tibia is broken, preternatural mobility would not be very marked, because, of the presence of the companion bone, whereas if both bones were broken, the preternatural mobility would be more marked. In the oblique fracture, which is a much more serious condition, there is great danger of the fracture becoming compound. The reason is, because the lower end of the upper fragment projects forward against the skin, while the action of the muscles pulls the lower fragment past the upper. The lower end of the upper fragment usually makes a sharp projection against the skin, and unless great care is exercised in handling the member, the skin may be broken.

Signs.—The signs of fracture are obvious. Evidences of injury, preternatural mobility, crepitus, deformity, loss of motion, etc., are present.

Treatment.—In treating fractures of the tibia and fibula, it is important to keep in mind that both the ankle- and knee-joints should be rendered immovable. Furthermore, in setting the fracture, it is of the greatest importance that the physician sees that he does not have union with deformity. Eversion of the foot is the rule. The contraction of the tibial muscles will be greater than the peroneal,

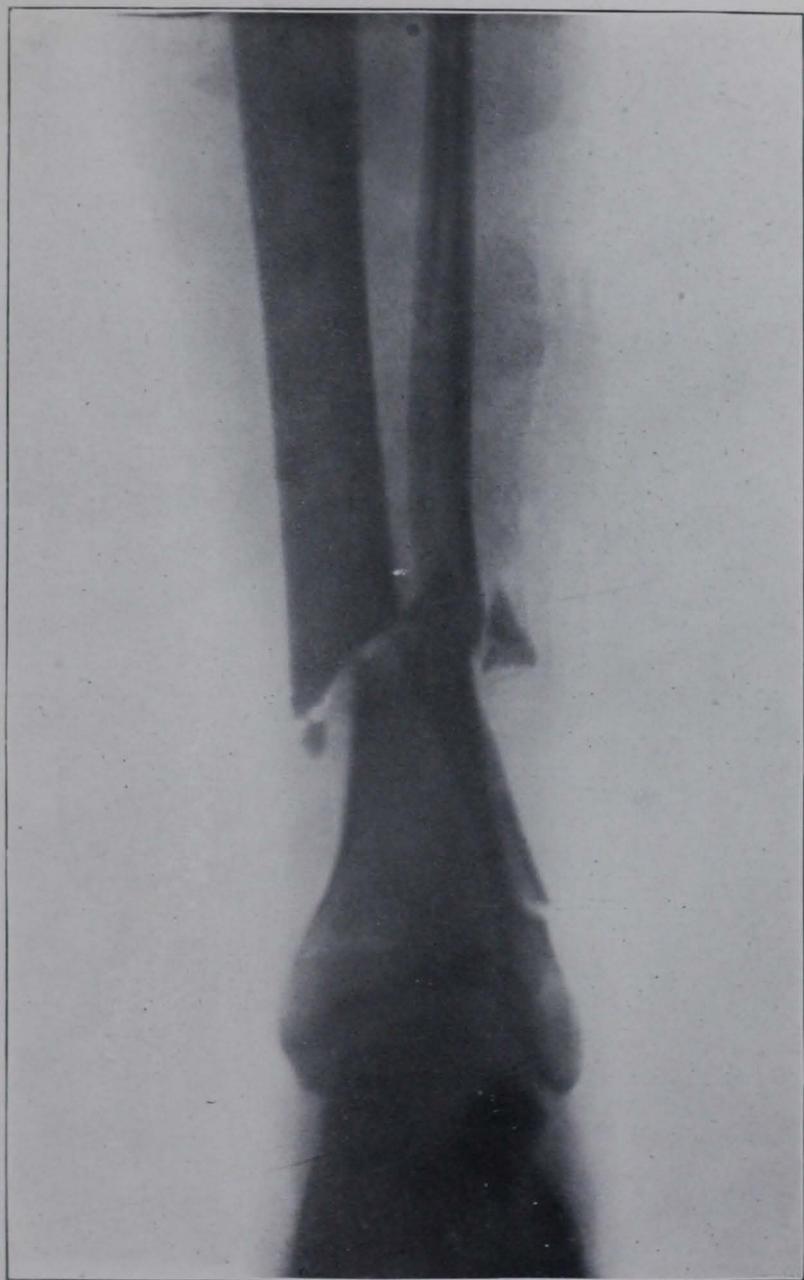
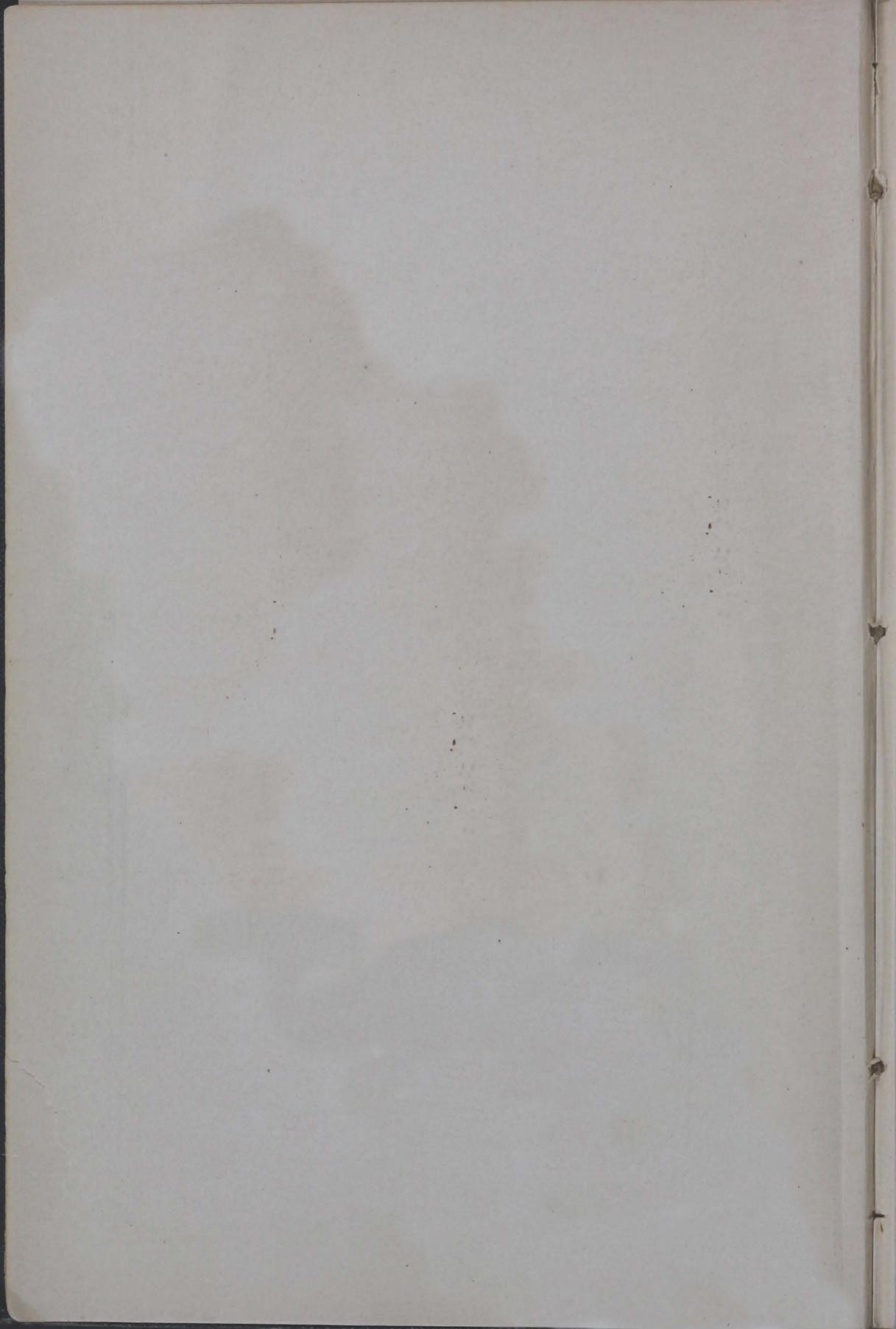


PLATE I.

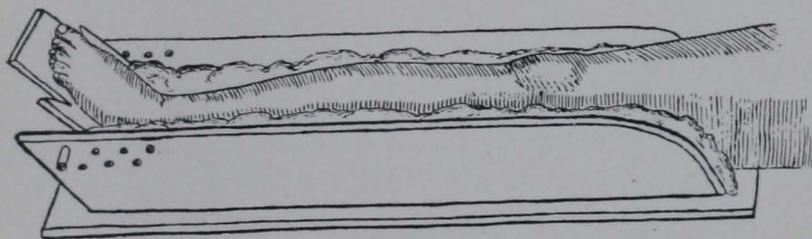
Radiograph by George M. Laughlin, D. O.

Radiograph of a compound fracture of both bones of the lower leg six weeks after the injury. Note that the bones are fragmented and that there is non-union. There is a multiple fracture of the fibula. The wound became infected and inflammatory tissue shows on the fibular side of the leg.



and a condition of varus, especially if the fracture is low down, may occur. This can be prevented by making extension and having the inner side of the great toe, the inner malleolus, and the inner border of the patella in the same plane. As long as these points are kept in the same plane and extension and counter-extension is maintained, a good result will follow. The best dressing, and the one easiest to apply, is the one advised by Dr. Still. The dressing used in hospitals, where there is not too much injury to the soft-parts, or where there is no comminution of the bones, is a plaster-of-Paris dressing. It is carried to just beyond the middle of the thigh, sufficiently high to render the knee immovable. Should the dressing become loose, it can be cut in front and a roller bandage applied over the plaster splint, so as to draw it tight to the leg. Extension is made on the lower fragments by weight and pulley, in the same manner as for fractures of the thigh. It is not necessary to keep this extension up if the bandage is properly applied.

FIG. 81.



Fracture box for fractures of either or both bones of the leg.

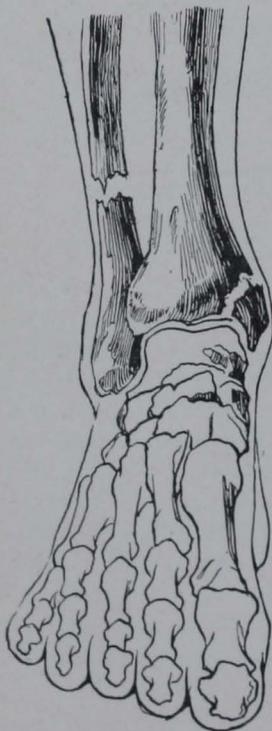
Fractures of the Tibia.—Fractures of the tibia may occur in any part of the bone, but fractures in the upper one-third are rare, except as the result of great direct violence, when the fracture may be multiple and comminuted. This is a very severe form of fracture, and may demand amputation. Where the vitality of the patient is good, and there is fairly good circulation, the limb may be put in a fracture-box for a few days and watched. Where the fracture is not compound, this procedure should always be followed. Amputation may be deferred until there is evidence of deficient circulation, or gangrene appears. Fracture of the middle or lower third of the shaft is caused by direct and indirect violence—blows directly upon the bone or falls upon the foot, either or both. Usually there is but little displacement, because the companion bone, the fibula, is uninjured. The diagnosis of the injury is easy, inasmuch as the bone is subcutaneous. As the finger is passed along the anterior border of the tibia, at the site of the fracture preternatural mobility and crepitus will be obtained, and there will be evidences of local injury. Fractures of the upper and lower third of the tibia may be treated similarly. It is necessary to carry the splint only to the tuberosity of the tibia. Where there seems to be a consid-

erable wrenching of the ligamentous attachments between the tibia and fibula at the time of the injury, and where it appears to the physician that there is mobility between the ends of the bones, it may be necessary to carry the splint or dressing up to the middle of the thigh. In all these fractures of the lower leg, the patient should be gotten up within two weeks after the fracture. A plaster dressing may be applied over the foot and up to the tuberosity of the tibia. In this fracture, Dr. Still's dressing is of the greatest service. It is easy to apply, and is light, and if applied with care, will maintain the bones in apposition, and will permit the patient to go about on crutches. The objection to the plaster-of-Paris dressing is, that it is weighty and cumbersome and in numerous ways troublesome.

Fractures of the Fibula.

Fractures of the fibula are more common than fractures of the tibia. The cause is direct violence, as blows directly upon the fibula, and indirect violence, such as wrenches of the foot.

FIG. 82.



Pott's fracture with the deformity reduced.

There is not much displacement of the bones in fractures of the fibula. The diagnosis is easy. The lower part of the bone is subcutaneous. There will not be much preternatural mobility, but the normal springiness between the tibia and fibula will be destroyed and there will be crepitus. The fracture most common in the fibula, and the one which merits the best description, is that which occurs in the lower one-fifth of the bone, or two or three inches above the malleolus. This fracture was first described by Percival Pott, and has since borne his name. It is usually caused by the patient slipping on the foot, as in stepping from a car or cab upon a cobble-

FIG. 83.



Pott's fracture, showing the characteristic deformity.

stone. The astragalus is driven against the lower extremity of the fibula, the force is transmitted up along the bone, the fracture occurring two or three inches above

the malleolus. The upper end of the lower fragment is directed in towards the tibia, while the astragalus is dislocated outward. The internal lateral ligament is ruptured, or the tip of the internal malleolus is broken off. The deformity in this fracture is characteristic. The inner side of the sole of the foot is directed downward, while the sole itself is directed downward and outward. The foot is displaced

FIG. 84.



Dupuytren's fracture, which closely simulates a Pott's fracture.

outward, and at the same time everted. The internal malleolus stretches the skin and is markedly prominent. There is a depression on the outer side of the leg above the external malleolus. This is by far the most common fracture. There are two or three similar fractures described, one of which is Dupuytren's. In this fracture, the fibula is broken, as before mentioned, the tip of the internal malleolus is broken off, while the tibio-fibular ligaments are likewise torn, i. e., there is a separation of the lower articulation of the tibia and fibula. In the third variety of fracture, the fibula is broken in the same situation, and the tibia is broken transversely just above the articulation. In these last two fractures, the deformity is very similar to that of a Pott's fracture, but the internal malleolus does not form such a sharp prominence on the inner side of the foot. Should the tip of the internal malleolus be broken off in Pott's fracture, the fragment of bone will be felt beneath the skin. Fracture of the internal malleolus does not occur in the majority of cases. In mild cases of Pott's fracture, with but little injury to the soft-parts, the patient may be able to walk some distance, or may not discover that he has a fracture, believing it is a sprain. There is a rare form of this fracture described by some authors, in which the foot is displaced inward, instead of outward. In this case, the upper end of the lower fragment projects outward against the skin, instead of inward. The diagnosis in Pott's fracture is fairly easy. Where the characteristic deformity is present, it is only necessary to determine the nature and amount of injury. If the surgeon grasps the ankle, the natural springiness of the fibula is absent. Crepitus will be obtained upon extension. Eversion or inversion of the foot will disclose preternatural mobility. In cases where the physician is in doubt, it should be treated as a fracture. This is equally true of all injuries to bones.

Treatment.—The treatment is to correct the deformity by traction and manipulate the foot in proper position. When the inner side of

the great toe, the inner malleolus, and the patella are in the same plane, a suitable fixed dressing may be applied. Dr. Still's dressing is preferable. An external splint, with a vertical foot-piece, or a plaster-of-Paris dressing may be used. In any case, the patient should be gotten up, so that he can get about on crutches, within two weeks after the injury. The foot may be manipulated and the integrity of the joint restored. It is necessary, in all cases, to maintain immobility of the fracture. If this is not done, eversion of the foot may take place and a condition of talipes valgus, or flat-foot, will result.

Fractures of the Tarsus.

Fracture of the tarsus is rare, except as a result of great direct violence. The diagnosis is usually easy. Preternatural mobility and crepitus are easily obtained. In cases where there is great swelling, the diagnosis cannot be readily made. The foot should be kept immovable and at rest, and antiphlogistic measures applied until the swelling is so reduced that a diagnosis may be readily made. An x-ray examination should be made when possible. The prognosis should be guarded in these fractures, inasmuch as death of one of the fragments may occur. Union is good. The fracture may result in the letting down of the arch of the foot. The person should not be allowed to walk until after good union has been obtained.

Fractures of the Metatarsus.

The metatarsal bones are fractured by direct violence, blows on top of the foot, or by weighty objects falling upon the foot. The diagnosis is easy. A stiff splint moulded to the sole of the foot and the member snugly bandaged to assist the return circulation, will be all that is necessary. The foot should be allowed rest for three or four weeks. In the meantime, the parts may be manipulated.

Fractures of the Phalanges.

Fractures of the phalanges are common, and the diagnosis is made without difficulty. The treatment is similar to treatment of the metatarsal bones.

DISEASES OF JOINTS.

Synovitis.

Synovitis is an inflammation of the synovial membrane of a joint. These inflammations may be divided into (1) acute, and (2) chronic.

Acute Synovitis is caused from injury, such as contusions, sprains, wrenches, exposure to wet and cold, and to the deposit of certain inflammatory products, or micro-organisms, about the synovial membrane. The abnormal relation of the articular surfaces of the joint, or partial dislocations and contractions of fascia and muscles interfering with the

return circulation, operate, as the most usual causes, in a large number of cases.

Pathology.—The synovial membrane becomes congested and red; following this there is an exudation of fluid into the synovial sac, which prevents the inflamed surfaces of the membrane coming in contact. This effusion may be very great, or may be only slight. There is always more or less inflammation about the joint, sometimes the congestion of the periarticular structures is considerable. Where the activity of the cause is not too great, and the case is properly treated, resolution may take place without any organic changes occurring in any of the joint structures. On the other hand, the inflammation may extend into the cartilages, the connective tissues about the joint, or into the bone. Suppuration and abscess may follow, and the cartilages and bones become eroded and destroyed, resulting in osteo-arthritis and bony ankylosis.

Symptoms.—The joint is swollen and painful; movements are impeded. Spasms of the muscles and a “fixed” condition of the ligaments serve to hold the joint in a position (generally a flexed one) of the greatest ease. In septic cases, congestion and inflammation are much greater and the case is attended by considerable fever, while in the milder cases, the fever may not rise to more than 100 degrees or 101 degrees F., or in very mild cases there may be no febrile reaction whatever. In the severer forms a chill may occur, together with a rise in temperature, sordes, loss of appetite, coated tongue, confined bowels—indications of the absorption of pus. If the joint is not covered with too many surrounding tissues the swelling is quite manifest. The outline of the distended synovial sac can be mapped out with ease. In the case of a *knee-joint* the greatest distension takes place on either side of the ligamentum patellae and just above the joint underneath the quadriceps extensor muscles. In some cases, this distension may be enormous. If pus forms within the joint, it burrows in the direction of least resistance, which may be along the sheath of some muscle, a distance away from the joint. In case of the *elbow*, the distension of the membrane takes place upward underneath the triceps. In the *ankle*, there is puffiness behind the malleoli and underneath the extensor tendons. Sometimes the fluid effusion is so small that it is difficult to detect it. In conditions of the hip and shoulder, it may be overlooked. In the *knee-joint*, the patella may even be lifted away from the condyles (riding of the patella). In other cases, it may be necessary for the person to bend at the hips in a standing position, with the legs extended, and the hands resting on the front of the thighs (Fisk’s method), when fluctuation may be felt on the inner side of the patella. The severer forms of septic synovitis will be indicated by the evidence of sepsis, the increased pain, and redness about the joint, together with the general systemic conditions already mentioned.

Treatment.—The treatment of acute synovitis is distinctly osteo-

pathic, until pus forms, when surgical interference may be necessary to evacuate the pus, and prevent erosion of the articular cartilages, and subsequent involvement of the ends of the bones. Destruction of the joint tissues to any extent means ankylosis, which will more than likely permanently interfere with the integrity of the joint. If the synovitis arises from a penetrating wound, by which infectious materials have been introduced, it is imperative to at once wash out the wound and joint with an antiseptic solution, as a saturated solution of boric acid, or 1:50 solution of carbolic acid in boiled water. Drainage must be provided and the wound washed and dressed twice daily until all danger of infection of the synovial membrane has passed. When the inflammation is set up by bruising the joint, and not by an open wound, cold should be applied during the first twenty-four hours, then manipulative measures, to secure normal circulation.

If the synovitis is the result of the deposit of germs in the joint, and of obstructions to the circulation, or from sublaxations or malposition of the bones, only manipulative measures will afford relief. Where the joint is a point of least resistance, lesions will be found directly affecting the blood supply, or spinal lesions affecting the nerves to the joint. The treatment consists of removing these lesions, releasing the nerves, and in stimulating the circulation. Slight passive motion must be kept up, to prevent ankylosis. Obstructions to the circulation, and local congestion, may be relieved by appropriate methods. When pus forms, which will be evidenced by chills and fever, loss of appetite, confined bowels, etc., a free incision should be made at the most convenient point and the pus evacuated. The joint may then be washed out daily with an antiseptic solution. Even though pus forms in the joint, and the synovial fluid drains out for weeks, there is no danger of ankylosis, unless the cartilages become eroded and destroyed. As the inflammation subsides, more vigorous manipulation of the joint should be made. Should any adhesions form, they may be readily broken up and the inflammatory tissues absorbed.

Chronic Synovitis, or subacute synovitis, frequently follows an attack of acute inflammation of the synovial membrane, or it may be subacute from the beginning. It is stated by excellent authors that many of these cases of chronic synovitis are tubercular inflammations. The opposite of this might be stated with perhaps equal truth, that many cases diagnosed as tubercular synovitis are nothing more than simple cases of subacute synovitis, the result of lesions, sublaxations, and contractions of fascia or muscles, which interfere with the circulation and bring about the inflammatory conditions. The habit of calling these prolonged cases of chronic synovitis which do not yield to the treatment administered, "tubercular," is nothing short of vicious. Without doubt, many cases are due to the deposit of the tubercle bacillus outside of the membrane, or within the membrane, and this low-grade inflammation results, but there are other causes more important than these bacilli, and those

causes might be summed up in the interference with the circulation to the joint and bad general health.

Pathology.—The synovial membrane may be congested, but the villus-like projections around the edges of the articular surfaces become hypertrophied and edematous. A considerable amount of fluid may exude into the joint. This may be so great as to give rise to a condition called "hydrops articuli." The nature of the fluid effused into the joint may be that of ordinary serum. The joint may remain in this condition for years without change, while on the other hand, absorption may take place and the disease disappear. The synovial membrane may become thickened and hypertrophied, and as it becomes distended, it may extend along sheaths of muscles in pouch-like dilations (Baker's cysts). The cartilages of the joints may become inflamed and thickened. Sometimes degenerations of the thickened portions of the synovial membrane may take place.

Symptoms.—Evidences of effusion in the joint, together with a history of acutesynovitis or lesions, indicating interference with the return circulation, or a history of injury, together with the presence of fluid in the joint. In some cases there may be false crepitus in the joint, occasioned by the formation of weak fibrous adhesions. On motion these are broken up. If the joint is aspirated, a viscid, straw-colored fluid will be obtained.

Treatment.—In the treatment of chronic, as in acute, synovitis, osteopathic methods have accomplished wonderful results. If these manipulative measures are persisted in, good results will be obtained, and amputation rendered unnecessary. It does not matter whether the case is tubercular or not, the same methods should be employed, while uniformly good results may be expected. Even in cases of long standing, where surgical authorities have advised amputation as the only means of relief, good results have been obtained in many cases. It is in this class of cases that osteopathic practitioners have achieved some of their most brilliant results.

The treatment consists in securing the proper blood supply, removing obstructions to the circulation, and reducing subluxations. Certain spinal lesions, affecting the nutrition to the joint, may be the cause of the disease. These should be removed at once. Resorption of the inflammatory thickenings and fibrous tissues about the joint may be secured by obtaining the proper circulation.

Acute Arthritis.

Arthritis is an inflammation of all the tissues of a joint. In synovitis, the inflammation is limited to the synovial membrane. In arthritis, the synovial membrane also may be involved, but the inflammation extends into the connective tissues about the joint. The origin of the disease may be within the synovial membrane, as synovitis, or it may

be within the bone, as osteitis, but at all events, the inflammation involves all of the articular structures.

Cause.—The causes are the same as in synovitis. In arthritis, there is usually a history of greater injury, often penetrating wounds, or a history of osteitis, periostitis, osteomyelitis, or abscess in the soft-parts which may have involved the joint, or there may have been the absorption of septic poisons from certain acute fevers, which have lodged in and about the joint, setting up a general inflammation.

Pathology.—The changes occurring in the joint vary according to the course of the disease, and according to its origin. It usually begins as an acute inflammation of the synovial membrane, which spreads into the surrounding tissues, the cartilages become eroded and softened, and may be entirely destroyed. The ligaments become infiltrated with inflammatory elements, softening may take place, with marked increase in the connective tissue elements. Because of the muscular spasm, and the weakened condition of the ligaments, luxation of the articular ends of the bones follows, while because of the interference in the circulation, and the partial arrest of the nutrition to the tissues about the joint, disorganization is followed by the formation of pus and further destruction of the articular structures. The pus will burrow in the direction of least resistance, finally rupturing, perhaps, some distance from the joint. It will continue discharging pus for a considerable length of time, afterward the abscess may heal and fibrous tissues form between the articular ends of the bones, producing true ankylosis. This ankylosis may, in some cases, be bony, leaving a permanently stiff joint. The cartilages are destroyed by the process of infiltration and degeneration. The ends of the bones may often be greatly eroded or destroyed by a process of caries. Sometimes, before the epiphysis has been united to the diaphysis, the entire epiphysis may be destroyed, because of interference to the circulation. There is a certain class of these cases in which the pus burrows in many directions into the muscles and along the bones, giving rise to a general septic condition. In such cases, the pus may even get into the medullary cavity, setting up an osteomyelitis. Such cases end unfavorably. In most cases, the pus will rupture in the neighborhood of the joint, afterward healing by third intention. After prolonged suppuration in the worst cases, lardaceous disease and affections of the viscera may occur.

Symptoms.—The symptoms may be those of an ordinary attack of synovitis, but as soon as the structures about the synovial membrane begin to be involved, the symptoms are more intense, greater swelling, edema about the joint, and a bluish-red color, will serve to distinguish it from synovitis. The temperature is higher, and the pulse more rapid. Where pus develops in the septic forms of the disease, there will be chills, followed by rigors, a quiet condition of the bowels, and a loss of appetite. The patient is often considerably debilitated.

The pain in the joint is usually very severe, and the reflex irritation of the muscles gives rise to painful startings. After rupture of the abscess, the condition heals slowly.

Treatment.—In general, the treatment is the same as in synovitis. The pus must be evacuated early and good drainage obtained. The patient must be given a nourishing diet, while the secretions should be made as nearly normal as possible. Where there is extensive destruction of bone, and the case continues a considerable length of time, resection of the joint and scraping away of all the necrosed bone may be necessary to save the limb. Even in bad cases, if good drainage is secured, manipulative methods will obtain good results. Obstructions to the return circulation must be removed, spinal lesions corrected, and the general health built up. The prognosis should always be guarded, although a fair result can usually be obtained.

Epiphysitis.

Epiphysitis is an inflammation of the epiphysis of the bone in young persons. It may be acute, subacute, or chronic, and arises from injury or lesions affecting the blood supply, or the abnormal relations of the bones. It may, or may not, involve a joint.

Cause.—The causes are the same as those of synovitis and arthritis. The changes taking place in the epiphysis are such as to terminate quickly in suppuration. Should the pus and inflammation extend into the joint, arthritis may result. Sometimes the epiphysis may be separated from the diaphysis of the bone, forming a sequestrum, when by a process of suppuration, ulceration, and a burrowing of the pus, the sequestrum may be dislodged, or even exfoliated by nature. In most cases, the injury and destruction of the epiphysis result in a shortened limb. There are cases in which the limb even grows longer, because of the formation of new tissues within the epiphysis. At all events, stiffness and fixidity of the joint are the rule. Sometimes a large abscess results.

Treatment.—The treatment is essentially the same as for arthritis and synovitis. The prognosis should be guarded. Should the case be seen before there is destruction of bone, relief may be given almost at once. The reduction of the subluxation and the relaxation of the contracted muscles, thus removing obstructions to the circulation, will prevent destructive changes.

Gonorrhœal Arthritis, or Gonorrhœal Rheumatism.

Not infrequently during the course of gonorrhœa, the patient may be attacked with inflammation of the joints. Cases have been reported where these inflammations attended gonorrhœal ophthalmia. These arthritic inflammations vary in intensity; some are very mild, while others are severe, furnishing a mental picture of the ordinary case of acute rheumatism. Not all the rheumatic attacks taking place during gonorrhœal arthritis are the result of this disease, but many are.

Cause.—The cause of the joint-inflammation seems to be the absorption of the products of inflammation. It may be, in some cases, the streptococci; in rare instances, the gonococci may be the exciting cause of the inflammation. It is really not a form of rheumatism, but a form of arthritis, due to the absorption of the inflammatory products from the ulcer found in the urethra, or upon the mucous membrane of the vagina. The inflammations are rather intractable, but yield to treatment. The inflammations usually end in resolution, but may end in ankylosis, fibrosis about the joint, and in suppuration. The disease occurs during the later stages of gonorrhœa, or after the discharge has disappeared. It is usually confined to one joint, most often the knee; the next most frequently affected are the tarsal-joints, which is often followed by flat-foot. It may affect the hands or wrists. The disease frequently recurs.

Symptoms.—The symptoms of the disease are those of acute and chronic arthritis and synovitis. The presence of chronic gonorrhœa, together with evidences of rheumatism, will determine the diagnosis.

Treatment.—In the treatment of gonorrhœal arthritis, the organs of elimination, especially the kidneys, must be kept active, and the circulation *through* the affected joint should be improved. Since the disease is produced by the absorption of toxic products from the gonorrhœal ulcer, it is plain that these elements would lodge and excite an inflammation at a weak point. Stimulation of the spinal origin of the nerves to the joint, together with local treatment about the joint, improving the circulation, and assisting resorption of the inflammatory elements, will be necessary. Any subluxation existing must be reduced, as these are regarded as responsible for the inflammation.

Tubercular Arthritis.

There is a large per cent of cases of chronic arthritis which are either tubercular, almost from the incipiency, or become tubercular some time within the history of the disease. The disease occurs more frequently in the spine than any other part of the body (See tuberculosis of the spine). In order of frequency, the following joints and bones are affected: Knee, hip, ankle, tarsus, elbow, wrist, hand, skull, face, sternum, clavicle, ribs, pelvis, femur, tibia, fibula, shoulder, scapula, ulna, radius, humerus, and patella. The disease is much more common in young people. It is claimed that the imperfect structure and the irregular contour of the vessels in the epiphyses of the bones entering into the formation of the joints involved, constitute an important factor in the development of tubercular disease. This is hardly true. The presence of spinal lesions, together with partial dislocations, muscular contractions, contractions of fascia, etc., all assist in bringing about a condition in which there is an abnormal blood supply and abnormal nerve influence to the joint or bone, and under these circumstances, the tubercle bacilli are deposited and the disease arises. The deposit of the

germ takes place more frequently in the epiphysis in children, but in adults the disease starts in the synovial membrane, or joint-capsule.

Changes Occurring In.—The pathological changes occurring in tuberculosis of joints are, in general, as follows:

1. The formation of granulation tissue. This is characteristic of all tubercular inflammations. Sometimes it is fungating in character. At other times there will be but few tubercles and but little granulation tissue, but the rule is that a considerable amount is formed.

2. Caseation and softening of the granulation tissue is sometimes termed gelatiniform degeneration. This takes place according to whether there is sufficient interference to the nutrition of certain areas of the affected tissues. In some cases, no caseation and softening follow, while in other cases the degenerative changes are extensive.

3. Joint-effusion. Effusion into the joint is the rule. Sometimes there is but little joint-effusion, while at other times it is extensive. There is a certain class of cases in which there is a considerable amount of granulation tissue, with no effusion and no tendency to caseate. In such cases there will be but few tubercles formed.

4. The contour of the joint is changed. The joint becomes spindle-shaped, and the tissues are more or less glued together, and the motions of the joint become limited. There may be considerable redness of the joint, or there may be none. The veins about are often considerably enlarged, due to the interference in the return circulation. Especially is this true where the granulation tissue involves the deep veins, in case of tuberculosis of the knee-joint.

5. Deformity is one of the most important changes occurring in joint-tuberculosis. This deformity arises, many times, before the deposit of the tubercle. Primary injury is an important factor in the cause of tubercular disease. This primary injury may be contusions of the ends of bones, or it may be a subluxation. The injury of the joint may produce spasm of the muscles, holding the bones in an abnormal position. This initial deformity is exaggerated in the later stages of the disease by muscular spasms, erosions of the bones, destruction of the cartilages, and relaxation of certain of the ligaments, and contraction of others, producing partial or complete dislocations. Furthermore, the position of the limb assumed by the patient in obtaining relief from pain, oftentimes results in deformity.

6. Abscess formation. In a certain proportion of cases, degeneration and softening occur, resulting in the formation of a fluid similar to pus. This fluid burrows along the sheaths of muscles, or fascia-planes, and finally reaches the surface and ruptures, forming a sinus. Occasionally infection will take place along back this sinus, which leads to pyogenic infection of the joint. Fever and other evidences of the septic process will be present. This acute suppuration is very often perilous to life, so it should be avoided under all circumstances.

7. Ankylosis. By the old method of treatment, ankylosis was the

rule, and in only a very few cases was the disease recognized sufficiently early, nor was the treatment sufficiently successful, to permit of a cure without limited motion. Osteopathic treatment has improved upon the older methods, from the fact that it not only secures an arrest of the tuberculous process, but likewise prevents ankylosis in a large number of cases. Sometimes ankylosis cannot be prevented. The disease may sometimes remain quiescent for several years, and again break out anew.

Treatment.—The treatment of tuberculosis of joints may be followed out on the same principles as of tuberculosis of any other structure. The deposit of the tubercle bacilli will not occur unless there is a diminished resistance of the tissues. This condition may be overcome by building up the system and increasing the nutrition of the tissues at the point of least resistance, or those affected. It is conceded that our only protection against the onslaughts of the tubercle bacilli is normal, healthy blood, and a free circulation. These may be best obtained by osteopathic methods.

The manipulation employed should be at the spinal origin of the nerves to the affected part or directly over the vessels carrying the blood to and from the diseased area, always working in the direction of the circulation; also local manipulation, to prevent stasis and to increase the local nutrition. Lesions directly, or reflexly, affecting the circulation, or nerve supply, must be removed as soon as possible. Motion must be kept up in the joint, to prevent ankylosis. There is no danger of disseminating the tubercle bacilli. Very vigorous manipulation will do mechanical injury. When abscesses occur, the necrosed tissues should be washed away by antiseptic solutions, and rigid cleanliness enforced. Antisepsis will not heal the sore—only good, fresh blood can accomplish it.

Tuberculosis of Special Joints.

Hip Disease.—This affection has a variety of names, such as *Morbus Coxarius*, *Morbus Coxae*, *Coxitis*, or Hip-joint disease.

Causes.—The causes of hip disease are (A) Contributory and (B) Exciting.

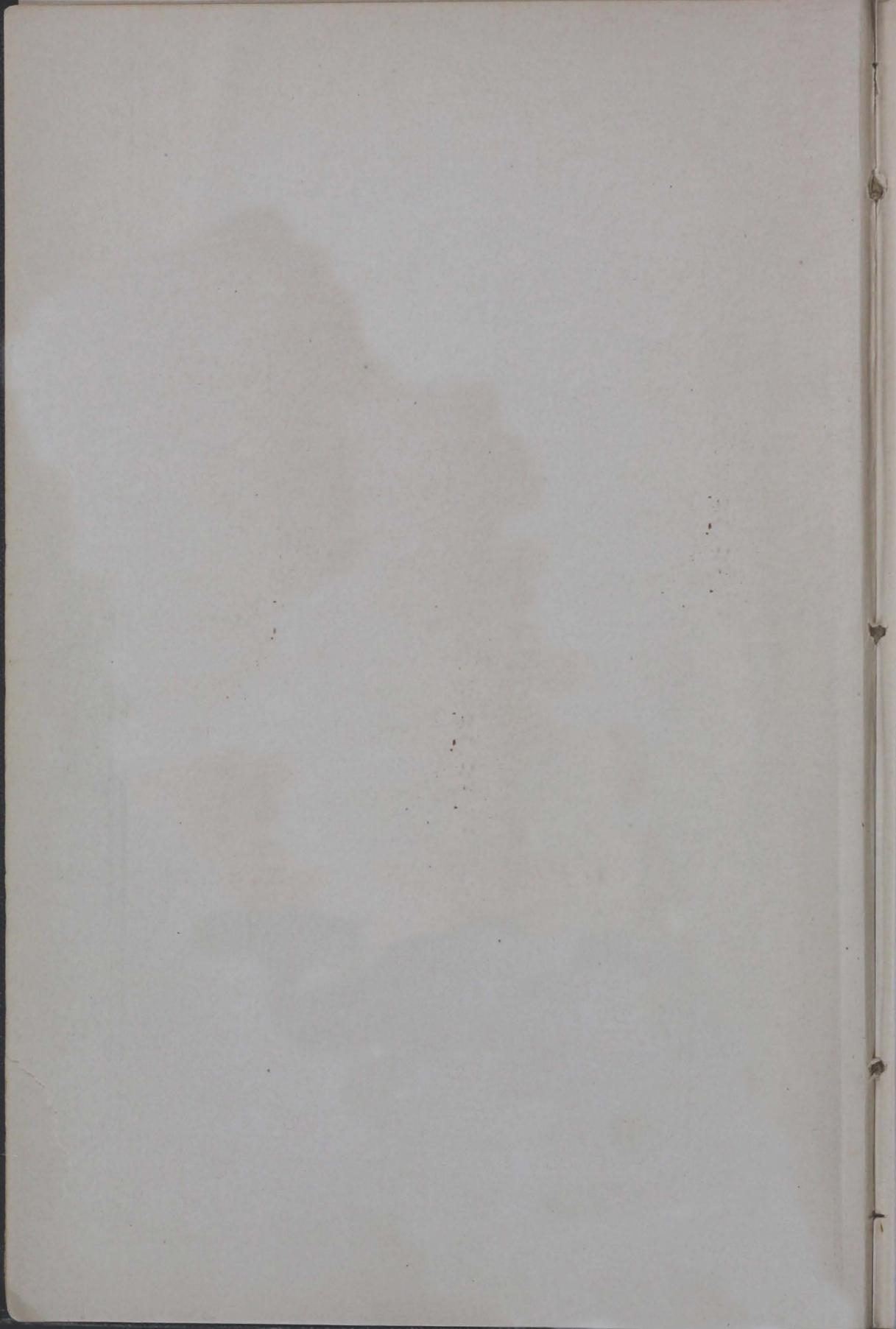
The contributory causes consist of luxations and subluxations of the hip, or conditions affecting the circulation and nerve supply to the joint and surrounding tissues. The nerve supply of the hip-joint comes from the anterior crural, obturator, great sciatic nerves, and filaments from the sacral plexus. These nerves may be pressed upon by luxations, curvatures in the lumbar spine, subluxations at the sacro-iliac joint, usually a twisted condition, or at the hip itself, or by contractions of the *psoas magnus*, *pyriformis*, and other muscles. The blood supply comes from the internal circumflex, sciatic, gluteal and obturator arteries. These arteries and their accompanying veins may be obstructed by contractions of the internal femoral, gluteal, obturator, *psoas*, and other muscles, also by certain bony lesions. By the operation



Radiograph of a condition of hip disease of the left hip (posterior view) in a girl aged five years. The disease is quiescent and the hip is ankylosed. Treatment will do no good.

PLATE II.

Radiograph by George M. Laughlin, D. O.



of these lesions, the joint becomes a weak point, when, because of a slight injury, or the deposit of the bacilli, degenerative changes are set up.

The exciting causes are injury and deposit of the tubercle bacilli.

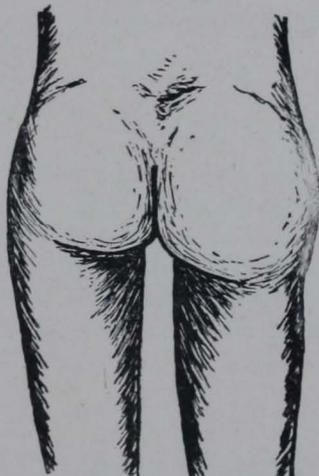
Occurrence.—The disease occurs more frequently in children. It is claimed that between sixty and sixty-five per cent of all cases occur in children under ten years of age, while eighty per cent. of the cases are found in individuals under twenty.

FIG. 85.



Early hip disease, showing obliquity of the pelvis.

FIG. 86.



Obliteration of the gluteal fold as occurs in hip disease.

Point of Origin.—In the largest number of cases, the disease arises from the deposit of the tubercle in the acetabulum. In a certain proportion of cases, it first begins in the head of the femur, while other times it may arise in the great trochanter. In cases developing in adults, the deposit of the tubercle will be in the synovial membrane, or in the connective tissues outside.

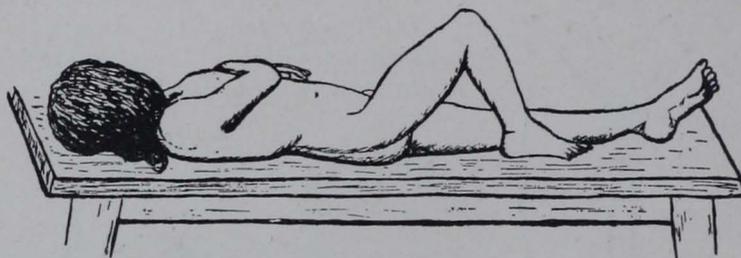
Symptoms.—The symptoms of hip-joint disease vary with the nature of the changes taking place in the joint. They may, perhaps, be best understood by classifying them in the following manner:

1. Sympathetic pain in the knee-joint, which is most likely due to the involvement, either directly or reflexly, of the obturator nerve. It may be due to pressure upon the obturator nerve, or to an irritation of the filaments within the hip-joint itself. The pain is usually localized on the inner side of the knee-joint. It may be on the front of the leg, or extend along down the inner side of the thigh, leg, and foot.

2. Faulty position of the limb. The abnormal position of the leg

early in the disease consists of flexion, external rotation, and abduction. The flexion may be slight and the abduction not great, depending upon the severity of the symptoms. The cause of this position seems to be the tension of the ilio-femoral, or Y-ligament. The fluid effusion in the joint apparently lifts the head of the bone out of the socket. This produces a greater tension upon the Y-ligament, causing the flexion.

FIG. 87.

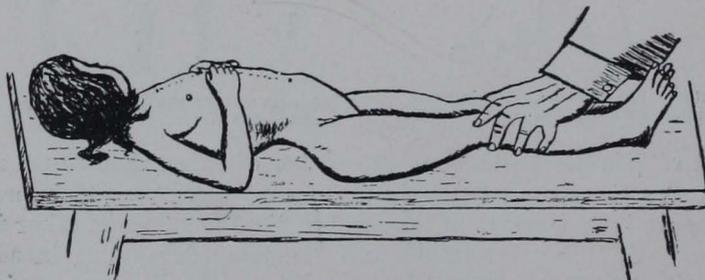


Flexion of the thigh produced by tension of the Y-ligament as happens in coxitis.

This flexion gives rise to one of the earliest symptoms, viz., inability of the patient to completely extend the limb, or should the limb be completely extended, it produces lordosis of the spine.

3. Later deformity. Later in the disease, because of the muscular spasm and contracted fascia, and because of the changes taking place in the head of the bone, or in the acetabulum, the limb becomes ad-

FIG. 88.



Lordosis of the spine, produced by extension of the legs, as occurs in hip disease.

ducted, rotated inward, and flexed. Should the epiphysis become separated from the shaft of the bone, it may resemble a fracture of the neck of the femur, while in other cases, the head of the femur is drawn against the upper rim of the acetabulum. Here it presses against the upper and back part of the capsule, which gives way, and the muscular contraction produces a dorsal dislocation. This is the most common and the characteristic position of old cases of hip-joint disease. From early in the disease, extending through its clinical course, there is a marked adductor spasm. Following fluid effusion in the joint, there may be extensive erosion of the bones, ligaments, and cartilages.

The fluid effusions may be so great that fluctuation can be made out. Where erosion of the bones and destruction of the cartilages, with formation of pus, follow, this pus will burrow through the muscles of the thigh, underneath the fascia lata, to the point where the tensor fascia femoris muscle is inserted, where it ruptures. In other cases, the pus may reach Scarpa's triangle, by passing through the cotyloid notch, or by passing through the bursa underneath the psoas muscle. In other cases, it may burrow upward underneath the glutei muscles.

4. Pain is produced in the hip-joint by pressure on the sole of the foot and great trochanter. While pain is present in hip-joint disease, it is markedly increased by pressure in these localities.

5. Marked atrophy of the muscles attends hip disease. There is flattening of the buttock, and the gluteal crease, or fold, is lessened, or absent, and is lower down on the affected side.

Early Signs.—The early symptoms of coxitis may be entirely overlooked. Usually there is evidence of malnutrition, the child has night terrors, and on arising in the morning, shows lameness, which wears off during the day. The child easily tires at play, and should he lie down to rest, the lameness is evident in the hip, which will, perhaps, wear off again shortly. Pain may, or may not, occur in the hip, upon tapping the sole of the foot, or upon pressure upon the trochanters. There is slight adductor spasm, and as the disease grows worse, the little patient complains of pain in the hip-joint and on the inside of the knee, while there may be more or less tilting of the pelvis to allow the foot to touch the ground in walking.

Diagnosis.—The diagnosis of early hip disease is very difficult. In making an examination, the pelvis should be placed in normal relation with the spine, the anterior superior spines of the ilia should be on the same level, when shortening of the limb can be detected. If the limb is flexed, with the ilia in normal position, and then extended, lordosis of the spine will be produced. There is usually limitation of motion in the joint in some direction.

This disease may be confounded with lumbar or psoas abscess from caries of the spine, sacro-iliac disease, congenital dislocations of the hip, lordosis from rickets, infantile paralysis, gluteal bursitis, or gluteal abscess. In psoas or lumbar abscess from caries of the spine, there will be evidence of disease of the vertebrae, whereas, the abscess appears below Poupart's ligament, external to the femoral vessels, at a point where hip abscess rarely, if ever, appears. In sacro-iliac disease, pressure upon the iliac crests will produce pain, whereas tapping of the sole of the foot will not produce pain. There will be no limitation of motion in the hip-joint. In congenital dislocations, a history of the case, and absence of inflammatory signs, together with an x-ray examination, will enable the physician to make a correct diagnosis. In rickets, there will be evidence of the rachitic rosary, and the involvement of other bones and joints than the hip. In infantile paralysis,

there are no inflammatory symptoms. There is progressive muscular atrophy, which takes place rather rapidly. In gluteal bursitis, the symptoms are continuous and unremitting. Exercise aggravates the pain, which is moderate. The location of the pain is behind the hip and behind the knee.

Treatment.—The treatment of hip disease consists in removing the lesions found. Twists in the pelvis and curvature of the spine call for attention at once. It is not necessary, in many cases, to manipulate the thigh at all. If the thigh is manipulated, it should be done gently, and not so as to do injury. Treatment to correct the position of the spine and the pelvic lesions will be followed by good results in from two to six months. In bad cases, treatment may be required longer—a year or more.

The methods employed in surgical practice are, fixation and extension for a long period (six months to a year). By this treatment, ankylosis is the rule. Ankylosis rarely, if ever, follows osteopathic treatment. In fact, the ankylosis already present is often cured by the treatment. When pus forms, it should be evacuated and the cavity well drained and cleansed. No local application of medicine is needed. If the strictly osteopathic methods are relied upon, good results will follow. Where luxations, or subluxations, of the hip result from the disease (which will nearly always occur in cases not treated), they should be reduced at once, and the limb kept in an easy normal position until the use is recovered and pain ceases.

Sacro-Iliac Disease.

Sacro-iliac disease is rare, and comes on after the age of fifteen. It may arise from the tubercle bacilli being deposited within the joint, or the adjacent bones, or through tuberculous pus burrowing into the joint from caries of the spine. It may be associated with extensive disease of the pelvic bones. The symptoms of the disease are obscure. It may be confounded with vertebral caries, sciatica, or coxitis. There is considerable limp on walking, subluxation of the ilium, and pain upon pressing the ilia together. The pain may be reflected down the leg, because of the close proximity of the obturator nerve. If iliac abscess results, there may be some fluctuation, otherwise there is none.

Diagnosis.—The tenderness and soreness over the iliac-joint, together with the absence of caries of the spine and hip-joint disease, and evidence of inflammatory exudates about the joint, will determine the diagnosis.

Treatment.—In sacro-iliac disease, there is a condition of curvature of the lumbar spine. This directly affects the nutrition to the joint. There is a subluxation at the sacro-iliac joint. Treatment should be directed to these conditions only. When abscess occurs, the pus should be evacuated, and the treatment directed toward improving the circulation and nutrition to the affected area.

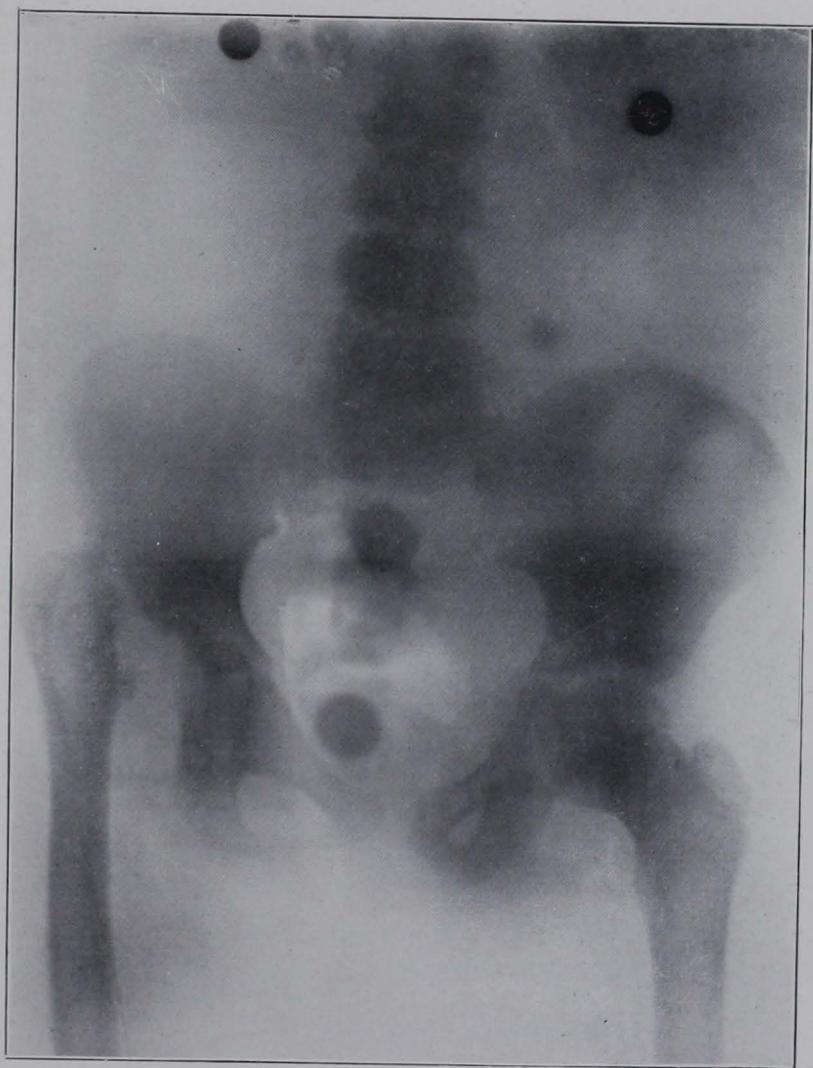
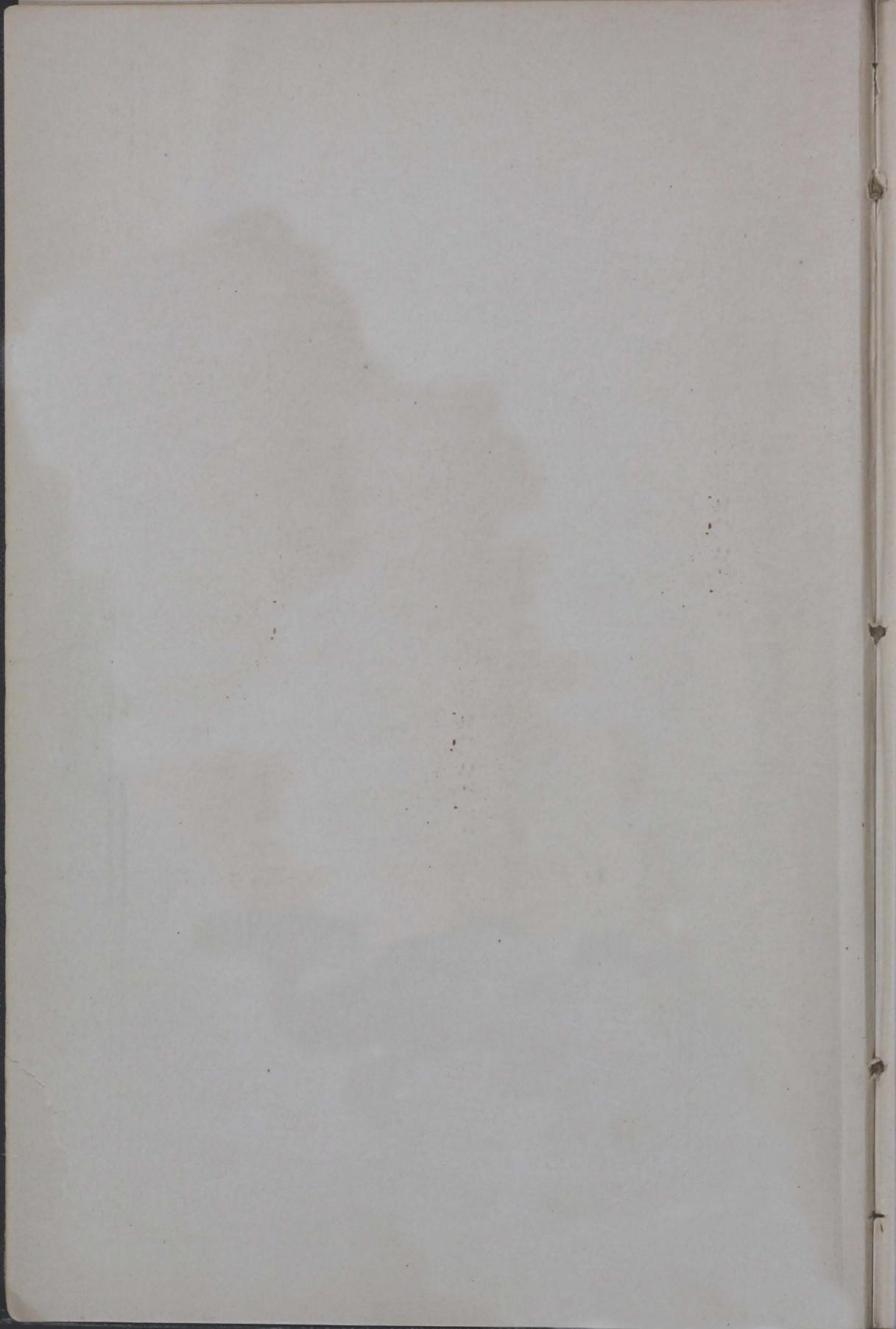


PLATE III.

Radiograph by George M. Laughlin, D. O.

Radiograph (posterior view) showing the condition of the hip in an old quiescent case of morbus coxarius in a boy aged ten years. There is entire destruction of the head and neck of the femur. There was no abscess formation. There is good motion and about two inches of shortening. Treatment is of no value.



Knee-joint.—(**White Swelling**).—The knee-joint is more frequently involved than any other of the joints, except in the spine. It is said that the disease begins, in case of the knee, in the femoral epiphysis most often, but may begin in the synovial sac, or joint-capsule. It is most common in young adults. It may follow an acute synovitis. In many cases there is but little swelling, while at other times there may be enormous swelling, with gelatiniform degeneration. There is great muscular spasm. The tissues become glued together and the tibia is dislocated backward. The disease may exist for years. Pain is rarely severe, and the lameness is usually the result of deformity. The sudden spasmodic muscular contraction is one of the peculiarities of the disease. In some cases, there may be rapid destruction of the joint, whereas, in others, it may become quiescent and thus continue for years.

Treatment.—The cause of the disease is a posterior condition of the ilium at the sacro-iliac joint. In many cases, there will be lumbar lesions. Muscular contractions, also, may directly affect the circulation. Subluxations of the hip may be responsible for the ailment. In a case, in a young lady, of one and one-half year's standing, after treatment with plaster cast and iodoform emulsion injections and various other methods, amputation was advised by eminent surgeons. An osteopath was consulted. He cut off the plaster cast, reduced the luxation at the hip, corrected the lumbar spine, encouraged the circulation to the inflamed joint, and obtained a complete cure within a month. The lady had been compelled to use crutches for nearly two years. It has been four years since the case was discharged cured. There has been no evidence of return of the trouble.

It is not necessary to manipulate the joint itself, but all attention should be directed to correcting the lesions, and securing a good blood supply. If seen early, or there is not too much destruction of bone, a cure may be expected in from one to six months. Ankylosis can usually be prevented. By medical or surgical treatment, ankylosis is the rule; in fact, what is looked for. Osteopathic treatment avoids ankylosis, secures good use of the affected joint, and cures the disease.

Ankle-joint.—The evidences of disease in the ankle-joint are simply the evidences of tuberculosis anywhere—more or less fluid effusion, pain in the joint, lameness and limitation of motion. Caseation and sinus may follow, with destruction of some of the bones of the tarsus. The disease is caused by luxations of one or more of the tarsal bones, coupled with injury and deposit of the germs. The treatment is directed to replacing the bones and securing the proper nerve and blood supply. If there is any abnormality at the hip, it should be corrected. Should abscess occur, the treatment must still be directed to assisting and encouraging the circulation. Uniformly good results will follow the treatment. Where the patient is in bad general health, and there is a condition of malnutrition, attention must be directed to any spinal lesions likely causing the mischief.

Elbow-joint.—The disease may arise in the humerus, ulna, or radius. The pain is never great, but is attended by great muscular wasting and limitation of motion. It is produced by subluxations at the elbow and shoulder and by lesions in the cervical spine. The treatment in general is that of synovitis. If a good circulation can be secured, the disease will subside and the inflammatory exudates will be absorbed. The prognosis is favorable.

Wrist-joint.—Tuberculosis of the wrist is rare, and may occur at any age. The joint presents signs of chronic inflammation, and it is fusiform in shape. All the motions of the wrist are impaired, as are also pronation and supination. The tubercular inflammation may begin in the joint-capsule or within the carpal bones. It is caused by luxations of the carpal bones and by lesions in the cervical and upper dorsal spine. The disease will extend over a considerable period. By judicious treatment, attention to the general health, and with the proper diet and hygienic surroundings, a good result may be obtained.

Shoulder-joint.—The disease usually begins at the head of the humerus. There is more or less destruction of the bone by process of dry caries (*caries sicca*). The disease is said to be more common in adults. In some cases, there may be no swelling, simply a shrinking and destruction of the joint, because of muscular spasm and caries. Pus formation is rare. The disease is occasioned by cervical lesions affecting the circumflex or suprascapular nerves. The blood supply may be affected by muscular contractions and subluxations of the humerus. The treatment is directed toward correcting these lesions.

Hysterical-joint.—Hysterical-joint, sometimes called Brodie's joint, is an affection occurring chiefly in young women. The knee- and hip-joints are the ones involved. There are always evidences of latent hysteria. The disease may be brought on by an injury, while sometimes it may arise almost from suggestion, without apparently any cause. It may follow cases of synovitis, or inflammation of the joints. The patient complains of pain, stiffness, and soreness. It is easy to discover that the patient resists efforts at motion. Muscular atrophy is not great, and is because of non-use. There is hyperesthesia of the skin, so that a slight touch causes more pain than deep pressure. The stiffness of the joint is produced by muscular rigidity. This muscular rigidity is apparently involuntarily produced, and the limb may be in any position of extension or flexion. The position of the thigh is changed at different times. The skin is usually cool, but may become hot at certain periods, when the pain is more excruciating. The pain is more in the nature of a neuralgia. The phenomena attending this disease are not all confined to the affected joint. There are other conditions which indicate that the subject is neurotic. There is evidence of neurasthenia, convulsions, globus hystericus, or other nervous disorders. On the whole, the general health of the patient is good. The hysterical joint simulates, correctly or incorrectly, a certain

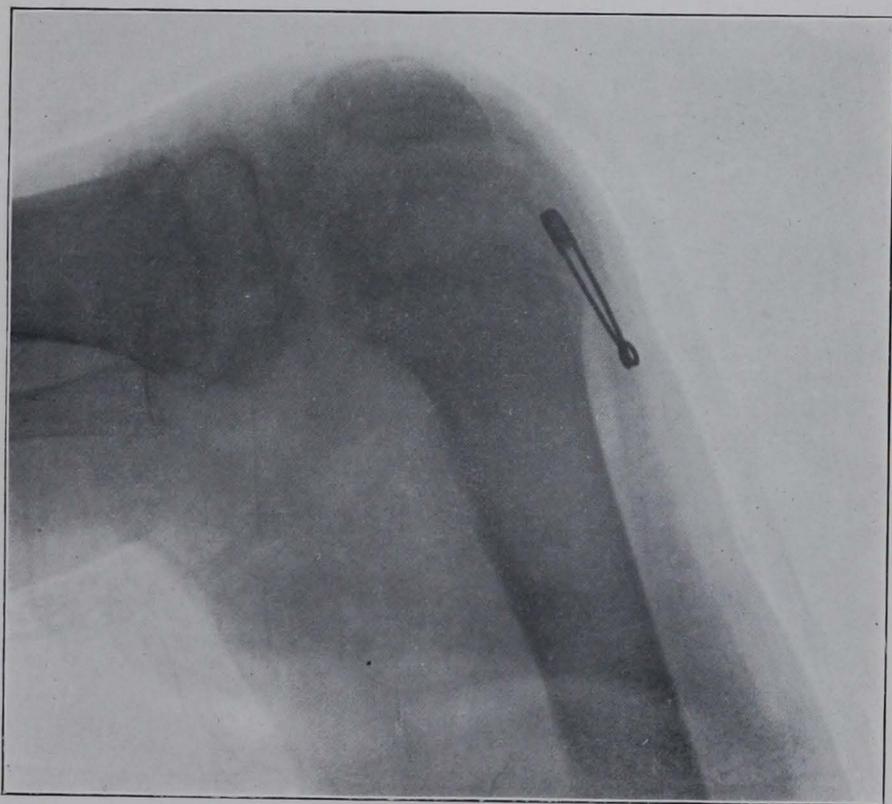
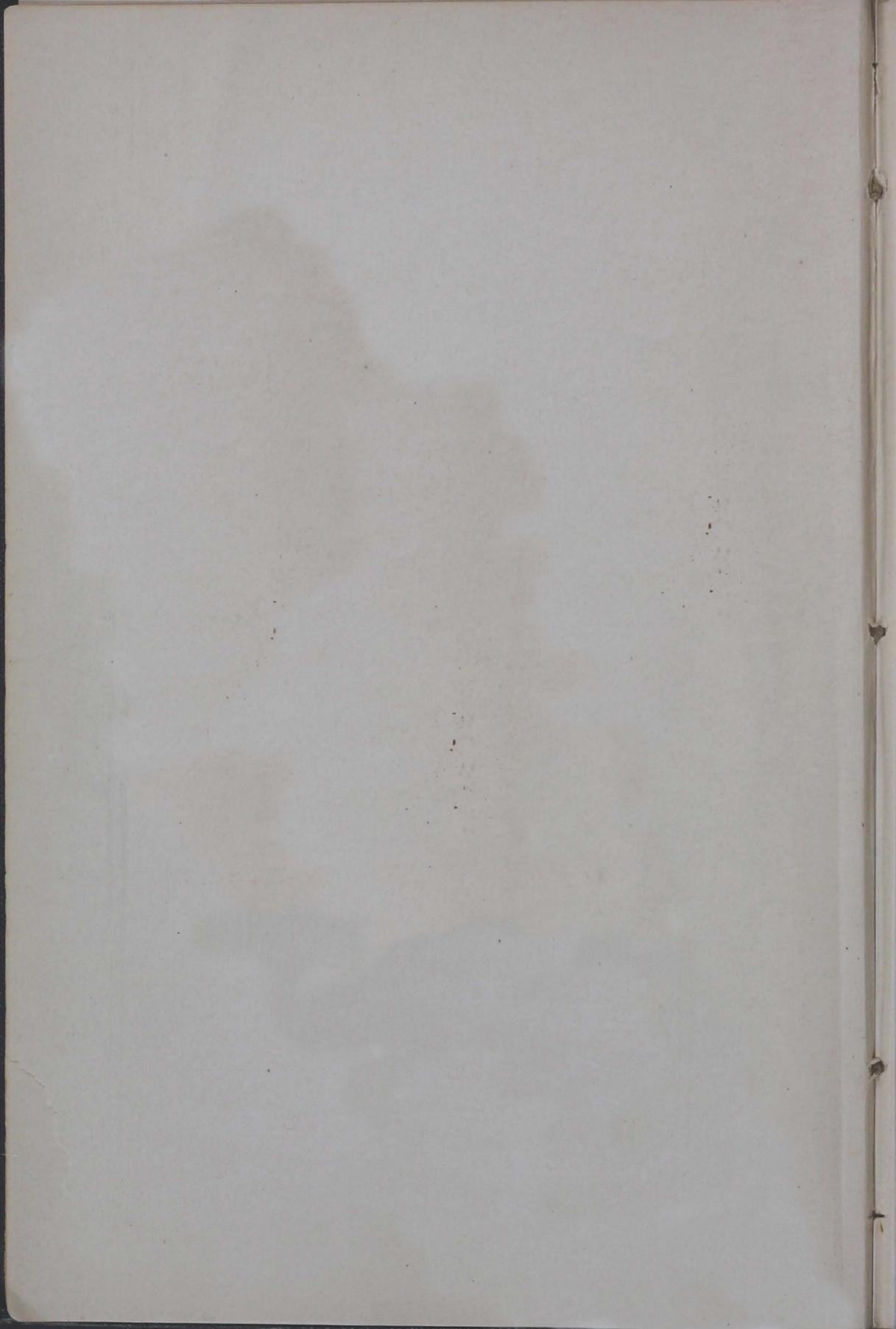


PLATE IV.

Radiograph by George M. Laughlin, D. O.

Radiograph showing white swelling of the knee joint. Infection followed vaccination. The case is of one year's standing in a boy fourteen years of age. Abscesses formed and the tibia, patella and the femur are affected. The prognosis is good.



affection, only as the patient understands the symptoms of the disease so simulated. The physician will likely observe that the symptoms disappear when the attention of the attendant is attracted elsewhere. This may not always be true.

Treatment.—The treatment consists in reducing whatever lesion may be found along the spine. Where partial dislocations are present, the reduction of these relieve the impinged nerves and will give instant relief, and the patient may be permanently cured. The application of local remedies and treatment will do no good.

Neuralgia of Joints.—The term "Neuralgia of a joint" applies to those conditions described in texts as "obscure pains within the joint." Pains do not arise *de novo*. The presence of neuralgia simply indicates that there is a nerve impinged somewhere. The location of this pressure upon the nerve can be accurately determined by proper physical examination. There is no excuse for labeling a case of subluxation which may give rise to a terrific pain, idiopathic neuralgia of the joint. Neuralgia of the joint is an impingement of the nerve of the joint without inflammatory reaction. Reduction of the subluxation relieves the condition.

Acute Rheumatic Arthritis, or Acute Rheumatism.

This is an acute febrile reaction, characterized by an inflammation and a fluid effusion in the joints, together with acid sweats and a general interference in the metabolism of the body. The disease begins with malaise and fever, when one or more joints may be affected. Where joints are simultaneously affected, they are apt to be symmetrical, or after the inflammation subsides in one joint, it is apt to reappear in another (metastasis). When the inflammation begins it is evidenced by a burning and pricking pain within the joint. The swelling is often considerable. The joint is hot, red, and stiff, and there may be considerable effusion. As soon as the fluid effusion is sufficient to separate the inflamed surfaces of the synovial membrane, the pain more or less disappears, when in several days inflammation subsides, and finally disappears. Suppuration rarely, if ever, takes place. The disease is attended by pronounced anemia, and the exhaustion is very great. The sweat is markedly acid, the urine scanty, highly colored, and highly acid. Diseases of the heart, such as endocarditis, pericarditis, or myocarditis, frequently result from the circulation of this changed condition of the blood, apparently brought about by the presence of the rheumatism. Occasionally cases are found in which there is a condition of hyperpyrexia.

Treatment.—The treatment consists in removing lesions affecting the kidneys and liver, or in stimulating the function of these organs, thus eliminating the poisons retained in the system. Other bony lesions directly affecting the joints inflamed must be removed. The contractions of the fascia, ligaments, and connective tissues about the joints, must

be relaxed. The lesions are not constant and should be searched for in any given case. The most essential point is to keep the eliminative organs active and the patient well nourished.

Chronic Rheumatic Arthritis.

Occasionally this disease is the result of an acute attack, but more often it arises from other conditions. Associated with this disease are exposure to cold and damp weather, poverty, and hardships. It seems that the tendon-sheaths and the joint-capsules are more or less congested and inflamed, and there may be effusions into the joint. Conditions simulating chronic rheumatism, such as painful joints, are frequently due to spinal lesions, subluxations, muscular contractions, partial dislocations of the hip, involvement of the peripheral nerves, etc. In pronounced cases of chronic rheumatism, affecting several joints, there is a general tendency to the formation of fibrous tissue. The joints become thickened and enlarged, and the muscles atrophy. The contraction of these inflammatory tissues which form about the joint, results in erosions of the articular ends of the bones and in great deformity. Sometimes this deformity may be frightful.

Symptoms.—The joints are enlarged, painful, and stiff. Changes of the weather, dampness, cold, etc., seem to aggravate the condition. Only one joint may be involved, but usually several are implicated. Effort at motion causes crackling in the joint and false crepitus. This may be within the joint itself, or along the tendon-sheaths, and is produced by the roughened condition of the tendons gliding in the sheaths or the roughened ends of the bones scraping over each other. Complete ankylosis may take place in the joints. There is great wasting of the muscles, with profound anemia. There is little tendency to pus formation, although suppuration and caseation sometimes form a disagreeable complication. There is little or no tendency towards recovery.

Treatment.—In this disease, bony lesions are the rule. The removal of these lesions will be attended by a cessation of the pain. Where fibrous tissues have formed extensively, and there is persistent contraction of muscles, not much can be done, especially if the case is of old standing. Nature does not have sufficient recuperative power. Resorption of the fibrous tissues will not take place, and degenerative changes are apt to occur in the tendons, muscles, and ligaments.

Gouty Arthritis, Rheumatic Gout.

This disease arises in the tarsal and metatarso-phalangeal articulations of the feet and hands. It is maintained that the disease is caused by the deposit of the urates of sodium in the periarticular structures. This chemical irritant excites the inflammation leading to the infiltration of the connective tissues about the joint by granulation tissue. This afterward is converted

into fibrous tissues, when contraction, with consequent deformity, arises. The mobility of the joint is lessened. Sometimes the deposit of the urates may be sufficiently large as to cause chalk-stones. Premonitory signs are not the rule, but in some cases they may be observed. The seizure is acute and occurs in the morning when the patient is asleep. He is aroused by excruciating pains in the metatarso-phalangeal articulations (usually the great toe), the joint becomes swollen, painful, and hot to the touch. There may be considerable fever. The intensity of the seizure usually abates within a short time, whereas a recurrence, often with renewed violence, happens the following morning. These attacks recur with varied intensity for several days (six to ten), when the disease subsides. Unless the person gets entirely rid of the cause of the disease, and the system is more or less regenerated, subsequent attacks will lead to a chronic condition, in which there may be great deformity and stiffness of the joint. In some cases, ulceration takes place, and these chalk-stone deposits may be exfoliated. The disease arises in people who eat highly concentrated and highly seasoned foods, and who have been addicted to the use of stimulants. It is attended by hypertrophy of the heart and increased arterial tension.

Treatment.—The treatment is directed toward removing lesions, causing a retention of these urates and to reducing subluxations of the affected joints. Lesions affecting the kidneys are responsible for most of the mischief. When these are removed, and the kidneys act normally, the irritating deposits are absorbed and eliminated. The subluxations of the bones forming the affected joints, as the phalanges and metatarsal, and tarsal, should be adjusted. The circulation to the affected part must be improved and the inflammatory products absorbed. Relief may be given almost at once by this means. The prognosis is favorable. The system must be renovated and the patient placed on a plain, wholesome diet, and stimulants must be avoided.

Osteo-Arthritis, Rheumatoid Arthritis, or Arthritis Deformans (Paget's Disease).

This is a progressive disease, which leads to great deformity, and, oftentimes, to complete impairment of the function of the joint. One of the marked peculiarities of the disease is that it is attended by a great deal of destruction of the cartilages, enlargement and alteration in the articular ends of the bones, and the formation of osteophytes in the fibrous tissue about the joint. Because of the formation of the fibrous tissue and the erosions of the ends of the bones, great shortening of certain bones, such as the phalanges and metacarpal bones of the thumb, may occur. The joints of the extremities are most frequently involved, although it may affect the spine or lower jaw.

Causes.—Exposure to cold, lesions affecting the central nervous system, or the roots of the spinal nerves, and a general depressed condition of the nervous system, are believed to be the causes of the disease.

Pathology.—Inflammatory changes take place in and about the joints, cartilages, ligaments, synovial membranes, etc., leading to fibrosis. The cartilages become eroded and cracked, and by friction on each other, gradually wear away. The pathological process is essentially that of fibrosis, together with a softening of the matrix of the cartilage and the absorption of its elements. It is claimed by some that the process is one of ulceration, but this is hardly true. The changes taking place in the synovial membrane are similar to those which occur in chronic synovitis. Some fluid effusion takes place in the joint. This comes from the congestion of the synovial membrane and the edematous condition of the villus-like processes and fringes of the synovial sac. Sometimes these processes become detached and form loose bodies within the joint. Occasionally cartilages entirely disappear, and because of the ends of the bones rubbing together, they become hard and polished (eburnated) and look like porcelain. This solid condition of the bone is likely due to the development of bony lesions within the Haversian canals and the cavities within the bone. In some cases, erosions take place before the development of such osseous tissues can take place, when the end of the bone presents a honey-combed appearance. Ossification may take place in the tendons and the connective tissues about the joint.

Symptoms.—The following symptoms will be sufficient to determine the disease early. First, a rapid action of the heart, together with vasomotor disturbances, resulting in an increased arterial tension. Second, trophic conditions, due to the affection of the central nervous system, together with a clamminess of the skin and a bronzing of certain areas. Pain is especially marked along the inside of the wrist and over the ball of the thumb. There is characteristic creaking of the joints as in rheumatism, and the pain is increased upon motion of the affected parts. Loose bodies are detected outside of the joints. The margins of the joints are not only thickened, but bulge out; the center of the bone is absorbed, while the margins of the articular surfaces become thickened, because of ossific deposit. Motion is limited and deformity is usually great.

Treatment.—The treatment is directed first to removing the spinal lesions affecting the nerve roots supplying the affected joint. Any lesions affecting the central nervous system must be removed. The treatment of the joint itself is directed toward encouraging the circulation and nutrition. Resorption of the fibrous tissue must be secured before a cure is obtained. The prognosis, especially in old cases, should be guarded.

Charcot's Disease, or Neuropathic Arthritis.

This disease is a peculiar affection of the joints attending the course of certain nervous diseases, especially locomotor ataxia. The exciting cause of the disease may be injury, but the chief cause seems to be cer-

tain lesions of the spine or certain diseases of the nervous system, which bring about the changes in the joint. The disease seems to be characterized by lightning-like pains, and with more or less effusion into the joint of light colored serum, which may diffuse into the surrounding bursae, causing marked enlargements and deformity. It is said, in some cases, that the distension of the joint may be so rapid as to cause dislocation. The joints most frequently affected are the hip, shoulder, and knee. In some cases, the fluid effusion is entirely absorbed, and the joint returns to its normal size, although, apparently, it is considerably weakened. Sometimes the attacks recur, and the patient becomes still more crippled. In certain cases, it may so weaken the ligaments and perivascular structures as to leave a condition of flail-joint. Osseous outgrowths are not unusual, and, in continued cases, this will lead to stiffness of the joint. Where the disease runs a chronic course, hypertrophy of the periarticular structures, and erosion of the ends of the bones, is the rule. Some cases resemble osteo-arthritis, but the rapidity of the onset, together with but one joint being affected, the general absence of pain, subsequent atrophy of the ends of the bones, and the presence of flail-joints, will serve to enable one to make the diagnosis.

Treatment.—The treatment is directed towards removing the spinal lesions affecting the cord and nerve roots supplying the joint. Unless further pathological change in the nervous system can be arrested, and a better nerve supply to the joint can be secured, the prognosis will be unfavorable. If seen early, the locomotor ataxia can be cured. In bad cases, it may be arrested. Usually this will serve to arrest further joint involvement.

Loose Bodies in Joints.

Loose bodies in joints consist of several varieties, which may be classified as follows:

1. Masses of articular cartilages, which have been broken off by violence, and which, by friction, have been worn off into rounded, smooth masses. There may be a nucleus of bone within the center.
2. "Melon seed-like" bodies, the result of fibrinous exudates.
3. Occasionally the villus-like fringes of the synovial membrane become detached, or worn off, and form loose bodies, which have been described by some as being fetal residue.
4. Certain portions of bone may become detached from the surrounding bone, and become covered with cartilage, and exist as foreign bodies. These foreign bodies are nourished by nutritious fluids, by which they are surrounded. The diagnosis of these loose bodies may occasionally be difficult. In the knee-joint, they must be differentiated from displaced semilunar cartilages. The fact that the joint locks in certain positions, would indicate a loose body.

Treatment.—If the foreign body is a serious obstacle to the mobility of the joint, it should be removed by a surgical operation.

Ankylosis.

Ankylosis is a condition of immobility, partial or complete, of a joint. It usually results from inflammation.

Varieties.—(1) false, (2) true, (3) fibrous, and (4) bony.

False Ankylosis is a term applied to that form of stiff joint or ankylosis which arises from changes without the capsule and among the ligaments, tendons, etc., around the joint. Cicatricial contraction in the skin, and formations of fibrous tissue between the tendons and their sheaths, as occur in palmar abscess, are examples of false ankylosis.

True Ankylosis is caused by changes within the joint-capsule, and is the result of inflammation or injury. It is the result of the formation of fibrous tissue, or because of osseous deposits, which bind together the articular ends of otherwise movable bones.

Fibrous Ankylosis (incomplete) may be either false or true, and is the result of thickening or contraction of the ligaments (as happens in rheumatic conditions), or of the formation of fibrous bands, or adhesions, between the ends of the bones (as occurs in synovitis), or in erosion of the cartilages, the result of inflammation, and the subsequent formation of fibrous bands between the cartilages. Some motion is possible in the majority of the cases, although the joints may be entirely fixed.

Bony Ankylosis (complete), sometimes called synostosis, is developed from the union of the whole, or part of the opposing surfaces of two bones, from which the cartilages have become eroded and destroyed. The union is at first fibrous, but afterwards ossification takes place.

Causes.—The causes of ankylosis are various, but may be enumerated as follows:

1. Injury involving the articular surfaces of a joint, the injury being sufficient to destroy the cartilages.
2. Rheumatic or gouty inflammations, which result in the progressive formation of fibrous tissue about the joints.
3. Erosions of the articular surfaces, the result of acute or chronic suppurative conditions.
4. Certain nervous disorders, such as spina bifida, locomotor ataxia, peripheral neuritis, Raynaud's disease, or operations on nerves.
5. Subluxations. The abnormal relations of the bones operate as a source of irritation. Subsequent formation of fibrous tissues may occasion more or less fibrous ankylosis.

Diagnosis.—It is of the utmost importance to determine whether the case is one of true, or bony, ankylosis. The history of the case will determine whether the ankylosis is the result of extensive injury, such as fracture in the joint, or if it is the result of suppuration within the joint. In such cases, the ankylosis will be bony. It is of importance to determine whether there was much abnormality of position or relation of the bones at the time ankylosis occurred. The more abnormal

the position, the greater will be the irritation, and the worse the ankylosis. Dislocations, complicating fractures, will often lead to extensive callus formation and the ankylosis will most likely be complete.

Treatment.—When the inflammatory reaction has not been severe, or within the joint, the prognosis is favorable, even though there is no motion whatever in the joint. All cases, except bony ankylosis, may be benefited. If not *entirely* cured, very great improvement may be obtained.

The treatment consists of persistent manipulative efforts to break up the old adhesions, and secure resorption of the connective tissue elements forming the adhesions and thickening the joint structures. Vigorous efforts once or twice a week, kept up for a period of from one month to two years, should cure all cases. Bony ankylosis is incurable. A surgical operation will do no good. Anesthesia is not necessary to break up the adhesions in false ankylosis, unless it is done at one treatment. It is better to break up the adhesions gradually, as less pain results, and there is no danger to the joint. The patient should be instructed to use the joint as much as possible, consistent with comfort and good health.

DISLOCATIONS.

A dislocation is a partial or complete separation of the articular surfaces of two bones which normally should be in apposition. In fact, any displacement, however slight, whether or not accompanied by injury to the ligaments or other articular structures, constitutes a dislocation. Without doubt, in many cases, such abnormality of relation exists. This abnormality of relation comes under the head of partial dislocations.

Varieties.—Dislocations are divided with reference to degree into partial and complete.

1. **Partial or Incomplete dislocation** is a condition in which the articular surfaces of two bones, which should normally be in relation, are partly separated, but not sufficiently, as a rule, to rupture the ligaments. This variety of dislocation is more common than any other. They are caused by slight external violence and muscular action. The effects of the dislocation are often overlooked, inasmuch as they may be slight at first. Where the bones continue in abnormal relation, structural and functional changes are set up. Dr. A. T. Still discovered the relation between these subluxations and disease. He proved beyond question that subluxations will affect nerve and blood supply directly, or reflexly through the vasomotors. The nutrition of some structure is interfered with, when inflammation, degeneration, atrophy, tumefaction, etc., result. A reduction of these subluxations is attended by a cessation of the diseased symptoms and a return to health. This has formed the foundation of the science of osteopathy. These subluxations are more common in the spine than in any other part of the body. Subluxation of a vertebra may be anterior, posterior,

lateral, or it may consist of a twisting of the bone on the axis of its body. Any of these lesions will cause pressure on the spinal nerve roots, or interfere with the blood supply to the cord itself. This constitutes the most important causative agent in the production of disease. Similar luxations of other bones, as the ribs, bones of the pelvis, thigh, leg, ankle, foot, clavicle, humerus, forearm, wrist and hand, may occur. In any case, disease production will depend upon whether a nerve, artery, or vein is compressed, or if there is an obstruction to the flow of the fluids in the tissues, thereby partially, or completely, arresting the nutrition. Therefore, certain lesions will be found uniformly associated with certain diseases. They constitute the underlying cause, rendering bacterial action, fermentative, and other destructive processes possible.

2. **Complete dislocation** is one in which the articular surfaces of two bones are entirely separated from each other.

3. **Simple dislocation** is one in which there is no wound leading to the surface.

4. **Compound dislocation** is one in which there is a wound leading into the joint, in addition to the articular surfaces of the bones being separated.

5. **Complicated dislocation** is one which is attended by fracture or laceration of the soft-parts, rupture of an artery, great injury to a nerve, etc.

6. **Recent dislocation** is one which is not sufficiently old to permit of the formation of fibrous adhesions which bind the ends of the bones down in an abnormal position.

7. **Old dislocation** is one which has been standing for some months. The inflammatory signs have disappeared, and fibrous adhesions have formed about the head of the bone, binding it down in an abnormal position.

8. **Habitual dislocation** is one occurring in a joint in which the conditions are such as to predispose to a dislocation, as a rent in the capsule not having healed, and the joint cavity being shallow, dislocation takes place readily.

9. **Congenital dislocation** is one which happens because of a lack of development of the joint cavity, or the articular end of the bone, or because luxations have occurred in utero.

10. **Spontaneous dislocation**, or pathological dislocation, is one resulting from slight injury or disease of the joint.

11. **Traumatic dislocation** is one which is caused by injury.

Congenital Dislocations.

Congenital dislocations should not be confounded with those occurring at delivery, as they are not properly congenital.

The *causes* of congenital dislocations are:—

1. Malformation of the joint.

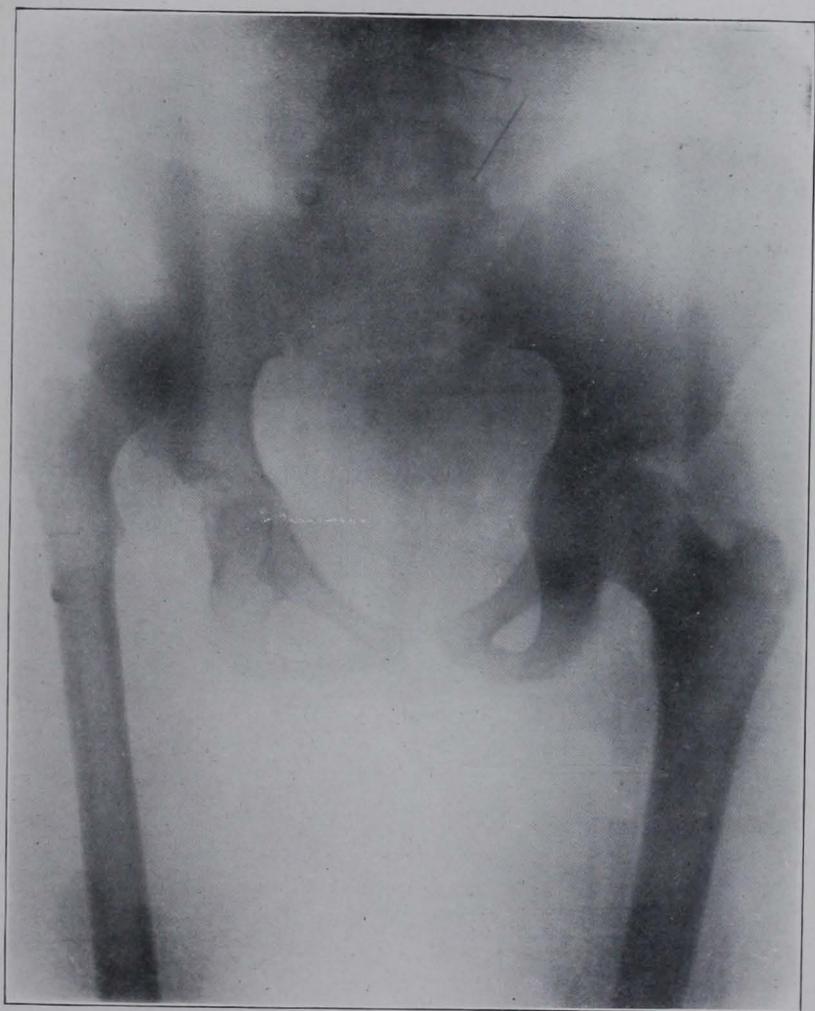


PLATE V.

Radiograph by George M. Laughlin, D. O.

Radiograph (posterior view) of a congenital dislocation of the left hip in a girl aged ten years. Note the malformation of the acetabulum and the smallness of the femur. To effect reduction a radical operation is required. The prognosis is doubtful. Several months' treatment established good motion.



2. Violence in Utero. These dislocations nearly always take place at the hip, but may occur in the shoulder. The causes are obscure. Without doubt, they sometimes follow injury. Because of the fact that sometimes the head of the bone is too large for the cavity, i. e., the head of the bone develops and the cavity does not, or that the cavity is poorly developed, or the head of the bone malformed, leads to the belief that it is one of the results of lesions of the nervous system. Quite likely lesions of the spine bring about this condition, these lesions having been produced by certain positions or injuries in utero.

Condition of the Joint.—The most universally present condition is that the head of the bone is malformed, or, if the head is of proper size and shape, the joint cavity is too small. There is marked atrophy of the muscles, and if the child has attained some age, a new cavity has formed where the head of the bone rests, which, in case of the hip, is on the dorsum of the ilium. The patient has a waddling gait, and if only one hip is involved, there is marked shortening, and when both are affected, there is marked lordosis of the spine. In a grown person, a new capsule has been formed, a new articular surface, and the head of the bone is rounded off so as to fit the abnormal conditions.

Treatment.—The treatment of congenital dislocation varies according to the age of the patient and the conditions present. Usually the case can be successfully treated before the age of ten years, but after that, not much can be done. In some cases, even afterward, the condition of the limb may be greatly improved by treatment, but the dislocation can not, as a rule, be reduced. The methods of reduction are the same as used in recent dislocations. Where shortening of the muscles has occurred, they will require stretching, and perhaps rupturing, to permit of reduction. Some months of energetic treatment may be required to prepare the muscles and other structures for the operation of reduction. The hip should be manipulated twice a week until such time as it is believed reduction may be made. In some cases, the dislocation may be reduced by the ordinary methods and a good result obtained. In these cases, there is a good socket, and the head of the femur is nearly normal. Where there is a malformed saucer-shaped socket, even if reduction can be made, the dislocation will recur. It is necessary to hold the femur in place by a stiff dressing, such as a plaster cast. In many of these older cases, it will be necessary to rupture the adductors before reduction can be made. As little injury to the soft parts should be done as is compatible with reduction. In general, a modification of the Lorenz method is best. An essential feature of the treatment is to secure a good blood and nerve supply to the joint, so that development of the muscles, ligaments, and joint structures, may be encouraged.

Lorenz's Method.—Lorenz devised what he has styled a bloodless method of reducing congenital dislocations of the hip, in contradistinction to the open method of division of the muscles, tendons, ligaments, etc., with the knife, and subsequently replacing the bone. It is

far from a bloodless method, and is condemned by many surgeons as brutal and in many cases harmful. The limb is forcibly abducted and the shortened adductors are torn asunder. All ligaments, or other structures, are torn or stretched by forcibly dragging down the limb. In some cases, a block is used as a fulcrum above and the thigh forcibly abducted, thus compelling the head of the bone to enter the cotyloid cavity. The limb is then fixed in extreme abduction by a plaster cast. After several months a new cast is applied and the limb put in about 50 degrees of abduction and 45 degrees of flexion. The patient is then encouraged to walk. After several months more, this cast is taken off and the limb straightened. The treatment, when modified and supplemented by osteopathic methods, is less harmful and more successful.

Pathological or Spontaneous Dislocations

Are those which occur with slight force, insufficient in the average case to bring about dislocation. The conditions which render these dislocations possible are:—1. A weak condition of the ligaments and a relaxed capsule. 2. Nature of the joint, which may not be thoroughly developed. 3. Chronic synovitis. 4. Tubercular disease. 5. Rheumatoid arthritis. 6. Typhoid fever. 7. Charcot's joint. 8. Locomotor ataxia. 9. Any irregularity in the cavity or head of the bone.

Dislocations, especially in typhoid fever, may take place (usually on the dorsum of the ilium) without the attending physician knowing anything about it, unless examination especially for this condition be made. A careful examination should occasionally be made during the course of this disease, to determine if a dislocation has occurred. A reduction is usually easy, if attempted early. Later, a reduction may be extremely difficult. Fluid effusions in the joint may lift the head of the bone out, or so relax the capsule that dislocations follow. Tubercular disease brings about fluid effusion in the joint, and by thickening of the ends of the bones, muscular contractions in certain positions will draw the head of the bone from its articular surface. In most cases of tubercular disease, dislocation, either partial or complete, is the rule. In rheumatoid arthritis, because of the formation of fibrous adhesions and a consequent contraction, dislocations occur.

Traumatic Dislocations

Are those following injury. The causes are, predisposing, and exciting.

The *predisposing causes* are: (1) Age. (2) Sex. (3) Muscular development. (4) Occupation. (5) Kind of joint. (6) Location of the joint. (7) Diseases of bone, joint, and ligaments. (8) Weakness of ligaments, etc.

Dislocations are most common in middle life, and more common in men than women, because of their occupations. Persons of great mus-



PLATE VI.

Radiograph by George M. Laughlin, D. O.

Radiograph showing a congenital dislocation of the left hip (posterior view) in a boy aged five years. The head and neck of the femur, also the acetabulum, are malformed. Forcible reduction and fixation in a plaster cast are the only means of relief.

cular development are more liable to dislocations, because of the vigorous muscular action. People of certain occupations are more liable to dislocation than those of others, it being necessary for them to take greater risks. Dislocations are more common in ball-and-socket joints than in hinge-joints. Diseases, because they affect the integrity of the ligaments, the amount of fluid within the joint, and sometimes the contour of the articular ends, predispose to dislocations. Some joints, because of their exposed position, are more liable to luxation. In atonic conditions, and in certain spinal lesions, the integrity of the ligaments may be affected to that extent that dislocation may occur. The ligaments require a nerve supply as well as do muscles, skin, arteries, and other structures, and any interference in the nerve or blood supply of these ligaments will necessarily interfere with their integrity. Weakness of the ligaments is a predisposing cause to traumatic dislocations, but more especially to partial dislocations.

The *exciting causes* are external violence and muscular contraction. External violence may be direct, or indirect. All of the causes may operate at the same time to produce dislocation. Deformity is the result of muscular contraction, tension upon the ligaments, and extension of the dislocating force.

State of the Parts in Dislocation.—Usually there is more or less laceration of the ligaments and of the capsule of the joint. There may be no laceration of the capsule, or the opening may be small, or large. When the opening in the capsule is small, it may operate as an impediment to reduction. When there is no laceration of the capsule, reduction is easy. It is only in conditions of lax capsule that will permit of complete dislocation without laceration of the capsule. There may be extensive injury to the soft-parts, such as rupture of muscles, tendons, nerves, or of large vessels. This injury sometimes operates as a complication, and may be of such severity as to demand operative interference.

Later Changes.—Should the dislocation not be reduced soon after its occurrence, inflammation will arise because of the irritation. This inflammation results in the formation of fibrous tissue. This fibrous tissue will be in the nature of adhesions about the ends of the bones. The inflammation may be sufficient to fill the socket which the bone normally occupied. The joint cavity will not be obliterated unless the inflammation is suppurative, when there may be erosion and destruction of the cartilages. Sometimes this inflammation and the pressure of the surrounding tissues cause the formation of a compact capsule, which will hold the bone in abnormal position. In very old cases, a new socket may be formed, while the old socket may still be good, but be filled with fibrous tissue, which of itself will operate as an obstacle to reduction. The muscles about the joint will atrophy because of non-use, and will be bound down because of the inflammation and the formation of the adhesions. Because of the

spasms which result from irritation, the muscles become permanently contracted and shortened. The ligaments undergo changes and become shortened, and in some cases weakened, and in other cases thickened. It may be that a fairly good joint will be formed in the new situation of the head of the bone. In old standing cases where a fairly good new joint is formed, and the history of the case indicates that there has been severe inflammation which would likely obliterate the joint structures, or at least interfere with their integrity, it may be advisable to not attempt reduction. In the treatment of all these old standing dislocations, even if the dislocation is not reduced, treatment will always be followed by benefit.

Signs.—The signs of dislocation may be classified as follows: (1) Pain of a nauseating or sickening nature. (2) Alteration in the general outline of the joint. (3) Rigidity of the muscles about the joint, which is increased on effort of the surgeon to manipulate the limb. (4) Change in relation of the bony prominences about the joint, as in dislocations of the humerus, the greater tuberosity is not found a little below and external to the acromion, as occurs normally. (5) Alteration in the length of the limb. In some cases there may be shortening, in other cases, lengthening of the limb. (6) Alteration in the axis of the limb. (7) The head of the bone may be felt in an abnormal position. (8) The head of the bone can not be felt in its normal cavity. (9) Loss of function, which is more or less complete. Where the diagnosis is impossible, or the signs are obscure, an x-ray examination should be made to determine, if possible, the nature of the injury.

Methods of Examination.—To determine whether or not a dislocation exists, or to definitely make out the pathological condition in the joint, an accurate knowledge of the anatomy of the part and the relation of the structures is necessary. The relation of the bony prominences and of the tendons, muscles, etc., must be observed. The examination should be complete and methodical. All available signs should be taken into consideration, and an effort should be made to determine the relation of each structure in turn. An accurate history of the injury should be obtained. The nature of the deformity should be considered, and whether or not it has recurred. A dislocation may be mistaken for a sprain, for effusions in the joint, or for fracture. Where the condition can not be made out, and there is too much swelling, antiphlogistic measures may be used to get rid of the inflammation and swelling, so an accurate diagnosis can be made. Where the parts are painful, it is better to administer an anesthetic and make a complete and careful examination. If a dislocation exists, it should be reduced at once. When it is possible, an x-ray examination should be made, which may lead to a diagnosis. Furthermore, when luxations occur, if they are reduced, usually they will not recur. Deformity from other injuries may recur.

Treatment.—(1) The luxation should be reduced. (2) The bones



PLATE VII.
Radiograph (posterior view) of a congenital dislocation of both hips in a girl aged nine years. Note that the coty-
loid cavities are malformed. Treatment was slightly beneficial.

Radiograph by George M. Laughlin, D. O.



should be maintained in a normal position until the capsule of the joint heals and the ligaments return to their normal condition.

Methods of Reduction.—A. Manipulation.—In general, this consists of:—

- | | |
|---------------|-------------------|
| 1. Adduction. | 4. Extension. |
| 2. Abduction. | 5. Rotation. |
| 3. Flexion. | 6. Circumduction. |

Or any combination of these movements which have for their purpose:

- (a) To relax tense muscles, tendons, ligaments, etc.
- (b) To disengage any bony prominence or the head of the bone.
- (c) To direct the luxated bone so that it will return to its articulation over the same route by which it got out. That this manipulation may be properly executed, it is very necessary that the anatomical relation of the structures be understood; furthermore, what muscles or ligaments are put on a stretch, or what structures operate against reduction. The reasons why manipulative methods are more successful in the hands of some operators than others, is because they more thoroughly understand the condition of the parts. This method is by all means best, because it is attended by little or no injury. That it will be successful in all cases, if attempted within a reasonable length of time, is proven by osteopathic methods and results.

B. Extension and Counter-extension. Extension and counter-extension should be used only as a *dernier* resort. This contemplates forcibly dragging the bone into the normal position, regardless of the way in which it got out. Great harm has been caused by this method of reducing dislocations, and as we better understand the anatomy of the joints, and the morbid conditions of dislocations, the more we will use manipulative methods. The old method of reducing a dislocation of the humerus under the coracoid process was to put the unbooted foot in the axilla and make traction on the arm, forcibly dragging the bone into the socket. Now we have better methods, although this method may be used with great advantage sometimes. Ofttimes extension and counter-extension can be used with great advantage with manipulation. It is of service many times in breaking up adhesions in old standing dislocations. Extension and counter-extension is made by the hands or by a clove-hitch, by weight and pulley, or by hooks. The hooks are fastened into one of the fragments, in case of fracture, and by this means traction can be made.

After Treatment.—The limb should be kept quiet until the opening in the capsule has had an opportunity to heal. A suitable bandage should be applied and the parts allowed rest.

Compound Dislocations.

Compound dislocations are those in which not only the bone is dislocated from its normal cavity, but there is a penetrating wound into the joint. The treatment depends largely upon the state of the

parts. Operative interference may be necessary. It may require amputation or excision, depending largely upon the amount of destruction of the bone. Should there be extensive destruction of the bone, and a stiff joint would render the limb useless, amputation may be advised. The wound should be treated as an ordinary wound, by the strictest asepsis, and provision for drainage. Manipulation should be begun early and kept up regularly in order to prevent fibrous adhesion. Sometimes fairly good results can be obtained in children after extensive injury to a joint, especially if manipulation is begun early and kept up. As a rule, in elderly people, true ankylosis of a permanent nature will develop if there is extensive injury.

Old Dislocations.

When a dislocation has existed for from four to eight weeks, fibrous adhesions form around the ends of the bones, the opening in the joint capsule closes, while other periarticular structures, such as tendons, arteries, veins, nerves, etc., become bound down in abnormal positions. By old methods, the reduction of these dislocations was often attended by frightful injury, as evulsion of the limb, or fracture. An open cutting method was advised, whereby all impediments to reduction were cut and the bone put back in its proper position. This operation is also unsuccessful. Hence the question, "How long after the dislocation happens may reduction be safely attempted," was a most important one. Here, as in many other instances, the results obtained by osteopathic methods are such as to revolutionize the science of surgery. Dr. Still has reduced dislocations of the hip of seventeen years' standing. Because of his great skill in reducing old dislocations of years' standing, when the most eminent practitioners of other schools had failed, he has earned a wide and enviable reputation. The methods are simple, but require a thorough knowledge of the anatomy of the joint and periarticular structures. The adhesions should be gradually broken up and the ligaments and muscles stretched to permit of reduction without injury. In some cases it may require some time to thoroughly prepare the joint. In other cases, reduction may be effected at once. In general, the manipulative methods are similar to those used in recent dislocations. It will be necessary in many cases to promote a healthy circulation and nerve supply to the joint to secure resorption of the inflammatory tissues before reduction may be safely attempted. No definite time may be set down as to when dislocations become irreducible. It all depends upon the condition of the tissues about the joint and the joint itself. Where too extensive injury has taken place, and the tissues will not yield readily to treatment, the prognosis is unfavorable.

Injuries Attending Reduction.—Sometimes, because of the vigorous methods used, injury to the articular or periarticular structures will occur. These may be classed as:—

1. Fracture. This is sometimes the result of using the bones as levers, or where too great force is used.

2. Extensive injury of the soft-parts, i. e., injury to nerve, vein, artery, muscle, or tendon.

3. An adhesive or suppurative inflammation may be excited, which may bring about ankylosis.

4. Rupture of the skin and soft-parts, producing a compound condition, will render sepsis possible.

5. Evulsion of the limb. Cases have occurred where such great force has been used in traction that a limb has been torn from the body. There is no need of any of the above injuries being produced. Dislocations may be reduced without such barbarous methods.

FIG. 89.



Dislocation of the lower jaw forward.

Special Dislocations.

Lower Jaw.—The lower jaw may be dislocated forward or backward (very rare). The forward dislocations may be unilateral or bilateral. They occur more frequently in women in middle life, and seem to be brought on by vigorous efforts at yawning, laughing, and vomiting. The condyle is drawn from its normal position, chiefly by the external pterygoid muscle. The condyle is usually luxated into the zygomatic fossa, while the temporal, masseter, and internal pterygoid muscles hold the bone fixed in the abnormal position.

Signs.—There is a hollow behind the luxated condyle. The mouth is permanently wide open, and the saliva dribbles away. The person attempts to talk, or to explain the condition, and is unable to because of inability to close the mouth. In the unilateral dislocation, there is a hollow on but one side of the head and the teeth are out of line.

Unilateral dislocations are rare. Backward dislocation is questionable, and the symptoms are not worth considering.

Treatment.—The reduction of dislocation of the jaw is best accomplished by wrapping the thumbs with a handkerchief, so as to protect them, and inserting them in the mouth, one on either side. Strong pressure is made downward upon the molar teeth, while at the same time the operator should lift up on the symphysis by means of the fingers. In this manner, the condyles are moved back into the glenoid fossa. Should this fail, a cork may be placed between the molar teeth. This acts as a fulcrum when pressure is made upward on the symphysis, and as the bone is lifted from its position, it may be carried backward into the articulation. As a rule, unless the thumbs are wrapped, because of the contraction of the muscles when the reduction is accomplished, the operator may have his thumbs wounded.

Subluxation of the Lower Jaw.

Subluxation or partial dislocation of the lower jaw may refer to one of two conditions. There may be a partial dislocation of the condyle from the interarticular fibro-cartilage, or there may be a subluxation of the fibro-cartilage from the eminentia articularis. In either case, it may interfere markedly in chewing, so that the person may, on effort to close the mouth, find motions of the jaw suddenly arrested. In several months, perhaps, this will disappear of itself, or there may be permanent difficulty in closing the mouth. The luxation can readily be relieved by the proper manipulation.

Dislocation of the Clavicle.

The clavicle may be dislocated both at its sternal and acromial extremity.

Sternal Extremity.—Dislocations of the sternal extremity are: 1. Forward. 2. Upward. 3. Backward.

Forward dislocations are produced by falls and blows upon the shoulder. Usually the blows are directed backward and the falls forward, so that the shoulder is driven backward. The sternal extremity is tilted forward and is driven on the front of the sternum.

Signs.—The symptoms are plain. The clavicle makes a marked prominence on the front of the sternum. Its relation with the sternum is impaired. The head of the bone lies over towards the middle line of the body. The distance to the acromion process is less than on the sound side. The sterno-mastoid and other muscles of the neck are put violently upon a stretch. The method of reduction is to place the knee in the interscapular space over the spine, and to make traction outward and backward on the two shoulders. In this manner, the head of the bone is drawn into its normal position. Should this not be successful, while an assistant makes traction outward and backward on the

shoulders, the operator may manipulate the bone and push it into place. This injury is best treated by means of a posterior figure-of-8 bandage. While the bone is held in position, a gutta-percha splint may be moulded to the surface of the body. This, when lightly padded with lint, may be bandaged into position. This, in addition to the figure-of-8 bandage, will be sufficient to maintain the bone in its normal position. A Velpeau's bandage may also be used. Where there is complete rupture of the ligaments, it is difficult to maintain the bone in position, so that more or less deformity will result. The original dressing to hold the bone in position should be kept on for a period of three or four weeks. After that, a dressing which will draw the shoulders backward will assist in keeping the bone in position.

Upward dislocation of the clavicle is very rare. The cause is a fall upon the shoulder, which drives the acromial end downward and inward, tilting the clavicle upward and inward. The diagnosis is easily made. The shoulder falls down and in, and the clavicle makes a marked prominence in the suprasternal notch. It may be possible that the head of the clavicle presses so much upon the trachea that dyspnea will result. The dislocation is easily reduced. Extension can be made upon the arm outward from the body, and the counter-extending force may be made by a sheet passed around the body beneath the arm. As the bone is dragged into position, it may be held in situ by means of a Velpeau's bandage. A firm pad, or gutta-percha splint, is placed over the sterno-clavicular joint. In some cases it may be advisable to wire the bone in position. Usually, if the case is seen sufficiently early, a good result may be obtained by the application of proper dressings.

Backward dislocation of the clavicle is rare. The causes are severe direct violence. The symptoms are pronounced and urgent. There is marked pain, interference in breathing, and dysphagia. The shoulder has fallen downward and inward, while there is a depression over the point where the head of the clavicle should normally be felt. Occasionally there may be obliteration of the pulse in the arm, because of pressure on the subclavian artery, or there may be great venous congestion of the head, because of pressure upon the external jugular, and to some extent, upon the internal jugular. The dislocation may be reduced by means of traction outward and backward upon the shoulders, with pressure by the knee between the scapulae. In some cases this method of reduction is said to have failed. Still more vigorous traction may be made upward and backward upon the affected side. In other rare instances it is said that an operation may be necessary to remove the end of the clavicle. After reduction, the head of the bone may be held in position by a posterior figure-of-8 bandage.

Acromial Extremity.—Dislocations of the acromial end of the clavicle may be upward or downward. If upward, the clavicle may lie on top of the acromion, and if downward, it may lie beneath it. These dislocations are produced by blows forcing the scapula forward, or by blows on top of the clavicle, forcing it downward.

Signs.—The signs in case of dislocation of the clavicle *upward* are a prominence of the clavicle on top of the acromion; more or less impaired function of the arm, as inability to raise the arm. The head is usually inclined to the affected side, and there is more or less contraction of the trapezius muscle with an outlining of its clavicular border. The arm is apparently lengthened. This dislocation upward is reduced by pulling the scapula backward, which can be done by traction on the arm and by pressing downward upon the clavicle. By former methods considerable deformity often resulted from this dislocation. A strip of adhesive plaster, carried around underneath the elbow and over the top of the clavicle, may be sufficient to hold the bone in proper position. Rhoads's dressing consists of a strap passing underneath the elbow and over the top of the clavicle, with a second strap extending around the chest underneath the axilla, and which is fastened to the perpendicular strap, thus preventing it from slipping off. This may be buckled sufficiently tight to hold the clavicle in position. In reducing a dislocation *downward*, the clavicle is raised, while the scapula is pushed outward and backward. Not much difficulty will be experienced in effecting reduction. The same kind of dressing is used as in dislocation upward.

Dislocation of both ends of the clavicle may occur in rare instances simultaneously. The treatment would be a combination of the methods used in reducing dislocations of the outer and inner extremity.

Dislocation of the Scapula.

A condition which was formerly called a dislocation of the scapula, as when the lower angle was believed to slip out from underneath the latissimus dorsi muscle, is now considered to be a condition of paralysis of the posterior thoracic nerve. Attending this condition will be found a vertebral lesion, which if reduced, will result in restoring the integrity of the serratus magnus muscle and the apparently luxated condition of the scapula will disappear. There are some cases where the latissimus dorsi muscle takes a portion of its attachment from the scapula, and because of injury, this attachment may be torn loose. In this condition, no vertebral lesion will be found.

Dislocations of the Shoulder-joint.

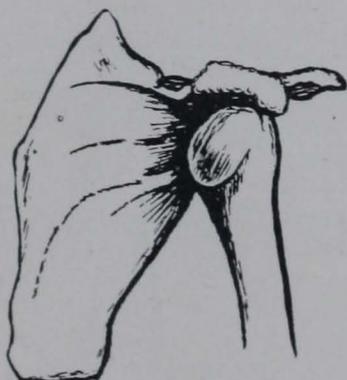
Dislocations of the Humerus, both partial and complete, are common, because of the exposed condition of the joint, shallowness of the glenoid cavity, and, in some cases, because of a relaxed or weakened condition of the ligaments. These dislocations are most frequently found in muscular adults.

Cause.—Falls on the extended arm or elbow, or directly upon the shoulder. It may result from twists of the arm, or from muscular action.

Varieties.—1. Subcoracoid. 2. Subglenoid. 3. Subclavicular. 4. Subspinous.

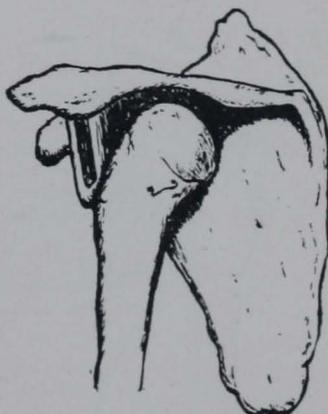
Symptoms.—In addition to the general symptoms of dislocation, there are certain signs in connection with dislocations of the shoulder, which are of great importance, and merit careful consideration. (1) Perhaps the most prominent symptom is prominence of the acromion process, together with (2) flattening of the shoulder. This will contrast sharply, when compared with the sound side and the normal rotundity of the shoulder. Sometimes this flattening of the shoulder will even be exaggerated into a depression beneath the acromion process. It is increased by raising the arm. (3) Change in the axis of the bone. (4) Alteration in the length of the limb when compared with the sound side. (5) Absence of the greater tuberosity from a little below and

FIG. 90.



Subcoracoid dislocation of the humerus.

FIG. 91.



Subspinous dislocation of the humerus.

external to the acromion process. In all cases, unless the condition is obvious, the examination should be taken up methodically.

Tests.—The following tests will be of use in determining the nature of the condition in question:

1. The circumference of the luxated shoulder is at least two inches greater than on the sound side. This is determined by passing a tape-line underneath the axilla and over the top of the acromion.

2. Straight edge test (Hamilton's). A straight edge, which touches the external condyle and the acromion process, proves that there is a dislocation. Normally, it will not touch these two points, because of the presence of the greater tuberosity a little below and external to the acromion.

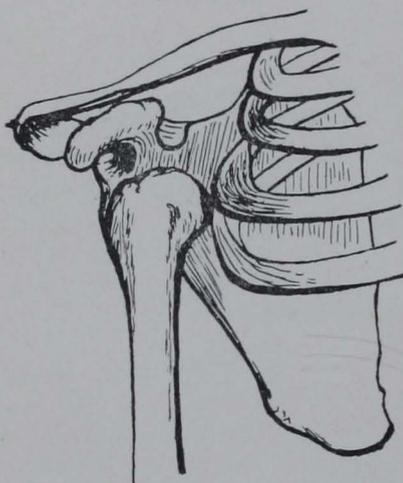
3. Change in the axis of the bone. With the hand on the opposite shoulder, the elbow can not be brought in relation with the chest.

4. In a thin subject, the greater tuberosity may be felt a little below and external to the acromion process.

In doubtful cases, the shoulder should be exposed to the x-rays.

Subcoracoid Dislocation is more frequent than all other dislocations of the shoulder. In this injury the head of the bone is displaced forward, downward, and inward under the coracoid process. The head of the bone rests on the anterior surface of the neck of the scapula, just beneath the coracoid process, while the groove just back of the head of the humerus rests on the anterior margin of the glenoid cavity. The capsular ligament is torn at its lower and inner portion. It may be detached from the glenoid cavity. The subscapularis muscle is often raised up, or partially torn loose, from the anterior surface of the scapula, while the muscles which are attached to the greater tuberosity (supraspinatus, infraspinatus, and teres minor) are put tightly

FIG. 92.



Subglenoid dislocation of the humerus.

FIG. 93.



Subclavicular dislocation of the humerus.

on a stretch. The subscapularis may be torn at its insertion, as may also happen with the muscles attached to the greater tuberosity. In rare instances, it is said that the greater tuberosity may be detached. This dislocation is described by the old writers as intracoracoid, inasmuch as the head of the bone rolls underneath the coracoid process. In this dislocation, the signs are distinctive; the head of the bone may be seen making a marked prominence on the front of the chest; the elbow projects outward and backward; there is shortening of the humerus, depending upon how far the head of the bone is displaced inward. All the other signs of dislocation of the humerus are present.

Subglenoid Dislocation.—Next to the subcoracoid, the subglenoid dislocation is the most common. In this dislocation, the head of the bone rests upon the anterior border of the scapula, below the glenoid cavity. The capsular ligament

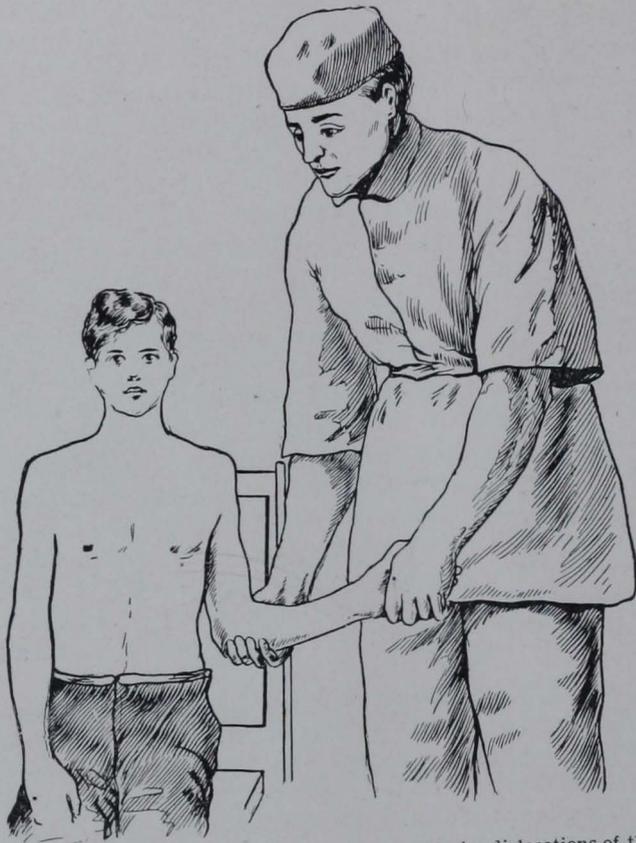
is ruptured in its lower portion, while the muscles attached to the greater tuberosity are put violently on a stretch. The deltoid muscle may be paralyzed, because of pressure or injury to the circumflex nerve. The symptoms of this dislocation are distinctive. In general, all the evidences of dislocation of the shoulder are present. There is lengthening of the arm, i. e., the distance between the external condyle and the acromion process is greater than on the sound side, and, in addition, there is a marked depression beneath the acromion process. The head of the bone can be felt in the axilla. In a moderately thin subject, a marked space of two inches can be felt between the head of the bone and the acromion. The elbow is carried away from the side; in some cases, it may be directed backward, and in others, forward, depending upon the position of the bone. In exaggerated conditions, it is said that the elbow will be raised on a level with the head, being neither abducted nor adducted—this was formerly called *luxatio erecta*.

Subclavicular Dislocation.—Subclavicular dislocation is rather rare, and it seems to be but an exaggerated form of the subcoracoid dislocation. The head of the bone is carried inward beyond the coracoid process, underneath the clavicle. The capsule is ruptured in the lower and inner part. The head of the bone plows up the pectoral muscles and rests on the ribs, beneath the clavicle. The subscapularis muscle is torn from its attachment to the anterior surface of the scapula; it is detached from the humerus. The attachments of the muscles to the greater tuberosity are more or less torn, but they retain their attachments, as a rule, to the capsular ligament. The head of the bone may be seen, making a marked prominence, beneath the clavicle. The shaft can be felt in the axilla, and there is marked shortening of the arm. It lies in close relation with the chest. The elbow usually projects backward, and a little outward.

Subspinous Dislocation.—Subspinous dislocation is very rare. The head of the bone is forced out of the glenoid cavity, between the infraspinatus and teres minor muscles, and rests on the dorsum of the scapula, just beneath the spine, in the infraspinous fossa. In some cases, the head of the bone will be found just behind, or resting upon the edge of the glenoid cavity. The elbow is directed forward and outward. The humerus is rotated inward. The head of the bone makes a marked prominence on the dorsum of the scapula, while the other signs of dislocation are present. In addition to the signs already mentioned, there may be evidences of injury to the soft tissues. These are evidences of injury to the brachial plexus, intense pain or numbness, and even paralysis in some cases, or the pressure upon the axillary vein causes intense edema of the arm. The axillary artery may be compressed to such an extent as to obliterate the pulse at the wrist. There may be great effusion of blood, especially where there is considerable laceration of the capsule and other soft tissues about the joint. These severe symptoms

and the signs of dislocation before mentioned, are not present in conditions of subluxation or partial dislocation at the shoulder-joint. These conditions are common, and are produced by pushing the head of the humerus underneath the coracoid process, without rupturing the capsule, but with injury to the long head of the biceps, or the long head of the biceps may be luxated from its tendinous groove.

FIG. 94.



First step in Kocher's method of reducing anterior dislocations of the humerus.

Treatment.—1. Kocher's method, suitable for anterior dislocations, consists of external rotation, adduction, and internal rotation. External rotation should be complete, and is performed in order to relax the muscles attached to the greater tuberosity. The elbow is then carried to the middle line of the body in order to bring the head in relation with the opening in the capsule, and, as internal rotation is accomplished, the head of the bone will slip through the rent in the capsule without difficulty.

2. Other manipulative methods are as follows: If the dislocation is in the right shoulder, the head of the bone is grasped by the left

hand, while the elbow is seized with the right hand; the arm, in case of an anterior dislocation, is rotated outward, with more or less extension from the body. The knee, against the chest wall, may be used as a counter-extending force. The head of the bone may be dragged by the left hand into the cavity. This manipulation may be modified to suit all the dislocations.

3. Manipulative methods, with extension, may be made with the patient sitting in a chair, when the operator's foot is placed on the edge

FIG. 95.



Second step in Kocher's method of reducing anterior dislocations of the humerus.

of the chair, with the knee in the axilla. The knee is used as a fulcrum, while the arm is seized above the elbow, the humerus being used as a lever, when the head of the bone is lifted into the socket.

4. Extension may be made from the body with counter-extension by means of a towel or sheet passed underneath the axilla. This method may be successful when other methods have failed.

5. Forcible extension downward. The unbooted foot may be placed in the axilla, so as to rest against the lower border of the glenoid cavity, and strong traction is made on the arm. Where sufficient grasp can

not be gotten on the arm, a clove-hitch may be used around the arm. By this means the head of the bone may be forcibly dragged into the socket.

6. Air-cushion in the axilla. Where the dislocation can not be reduced, an excellent treatment is to place an air-cushion in the axilla, and bind the arm to the side. This air-cushion may lift the head of the bone out of its position, when reduction can easily be effected. In

FIG. 96.



Completion of the manipulation in Kocher's method of reducing anterior dislocations of the humerus.

reducing a dislocation of the shoulder, care should be taken not to injure the axillary vessels, the brachial plexus, or to fracture the bone. The old method of placing the foot against the chest wall, and making traction on the arm, has resulted in fracture of the upper ribs. These methods are barbarous. Extension by means of pulley and tackle should not be used, as it has resulted in severe and extensive injury. Milder methods are more successful. All recent dislocations should be reduced by manipulative methods. Anesthesia may be necessary, but, in nearly all cases, the dislocation may be reduced without it. After the dislocation is reduced, a Velpeau's bandage may be applied or the

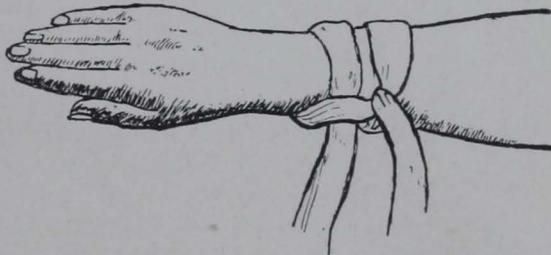
arm may be bound to the chest, for a period of three weeks. After the first week, manipulation will assist the return of the tissues to their normal condition, and, after the third week, the bandage may be removed.

Reduction of old dislocations of the shoulder is best effected by means of manipulation. Extension under ether is a bad procedure. The great mortality of anesthesia, in the reduction of shoulder dislocations, is brought about by the fact that the chest is compressed and respiration interfered with, together with the fact that profound anesthesia is necessary to effect the entire relaxation of the muscles. Such vigorous methods are unwarranted. Milder methods will be found successful, if persisted in. Manipulation might not be successful at first, but it may be successful later. Continued manipulation, breaking up of adhesions, relaxing contracted muscles, releasing bony prominences, and securing a better circulation to the injured tissues, all tend to make reduction easier. If the dislocation is compli-

icated by fracture, an effort at reduction should be made by traction and manipulation of the head of the bone. This should be done very cautiously. If reduction is impossible, McBurney advises an open incision and a hook attached to the scapula, with another hook fastened to the humerus; by these, traction is made, and the dislocation reduced, when the fragments are subsequently wired together. Usually, there is sufficient periosteum, which unites the fragments, and the muscular attachments are such that the dislocation can be reduced without operative procedure. In emergency cases, gimlets have been used to bore into the bones and traction made from them. This is hardly warranted.

Subluxations are reduced by methods similar to those used in complete dislocations. The condition may return, when subsequent reduction is necessary. If the nerve and blood supply to the joint and other structures are properly improved, a cure will be effected.

FIG. 97.



The clove-hitch applied as a means of making extension.

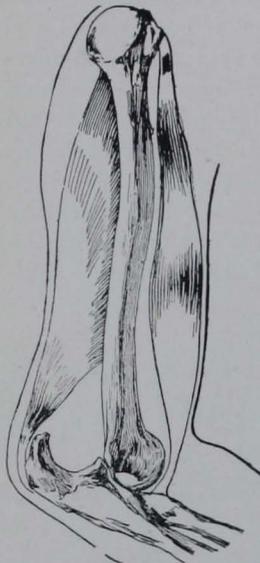
Dislocations of the Elbow.

Varieties:

1. Dislocation of both bones (ulna and radius).
 - a. Backward. b. Inward. c. Outward.
 - d. Forward (with fracture of olecranon.)
 - e. Ulna backward and radius forward.
2. Dislocation of the ulna backward.
3. Dislocation of the radius.
 - a. Forward. b. Outward. c. Backward.

Dislocation of Ulna and Radius Backward.—**Causes.**—The causes are direct and indirect violence, operating together, as falls upon the hand or wrenches of the arm. The injury is more frequent in young people, and is often accompanied by laceration of the soft-parts. The injury to the tissues depends somewhat upon the nature of the dislocation.

FIG. 98.



Dislocation of both bones of the forearm backward.

Condition of the Parts.—In dislocation backward, (which is the most common dislocation at the elbow) there may be, at the same time, more or less displacement of the bones inward or outward. As a rule, the coronoid process will be found in the olecranon fossa. If the coronoid process is not broken off, the attachment of the brachialis anticus muscle is, more or less, torn loose. The neck of the radius will be found in relation with the articular surface of the humerus. The anterior ligament is nearly always torn, while sometimes the lateral ligaments are ruptured. The olecranon and the head of the radius form a marked prominence on the back of the arm, while the lower end of the humerus makes a marked prominence below the crease at the bend of the elbow. The relation between the condyles and the olecranon will be found changed. The forearm is *fixed, flexed and shortened*.

Dislocation of Both Bones Inward is produced by falls upon the elbow and forearm. The internal and external lateral ligaments are ruptured unless the dislocation is but slight. The relation of the condyles and the olecranon will be found changed. The outer condyle stands out prominently, while the inner condyle is obscured by the upper extremity of the ulna lifting up the flexor muscles. The upper extremity of the ulna will be found to stand out prominently on the inner side of the arm, while the head of the radius can not be felt. The deformity resulting may be twisted or angular.

Dislocation of Both Bones Outward will be evidenced by the marked prominence of the inner condyle of the humerus, and the prominence of the head of the radius beneath the supinator longus on the outside of the arm. The relation between the

FIG. 99.



Dislocation of the radius forward and the ulna backward at the elbow.

condyles and the olecranon is altered. There is loss of function, and the swelling and elevated muscles more or less obliterate the external condyle.

Dislocation of Both Bones Forward.—In this dislocation, fracture of the olecranon process usually takes place, although rare cases have occurred where there is no fracture, the dislocation having been produced by dragging down both bones, and, at the same time, forcing them forward. In either case, a marked lengthening of the limb, the absence of the olecranon process on the back of the humerus, and alteration in the relation between the condyles and the olecranon, will serve to make the diagnosis.

Treatment.—Reduction of the backward dislocation is best accomplished by the following methods:

1. Dr. Still makes traction on the forearm in exaggerated extension, the object being to lift the coronoid process out of the olecranon fossa. This method will be found successful in all recent cases.

2. Some operators use the following method: The front of the knee is placed against the front of the elbow-joint; this operates as a fulcrum against the upper extremity of the forearm. Traction and flexion are made simultaneously, the forearm being used purely as a lever. In this way, the coronoid process is lifted out of the olecranon fossa and reduction is accomplished. In dislocations inward, outward, or forward, extension and counter-extension are made to overcome the rigidity of the muscles and the contracted ligaments, while the operator molds the bones into position. The same course should be pursued in dislocations of the ulna backward and the radius forward. Where the diagnosis can not be made, an x-ray examination should be made, if possible. Great swelling is the rule. This swelling obliterates the landmarks about the elbow-joint. Sometimes the elbow is so painful that even a superficial examination can hardly be made. Under no circumstances should the patient be treated, except, perhaps, for a few days, to combat the swelling, unless an accurate diagnosis has been made. The reasons for this are that old dislocations of the elbow are difficult to reduce, and the great liability of fibrous adhesions impairing the integrity of the joint. Perhaps in no other location of the body are injuries attended by worse results; still, there are many cases where the severest forms of injury have been attended by the most remarkable results, but these cases are unusual. In old cases, the family or friends of the patient should be notified of its gravity. A too favorable prognosis should not be made. The treatment will depend upon the nature of the injury. In old dislocations of both bones backward, the prognosis is not favorable, especially if there has been extensive inflammation following the injury. The coronoid process will become, as it were, glued into the olecranon fossa. Fibrous adhesions will prevent reduction. In dislocations inward, or outward, and both bones forward, or the ulna backward and the radius forward, reduction can be accomplished better, and

more readily, and the results are better. In reducing these old dislocations, it is necessary to prepare the joint for the operation of reduction. This means that the fibrous tissue must be gotten rid of. While the bones may not be gotten into absolutely normal relation, the treatment by manipulative methods will be attended by improvement of the condition of the joint. Not only the range of motion will be increased, but the pain will be lessened, and the deformity more or less removed, so that the prognosis in old cases is much more favorable where osteopathic methods prevail.

Dislocation of the Ulna Backward.—This injury is rare and occurs because of force directed upon the ulna itself. The most common dislocation of the ulna is a condition of subluxation of the upper extremity brought about by falls upon the hand, where more or less force is directed against the inner side of the arm. The head of the radius is used as a fulcrum, while the forearm is adducted. Partial dislocation of the upper extremity of the ulna may take place without rupture of any of the ligaments. This injury is often overlooked. Reduction is accomplished by exaggeration of the deformity, the thumb being placed against the inner border of the coronoid process. While extension with abduction and adduction is made, the ulna will be returned to its normal position.

Dislocation of the Radius Forward is said to be the most common dislocation at the elbow, and is caused by falls upon the hand with the

FIG. 100.



Dislocation of the radius forward at the elbow.

arm extended, and the forearm pronated. Some writers have maintained that forced pronation and muscular contraction will produce the dislocation. The head of the radius rests against the front of the humerus, the arm is in a semi-flexed position, while the head of the bone can no longer be felt beneath the external condyle. The arm may be flexed voluntarily, but will come to a sudden stop, because the head of the bone, being drawn upward by the biceps muscle, will be brought forcibly against the anterior surface of the

lower extremity of the humerus. At the point beneath the external condyle, where the head of the radius should be, there is more or less of a hollow. The arm can not be fully supinated, but can be pronated.

The diagnosis of the dislocation is difficult, especially in muscular or fleshy subjects. The injury may be confounded with fracture of the neck of the radius or an epiphyseal separation.

Differential Diagnosis.—1. **Crepitus.** In fracture, crepitus may be obtained, while in dislocation, crepitus will be absent, except in case of adhesions or roughened conditions of the ends of the bones, when false crepitus only will be obtained.

2. **Preternatural mobility.** In fracture, preternatural mobility may be obtained, by grasping the head of the bone and pronating and supinating the arm; the head of the bone will be found not to move. In dislocation, if the head of the bone can be grasped, it will be found to rotate with the shaft of the bone, upon pronation and supination.

3. **Reduction of the fracture** will be followed by a return of the deformity, whereas, in dislocation, if it is reduced, the deformity will not return. In epiphyseal separation, where there is not much swelling, a sensation as of a foreign body in the joint may be obtained and moist crepitus is present. Where the diagnosis is clouded, an x-ray examination should be made. Where this is not possible, the prognosis should be guarded. Where the diagnosis can not be made, the deformity should be reduced and treated as a fracture.

Reduction of the dislocation is accomplished by extension applied more particularly to the radius, while the bone is manipulated into position, or the knee may be used as a fulcrum against the upper part of the forearm, as the forearm itself is used as a lever, at the same time, more or less extension is made.

Dislocation of the Radius Backward is produced by falls upon the hand in supination. The head of the bone can be readily felt beside the olecranon back of the external condyle. The forearm is flexed and pronated. The diagnosis is usually easy. While extension is being made, the bone is manipulated into position. The knee may be used as a fulcrum, as the head of the bone is drawn into position.

Dislocation of the Radius Outward is rare. The head of the bone is displaced to the outer side of the outer condyle, where it makes a marked prominence. The head of the bone can be readily felt rotating in this position, upon pronation and supination. Rotation of the radius, together with forced extension, will easily effect reduction.

Subluxation of the Radius.—Subluxation of the head of the radius is a common injury, more frequent in children. It is the result of muscular action, twisting or traction of the forearm. Various explanations have been offered for the injury. Some operators say that extension and adduction produce the injury, while others say that only extension is necessary. In a child, the injury is called "pulled-elbow," and usually occurs between two and four years of age. Complete supination or falls produce subluxation. The symptoms are various, depending upon the amount of displacement and the extent of injury to the ligaments. There is not much deformity at the elbow. Pressure over the upper extremity of the radius will cause severe pain. The arm is usually

flexed at an angle of about sixty degrees. Some movements of the arm are painless, while complete extension of the arm causes great pain. Complete pronation and supination also cause pain. Forced supination will cause a distinct clicking sound. The subluxation can be reduced by completely flexing the arm with supination and pronation, together with abduction and extension. In some cases the edge of the fibro-cartilage will be displaced or slip between the head of the bone and the articular surface of the humerus. After reduction has been accomplished, it is necessary to put a figure-of-8 bandage around the elbow and carry the arm in a sling for a few days until the ligaments return to a normal condition. In all dislocations at the elbow starch-paste dressing may be put over the joint by means of paste-board and a four-tailed bandage and the arm carried in a sling. After the preliminary inflammation has disappeared, which will take place within a week, the joint may be manipulated every few days, so as to prevent ankylosis. Recovery is complete in uncomplicated cases.

Other **peculiar conditions** which may occur at the elbow, and which may cause pronounced symptoms are:

1. Slight posterior displacement.
2. Slight anterior displacement of the head of the radius.
3. Luxations of the interarticular cartilages.
4. Locking of the tuberosity of the radius with the inner edge of the ulna.
5. Intracapsular fracture of the head of the radius.
6. Paralysis or neuritis of one of the large nerves of the arm brought about by injury.

The conditions may be made out only by careful physical examination by one who has an accurate knowledge of anatomical relations.

Dislocations of the Wrist are common and may be classified as:

1. Dislocations forward.
2. Dislocations backward.
3. Backward luxation of the ulna from the radius.
4. Forward luxations of the ulna from the radius.
5. Subluxations.

Dislocations Backward.—This dislocation is produced by falls upon the hands. The carpus stands out prominently on the back of the wrist, while the fingers are flexed and the lower extremity of the radius and ulna project prominently in front of the forearm. It must be noted that the styloid process of the radius is upon a lower level than that of the ulna.

Fracture through the base of the styloid process of the radius (Colles's fracture) simulates dislocation of the wrist, but the styloid process of the radius is on the same level or higher than that of the ulna. There is muscular rigidity and an absence of crepitus. Extension and manipulation usually reduce the deformity.

Dislocations Forward.—In dislocations forward the carpus makes a prominence on the front of the wrist, while the ulna stands out prom-

inently on the back of the forearm. This injury is very rare. Reduction is accomplished by extension and counter-extension.

Dislocation of the Ulna from the Radius, either forward or backward, is accomplished by forced supination or pronation, as occurs in violent twisting of the hand. In the backward dislocation, the forearm is pronated and the space between the styloid processes of the ulna and radius is diminished. The ulna stands out prominently on the back of the wrist. In the forward dislocation, the ulna projects in front, while the distance between the two styloid processes may be found lessened. The arm is supinated. Reduction is accomplished by traction, exaggeration of the deformity, and pressure upon the head of the bone with flexion or extension, as the case may be, when it may be readily forced into position.

Dislocation of the Carpus.—Dislocation of one of the carpal bones may take place because of injury or forced movements of the wrist. The deformity may not be great, but the involvement of the nerve filaments causes great pain. The diagnosis can be made by a careful examination. The weakest point in the wrist is between the scaphoid, os magnum, and semilunar bones. Reduction is accomplished by exaggeration of the deformity, and pressure upon the projecting bone, with forced flexion or extension as the case may require.

Dislocation of the Metacarpus.—Dislocation of the metacarpal bones in their articulation with the carpus is rare. Subluxations are fairly common, and when any nerve structures are involved, severe pain is the chief symptom. The deformity is not great. The first metacarpal bone is the one most frequently dislocated. The diagnosis is usually readily made upon careful examination. Flexion and extension with adduction and abduction, while compression is made by the thumb upon the end of the dislocated bone, will accomplish reduction.

Dislocations of the Metacarpo-phalangeal Articulations are rare. The dislocation usually takes place backward, and is caused by falls on the outstretched hand. The diagnosis is made without difficulty. Reduction is accomplished by manipulation as extension is being made. In only one of these dislocations will any difficulty be found in making reduction, i. e., dislocation of the first phalanx of the thumb. This dislocation takes place backward. The obstacles to reduction are the margin of the capsular ligament, together with a stretched condition of the flexor longus pollicis and the sesamoid bones developed in the tendons of the flexor brevis pollicis. Reduction is accomplished by forced extension and lifting the head of the bone into place. Extension should be made until the phalanx is at right angles

FIG. 101.



Dislocation of the first phalanx of the thumb.

with the head of the metacarpal bone. This enlarges the opening through which the dislocation took place. In some cases tenotomy may be necessary.

Dislocations of the Phalanges are fairly common. The diagnosis is easy and reduction is accomplished by extension and counter-extension. Where sufficient extension can not be made by grasping the finger, a Levis's splint may be used. This splint is made by means of a narrow board, having two rows of holes the width of the finger. Tape is passed through the holes so as to form loops upon one side of the splint. The finger is inserted into these loops and the tape is drawn tightly to the finger. Traction can be made by means of the splint.

Dislocations of the Ribs.—Clinical experience shows that traumatic dislocations of the ribs often take place. These may accompany fractures of the spine, or the luxation may take place without other injury, being caused by direct or indirect violence. The displacement of the head of the rib may be forward or backward, upward or downward. The signs are:

1. Elevation or prominence of the luxated rib.
2. Depression or lessened prominence of the luxated rib.
3. Widening or narrowing of the intercostal space.

A history of the accident, together with the deformity present, will easily enable the physician to make the diagnosis. Conditions of subluxations are more thoroughly described in works on Osteopathic Practice, to which the reader is referred.

Reduction is accomplished by manipulation. These are elaborated upon in works on osteopathic methods.

Dislocation of the rib from its costal cartilage may be produced by direct or indirect violence. Inasmuch as the bone is subcutaneous, the condition can readily be made out. Pain will be a prominent symptom, together with an offset in the rib at that point. Reduction is accomplished by manipulation. It may be held in position by strapping. In severe conditions of luxation of the head of the rib from its articulation with the spine, strapping of the rib, as in case of fracture, may be required.

Dislocation of the Costal Cartilages at their articulation with the sternum may also take place and is the result of direct violence. The symptoms are pain and deformity. If the ribs are raised, and that part of the chest kept immovable by strapping, complete recovery will take place without any troublesome symptoms.

Dislocation of the Sternum.—Inasmuch as bony union takes place between the three portions of the sternum late in life, dislocations of these parts of the bone may take place in children. Dislocation of the **gladiolus from the manubrium** may take place because of great direct violence. The symptoms are usually evidences of severe local injury, together with a ridge at the point of union of the two bones. Where the injury is very severe, there may be marked dyspnea, and irregular heart action. Dorsal flexion, with pressure over the manu-

brium and a raising of the ribs, will draw the bone into position. A figure-of-8 bandage about the chest, to limit motion, will relieve the pain and hasten recovery.

The **Ensiform Cartilage** may be dislocated by means of pressure, or blows received. The displacement may be slight, or the deformity may even be angular, and it may interfere with taking food. Cases are reported where persistent vomiting followed such injury. The symptoms are usually plain; a history of the injury and pressure upon the cartilage are indicative; also there is a marked depression at the lower end of the sternum. Raising the ribs will lift out the cartilage. Operative treatment is necessary.

Dislocation of the Sacro-iliac Joint.—Sacro-iliac dislocations partake of the nature of subluxations. They are common and consist of displacements backward, forward, upward, or downward, or of combinations of these, as a luxation upward and backward. One or both sides may be affected. It will produce inequality in the length of the limbs and tilting or twisting of the pelvis. The posterior superior iliac spines may be more prominent, or less so, and may be higher up, or lower down, than normally. It may be evidenced by pain at the symphysis pubis, in the back, down the thigh, or within the joint. It may cause hip-joint disease, white swelling, sciatica, pelvic disease, neuralgic conditions, and various other diseases. A careful examination will reveal the condition. The luxations are reduced by manipulation, or well known osteopathic methods.

FIG. 102.



The Y-ligament intact.

Dislocations of the Hip.—Dislocations of the hip are more common than dislocations of many other joints, although the nature of the anatomy of the joint is such as to rather protect it from injury. The cotyloid cavity is deep and the head of the femur fits in with such nicety and the ligaments are sufficiently strong to render dislocations unlikely. They form, perhaps, ten per cent. of all dislocations. They are more common between the ages of twenty and thirty, but may occur at any age. It is important to thoroughly understand the anatomy of the hip-joint to understand the dislocations. The most important of the ligaments is the Y-ligament, which is the form of an inverted Y, whose upper attachment is the anterior inferior spine of the ilium, and the lower

attachment, the outer limb, at the upper extremity of the anterior intertrochanteric line, and the inner limb to the inner extremity of the anterior intertrochanteric line. This Y-ligament is really a thickened anterior portion of the capsular ligament. It is this ligament which determines the position of the thigh in what are understood as the regular dislocations. Regular dislocations are those in which the Y-ligament is intact. The irregular dislocations are those in which the Y-ligament, either the inner or outer limb, is ruptured.

The *causes* of the dislocations are those of dislocations of other joints, but the luxations may happen in typhoid fever or they may be produced by the assumption of habitual attitudes. The exciting cause of the dislocation in certain abnormal conditions may be slight force, as turning in bed. Muscular contractions play a great part in some of the dislocations. In eighty per cent. the head of the bone gets out of

the capsule at its posterior portion. In other cases, the head of the bone may rupture the lower or the inner portion of the capsule. It is believed that the dislocation takes place largely by leverage. This may not always be true. Many different classifications will be found, but it is more important to understand the nature of these dislocations than the particular classification. They may be best understood as follows:

A. Regular. 1. Iliac, where the head of the bone rests on the dorsum of the ilium. 2. Sciatic, where the head of the bone is dislocated beneath the obturator internus muscle. 3. Obturator or thyroid, where the head of the bone is displaced in the thyroid foramen. 4. Pubic, where the head of the bone is displaced inward on the front of the pubes.

B. Irregular. 1. Anterior oblique. 2. Everted dorsal. 3. Perineal. 4. Supracotyloid. 5. Ischial.

Both **iliac** and **sciatic** dislocations are backward displacements of the bone. The bone gets out of the lower or upper part of the capsule during flexion, adduction, and internal rotation of the thigh. There are cases where a thyroid dislocation may be transformed into a dorsal, but this is unusual. The Y-ligament

A drawing illustrating dorsal dislocations of the hip.

is intact and stretched, producing flexion of the thigh. The ligamentum teres is usually ruptured. The quadratus femoris, the gemelli, and perhaps the obturator internus and piriformis muscles, are injured. The head of the bone dissects up the glutei muscles, and in fairly thin subjects, can often be felt imperfectly on the dorsum of the ilium.





PLATE VIII.

Radiograph (posterior view) of a normal pelvis in a girl five years of age. Note a partial arrest of the development of the right thigh as the result of infantile paralysis.

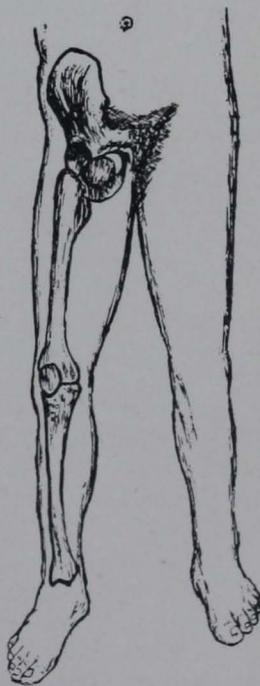
Radiograph by George M. Laughlin, D. O.

In the **sciatic** dislocation, the head of the bone gets out at the lower and posterior part of the capsule. The head of the bone becomes engaged beneath the tendon of the obturator internus muscle and usually lies between it and the piriformis. Sometimes it may rest upon the piriformis muscle. It seldom ever reaches the sciatic notch. As a rule, if the head of the bone leaves the cavity at the lower and posterior part of the capsule, a sciatic dislocation will result. If it leaves at a higher point, the iliac dislocation results. The rim of the acetabulum may be chipped off, or the head of the femur may be broken. Fifty per cent. of all dislocations of the hip are dorsal; thirty per cent. are sciatic.

The *symptoms* of these dislocations are adduction, internal rotation, and flexion. There may be considerable tilting of the pelvis, causing marked lordosis of the spine. The lower extremity of the femur on the injured side, if projected, would cross the lower extremity of the femur on the sound side, while in the erect position, the foot rests on the top of the foot of the sound side. The hip is broadened, the trochanter is elevated above Nelaton's line, while Bryant's line is shortened, also indicating the ascent of the trochanter. The voluntary movements are for the most part lost. Passive movements are possible in flexion and adduction, but are impossible in extension and external rotation or abduction. Much shortening is the rule, but this comes largely from the adduction and flexion of the thigh. The adduction and flexion are produced by the tension on the Y-ligament and the adductor muscles. The signs of a sciatic dislocation are similar to those of an iliac dislocation, but are not so pronounced. The shortening is less upon extension of the thigh and greater upon flexion of the thigh.

Obturator or Thyroid Dislocations constitute eleven per cent. of the hip dislocations, and may be produced by blows on the back part of the pelvis. The head of the bone is displaced downward and inward. The Y-ligament is intact and holds the limb in abduction and flexion. The limb can not be extended or adducted. Because of the tilting of the pelvis forward, due to the tension upon the Y-ligament, the limb is apparently lengthened, but is shortened to some extent. While the patient stands erect the limb is held forward in abduction by the Y-ligament. In the obturator dislocation the head of the bone gets out of the cavity through the lower, or lower and inner part of the capsule.

FIG. 104.



A drawing illustrating a thyroid dislocation of the hip.

In **Pubic** dislocations, the head of the bone rests on the front of the pubes. It may be transformed obturator dislocation, or the bone may get out through the upper and inner part of the capsule. The injury is produced by hyper-extension, or by forced abduction and external rotation.

FIG. 105.



A drawing showing the position of the limb in pubic dislocations of the hip.

The head of the bone rests on the ilio-pectineal eminence most often, but it may be displaced farther inward. The limb is markedly abducted and everted. The hip is flattened, and there is considerable shortening.

Irregular Dislocations constitute about two per cent. of all the dislocations of the hip. One or both limbs of the Y-ligament are ruptured.

The **Everted Dorsal** dislocation is the same as the dorsal, with the exception that the head of the bone is displaced forward and inward, while the limb is abducted and extended. The outer limb of the Y-ligament is broken.

In the **Anterior Oblique** dislocation there is outward rotation and marked flexion and abduction. The head of the bone rests just above the acetabulum. The Y-ligament is broken.

Perineal dislocation is the same as the thyroid dislocation, with the exception that the head of the bone is displaced farther inward, while flexion and abduction are more marked. Sometimes the head of the bone may be felt in the perineum.

In the **Supracotyloid** dislocation, the head of the bone is just above the acetabulum. There is eversion and abduction.

A **Suprapubic** dislocation, which is an anterior dislocation displaced upward, may resemble the supracotyloid, or an everted dorsal luxation.

Ischial dislocations are rare. The head of the bone is displaced downward and backward, and rests upon the tuberosity of the ischium. The limb is everted, abducted, and flexed.

Methods of Reduction.

In the **backward** dislocations, the dorsal and sciatic, the manip-

FIG. 106.



A drawing showing the method of reduction in dorsal and sciatic dislocations. In pubic and thyroid luxations the limb is abducted instead of abducted and also rotated inward.

ulations should be directed towards relaxing the Y-ligament and directing the head of the bone toward the opening in the capsular ligament. The patient should lie flat on his back, while the pelvis is held fixed by an assistant. Flex the knee at right angles and rotate the thigh a little further inward, then lift up or make traction upon the femur with considerable force, at the same time rotating the limb outward. This is followed by abduction and extension. Dr. Charles Still prefers to lift the thigh in position by grasping the trochanter. He is very successful with this method. Some operators have the patient lie upon the floor, while the pelvis is held fixed, believing that more traction can be made upon the thigh during the manipulation. Stimson places the patient with the face down, with the hips projecting just beyond the end of the table. An assistant holds the sound thigh, while the operator grasps the foot on the injured side and allows the weight of the limb to pull the thigh in position. Ten or fifteen pounds of weight may be added to overcome the tension of the muscles, when the hip may be dropped in position. This manipulation is suitable for the reduction of backward dislocations. Leverage is, perhaps, one of the most important forces to be utilized in the reduction of hip dislocations.

In **Obturator** dislocations, the thigh should be flexed at right angles, while traction should be made upon the femur. The limb should then be adducted and extended. It may be necessary to rotate the thigh farther outward in order to secure relaxation of the Y-ligament.

In the **Pubic** dislocations, traction is made in flexion, while an assistant makes pressure against the upper extremity of the thigh, on the inner side, thus preventing the head of the bone returning on the front of the pubes while internal rotation is performed by the operator. In some cases, reduction may not be accomplished, but the skill of the physician will depend upon his experience and his knowledge of the anatomical relations.

Compound Dislocations.—Compound dislocations are very rare, and are usually fatal; but a few cases are on record. There is generally such extensive injury to the soft-parts, and bone, that sepsis results.

Old Dislocations.—Unreduced dislocations are treated in the same manner as recent dislocations. Should the operator fail to reduce the dislocation at the first attempt, he should not be discouraged. Many times, by breaking up the adhesions and relaxing the muscles, the head of the bone may be made to retrace its steps. If there is no injury to the cotyloid cavity, and the inflammatory reaction about has not been too severe, reduction may be accomplished after a number of years. Dr. A. T. Still has reduced a large number of these dislocations, even after they had existed many years. Reduction, in many cases, may be accomplished only after months of treatment preparing the parts for reduction. After reduction has been accomplished, treatment may still be required for some length of time to prevent the dislocation returning.

Pathological Dislocations.—Pathological dislocations are very com-

mon in inflammations of the joint, paralysis, in conditions of rickets, and septic fevers, especially in conditions where the person assumes a certain position for a considerable length of time. These pathological dislocations are reduced by methods similar to those used in recent dislocations. The joint must first be prepared for reduction. The ligaments must be relaxed, the tonicity of the muscles improved, and the adhesions broken up. After this has been done, the pelvis must be held securely by an assistant while the operator makes traction on the thigh. Too much force should not be applied to the limb. It is unnecessary and may do harm. The old method of Sir Ashley Cooper of forcibly dragging the head of the bone into the socket is bad, inasmuch as it may do a vast deal of harm. Reduction can be made by manipulative means much more readily, even in old dislocations. If the femur is dislocated inward or downward, the pelvis should be held securely to the table or floor, while the physician makes traction on the thigh. Pressure may be made on the inner side of the neck of the femur, while at the same time the physician performs adduction, thus using the femur as a lever. This may force the bone in the socket. Similar methods may be used if the femur is dislocated backward. In this case, the assistant may press upon the back part of the femur while abduction and extension are made.

Dislocations of the Knee-Joint may be classified as:

1. Dislocations of the patella.
2. Dislocations of the tibia.
3. Dislocations of the semilunar cartilages.

Dislocations of the Patella.—The patella may be dislocated (a) outward, (b) inward (very rare), and (c) edgewise (vertical rotation).

Dislocation Outward is the most common, on account of the obliquity of the femur. It occurs in subjects suffering with genu valgum, and is produced by direct violence. It occurs while the limb is extended. If the luxation is complete, the patella will be felt lying entirely on the outside of the external condyle. The knee will be flattened, while the intracondylar space will be marked by a depression. Where the luxation is incomplete, the inner half of the articular surface of the patella lies in relation with the articular surface of the outer condyle. Reduction is accomplished by means of extension and manipulation, the thigh at the same time being flexed upon the abdomen, which thoroughly relaxes the quadriceps extensors, when the bone may readily be moved into position.

Inward Dislocation is extremely rare, and is due to direct violence. The diagnosis is easy. The treatment is similar to that of dislocation outward.

Dislocation edgewise, or vertical rotation, is a rare condition produced by twisting the patella on its own axis. Cases are on record where the patella has been turned completely over. Partial rotation of the bone is similar to an incomplete dislocation, either inward or out-

ward, and reduction is accomplished in the same manner as reduction of a dislocation either inward or outward. Complete rotation may be reduced by relaxing the quadriceps extensors and rotating the bone into position.

Dislocations of the Tibia.—Dislocations of the tibia may occur (a) inward, (b) outward, (c) backward, or (d) forward. When the dislocation is caused by disease it is *backward*, but when caused by traumatism, it is nearly always *lateral*. Dislocation either *inward* or *outward* is rarely ever complete, and is accompanied by more or less twisting of the leg. One or the other of the lateral ligaments will be ruptured. The diagnosis of the dislocation can be readily made, as the symptoms are prominent. Reduction of the dislocation is easy. While extension is made, the limb is abducted or adducted as required and rotated either inward or outward, or, while an assistant makes extension, the bone may be lifted into position by the operator.

Dislocation of the tibia *forward* is more common than dislocation backward, when the result of trauma. The dislocation may be complete. The lower extremity of the femur will project into the popliteal space and obstruct the femoral vessels, while the tuberosity of the tibia will stand out prominently on the front of the leg. There may be considerable shortening. Usually, the dislocation is incomplete and the symptoms are not so prominent. Reduction is accomplished by extension and manipulation.

Dislocation of the tibia *backward* is usually not complete. The cause of the injury is direct and indirect violence. The signs are so constant and prominent as to be characteristic. The tibia is more or less displaced into the popliteal space, and operates as an obstruction to the return circulation through the femoral vessels. There will be engorgement of the short saphenous vein. A depression beneath the condyles of the femur in front will be prominent and the nature of the dislocation is evident upon inspection. Like other dislocations of the tibia, reduction can readily be accomplished in recent dislocations by traction and manipulation. Under no circumstances should this dislocation be allowed to continue for any length of time, not even a few days, before reduction is made. The limb should be kept at rest for a few days until the swelling and inflammation have subsided, when a knee-boot can be applied, which is drawn tightly to the knee, and which prevents a recurrence of the condition. Where there is rupture of the ligaments of the knee, it is best to keep the knee at rest for a period of two or three weeks, to permit union of the torn ends of the ligaments.

Dislocation of the Semilunar Cartilages is sometimes called a subluxation of the knee. The injury is frequent and happens during flexion with rotary motion at the knee. Pressure of the condyles, under certain circumstances, tends to displace the cartilages. In a condition of flexion, these cartilages are more movable upon the surface of the

tibia than upon extension, so that in a flexed condition a sudden wrenching or spraining of the joint may lead to a displacement of the cartilage. The internal cartilage is more frequently displaced than the external. The extent of the displacement varies, and the coronary ligament may, or may not, be ruptured. Displacement of the cartilage usually takes place anteriorly, but may take place laterally. In certain cases, it is said to have been displaced into the intra-condyloid notch, or to have been doubled upon itself.

Signs.—The first sign of the injury is a cracking sound, as if something gives way in the joint, which is accompanied by an intense sickening sensation. The joint remains fixed in a position of flexion. The limb can not be forcibly extended, because of the obstruction afforded by the cartilage. Efforts at manipulation cause a sickening pain. It may be that more or less twisting of the leg in a position of flexion will result in spontaneous recovery. The disarticulated cartilage forms a prominence on the front of the joint. A history of the accident, together with the absence of other injury, will serve to complete the diagnosis.

Methods of Reduction.—The flexion should be exaggerated. Should it be the internal cartilage which is dislocated, the operator places his two thumbs upon the dislocated cartilage, while his hands grasp the hamstring tendons, and an assistant makes extension and abduction. The extension and abduction should be forcibly made, while at the same time vigorous pressure is made upon the luxated cartilage. Where the external cartilage is dislocated, the same procedure is adopted, with the exception that at the time of extension the lower leg is adducted. This manipulation should be successful in all cases. Operative treatment is recommended in various texts for the removal of the cartilage where there has been a failure in the attempts at reduction. This operative treatment consists in removing the cartilage under the strictest aseptic conditions, or by fixation of the cartilage by means of aseptic chromicized catgut sutures. In case of such operation, it is necessary to drain the joint for a day or two after the operation. Manipulative methods, if kept up some length of time, and judiciously applied, will be successful in restoring the integrity of the joint in all cases.

Dislocations of the Ankle-joint.—Dislocations of the ankle are (a) outward, (b) inward, (c) backward, (d) forward, and (e) upward. Because of the peculiar relation of the astragalus with the tibia and fibula, fractures not unusually complicate these dislocations. Dislocations laterally rarely occur without fracture, therefore in reality they are fracture-dislocations, as is the case in Pott's fracture of the lower one-fifth of the fibula, or Dupuytren's fracture. The diagnosis may be difficult, and will require a careful examination, perhaps with the assistance of the x-rays, to make an accurate diagnosis. The luxation is usually readily reduced.

Dislocation Backward is more common than dislocation forward, and usually takes place in jumping. Both malleoli may be fractured, while

the astragalus is driven behind the lower extremity of the tibia. The heel protrudes prominently. The lower extremity of the tibia may rest upon the scaphoid or cuneiform bones.

Dislocation Forward is very common, and is not associated with fracture of the bones of the leg. Apparently the foot is lengthened. The tibia stands out prominently on the upper surface of the os calcis. The heel is not so prominent as normally, and a depression exists over the top of the astragalus.

Dislocation Upward.—In this dislocation, the astragalus, with perhaps other bones of the foot, is driven upward between the tibia and fibula, after the ligamentous attachments of these bones have been forcibly divided. At first glance it may be denied that this dislocation is possible, but competent observers attest to the fact that the dislocation does occur. Widening of the malleoli, together with a shortening of the foot and leg, make the diagnosis easy. There is a history of violent injury.

Treatment.—Dislocation of the ankle may be reduced by means of extension, together with rotation, abduction, adduction, and flexion. By extension and counter-extension the tense muscles are relaxed, and the bones may be manipulated into position. In some cases, it is said that it is necessary to divide the tendo Achillis in muscular subjects. In fracture-dislocations, the fracture requires special treatment. Where there is dislocation pure and simple, it is necessary to keep the foot immovable, and to apply antiphlogistic measures, such as assisting the return circulation, relaxing the tissues, and keeping the foot immovable for ten days. After that time, manipulation of the joint, to prevent adhesions and to reduce inflammation, will be found necessary. The person should go about on crutches within a week, but for a considerable part of the day the foot should be elevated, to assist the return circulation.

Dislocation of the Astragalus.—Dislocations of the astragalus alone deserve special consideration. They consist of a partial or complete detachment of the bone from its normal connection. It may be luxated either anteriorly or posteriorly.

Anterior Dislocation is usually associated with more or less rotation, which may be outward or inward. If the dislocation should be complete, the bone will be found lying in front of the ankle loose and readily movable upon the scaphoid. The skin over the dorsum of the foot is tightly drawn over the bone. The limb is shortened, while the malleoli approximate the bottom of the foot. The lower extremity of the tibia usually rests upon the articular surface of the os calcis, instead of the astragalus. In the incomplete variety, the head of the bone simply presses upon the scaphoid or cuboid. Only about half of the articular surface is displaced from the tibia. Prominence of the bone may be felt in front of the ankle.

Backward Dislocation may also be complete or incomplete. Rotation of the bone may attend the injury. The bone may be readily felt making a marked prominence above the os calcis, the degree of prominence depending upon the degree of luxation of the bone. The diagnosis in either dislocation, forward or backward, with or without rotation, complete or incomplete, is usually easy, providing the swelling is not too extensive. It may be confounded with a sprain, and until the swelling is gotten rid of, the diagnosis may not be accurately made.

Treatment.—Reduction is accomplished in the incomplete form of dislocation by exaggerating the deformity, while the operator presses upon the bone with his thumbs, extension being made at the same time. In this manner the bone is forced into its normal location. More or less rotation may be necessary. Not a great deal of force will be required, except in muscular subjects, or where the bone is tightly wedged in. In complete dislocations an anesthetic may be required. If the case is seen early, a reduction can be accomplished without great difficulty. In all dislocations, after some hours, great swelling obliterates the characteristic evidences of the injury, while the pain, because of the pressure of the effused fluids, is intense. The joint-reflexes are exaggerated and muscular spasms occur, so that reduction of the dislocation may be difficult. Where there is violent inflammation, an anesthetic may be necessary for a thorough examination. In cases where the diagnosis can not be made, an x-ray examination may assist in clearing up the diagnosis.

Subastragaloid Dislocations.—These dislocations refer to the forcible separation of the other bones of the tarsus from the astragalus. Generally the astragalus maintains its normal relation with the malleoli, while the ligaments which attach the astragalus to the other tarsal bones have been either considerably stretched, or ruptured. The dislocations are produced by violent wrenching of the foot. The displacement of the bones may be inward, outward, or backward, but is usually backward and outward, or backward and inward. The luxation is incomplete, and while being classified under traumatic dislocations, it properly belongs to partial dislocations. The dislocation may even be compound, and yet not be complete. The scaphoid is sometimes completely separated from the head of the astragalus. Great deformity is the rule. The heel projects prominently, while the anterior part of the foot is apparently shortened. As a rule, the toes point downward, the heel being drawn upward by contraction of the calf muscles. The tendo Achillis is put violently upon a stretch, while beneath the skin on the front of the foot the astragalus projects prominently. The anterior tibial vessels and nerves are usually severely injured. The extensor tendons may be so engaged about the head of the astragalus as to operate against reduction. When the bones are dislocated inward, the foot is everted so that the outer malleolus stands out prominently, and the



PLATE IX.
Radiograph showing a subluxation at the calcaneo-cuboid and astragalo-scapaloid articulations, as occurs in gouty conditions.
Radiograph by George M. Laughlin, D. O.



normal projection of the internal malleolus is lost. The position of the foot resembles that of equino-varus. When the tarsus is displaced outward, the foot is everted, while the inner malleolus is prominent and a depression marks the position of the external malleolus. The position of the foot is that of equino-valgus. In either variety, the tendo Achillis is put violently upon a stretch and is somewhat curved, depending upon the degree and nature of the displacement. Tenotomy may be necessary before reduction of the dislocation can be made. Extension and rotation and an exaggeration of the deformity, with pressure upon the projecting bone, will enable the operator to force the luxated bones into position.

Dislocations of Other Tarsal Bones, as the cuneiform, scaphoid, or cuboid, occur but rarely, and are the result of severe direct violence and twisting of the foot. The diagnosis is usually easy. The treatment is to reduce the dislocation and to keep the foot quiet, to give it rest until the ligaments may be restored, since there may be a sinking down of the arch of the foot, because of a giving way of the ligaments. This condition of subluxation in the tarsal bones will result in a deformity which interferes greatly in walking.

Dislocations of the Metatarso-Phalangeal, or the Phalangeal Articulations, occasionally occur, but are easily recognized and readily reduced by extension and counter-extension. They are not sufficiently serious to merit description. Subluxations may cause bunions, Morton's disease, or other affections.

DISEASES AND INJURIES OF THE SPINE.

Spina Bifida.

Spina bifida is a congenital condition due to maldevelopment of the dorsal plates in embryo. The dorsal plates not having properly closed, the lamina, pedicles, spinous processes, and sometimes part of the membranes of the brain and cord, fail to develop. The tension of the fluid within the neural canal is such as to form a tumor. The only structures lying over the spinal cord are the skin, and perhaps a little connective tissue, or the membranes may lie directly in connection with the skin. The tumor presenting is produced by a collection of fluid in the subdural spaces, or subarachnoidal spaces, or from within the spinal canal. Three forms of tumor are usually described.

A. **Meningocele**, which consists of a protrusion of the dura mater and arachnoid, but contains no part of the cord or spinal nerves. The posterior portion of one, two, or more vertebrae may be absent. The tumor may be of considerable size.

B. **Meningo-myelocoele** is a condition where the fluid distension is beneath the arachnoid and dura mater, the wall of the tumor containing these two membranes, together with the cord and spinal nerves. The cord may be spread out over the side of the tumor.

C. Syringo-myelocele is a condition where the fluid distension is within the central canal of the spinal cord, so that the spinal cord is spread out around the tumor. Certain spinal nerves which run down some distance within the spinal canal before making their exit may be included in the tumor, providing it is located in the lumbar region.

Signs.—The location of the tumor is in the middle line of the back, over the lower part of the spine. It may be covered with healthy skin, but very often it is apparently scarred. The vessels often are obliterated and the tumor is translucent. In infants, if the tumor is compressed, it will be noticed that the fontanels raise up. On coughing, or crying, there will be a distinct impulse over the tumor. The edges of the bones, which are the imperfectly developed lamina or pedicles, may be felt. There is more or less paralysis and imperfect development below the tumor, because of the pressure upon the nervous tissues. There may be talipes, perforating ulcers of the foot, or more or less complete anesthesia. The child may be the subject of hydrocephalus. The prognosis is not good.

Treatment.—When the tumor is small, an elastic band may be applied, which will, perhaps, prevent its development. Treatment of the parts below will be found of service. The circulation to the atrophied muscles and partially paralyzed nerves may be increased, but by no known methods can the ill-developed vertebrae be restored. Tapping has been advised. Where the wall of the tumor is not very thick, as it enlarges, which may happen in some cases, spontaneous rupture may take place. If this occurs, the contents will escape from the tumor and the meningeal fluid will continue flowing for some days, when the opening will heal up. The tumor will reappear in a short time. Tapping has been advised, but it will do but little good, as the tumor will quickly return. Enucleation of the sac has been advised by some surgeons, but it is not known whether the operation is attended by good results or not. The best that osteopathic treatment can do for the affection is to prevent the atrophy of the muscles, and to increase the blood supply to the areas of paralysis, or paresis, and to increase the nerve impulses to the weakened structures. Where perforating ulcers are present, usually osteopathic treatment will cause these to heal up, but the condition can not be cured.

Tumors of the Spine.—New growths are of rare occurrence in the spine. They may consist of **gummata**, because of tuberculosis, or syphilis, or **fibromata**, **lipomata**, or **gliomata**, may develop. Rarely secondary cancers of the spinal cord occur. Spinal tumor will not cause any difficulty until it attains the size of a medium sized marble. The symptoms are pain, more or less localized, followed by progressive anesthesia, usually ending in paraplegia, monoplegia, or evidences of ataxia. The symptoms are those of compression and irritation of the spinal cord. The reflexes are at first exaggerated, afterwards paralyzed. Following exaggeration of the reflexes, there is paresis

of the muscles, followed by paralysis. Sometimes spasms of the muscles form a prominent symptom, because of irritation. Occasionally, instead of paralysis, there is a condition of contracted muscles, due to irritation of the motor cells. Different locations of the tumor will occasion different symptoms. The diagnosis is usually made by eliminating other conditions which might cause the same symptoms. These other conditions are hemorrhage within the spinal canal, compression from inflammatory products, and luxations. Should the diagnosis be accurately made, which in most cases can be done, the tumor should be removed by a surgical operation. The technic of the operation is that of laminectomy.

Osteomyelitis of the Vertebrae.—Osteomyelitis is a rare, acute, suppurative disease of the vertebral bodies. It is caused by infection from the pus cocci, and is often associated with osteomyelitis of other bones, or by infection of the viscera. The symptoms, in general, are those of osteomyelitis of other parts of the body, with the exception that the disease involves the spine, causing, perhaps, paralysis, also sequestration of the bodies of the vertebrae and abscess formation.

Treatment.—The treatment is similar to that for osteomyelitis. This disease does not include the chronic suppuration of the bodies of the vertebrae, a condition which arises from other causes. Acute osteomyelitis of the vertebrae occurs in ill-fed and ill-nourished children, and is a very difficult disease to treat. As soon as pus is evident, a free incision and good drainage, with antisepsis, should be made. Likely, in each of these individual cases, a certain spinal lesion will be found, which will account for the origin of the disease. The general condition of the patient will demand treatment, as well as the specific inflammatory process.

Spinal Curvature.

The more common curvatures of the spine are scoliosis, kyphosis, and lordosis. **Scoliosis**, or lateral curvature, is most common in the upper dorsal region. The curvature usually extends to the right. A compensatory curve occurs in the lumbar region, while a second compensatory curve may occur in the neck. There are cases where even more curves are found in the spine. The intervertebral discs are unequally compressed, while the ribs form a great convexity upon one side, and as a rule, are widely separated. They are more horizontal, and the scapula is crowded forward with them. As a general rule, with the lateral curvature there exists considerable rotation. This rotation may be so marked that the side of the body of the vertebra may look directly backward, while the angles of the ribs upon one side may occupy the position of the spinous processes. While the ribs are greatly projected upon one side, they are markedly depressed upon the opposite side, and in some cases the thorax may be so distorted that the lower ribs upon one side may touch the iliac crest. One breast is usually much more prominent than the other.

Cause.—The causes of spinal curvature are: A. Lesions of the spinal column (bones and cartilages). B. Lesions of the muscles. C. Lesions of other tissues.

A. Lesions of the Spinal Column are: 1. Subluxations of the vertebrae and ribs interfering with the nutrition to the intervertebral discs, or parts of the body of the vertebrae, thus causing maldevelopment. 2. Luxations of the vertebrae and ribs affecting directly the blood and nerve supply to the bones. 3. Fractures of the vertebrae. 4. Destructive osteitis or Pott's disease of the spine. 5. Spina bifida, etc.

B. Lesions of the Muscles are: 1. Muscular spasm, producing subluxations, or luxations, as happens in torticollis. 2. Muscular contractions, as occur in muscular rheumatism. 3. Muscular atrophy, whereby the muscles upon one side of the spine are rendered weak, when those acting upon the opposite side produce curvature. 4. Muscular hypertrophy, where the muscles upon one side of the spine become hypertrophied and stronger than those upon the opposite side. 5. Contractions from burns.

C. Lesions of Other Tissues are: 1. Collapse of the lung. 2. Pleuritic adhesions. 3. Habitual one-sided position of the body. 4. Strama, rickets, etc. 5. Weakness and ill health.

Kyphosis, or posterior curvature, is produced by: 1. Relaxed condition of the ligaments. 2. Failure of development of the anterior parts of the bodies of the vertebrae. 3. Rickets and ill-nourished conditions. 4. Certain occupations and bad hygienic surroundings. 5. Caries of the anterior portions of the bodies of the vertebrae.

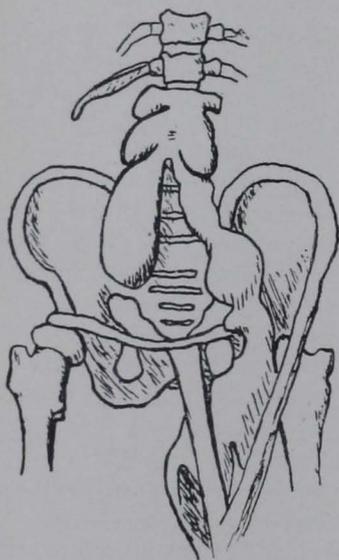
Lordosis, or anterior curvature, is often congenital. It may be secondary to Pott's disease, hip-joint disease, or sacro-iliac disease. This curvature is usually found in the lumbo-dorsal region.

Pathology.—In general, pronounced cases of spinal curvature are found in persons whose general health is more or less affected. There may be lesions accounting for this condition. The curvature is the result of subluxations, or luxations of the vertebrae. These are really pathological dislocations. Curvature of the spine will affect the integrity of the spinal nerve roots. These nerve roots will be more or less impinged upon and the blood supply to the spinal cord more or less arrested. The trophic influence of these nerves to certain of the tissues will be withdrawn. This results in paralysis, and in disease of organs.

Treatment.—The treatment of curvature of the spine has been revolutionized in recent years, and especially by osteopathic methods. Formerly braces, plaster casts, the jury mast and other apparatus were used to correct curvature, while no attempt was made to increase the nutrition of the weak and diseased structures. The results from such treatment were unfavorable. Some authors now advise against the use of what Dr. Still condemned years ago. An instance is as follows: "Perhaps the most important advice to be given to the general practitioner in relation to the treatment of this condition is caution against

the use of braces, corsets, jackets, and other mechanical appliances, which by confining the movements of the chest and supplying all artificial support in place of the muscle which it is desired to develop, *actually do great harm to many patients instead of good*" (American Text Book of Surgery, page 622). The curvature may be cured by means of manipulation. Whatever cause exists, this should be removed. Luxated vertebrae should be reduced; tense ligaments should be stretched, while spastic conditions of the muscles must be relieved by proper manipulative measures, such as rotating the vertebra upon its axis and removing pressure on certain nerves. By securing a better blood and nerve supply to the structures outside of the spine, the curvature may be cured. Many times the spinal curvature is looked upon as secondary to other

FIG. 107.



Pott's disease of the spine with abscess formation.

ailments, when, on the other hand, it is primary, or, if secondary, it serves to keep up the disease process. If the spinal curvature is relieved, the disease usually abates. If manipulative means are kept up, the most obstinate cases may be cured. Cases of complete paraplegia and of the worst forms of paralysis have been entirely cured and the patient restored to health by correcting the spinal curvature.

Caries of the Spine, or Pott's Disease is sometimes called tuberculosis of the spine. It is claimed by the majority of authors that this disease is tubercular. The ground for calling this affection a tubercular process is its clinical course. The pathological conditions do not warrant the statement that the disease is always tubercular. There are some cases which undoubtedly are tubercular.

The **exciting cause** of the disease consists of blows, wrenches, or strains which excite inflammation.

The **predisposing causes** to this affection are spinal curvature, subluxations of the vertebrae, such as spinal lesions, which may consist of lateral, rotary, or antero-posterior displacement, subluxations of the ribs, and muscular contractions. These interfere, more or less, with the nutrition of the parts where the disease arises. This interference in the nutrition may be in the shape of an obstruction to the return circulation and an impingement of the arterial circulation, or a more or less interference with the normal flow of nerve force.

Other Causes are tuberculosis, syphilis, acute infectious fevers, or infection by the pus germs.

Situation of the Disease.—Any part of the spine may be affected, but usually the dorsal and lumbar portions are the parts involved.

The disease nearly always starts in the anterior portion of the body of the vertebra, and may result in the destruction of the vertebral body and the intervertebral substance, but the vertebral body is destroyed before the intervertebral substance. The reason why the anterior part of the bodies of the vertebrae is affected is because of the anatomical relations. The blood supply to this part of the vertebral body is more liable to interference because of displacement of the body of the vertebra, or because of rib lesions.

Pathology.—The tissue changes occurring in this disease are the same as those occurring in caries of bone elsewhere, or in formation of chronic abscess. For the pathology of which see Caries of Bone and Chronic Abscess. Because of the habits of the person, contractures of the muscles, rib lesions, and a more or less debilitated state, the circulation to the anterior portions of the bodies of the vertebrae become so affected that sprains, wrenches, bruises, or other injuries, cause an inflammation which results in some form of caries. This may be caries sicca, caries necrotica, or caries suppurativa (usually caries suppurativa). In Pott's disease of the spine, pus is the rule. When the disease occurs in the cervical region, a postpharyngeal abscess arises. When in the lower cervical region, the abscess may burrow laterally between the scaleni muscles and open above the clavicle. If the disease is in the dorsal region, a dorsal abscess may occur, when the pus may burrow into the viscera. When the abscess occurs in the lumbar region, in the neighborhood of the attachments of the psoas muscle, a psoas abscess arises. In some cases sequestration of the bodies of the vertebrae may occur. In other cases, the pus may form a distinct abscess, and caseation, and absorption of the pus taking place, the active symptoms disappear. The lamina, pedicles, and posterior portions of the bodies of the vertebrae are rarely affected. The cord membranes are never affected. They may be compressed because of luxations of the vertebrae, or the developing of inflammatory products, or pus formation, but the disease process does not invade the spinal cord. It more often affects certain nerves as they come off from the spinal cord, so that the symptoms are localized and refer to the compression or irritation of certain nerves. The cord may be compressed to some extent, giving evidences of spinal irritation, shown by contracture of the muscles, or exaggeration, or interferences with reflexes, but paralysis is rare.

Signs.—The signs of the disease are: 1. Pain. 2. Rigidity of the spine. 3. Deformity. 4. Abscess. 5. Muscular spasm. 6. Paralysis. The pain manifests itself variously. There is always a localized spot over the diseased bone which is painful. Other pains are neuralgic in character, and may be in the nature of referred pains—those produced by the pressure or irritation upon a nerve. The pain is referred to the distribution of the nerve, as, for instance, the genito-crural nerve may

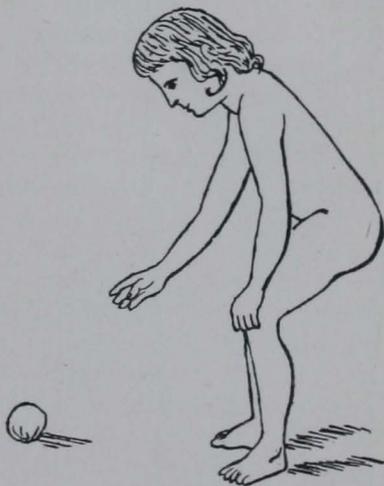
be affected, or the anterior crural, or some other of the lumbar nerves. If the second and third cervical vertebrae are affected, the auricularis magnus, occipitalis major and minor nerves will be affected, causing pain behind the ear on the back of the head. The pain may be in the nature of bilateral cramps. In grown people, the pain is in the nature of headache, backache, and girdle-pains.

Rigidity of the Spine is a constant accompaniment of Pott's disease, and is one of the earliest symptoms. It is produced by contracture of the muscles and ligaments, brought about by irritation. This of itself operates against recovery, inasmuch as it interferes with a proper circulation of the fluids. When the lower part of the spine is affected, the back is held stiff and causes a peculiar gait, while the movements of the body in sitting or stooping are greatly modified. The patient often becomes weak and supports himself by extended arms upon his legs. In a little child, this rigidity of the spine can be tested by having the patient lie prone while the legs are lifted. Under normal conditions the spine is fairly flexible. It is hardly necessary for the benefit of the osteopathic practitioner to describe the methods of determining the rigid condition of certain portions of the spine, inasmuch as his teachings include all such conditions. Stiffness in the neck, caused by caries, will be evident upon forced movements.

The **deformity** depends upon the part of the spine involved and the extent of such involvement. In the lumbar region, when but one or two vertebrae are involved, there may be no deformity appreciable upon inspection, but palpation will reveal a lesion. This lesion may be of a single vertebra, or three or four, and may be displaced laterally, antero-posteriorly, or twisted. When several of the vertebrae are affected, and there is extensive destruction of the bodies, there may be angular deformity, or a considerable area may be markedly curved. In the cervical region, much curvature is not common, but the lesion is apparent. The most profound curvature is found in caries of the dorsal region. In the cervical region, the deformity present may manifest itself as a twisting of the vertebra and a partial dislocation of the articular surfaces.

Abscess in Pott's disease occurs in the majority of cases. The abscess may reach large proportions, or it may be small. The direction which the pus may take will depend largely upon the part of the spine affected.

FIG. 108.



Method of testing the rigidity of the spine, as occurs in spinal caries.

Retropharyngeal or Postpharyngeal Abscess arises in caries of the cervical vertebrae. It forms a soft, fluctuating mass in the back part of the pharynx, and may cause difficulty in swallowing and breathing. The pus may rupture into the pharynx, or it may burrow down behind the esophagus into the chest and posterior mediastinum. It may burrow laterally, opening above the clavicle, or passing beneath the clavicle behind the axillary vessels. If it ruptures

within the pharynx, and the opening becomes septic, the disease may terminate fatally.

FIG. 109.



Psoas Abscess, pointing in Scarpa's triangle.

Dorsal Abscess.—The pus which forms in caries of the dorsal vertebrae passes backward between the vertebral ends of the ribs underneath the erector spinae mass, forming an abscess four or five inches from the spinous processes. This abscess *yields an impulse upon coughing*. There are cases where the abscess burrows along the vessels and nerves and appears where the lateral cutaneous branches are given off on the side. In some cases, it may pass down the spine, going underneath the ligamentum arcuatum internum and into the sheath of the psoas muscle, forming a psoas abscess.

Lumbar Abscess is due to the pus passing backward along the posterior branches of the lumbar vessels and nerves. It appears on the surface of the outer border of the erector spinae mass and usually points in Petit's triangle. Psoas abscess forms in the sheath of the psoas muscle, passes underneath Poupart's ligament, forming a tumefaction on the front and inner side of the thigh. It may then burrow underneath the fascia lata, but usually ruptures in Scarpa's triangle. The pus appears at a point at the junction of the middle and inner one-third of Poupart's ligament and to the outer side of the femoral vessels. The constitutional symptoms attending the formation of these abscesses are like those attending the formation of any chronic abscess. The pain depends entirely upon whether the trunk of a sensory nerve is affected.

Paralysis and Muscular Spasm do not, as a rule, occur in the course of spinal caries. The cause is often due to the formation of a mass of inflammatory tissue beneath the posterior common ligament. This, if the irritation is slight, will cause muscular spasm and pain, or if the pressure is considerable, cause areas of anesthesia, or localized

muscular paralysis. The effect will depend largely upon the rapidity of the development of the pressure. Where the pressure comes on very gradually, the symptoms are those of sclerosis. Where it comes on rapidly, the symptoms indicate inflammatory softening. Where the paralysis is sudden, it is due to hemorrhage, or luxations. In conditions of paralysis, the disease is usually located in the upper dorsal region. Paraplegia, or paralysis of the body below, happens only in about one case in fifteen. Paraplegic symptoms must be differentiated from those of pressure upon nerve roots. The pressure upon nerve roots causes neuralgic pains, or paresis, or paralysis of a limited area. In compression of the cord, motor and sensory symptoms are combined, but the motor symptoms usually predominate. At first there is a dragging of the toes, a loss of power in the legs, weakness of the sphincters, and an exaggeration of the reflexes. Later on paralysis becomes complete, because of degeneration of the cord. Afterward, *rigidity of the muscles* and a loss of the reflexes occur. In sacral caries there may be no deformity and but little pain. An abscess may form on the buttock, or in the groin, and may be bilateral. Where the abscess ruptures of itself, mixed infection usually occurs, which is followed by hectic symptoms, and should the patient's resistance be low, the case will likely terminate fatally. Long continued suppuration is of itself exhausting, while at the same time lardaceous disease, together with degenerations in the organs, may set up, which terminate the case fatally. The pus may burrow into the viscera and cause death by rupture, or meningitis may be set up, or a condition of pyemia or multiple abscess formation may develop upon the absorption of pus germs. In paraplegic cases, bed sores often operate as a complication, while septic cystitis may bring about a fatal termination from exhaustion.

Diagnosis.—The diagnosis of the disease is easy. A psoas abscess may be differentiated from an abscess of the hip by the fact that if it ruptures in Scarpa's triangle the sinus extends back up the psoas muscle, while in a hip abscess, should it rupture in the groin, the sinus will extend backward and downward. It may be differentiated from an iliac abscess by the presence of spinal disease. Occasionally abscess of the appendix, in chronic appendicitis, ruptures in this same neighborhood. A careful examination will enable the physician to distinguish between them. It may be confounded with femoral hernia (see femoral hernia).

Treatment.—A. Osteopathic.—Like chronic abscess, or chronic bone disease, this affection has its origin in the fact that the tissues of the anterior parts of the bodies of the vertebrae have been partly deprived of their nutrition because of luxated ribs, or subluxated or twisted vertebrae. These displacements cause direct pressure on the small arteries, depriving the diseased part of its proper blood supply. The question as to whether the diseased process is tubercular or a degenerative one does not in any way modify the treatment, since the deposit

of the tubercle is dependent upon the lesions. It is not possible to introduce into the diseased area any drug which will destroy the germ, if present. The only treatment is to build up the tissues so that they may, after a time, resist the ravages of the germs, or destroy them. Where the disease depends partly upon a general nutritive disorder, the removal of the lesions directly responsible for the carious process will not effect a cure. Other lesions in these cases will be found responsible for the general depraved condition of the system. Where the cases are seen early, no deformity apparatus will be found necessary, but the lesions should be corrected and the blood supply encouraged through the vasomotors. In cases seen late, after abscess forms, the same treatment must be followed out. The abscess may be opened after it points and rupture is imminent. Good drainage must be established and the abscess cavity must be washed out daily with an antiseptic solution 1:2000 bichloride of mercury, or 1:40 carbolic acid solution. This will not always be necessary. Only where streptococcic infection seems likely will it be demanded. Where great deformity and paralysis have occurred, the disease will require treatment for from six months to two years. Many cases will get well in four or five months after abscess has formed. The patient must have the benefit of a good substantial diet, fresh air, and sunshine. As far as can be done, apparatus to limit the use of the spine, as the jurymast, plaster casts, etc., should be avoided. The results of the treatment are uniformly good. As a rule, the deformity and paralysis can be overcome in time. Hopeless cripples of years' standing have been entirely cured by the above methods.

B. Surgical.—In view of the very favorable results obtained by osteopathic treatment in spinal caries, operative measures such as advised by Treves and Halsted are not necessary. In the case of a psoas or lumbar abscess, before much pus is formed, aspiration of the abscess may be done under aseptic conditions, while osteopathic treatment is regularly kept up. Usually this will be successful. Where it is not successful, the abscess should be allowed to point. After pointing it should be freely opened, the cavity thoroughly washed out, and good drainage established. The abscess cavity should be washed daily with an antiseptic solution until the discharge has apparently ceased. Drainage should be provided for, while the osteopathic treatment is continued. Favorable results will be obtained. The application of plaster jackets, or extension of the spine, are methods not advisable. Formerly, many surgeons advised forcibly straightening the spine to overcome the deformity, but this is not needed. Operations for the removal of the carious bone and all of the diseased tissues have not been attended by results sufficiently favorable to warrant such procedure. More or less ankylosis of the spine will take place because of the formation of inflammatory tissues and a gluing together of the lamina and articular processes, the ligaments of the spine remaining intact. The deformity and ankylosis resulting may be more or less relieved by appropriate treatment. The patient should have the benefit of out-door

air and a nourishing diet. The secretions should be attended to, while pressure symptoms may be relieved by a correction of the deformity and relief of the inflammation. Septic cystitis developing demands irrigation of the bladder by an antiseptic solution.

Osteo-arthritis.—Arthritis deformans of the spine is a rare affection. The margins of the bodies of the vertebrae become thickened and enlarged, resulting in more or less ankylosis of the spine. This ankylosis may extend even to the ribs, so as to render them almost entirely immovable. The cause of the disease is obscure. The symptoms will depend upon the amount of involvement of the spinal nerves. Paralysis and neuralgic pains are the rule.

Treatment.—Heretofore no favorable results have been reported in the treatment. The osteopath should remove whatever lesions he finds. Whether or not these will be attended by good results will depend upon how early the case is seen.

Dislocations of the Spine may be complete, or incomplete. They are more common in the cervical region, but may occur in the dorsal and lumbar regions. It has been disputed by many that complete dislocations of the lumbar spine may take place without fracture, but unquestioned cases have been found upon autopsy (See American Text Book Surgery, p. 646). Dorsal dislocations occur in the lower part of the dorsal region most frequently. Partial dislocations of the spine are the rule, and are believed many times to play a great part in disease production, sometimes operating as the direct cause of disease, at other times as the indirect cause. The luxations may be bilateral, or unilateral. Bilateral dislocations may be produced by forced flexion, or extension, and the dislocation may be forward, or backward. It is the rule to speak of the upper vertebra as the one dislocated. In complete forward dislocations, the inferior articular process will rest on the pedicle of the vertebra below at a point between the articular process and the body. In backward dislocations, the superior articular process will rest between the inferior articular process and the body of the vertebra above. In this condition there may be little or no pressure upon the spinal cord, but there will be pressure upon the nerve roots as they leave the spine, hence the paralysis may be only limited. In some cases, the paralysis may be extensive, depending upon the amount of injury to the spinal cord. Unilateral luxations are produced by extreme lateral motions of the spine, with or without rotation. In such cases, it is much less likely that there will be pressure upon the spinal cord. There may be pressure only upon a single nerve as it passes out of the intervertebral foramen. This pressure may be evidenced by pain, or by paralysis.

The causes of the dislocations are the same as dislocations in other parts of the body, forced movements, muscular contractions, direct and indirect violence, and wrenching or twisting of the spine. In incomplete dislocations, more or less pressure is made upon the roots of the

spinal nerves, cutting off the nerve supply to certain structures, making a weak point, thus permitting the development of disease.

The **diagnosis** of these conditions may be made by palpating the articular processes and by noticing the general alignment of the spine. The transverse or articular process may be palpated and luxations can be made out. The spinous processes will not always give an accurate idea of the positions of the bodies of the vertebrae, inasmuch as they may often be absent, twisted, or deformed, indicating that there might be curvature, or luxation, when there is none. Usually the symptoms, direct or reflex, are sufficiently pronounced to lead one to investigate a certain part of the spine. Upon close examination, a subluxation, or complete luxation, may be made out.

Reduction.—These luxations are reduced by manipulation. The manipulation consists, in the main, of exaggerating the deformity, then catching the luxated bone with the thumb, or finger, the body is rotated, and the bone pushed into place by firm pressure. In general, this applies to all of the vertebrae. Reduction can easily be accomplished without injury to the spinal cord. It was the former practice of physicians of other schools to allow these luxations to remain, for fear death would be produced by attempts to effect reduction. Complete dislocations of the atlas and axis have occurred, reduction has been made, the person afterward continuing in good health. Subluxations of these vertebrae are much more common, and by the osteopathic practitioner will bear an exhaustive study.

Fractures of the Spine are usually in the nature of a fracture-dislocation; that is, a fracture accompanied by dislocation. The most common site is in the dorsal and lumbar regions. Dislocations of the spine are more common in the upper part of the column.

Cause.—The cause of the fracture is direct and indirect violence. Direct violence, by blows, or heavy falls, where the force is transmitted from behind directly upon the spinal column, or by falls upon the buttocks or extended legs. The nature of the fracture varies with the kind of violence producing it.

Nature of the Injury.—When the fracture is produced by direct violence, the inferior articular processes may be broken off and the vertebrae displaced forward. This results in rupturing of the anterior common ligament. The spinous processes, laminae, or pedicles, may be broken without fracturing the bodies of the vertebrae. This is the rule in fractures from direct violence. In fractures from indirect violence, one or two vertebrae may be fissured, the bodies usually being affected, inasmuch as the chief force is directed upon them. As a rule, the transverse, articular, or spinous processes are not affected, nor are the laminae or pedicles. The displacement of the vertebrae may be much, or little.

Nature of the Injury to the Cord.—*The importance of a condition of fractured spine is not so much the injury to the vertebrae as it is the injury*

to the cord. The cord may be torn asunder, which will result in complete and permanent paralysis of the structures below that point. It may be compressed so that its conductivity is only temporarily suspended. In other cases, fractures of the spine may occur without any paralytic symptoms, nor is the primary injury to the spinal cord always of the greatest importance. The nature of the inflammatory reaction which follows is, perhaps, of greater importance. The functioning of the spinal cord is usually destroyed by inflammatory softening. If the injury is extensive, this inflammatory softening is more likely to occur. Absolute paralysis of motion, sensation, and the reflexes below may be followed by a complete recovery with proper treatment, providing the inflammation is not too great.

Symptoms.—The symptoms of fracture of the spine vary, according to the region injured, and according to the degree of compression of the cord. The clearest mental picture may be obtained from considering a fracture at a single location. In fracture of the upper or mid-dorsal region the symptoms are, in the main, as follows: There is paralysis below, more or less complete—paraplegia. Immediately above the site of injury, there quickly appears a zone of hyperesthesia. The intercostal and abdominal muscles are more or less paralyzed, so that respiration is carried on chiefly by the diaphragm and the elastic and involuntary muscular tissues of the lung, the abdomen rising and falling with the action of the diaphragm. There is paralysis of the sphincters, the urine at first being retained, but after the bladder becomes distended, it dribbles away. There is incontinence of feces. In the male, priapisms are liable to occur, especially upon using a catheter. There may be a spastic condition of some certain groups of muscles, while others may be completely paralyzed. Some of the deep reflexes may be present. Evidences of the reflexes returning, is a sign of the conductivity of the cord returning. After a few days, bronchial troubles will arise, or, if the fracture is high up, cardiac symptoms may appear, because of injury to the vasomotor fibres in the upper dorsal region. The bronchitis will end fatally in a few days. If the patient escapes these troubles, he may live two or three weeks, when secondary complications, such as bed-sores, cystitis, etc., will cause the case to terminate fatally. Bed-sores are the result of the dribbling away of the urine, the bed-clothing being continually saturated with the urine, which decomposes and brings about a foul condition. A little scratch, or slight irritation of the skin, will result in bed-sores which are very difficult to heal. The bed-sores are partially the result of the irritation of the urine, and partially the result of vasomotor disturbances and interference in the nerve influence to the tissues.

Cystitis.—Because the bladder is deprived of the proper nerve and blood supply, and because micro-organisms are likely introduced into the bladder with a catheter, decomposition of the urine may take place. It becomes ammoniacal and will contain ropy mucus and pus. The absorption of this pus brings about a septic condition. This in-

flammation may extend up the ureters and produce pyonephrosis or a suppurative condition of the kidneys. This cystitis is usually fatal. Sometimes bed-sores and cystitis will occur conjointly. The bed-sores are best treated before the sore appears, by sponging the tissues off with strong alcohol once or twice daily and dusting talcum over the parts so as to keep them dry, or, as each small pimple appears, apply oxide of zinc ointment. After the sore appears, it should be dressed once or twice daily with antiseptics. A solution of 1:20 carbolic acid for a time, then 1:2000 corrosive sublimate. After the sores are thoroughly washed, boracic acid may be dusted in them, or aristol, or a little balsam of Peru applied on cotton. Gauze and cotton may be applied to the sore and held in place by adhesive strips. A water-bed is the most useful appliance in the treatment of these cases. Cystitis is best treated by washing out the bladder with a solution of boracic acid (ten grains to the ounce) once or twice daily.

Terminations.—A. In the cervical region. If the fracture is of any of the four upper cervical vertebrae, death is liable to occur, because of paralysis of respiration.

B. Lower cervical and upper dorsal region. Hemorrhage into the cord may extravasate upward, pressing upon the roots of the phrenic nerve and producing death, or a low bronchitis may develop in a few days. Bed-sores, cystitis, etc., usually cause the case to terminate fatally within three or four weeks.

C. Middle and lower dorsal region. If the person survives the inflammatory reaction which follows the injury, he will partially recover, and in some cases, almost complete recovery may occur, leaving only some deformity of the spine as an evidence of the fracture.

D. Lumbar region. In the lumbar region, a fracture with dislocation may occur without any paralytic symptoms. Below the second lumbar there will be no injury to the cord, but the cauda equina will suffer. There may be partial or complete paralysis of a group, or groups, of muscles.

Prognosis.—The prognosis will entirely depend upon the nature of the treatment. Osteopathic methods are superior to those of any system of treatment.

Treatment.—A. First, rest until fibrous and bony union has occurred.

B. Manipulative measures to increase the blood supply to the parts affected.

C. Guard against cystitis and bed-sores, with attention to the secretions. In the treatment of bed-sores above mentioned only surgical treatment has been given. The osteopathic treatment is of greater importance. Even with the strictest asepsis, a good recovery can not be obtained unless nature herself can produce it. Osteopathic treatment means to assist nature in that it increases the blood and nerve supply to the affected areas. Congestion of the inflamed area of the cord should be

relieved, and the relieving of this congestion of the inflamed cord brings about the recovery of its conductivity. This is followed by a better nerve and blood supply to the tissues generally, so that bed-sores are avoided. Extensive bed-sores, attended by necrosis of large masses of the tissues involving the erector spinae mass, denuding the iliac bones and the lumbar spine, in fact, extending over the entire lower back, have been successfully treated by osteopathic methods after all hope had been given up by eminent surgeons. This but illustrates the osteopathic principle. In almost all cases of bed-sores, unless there is absolute paralysis of the tissues below, the sore may be readily healed, if simple cleanliness is maintained and appropriate osteopathic treatment is administered. This osteopathic treatment consists in increasing the blood supply to the sore, and in gently manipulating the spine, so as to increase its blood supply if required, or to relieve the congestion, as the case may be, or to reduce any luxation present. Where the case is seen early during inflammatory softening, appropriate osteopathic treatment will prevent the appearance of the bed-sore.

Concussion of the Spine consists of a molecular displacement of the anatomical elements of the spine. It is a disarrangement of the cells because of severe jarring, as occurs in railway accidents. In some cases, there may be punctuate hemorrhages, or even lacerations, attended by paralysis, or the injury may be simply a partial dislocation, more or less interfering with the blood supply to the spinal cord itself, rendering it anemic, resulting in paresis. Where paralysis occurs, it is likely due to hemorrhage, or laceration. The condition of railway spine is the result of certain spinal lesions. The symptoms vary in the different cases, according to the lesions present and to their length of standing.

Treatment.—In concussion of the spinal cord, or in conditions of railway spine, the treatment is to remove the lesions present. If the lesions are not of too long standing, the prognosis is favorable.

Compression of the Cord.—Compression of the cord is produced by (1) dislocations, (2) hemorrhages, (3) inflammatory products, pus, etc., (4) tumors, (5) fractures. The differential diagnosis between these conditions is usually easy. The evidences of inflammation and pus are sufficiently plain and have been discussed elsewhere. The presence of the fracture, or dislocation, may be determined by the deformity. In the case of dislocation, the diagnosis is made by the alteration of the alignment of the vertebrae and by crepitus, in case of fracture of the spine. The symptoms of compression vary according to the degree of compression and the part of the spine affected.

Traumatic Hysteria.—Traumatic hysteria, or a hysterical condition the result of injury, always bears with it the element of suggestion; furthermore, the stigmata of hysteria will be found present. There are evidences of a neurosis. There are numbers of these cases where the removal of a lesion will cure the case, but the prognosis should be

guarded. Many times the patient will be apparently helpless and the removal of the lesion will produce remarkable recovery. As to whether or not the lesion will produce the symptoms in question, will be evident to the observer. Inasmuch as the patient has no knowledge of the anatomy, the symptoms which are simulated will not be in accordance with the anatomy.

Operations on the Spine consist in operations for tumor, or laminectomy, for the removal of pieces of bone or foreign bodies pressing upon the spinal cord.

DISEASES AND INJURIES OF THE HEAD.

Contusions of the Scalp.—Contusions of the scalp, if sufficiently severe, will cause extravasation of blood. This extravasation may take place between the aponeurosis of the occipito-frontalis and the periosteum, or may take place beneath the periosteum. In any case, it forms a puffy tumor. The blood may coagulate, afterward liquefaction may follow, and a sort of cystic tumor result. The tumor will disappear by absorption. A hematoma may be produced by the blade of the forceps in instrumental delivery of a child. The diagnosis can be made without difficulty by running the finger around along the edge of the tumor, gradually encroaching upon it. The blood will be felt to give way, and there will be no erosion of the bone. In the formation of a cold abscess, there will be erosion of the bone and a ridge of inflammatory tissue around the edge of the tumor. If suppuration of the tumor occurs, it should be opened and freely drained. Where the tumor persists, the contents may be aspirated. Manipulation, such as loosening the tissues about the tumor, relieving contracted muscles and fascia of the neck, to assist the return circulation, will secure absorption of the fluid.

Wounds of the Scalp.—Wounds of the scalp are of the varieties of wounds in other soft tissues. Two dangers beset wounds of the scalp which may not be present in wounds of other parts of the body. These dangers are:

1. Hemorrhage, because of the extensive blood supply.
2. Sepsis, inasmuch as the scalp is an unclean part of the body. Sharp hemorrhage will occur from wounding the anterior or posterior divisions of the temporal artery, or branches of the occipital artery. This hemorrhage can be readily arrested by compression, but where it is very severe, the artery should be caught up with hemostatic forceps and the end of the vessel tied. If the wound is extensive, it is necessary to provide for drainage, which should be at the most dependent portion of the wound. Small scalp abrasions will require no suturing, but extensive wounds will require a few sutures. The number of sutures should be few, and the distance between them greater than in other parts of the body. A small cicatrix will do no harm, unless it is on a part of the scalp where there is no hair. The wound should be

rendered aseptic by thoroughly washing with antiseptic solutions, the hair along the margins of the wound should be shaved off, and the skin approximated. The wound may then be dressed with boracic acid, borated gauze and cotton. A compress may be applied by means of layers of gauze and a mass of cotton, the bandage being applied sufficiently tight about the head to keep the dressing in position. These wounds usually heal very quickly, providing there is no sepsis, since there is a luxuriant blood supply. Should the wound become unhealthy, it must be freely opened by removing the sutures and every part thoroughly washed with an antiseptic solution.

Contusions of the Bones of the Skull.—Contusions of the bones of the skull are not serious in the ordinary healthy individual, but in persons the subject of tuberculosis, or syphilis, necrosis of the bone may occur. This may be serious. These contusions will require no special treatment.

Fractures of the Skull.—Fractures of the skull may conveniently be divided into:

A. Fractures of the vault.

B. Fractures of the base.

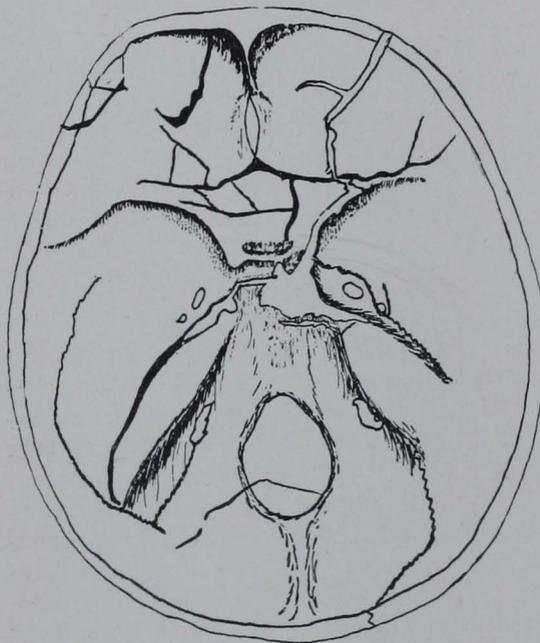
Fractures of the Vault of the skull are nearly always produced by direct violence. Fractures by indirect violence may occur, as by *contrecoup*. The varieties of fractures are, in general, those of other bones. The most common are fissured, stellate, depressed, and punctured. Elevated fractures may occur in military, but rarely in civil, practice. The fracture may be simple, or compound, depending upon whether there is a wound extending into the site of fracture.

Condition of the Parts.—This will vary according to the nature of the fracture. A simple fissured fracture of the skull may be attended by no signs whatever save that of a bruise of the soft tissues. In stellate fractures, several lines of fracture extend out in different directions from the same point. These irregularities may be felt. In depressed fractures, the depression may be round, or oblong, the "pond and gutter" fracture of the old writers. The fracture may be fissured, with one fragment depressed, or both sides of the fissure may be depressed. The fracture may be extensive, traversing the parietal, frontal, and temporal bones. Where the fracture is compound, the diagnosis is easy, but where it is simple, unless the fracture is elevated, depressed, or punctured, it is difficult to determine. The only other symptoms indicating fracture may be evidences of compression. Where the case is doubtful, it should be carefully watched, and if secondary symptoms, such as headache, epilepsy, evidences of neuritis, etc., develop, a flap should be raised and the skull trephined at the point of injury. In general, where there are evidences of depressed bone, the chisel, or trephine, should be brought into use. The case should not be allowed to continue until traumatic epilepsy develops. After epileptiform seizures have developed, the operation may not be attended by

good results. In some cases of compound or depressed fracture, there may be extensive destruction of the brain substance, or a fragment of the fractured bone may extend down through the dura mater, lacerating or puncturing the brain. In these cases, a flap should be raised, the loose pieces of bone removed, the lacerated tissues placed in normal position, the dura mater sutured, and the periosteum having been separated from the loose fragments of bone, should be sutured over the opening and drainage established. If the wound is extensive, the strictest asepsis should be maintained, inasmuch as septic meningitis may develop. If possible, drainage should be dispensed with, as it renders infection more liable. In any case, it should be removed early. Every possible attempt should be made to have the wound heal by first intention.

Fractures of the Base of the skull may result from direct, or indirect, violence. Fractures from direct violence are caused by blows or falls directly upon the skull.

FIG. 110.



Fracture at the base of the skull.

Fractures from indirect violence occur where a person falling from a great height alights on the feet or buttocks; the force is transmitted through the spinal column to the base of the skull, which is fractured.

Site of Fracture.—

The fracture may extend in any direction, through the (a) anterior, (b) middle, or (c) posterior fossa, or two of the fossae may be implicated in the same line of fracture.

Anterior Fossa.—

The line of fracture may extend through the orbital plates, or through the cribriform plate of the ethmoid, so that

hemorrhage may take place through the nose, or effusions of blood may take place within the orbit and appear beneath the conjunctiva. Paralysis of some of the nerves which enter the orbit may occur.

Middle Fossa.— Fracture of the middle fossa usually involves the middle part of the petrous portion of the temporal bone, or may involve

all of the bones. The fracture may extend into the tympanum by lacerating the membrana tympani, and may open into the meatus auditorius externus. The lateral sinus may be implicated, or branches of the middle meningeal artery being ruptured, blood may effuse into the middle ear and come out of the external ear. Blood extravasations within the skull, or pressure of fragments of the bone may involve some of the cranial nerves at their exit.

Posterior Fossa.—The fracture usually extends through the foramen magnum. It may extend into the petrous portion of the temporal bone, or the fracture may take place through the basilar portion of the occipital bone and by rupturing the mucous membrane beneath, hemorrhage will take place into the pharynx. Certain of the cranial nerves will also be affected.

Symptoms.—The symptoms may be divided into (A) General and (B) Local.

The **general symptoms** of fracture at the base of the skull are those of *compression* of the brain.

The **local symptoms** are:

1. The escape of cerebrospinal fluid. The most characteristic feature of this symptom is the large quantity of the fluid escaping. The quantity is variously estimated by different writers at from one to three or four pints in twenty-four hours, so that numerous dressings will be required to absorb the flow. The fluid is clear and somewhat resembles serum. A chemical analysis is hardly necessary to determine whether the fluid is cerebrospinal or not. The points from which the escape of this fluid may be made, are wounds, the nose, mouth, and ear. The escape of fluid may take place from wounds when the fracture at the base of the skull is compound. It may take place through the nose, when the fracture extends through the cribriform plate of the ethmoid. It may take place through the mouth, when the fracture extends into the vault of the pharynx. It may take place through the ear, when the fracture extends entirely into the middle ear and the membrana tympani is lacerated.

2. Blood Symptoms. These consist of hemorrhage and blood effusions. Hemorrhage is of little value as an indication of fracture at the base of the skull, inasmuch as the flow of blood is no more severe than when there is but a wound in the soft tissues, but blood effusion is of more value. Blood effusions may be subconjunctival in fractures through the orbital plates, and the effusion of blood takes place in the orbit, or they may be about the mastoid process in fractures of the posterior fossa, or the blood effusions may take place in the suboccipital region. Blood effusions in these localities, without evidence of local injury, are an indication of fracture of the base of the skull.

3. Paralysis of the Cranial Nerves. These may be manifest in strabismus, ptosis, Bell's paralysis (where the facial nerve is implicated), the pupils may be irregular and dilated, there may be diplopia, or there

may be paralysis of accommodation. Where the patient is not unconscious, the latter symptoms are of importance, but where the patient is unconscious, they may not be of as much value.

Treatment.—The treatment of fracture at the base of the skull is rest and attention to the secretions, together with local treatment of the wound and manipulation, in general, to assist the return circulation. No drugs will be found of any advantage. There are cases where the patient is delirious and more or less irritable, but under no circumstances should morphine, alcoholic stimulants or other drugs be allowed. If the person survives the early compression, absorption of the fluids may be secured, and the paralytic and other symptoms will gradually disappear. The prognosis is unfavorable, but many cases recover.

Concussion of the Brain.—Injury to the brain itself is manifest by certain symptoms which are classified, as a rule, under two conditions, concussion and compression. The difference in the pathology of these two affections is not always well defined, and the symptoms vary.

Concussion is a condition of extensive jarring of the brain. The tissue elements of the brain are shaken up and the connections between the cells and groups of cells are for a time suspended. It may be described as a molecular displacement of the brain elements. In some cases there may be punctuate hemorrhages; others describe the conditions as a vasomotor disturbance. A person suffering from concussion is popularly said to have been “knocked silly,” or “stunned.” The severity of the symptoms varies with the severity of the injury to the brain. There may be cases where the person is temporarily “queer,” and may stagger about and be unable to speak for a little time, and will appear as if drunk, but consciousness will quickly return and the queer feeling disappear. Pronounced cases are attended with severe symptoms, which may be classified as follows:

1. State of Mind. The person is more or less unconscious of his surroundings. In mild cases, he may know something of what is going on about him, but in severe cases, he knows nothing. Under all circumstances, he may be aroused to make an intelligent answer in monosyllables, as “yes” or “no.”

2. Skin. The skin is pale and cold, and the extremities are cold. The body-temperature may be subnormal.

3. Muscular Symptoms. There may only be a giddiness, or a giving-way of the muscles, or there may be complete muscular relaxation.

4. Respiration. Respirations are shallow, quiet, and a little more rapid.

5. Pulse. The pulse is small, soft, irregular, and more rapid. The heart is fluttering.

6. Pupils. The pupils react to light. They may be dilated, or contracted, but are unequal.

7. Paralysis. Paralysis of any part is rare, and if it occurs, is only temporary. There may be muscular twitchings in certain muscles.

There are severe cases of profound concussion in which there is evidence of great cortical irritation. This is manifest by the person shunning light and curling up in bed, and by more or less rigidity and twitching of the muscles. It may be almost impossible to open the person's eyes, as it causes pain.

8. Urine and Feces. The urine and feces may both be voided involuntarily.

9. Nausea and Vomiting. Nausea and vomiting appear late, and are favorable signs, as they are an evidence of reaction which they precede.

Reactionary Signs.—Reactionary signs are, as indicated, vomiting, followed by headache, lassitude, insomnia, low spirits, perhaps hysteria, and in severe cases, epilepsy and insanity. The longer the person remains unconscious, the more likely is the mentality to be seriously affected.

Treatment.—The treatment of concussion consists of equalizing the circulation and the proper restoration of the vasomotor impulse. In conditions of congestion of the brain, this congestion should be relieved. Cases may be brought out of concussion by manipulation of the bowels, which attracts the blood to the splanchnic area. Under no circumstances should alcohol be given. The application of hot water bottles to the abdomen and legs and restoring the circulation by treatment in the neck and upper dorsal region, together with rest and quiet, are all that is required. Enemata of hot water, or hot milk, after the lower bowel has been evacuated, is advised. A few drops of ammonia on a handkerchief may be of some service. Even if obstinate wakefulness and cortical irritation are manifest, no opiates should be allowed. Sleep can be produced by equalizing the circulation. It is believed, in concussion, that the chief difficulty is the suspension of the vasomotor function to the cerebral vessels. Undoubtedly in many of these cases, cervical lesions will be found, and if these are reduced, the concussion will disappear. It is believed that many of the cases which are described as concussion are the result of displacement of the atlas or some of the cervical vertebrae obstructing the return circulation.

Compression of the Brain.—Compression of the brain is produced by the following conditions:

1. Fractures, as depressed fractures of the vault, or fractures at the base of the skull.
2. Intracranial hemorrhage.
3. Tumor.
4. Pus, as in abscess formation.
5. Inflammatory exudates.
6. Foreign bodies.

Symptoms.—1. State of the Mind. The state of mind in compression of the brain is usually coma. The person may emit articulate sounds, but they are not intelligent, in contradistinction to concussion in which a reply can be obtained by speaking loudly in the ear.

2. Skin. The skin is hot and perspiring, while the face is flushed. The temperature may be elevated, or may be subnormal.

3. Muscular System. In general, there is a loss of all voluntary motion.

4. Respiration. Respirations are slow, deep, and noisy, because of paralysis of the soft palate, which flaps back and forth during respiration, and the buccinator muscles being paralyzed, the cheeks flap in and out.

5. Pulse. The pulse is full and bounding. It may be slow, or rapid, but is usually strong. It may be irregular.

6. Pupils. The pupils are fixed, and will not react to light. They may be regular, or irregular, dilated, or contracted.

7. Paralysis. Paralysis exists and may be extensive, involving one entire side—hemiplegia—or it may be limited to a member—monoplegia. There may be paralysis of some one of the cranial nerves, producing strabismus, ptosis, Bell's paralysis, etc.

8. Urine and Bowels. There is incontinence of feces and urine.

9. Nausea and Vomiting. Nausea and vomiting are unfavorable signs, indicating involvement of the base of the brain or medulla.

Differential Diagnosis.—Coma, present in compression of the brain, may be simulated by comatose conditions arising in:

1. Apoplexy. 2. Uremia. 3. Diabetes. 4. Opium poisoning.
5. Alcoholic intoxication. 6. Epilepsy. 7. Hysteria.

Confusion in the diagnosis is not so liable in private practice as in hospital practice.

Apoplexy.—Apoplexy may be ushered in by convulsive movements. Hemiplegia is the rule. The temperature may be subnormal. It is more liable in conditions of arterio-sclerosis during excitement, or in a person the subject of syphilitic disease.

Uremia.—In uremia, albuminuria is one of the chief symptoms. In a doubtful case, the urine should be withdrawn and tested. The presence of albumen and tube casts indicates Bright's disease. The skin is sallow. Puffiness of the eyes and edema about the ankles are present.

Diabetes.—In diabetes, the quantity of urine is greatly increased and has a sweetish odor. The patient also has a sweetish breath. There is sugar in the urine. The pupils react to light.

Opium Poisoning.—In opium poisoning, there is a pin-point pupil, and it will not react to light. The respirations are slow and shallow, and there may be a history of the drug. In doubtful cases, the urine may be withdrawn and tested for the drug.

Epilepsy.—In epilepsy, the person can be aroused. The attitude of the person simulates that of natural sleep. The presence of bloody and frothy saliva is also indicative. There may be paralytic symptoms, but these are usually temporary.

Hysteria.—In hysteria the coma apparently is the result of choice. The patient can not be aroused, but can readily swal-

low articles put in the mouth. The pupils are normal. The disease occurs in neurotic individuals.

Treatment.—The treatment of compression will depend upon the cause. Where there is a depressed fracture, it should be elevated. Where it is the result of a tumor, and the case is operable, the tumor should be removed. If caused by pus formation, a button of bone should be removed over the site of the abscess and the pus evacuated. If from foreign bodies, these should be removed, if possible. Where the cerebral compression is caused by hemorrhage, if the hemorrhage is extradural, or subdural, operative treatment may give relief. Where operative treatment is questionable, the patient should be kept quiet in bed and all efforts made to assist the return circulation.

Extravasation of Blood Within the Cranium.

Extravasations of blood within the cranium may be classified as follows:

A. Extradural, where the effusion of blood is between the bone and the dura mater.

B. Subdural, where the effusion of blood is below the dura mater and between it and the brain.

C. Subarachnoid, when the effusion of blood takes place in the subarachnoid spaces.

D. Intracerebral, when the hemorrhage takes place within the brain substance.

Extradural.—Extradural hemorrhage results from rupture of the middle cerebral artery—usually the anterior branch. It is frequently associated with fracture of the skull. It may also be caused by wounds of the lateral sinus, superior longitudinal sinus, or small vessels passing through the inner table of the skull going to the diploe.

Symptoms.—While there may be symptoms of concussion, still a distinct period of consciousness, as a rule, intervenes before evidences of compression. As the extravasated blood dissects up the



FIG. 111.
Extradural hemorrhage from rupture of the middle meningeal artery.

presses upon the brain, the symptoms

will increase in severity, depending upon the amount of the effusion. Usually there is paralysis of one side, which gradually increases, involving the face, arm and perhaps the leg. The temperature of the affected side is elevated. The paralysis is on the opposite side to the injury. At first it is limited. The coma gradually deepens, until death may occur within a few days. In some cases the blood may force the brain substance out of the site of fracture.

Subdural.—In subdural hemorrhage, there is no interval of consciousness between the injury and the pressure symptoms, but paralysis comes on at once and is soon complete. As a rule, it cannot be diagnosed from hemorrhage within the brain.

Subarachnoid.—Subarachnoid hemorrhage, when of any quantity, attends lacerations of the brain, hence the symptoms of compression are immediate.

Intracerebral.—Intracerebral hemorrhage in nearly all cases comes from the rupture of the lenticulo-striate artery of Charcot. It is this artery which is ruptured in cerebral apoplexy. For the symptoms and diagnosis, text-books on *The Practice of Osteopathy* should be consulted.

Treatment of Cerebral Hemorrhage.—When the symptoms show that the hemorrhage is extradural, operation should at once be performed and the bleeding sinus or artery ligated. In subdural hemorrhage, if operation is done early, it will be of use. Where the rupture of the artery attends fracture, this is the only method of treatment which will give relief. All other methods will result in permanent paralysis, or death. Other forms of hemorrhage must be treated by other means. No drugs administered will lessen the amount of effused blood. An ice-cap may be applied, the person kept quiet in bed, and when the hemorrhage is arrested, treatment to encourage the return circulation from the brain and the absorption of the fluid may be administered.

Contusions and Lacerations of the Brain.

These injuries, like injuries of other soft-tissues, are attended by extravasations of blood, subsequent congestion, and inflammation sufficient to repair the injury. The symptoms, in general, are those of compression and concussion. They will vary from cerebral irritability, restlessness, lassitude, headache, and spasms of muscles, to paralysis, and perhaps coma. The symptoms vary according to the severity of the injury, and also according to its location. If Broca's convolution is affected, motor aphasia will result. If the lower part of the motor area is affected, the lower part of the face will be paralyzed. Where the tissues on either side of the upper part of the fissure of Rolando are affected, the leg will be paralyzed. The paralysis may be incomplete, localized, and delayed, and involve the entire limb, or but a group of muscles. When the laceration is within the brain, the paralysis is immediate, complete, and extensive.

Treatment of Cerebral Injuries.—If possible, foreign bodies within the brain should be located by means of the x-rays, the aluminium probe, or gravity probe, and an operation at once performed and the foreign body removed. To determine the site of the injury, or the location of a foreign body, tumor, or other object pressing upon the brain tissue, it is necessary to understand cerebral localization. The most pronounced symptoms attend pressure upon the motor area. To locate this part of the brain is of the greatest importance. In general, it is situated in the paracentral and postcentral lobules on either side of the fissure of Rolando. Inasmuch as extradural hemorrhage is from rupture of the branches of the meningeal artery, to locate this artery is of importance. The **anterior branch** of the middle meningeal artery may be uncovered by a button of bone removed at a point one and one-half inches directly behind the external angular process of the frontal bone. Providing the hemorrhage does not occur from rupture of this artery, a button of bone may be taken out on the same line, just below the parietal eminences. This will uncover the **posterior branch** of the middle meningeal artery. To locate the **fissure of Rolando**, first locate the bregma, which is found by drawing a line from one external auditory meatus to the other. The upper end of the fissure of Rolando is two inches behind the bregma. The fissure extends downward and forward from the bregma a distance of three and three-eighths inches. It makes an angle of $67\frac{1}{2}$ degrees, with a line drawn from the glabella to the external occipital protuberance. The lower extremity of the fissure of Rolando will then be found two and three-fourths inches behind the external angular process and one inch above it. It will be found that pressure upon the tissues on either side of the upper part of the fissure of Rolando results in paralysis of the leg, while pressure behind the middle part, the arm, and pressure upon the lower extremity produces paralysis of the face. For an exhaustive discussion of this subject, larger texts should be consulted.

Intracranial Inflammation.—Intracranial inflammation consists of:

- A. Meningitis, or inflammation of the coverings of the brain.
- B. Encephalitis, or inflammation of the brain substance.

Cause.—The causes of these inflammations are acute, general diseases of an infectious nature, middle ear disease, syphilis, tuberculosis, injury, lacerations, bone disease, contusions, fracture, rheumatism, and sunstroke.

Pachymeningitis is an inflammation of the dura mater, usually circumscribed, and is caused by inflammation extending from without, in.

Leptomeningitis is an inflammation of the pia mater and arachnoid, and may be localized because of infection from without. It is extensive, when the inflammation spreads throughout the membranes of the brain and cord.

Pathology.—The pathology of these inflammations is similar to the

pathology of inflammations of other like membranes. The extent of the inflammation depends upon the nature of the cause and the condition of the tissues.

Symptoms.—The symptoms are fever, pain in the head, which is greatest over the site of the severest inflammation, intolerance to light and sound. There is more or less nausea and retching, while the tongue does not indicate any trouble with the intestinal tract. The pulse is quick and full, the face is flushed, the pupils usually contract. There is restlessness and insomnia, and perhaps delirium. Later, serous effusions, inflammatory exudates, or pus formation, etc., press on the brain substance, and symptoms of compression supervene. These will be recognized by a fixed and dilated pupil on the affected side, slow pulse, stertorous breathing, paralysis, and coma. There may be rigors, indicating pus formation. In chronic inflammations, the symptoms are less severe and the onset sudden. There are localized evidences of sepsis. If the abscess is between the dura mater and the skull, puffiness of the skin, and the presence of pus, or a foul wound, would indicate abscess. Where there is no injury to the scalp, the symptoms arising may be due to the vascularity of the membranes, produced by a concussion or shaking up of the brain. After four or five days, the pia mater and the brain substance may be affected. In bruises and lacerations of the pia mater and brain, inflammatory symptoms may supervene several days after the injury.

Cerebral Abscess.—In the formation of a cerebral abscess, the symptoms are often delayed and are more or less obscure. There is evidence of optic neuritis and paralytic disturbance in the motor area. Rigors may, or may not, occur. The temperature may be primarily elevated, but as the inflammatory reaction continues, it is usually subnormal. Later along in the disease there may be an elevated temperature of 101 or 102 degrees F. There is persistent headache, which is more or less localized, and persists throughout the delirium, in contradistinction to headaches from any other cause. The pulse is slow, respirations are shallow, or may be of the Cheyne-Stokes variety. Vomiting of a retching character is a frequent symptom of cerebral abscess. The symptoms are those of irritation; spasmodic action of the muscles, followed by paralysis; the pupil on the affected side becomes fixed; choke-disc may be present; later, one or more of the cranial nerves may become involved. It is said that more than one-half of all the cases of cerebral abscess come from middle ear disease. Cases are caused by fractures of the skull, tubercular disease, and by infections through the mouth and nose.

Intracranial Tumor.

New growths in the brain are tumors, such as gliomata, psammomata, gummata (tubercular and syphilitic formations), cysts, and malignant neoplasms.

Symptoms.—The symptoms of new growth of the brain are, vomit-

ing, headache, optic neuritis, spasms, and paralysis. Epileptiform seizures, in the nature of Jacksonian epilepsy, are a more or less constant accompaniment of the development of intracranial tumor. Localization is more or less indicated by these symptoms: (1) The beginning of the epileptiform seizures may indicate the part of the brain affected. (2) Pain. (3) The exaggerated contraction of the flexor or extensor muscles proceeds from a certain area of the brain. (4) Paralysis of muscles, as of the face, monoplegia, etc.; the affection of sensation or the special senses, as of sight, hearing, etc. (5) The involvement of certain cranial nerves. These symptoms may indicate the location of the new growth.

Treatment.—The treatment of the new growth will somewhat depend upon its nature and location. Some of these tumors are inoperable and can best be treated by the ordinary methods in the treatment of tumors. In tuberculosis and syphilis of the brain, the general treatment for these affections will be required.

Hernia Cerebri.—Hernia cerebri is a condition where there is protrusion of the brain substance from a wound. It looks like a reddish-brown, blood stained fungus mass. It pulsates with the brain. It usually overhangs an opening in the skull bone. It may slough off and the wound cicatrize and heal, with more or less interference of function, or the mass may recede and the patient recover. In other cases, paralysis, coma, and death will occur.

Trephining.—For the treatment of extradural and subdural hemorrhage, cerebral abscess, intracranial tumor, depressed and punctured fractures, bullet wounds, etc., and the removal of foreign bodies, the operation of trephining is often required. It consists of the following procedure: If the patient is in a state of unconsciousness, an anesthetic may not be required, but where there is more or less consciousness, an anesthetic should be given. Preparatory to the operation, the head should be shaved, the scalp thoroughly scrubbed, and rendered as nearly aseptic as possible. A semi-circular flap, including all the structures to the bone, should be raised. The flap should be so constructed as to receive the maximum blood supply and to give the best opportunity for drainage. The instruments necessary for opening the skull are the Galt's trephine, or a good bone chisel and mallet. It is necessary to have a small brush for removing the saw-dust, or this may be removed by means of irrigation. The trephine should be set upon solid bone. A rongeur forceps should be at hand for the purpose of enlarging the opening if necessary. Care should be taken not to puncture the dura mater. In case of extradural hemorrhage, the dura will not need to be opened. In depressed fracture, after the button is removed, the chisel may be used as a lever and the depressed bone elevated. In case of cerebral abscess, the dura mater may be opened, the abscess incised, thoroughly drained, and washed out with a saturated solution of boracic acid. The strictest asepsis is necessary throughout the operation

to prevent the development of meningitis. Before the operation, the fissure of Rolando and the anterior and posterior branches of the middle meningeal artery, or the lateral sinus, or any part of the brain upon which the operation is to be made, must be outlined with an anilin pencil. This will serve as a guide to the operator. The pin of the trephine should protrude perhaps one-tenth of an inch beyond the saw's edge, and as soon as the diploe is reached, this pin should be withdrawn. If it is necessary to open the dura mater, the greatest care should be taken not to injure the cerebral vessels. After the removal of the foreign body, the dura mater may again be closed by means of sterile catgut or tendon sutures. Some surgeons make an osteoplastic flap by raising the scalp and skull by means of an incision through the scalp and chiseling through the bone. The operation, when the technic has been carefully observed in every detail, is eminently successful in the removal of many brain tumors, in draining abscesses, and in the removal of foreign bodies and other conditions before mentioned.

Epilepsy.

By traumatic epilepsy is here meant that form of epilepsy which is usually considered operable. This kind of epilepsy may be due to the following conditions:

- | | |
|---|--|
| 1. Fragments or outgrowth of bones. | 4. Thickening of the meninges from chronic meningitis. |
| 2. Tumors. | 5. Hemorrhagic cysts or aneurysms. |
| 3. Scars or cicatrices of the meninges. | |

The time to operate in cases of depressed bone, or injuries of the brain, is at the time of the injury, and not after the development of epilepsy. Too often the epilepsy becomes much worse after the operation. Some cases of cure by operation for epilepsy are reported in the non-traumatic form, but almost all cases are not benefited, while some may be made much worse. It is questionable whether operation in either form of epilepsy is of any use. The removal of any object pressing upon the cortex of the brain would be attended by benefit, if not by actual relief of the epileptiform seizures.

Treatment.—The treatment of epilepsy must be considered from other standpoints. Osteopathic methods offer more hope than other forms of treatment.

Mastoid Disease.—Mastoid disease is an inflammation of the mastoid cells caused by the extension of the inflammation from the tympanum (in cases of otitis media). The symptoms vary according to the severity of the inflammation. The inflammation may be slight and terminate in resolution, or it may become chronic and be followed by fibroid changes, with subsequent ossification of the inflammatory products, thus converting the antrum into bone. Often suppura-

tion results. Pus may open at the tip of the mastoid process, or burrow down the neck. In other cases, the infection may extend into the lateral sinus and an infected thrombus result, while in other cases cerebral abscess may develop.

Symptoms.—Where the abscess makes its way into the cranial cavity, there will be symptoms of cerebral abscess. Over the mastoid process there is deep seated pain upon pressure. Where the periosteum over the mastoid is involved, there will be great redness and swelling and inflammation of the tissues behind the ear. Sometimes the abscess is but superficial and will point, and after rupturing, discharge its contents spontaneously, but after pus forms, many cases will require some operative interference.

Treatment.—The treatment of the disease is anti-inflammatory. Hot fomentations should be applied, to attract the pus towards the surface. As soon as fluctuation is felt, the abscess should be thoroughly opened and cleansed. It should then be treated by hot borated poultices and any cervical lesions removed, while the contracted fascia and muscles of the neck should be relaxed. Suppuration is the rule. No measures are entirely successful, inasmuch as the blood supply to the middle ear and the mastoid cells must come through bony canals, which will not permit of sufficient nutrition to enable the tissues to combat the infection. Where the inflammation is deep seated, and the pus does not show a tendency to burrow towards the surface, and there are evidences of meningitis, the operation for trephining the mastoid should be done. To open the mastoid antrum, the trephine should be set a half-inch behind and one-fourth inch above the middle of the external auditory meatus. In case the anterior surface of the petrous bone and the roof of the tympanum are to be excised, the operation should be seven-eighths of an inch above the middle of the auditory meatus, while if the lateral sinus is to be operated upon, the point of operation is one and one-eighth inches behind and one-fourth inch above the middle of the auditory meatus. Abscess in the cerebellar region is opened at a point one and one-fourth inches behind and a half inch below the middle of the auditory meatus.

Abscess of the Scalp.—Abscess of the scalp, if it occurs beneath the aponeurosis of the occipito-frontalis, may be spread over a large area. It will require free incision and good drainage. It should be washed out twice daily and thoroughly cleansed.

Microcephalus is a condition of abnormally small head, due to mal-development. The skull frequently becomes ossified early. Operations for the removal of sections of bone have been performed with the hope of the brain developing, but this operation has not been attended with any success. These patients should be sent to a home for the feeble-minded. It is not known that any treatment will accomplish much good.

Meningocele is a congenital tumor of the membranes of the brain

which contains fluid. The tumor is translucent, and does not pulsate. It is usually located in the occipital region. It is small and pedunculated. It may occur at the root of the nose. At this point, it is small and sessile.

Encephalocele is a congenital tumor which is made up not only of the membranes, but of the brain tissues. These tumors are small, opaque, and pulsatile. They have a broad base, and compression gives pressure symptoms. Operative treatment is advised in some cases. In meningocele, the tumor may be excised by plastic operation. In encephalocele, no treatment is known to be of any use.

Hydrencephalus is a condition similar to encephalocele, but differs from it in that the cavity of the tumor communicates with the ventricle. The tumor is larger than an encephalocele.

Hydrocephalus may be acute, or chronic, external, or internal.

Acute Hydrencephalus is caused by meningitis, and usually results in tubercular meningitis. For the symptoms and treatment, texts on osteopathic practice should be consulted.

Chronic Hydrencephalus is a congenital condition. The cranium enlarges enormously, and the forehead is broad and overhangs the eyes. Sometimes the skull bones are widely separated. The case is usually apparent upon inspection. The child is often an idiot, and may not be able to learn to walk, or talk. It usually dies young.

In **External Hydrocephalus** the fluid is between the membranes and the brain, while in **Internal Hydrocephalus** the increase in the fluid takes place within the ventricles.

Injuries and Diseases of Muscles, Tendons, Fascia, and Bursae.

Contusion of Muscles.—Contusion of muscles is a common and painful injury, and is usually associated with considerable extravasation of blood within the tissues.

Treatment.—Apply cold water the first twenty-four hours; subsequent manipulation to diffuse the blood-clot will be of advantage. Sometimes intense discoloration of the subcutaneous tissues and skin will take place. Unless abscess occurs, no other treatment will be necessary, even though the condition is quite painful. If abscess occurs, applications of heat should be made. As soon as fluctuation is felt, the abscess should be opened. However extensive the blood extravasation, it should not be opened unless pus forms. Contusion of the muscles may result in temporary paralysis, but manipulation and encouraging the circulation and nerve force will result in recovery of function.

Strain and Rupture of Muscles.—Strain and rupture of muscles may take place in violent exercise, or while performing athletic feats, or from spasmodic action of muscles, such as happen in vomiting, delirium, tetanus, and parturition. The muscles most often affected are the biceps in raising weights, supinator longus, gastrocnemius, and rectus

femoris in tennis, quadriceps extensor cruris in sprinters, and rectus abdominus in parturition, etc.

Signs—Often there is a giving-way of the muscle, with a sudden snap and severe pain, while a gap forms between the ruptured ends. The ruptured ends of the muscle form hard knots on either side of the gap.

Treatment—The ends of the muscle should be approximated as nearly as possible by position and relaxation. Keep the limb at rest and apply cold water for the first twenty-four hours, then daily manipulation, together with rest, will bring about recovery. The integrity of the muscle may be somewhat impaired.

Open Wounds of Muscles and Tendons—The division of muscles and tendons requires approximation of the structures by special suture, to re-establish their function. This should be done in the manner described in the treatment under "Closure of Wounds." It is best done with aseptic catgut, or kangaroo tendon suture.

Dislocation of Muscles and Tendons—Displacement of muscles and tendons takes place more frequently than is generally supposed. Sudden and violent contractions, spasmodic efforts, etc., are the cause. Perhaps the long head of the biceps is more frequently dislocated than any other individual muscle. The signs somewhat resemble dislocation of the shoulder. Where the tendon is not returned to its normal position, it may become absorbed. The peroneus longus and brevis may be dislocated from behind the external malleolus. They will stand out prominently beneath the skin over the lower extremity of the fibula. The tibialis posticus may be dislocated from behind the internal malleolus. Muscles of the calf, thigh, back, neck, arm, and forearm are all liable to dislocation. The diagnosis can only be made by understanding the anatomical relations.

Treatment—The treatment is to manipulate the parts into position and enjoin rest and quiet until the ruptured sheaths heal. Operations to place a halter about luxated tendons may sometimes be necessary, where the dislocation becomes habitual. This operation is, if properly done, successful.

Rupture of Tendons—Tendon-rupture occurs because of violent muscular contraction or violence to the tendon itself. The ends of the ruptured tendon should be approximated and the limb flexed or extended, abducted or adducted, as the case may be, to thoroughly relax the muscle. The member should be put in a splint until the tendon heals, which will be within two or three weeks.

Myalgia—Myalgia, or muscular rheumatism, so-called, is a painful affection of voluntary muscles, or of the periosteum and fascia to which these muscles are attached and by which they are surrounded. The disease is properly not a rheumatism, but is more in the nature of a neuralgia. The cause of the disease is a specific bony lesion pressing

upon the vessels and nerves to the part affected, or congestion of the muscles brought about by cold, damp, exposure, and climatic conditions. These congestions bring about muscular contractions, producing bony lesions, which of themselves serve to prolong the ailment. When it affects the muscles of the back, it is termed lumbago; the intercostal muscles, pleurodynia; the muscles of the scalp, cephalodynia. Myalgia of the muscles of the neck is called rheumatic torticollis. A certain class of these diseases is produced by mercury and lead poisoning, syphilis, alcoholic excesses, gouty and rheumatic conditions.

Treatment.—The treatment is distinctly osteopathic. Certain lesions are responsible for the affection. Sometimes these are bony, and sometimes muscular. Occasionally, bony lesions will irritate certain nerve filaments, when spasm of some muscle, or group of muscles, results. This serves to perpetuate the lesion and to increase the pain and congestion. Sometimes congestion of muscles and fascia will produce sufficient irritation to bring about muscular contraction and thus cause lesions. Wherever myalgia occurs, certain lesions may be found to which the disease can be traced. The removal of these lesions will be attended by a cessation of pain and recovery. Manipulation directed toward relieving contracted and congested muscles, fascia, and ligaments, will be necessary, as well as the removal of bony lesions. In the largest number of cases, spinal lesions, causing pressure upon the roots of the nerves as they leave the spinal canal through the intervertebral foramina, are the direct cause of the ailment. These may be found upon careful examination. In any case, the appropriate treatment of the lesions present will give relief.

Myositis.—Myositis is an inflammation of muscles produced by injury and infection. The course it runs is not unlike that of inflammations of other structures, and the treatment is similar. Should an abscess develop, it should be freely opened and drained.

Gummata.—Syphilitic gummata may occur as local swellings in muscles in tertiary syphilis. History of the disease and the absence of other causes will serve to make the diagnosis. The treatment is anti-syphilitic.

Atrophy and Degeneration.—Atrophy of the muscles may be simple, or numerical. **Simple atrophy** is usually due to non-use. This happens in the case of fractures. The muscles do not lose their striations, and appropriate treatment, or use, brings about the entire recovery and development. **Numerical atrophy** often attends critical joint disease, with long disuse of the limb. It may be impossible to secure complete recovery of the muscles affected.

Degeneration of Muscle takes place in acute fevers, progressive muscular trophy, infantile palsy, and other paralysis. The prognosis is only fair, if the case is of long standing. The degenerations are fatty, waxy, and albuminoid in nature. The integrity of the muscle may be more or less permanently impaired.

Treatment.—The condition of atrophied or degenerated muscles may always be improved. The extent of improvement depends upon the amount of pressure on, or injury to, the nerves, and as to whether these nerves may be regenerated. Much depends on the condition of the circulation, and to what extent the tissues respond to the treatment. In many instances, withered limbs, or paralyzed members of years' standing, have been relieved in a few months, the muscles being restored to their normal strength and tonicity. In other instances, not much relief can be given. Where there is disease of the nerve cells governing the muscles, the prognosis is not favorable. In all other instances manipulation directed toward assisting the circulation, nerve supply, and to removing lesions affecting the nerve and blood supply directly, will secure regeneration of the affected parts.

Ossification of Muscles.—Ossification of muscles may arise from certain diseased conditions, chronic irritation, or occupations. The most frequent examples met with are the rider's bone in the adductor muscles, or ossification of the deltoid in soldiers, the result of carrying arms. Ossification of the quadriceps extensor is said to take place in cases of Charcot's disease.

Tenosynovitis, or Thecitis.—This disease may occur in the form of a simple inflammation of tendon-sheaths, as the result of injury or over-exertion. It often affects the common extensor tendons of the thumb. It is accompanied by a globular or elongated swelling over the tendon. It is painful until after the swelling takes place. The swelling is more or less fluctuating and movable. After the swelling disappears, or in chronic forms of the disease, movement will produce a characteristic creaking sensation (false crepitus).

Treatment.—Strapping, as a strap buckled tightly around the wrist, will give relief from pain. Local manipulation will assist the circulation and may secure resorption of the inflammatory products. The treatment must be persisted in, since the case yields but slowly. The tendons should be given sufficient rest to permit the reparative process to take place when there has been injury.

Thecal Abscess.—(Paronychia tendinosa). This is a suppurative form of inflammation occurring in tendon-sheaths. The non-suppurative form may occur in gonorrhoea, rheumatism, and influenza. It is attended by fluid effusions, crepitus, etc. Thecal abscess is one of the forms of whitlow, or felon. It occurs in persons who are debilitated. Constipation exists, or the urinary secretions are abnormal. In addition, there are bony or muscular lesions affecting the circulation or nerve supply to the part. This renders infection possible. Bacterial invasion takes place in a finger or toe. The disease is more common in the hand, where it is in the form of a palmar abscess. Thecal abscess of the little finger and thumb is more serious than of the middle, index, and ring fingers, inasmuch as the effusion of pus may take place along back the tendon-sheath which communicates with the sheath of the common

flexors in the hand. The pus may burrow underneath the annular ligament and in some cases may extend up the arm. Such extension of the pus is not possible in abscess of the index, middle, and ring fingers, inasmuch as the tendon-sheaths do not communicate directly with the tendon-sheaths in the palm. The abscess may extend into the palm, pass between the heads of the interossei muscles, and open on the back of the hand, or may burrow underneath the annular ligament, producing a swelling above the wrist, or may even extend up the sheath of the muscles into the forearm. Sepsis may result. Necrosis of the bone may occur, or a considerable amount of fibrous tissue may form and the sheaths of the tendons become glued to the tendon itself, producing contractions and deformity, or it may involve the carpal, phalangeal, metacarpo-phalangeal, or wrist-joints, producing ankylosis.

Symptoms.—Severe throbbing pain, extreme tenderness upon pressure, swelling, and a dusky redness. Oftentimes there is swelling, edema, and redness of the back of the hand. The lymphatics in the axilla are enlarged and painful; constitutional symptoms, as rise of temperature, are present; the appetite is lost; there is constipation; the urine is less in amount and highly colored. Only one other affection resembles this disease, and that is acute septic inflammation of the connective tissues of the fingers and not involving the tendon-sheaths. Care should be taken when the abscess is opened, which will nearly always be necessary, not to make an incision into the tendon-sheath, unless it is necessary.

Treatment.—The treatment is manipulative and anti-inflammatory. The manipulation consists of removing local lesions, increasing the circulation and nerve supply to the part, together with correcting the constipation and urinary secretions. Attention should be paid to any constitutional defect found. Should suppuration be imminent, an early incision is necessary. The incision should be made just a little to one side of the middle line of the finger. The abscess should be thoroughly washed out once or twice daily with antiseptic solutions (1:20 carbolic acid, or 1:2000 bichloride of mercury). In the meantime, hot borated poultices should be applied. This facilitates the flow of pus, loosens the tissues and maintains mild antiseptics. As the inflammation disappears, a dry dressing may be substituted and manipulation of the hand be made to prevent adhesions. If the treatment is instituted early, before the pus has extended beyond the annular ligament, even though a palmar abscess has formed, no deformity of the hand will follow. In opening a palmar abscess, an incision should not be made above the web of the thumb, but beyond that point. If made beyond a line on the level with the web of the thumb, there is no danger of wounding the palmar arch, which would occasion severe hemorrhage. Efforts to ligate the palmar arch may be futile, and it may be necessary to ligate the brachial.

Whitlow, or Felon.—Whitlow is a pyogenic invasion of a finger or

toe. The cause is the same as that mentioned in thecitis. The location of whitlow may be: 1. In the superficial connective tissues, which, when it occurs at the root of the nail, is popularly termed a "run-around." 2. When within a tendon-sheath "thecitis." 3. Beneath the periosteum it is called a bone felon.

The symptoms vary according to the location of the infection. Manipulation to assist the circulation, the application of hot poultices to secure the relaxation of the tissues, together with an early incision to let out the stagnated blood and pus, and rigid antisepsis afterward, form the best treatment.

Dupuytren's Contraction takes place in the palmar fascia. The disease begins as a small, round, fibrous nodule in the process of fascia extending from the palm to the fingers. Generally two or three fingers are affected. The skin is drawn and puckered because of its attachment to the fascia. In this manner it may be told from contractions of the tendons. Local manipulation does but little good. The disease may be attended by a cervical lesion, which is indirectly responsible for the fascial contraction. Perhaps it is due to chronic inflammation of the fascia, or to rheumatic conditions. Incisions between the puckered portions and the use of splints to straighten the fingers will be found to be successful. An open incision should be made under strictest asepsis.

Ganglia.—Ganglia are of two varieties, simple and compound. **Simple ganglia** are cysts in connection with the tendon-sheaths. They develop from the synovial fringes in connection with the extensor tendons, but may occur on the front of the wrist, palm, or about the ankle. They vary in size from a small pea to a guinea-egg, and contain a viscid, semi-viscid, or jelly-like material. They impair the action of the tendon and produce some deformity. The disease is quite common in piano players.

Treatment.—Rupture by pressure of the thumbs. If this is not successful, the tumor may be struck a smart blow with a piece of shingle. Failing in this, the skin should be aseptized, a tenotome introduced, the inside of the sac cut in several places, the contents expressed, and the wound afterwards dressed antiseptically. The ganglion will likely not return, nor will it affect the use of the part, providing proper manipulation is used to prevent adhesion. Compound ganglia usually appear on the front of the wrist in connection with the flexor tendons. They are oblong, or oval, sometimes containing a dark fluid, or they may be filled with melon seed-like bodies, or the bits may resemble rice-grains. Often there is some constitutional defect attending these conditions, which should be treated. These ganglia can not be ruptured by the methods mentioned before, but on the other hand, a valvular incision should be made, the contents expressed and drained out, while antiseptic dressings should be strapped on tightly.

Bursitis.—Bursitis is an inflammation of bursae, which may lie be-

tween the skin and the tendons or bone, or between tendons and other structures. There are two forms, acute and chronic. Acute inflammation is the result of injury, and anti-inflammatory treatment is necessary. Rest and manipulation will usually relieve the fluid effusion. The chronic form arises where the bursa is subject to chronic irritation. Fluid effusions into the bursae seem to be more common in persons of rheumatic tendency. The contents may be a clear fluid, or may be rice-grain or melon seed-like bodies, or may be a fibrinous mass. The most common site of this bursal inflammation is the bursa of the patella, where it forms a condition called "housemaid's knee;" or it may occur in the bursa beneath the semimembranosus and form an enlargement in the popliteal space, which more or less disappears upon flexion. (Baker's cyst.) Enlargement of the bursa over the ischial tuberosity is called "weaver's bottom." Inflammation and enlargement of the bursa over the olecranon is called "miner's elbow," while inflammation of the bursa over the head of the first metatarsal bone occasions a condition called "bunion." In other cases, adventitious bursae may form and produce corns. These bursae may produce dislocations of bones. Absorption of the fluid in these bursae will not, as a rule, take place of itself, unless the part is permitted rest and the irritation and cause removed. Manipulative methods may be tried, and failing in this, antiseptic draining of the bursae will be found successful.

Torticollis.—Torticollis, or wry-neck, is a condition of contraction of the sterno-mastoid and trapezius muscles. There are two forms, congenital and acquired. The *congenital form* is produced by malposition in utero, or injury at birth. These produce specific lesions in the cervical vertebrae from the first to the fifth, inclusive. The *acquired form* is produced by rheumatism, inflamed lymphatic glands, producing contractions of the muscles, hysteria, and by traumatic lesions of the first to the fifth cervical vertebrae. These lesions affect the external division of the spinal accessory nerve, which is the motor supply to the trapezius and sterno-mastoid, or it affects filaments of the cervical plexus, which sometimes also supply these muscles. In cases where the lesion was the first cause, reduction of the lesion will accomplish a cure. In old cases, congestion and chronic inflammation take place within the muscles. This is accompanied by the formation of fibrous tissue, which displaces the striated fibres and impairs the integrity of the muscles, and subsequent contraction produces permanent shortening, so that a cure may not be accomplished by the correction of the lesion. All cases may be markedly benefited by treatment. Cases have been cured by osteopathic treatment after section of the muscle and resection of the nerve had failed. The *treatment* consists of correcting the neck lesions and improving the general health.

Tenotomy.—Tenotomy consists in the division of a tendon, or muscle, the contraction of which produces deformity. Two methods are in use, the open, and closed. The closed method is preferred, since it eliminates

the danger of sepsis. The tendo Achillis is frequently tenotomized for correcting conditions of club-foot, as equino-varus. This operation is best performed by having the patient lie upon his back, inclined towards the affected side. The part is rendered thoroughly aseptic. The instruments used are a blunt and sharp-pointed tenotome. A knife is inserted flatwise along the anterior border of the tendon until the point of the knife may be felt on the opposite side of the leg just beneath the skin. Care should be taken not to split the tendon. After this incision is made, a blunt-pointed tenotome is introduced. After introduction, the sharp edge of the tenotome is turned towards the tendon and brought against it and held in that position firmly, while the tendon is thoroughly stretched by flexing the foot. The tendon will snap in two. The operation is done one and a half inches above the insertion of the tendo Achillis into the tuberosity of the os calcis. The tibialis anticus is tenotomized one and one-half inches above its insertion for conditions of talipes varus. The peroneus longus and brevis may be tenotomized one and one-half inches above the external malleolus. The tibialis posticus is divided one and a half inches above the anterior annular ligament. Fasciotomy of the plantar fascia is sometimes performed by passing the knife flatwise between the skin and fascia and cutting inward, dividing the fascia or the structures which are producing the abnormal arching of the foot. Sometimes instead of tenotomy, tendon lengthening is performed. This is a plastic operation done by splitting the tendon and sliding the two portions a distance apart. The operation of tendon lengthening is also sometimes necessary where sections of the tendons have been lost because of injury. In case of injury, it may sometimes be necessary to attach the ruptured tendon to adjacent muscles or tendons in order to not entirely lose the use of the muscle. For more exhaustive descriptions of these operative procedures, an operative surgery should be consulted.

Syndactylism, or **Web Finger**, is a congenital condition and is relieved by operation. Some such operation as Diday's should be done in dividing the fingers.

Polydactylism is a condition of supernumerary digits. The extra finger should be amputated while the child is young, to prevent deformity.

Trigger-finger is a condition in which one or more of the fingers are held in a flexed condition, but when forcibly extended they will open with a snap, as in opening a knife. The hand may be readily closed. It is said to be produced by contraction of the transverse ligament of the palm. It may be produced by cartilagenous tumors, or ganglia. Some maintain it is due to enlargement or an inflamed condition of the flexor tendons.

Mallet-finger is a condition due to the rupture of the extensor tendon, where it forms the posterior ligament of the phalangeal articulation. A similar condition is found in base-ball players, and is due to a

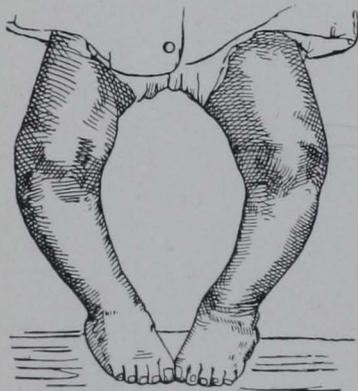
dislocation backward of the first phalanx. The condition may be cured by reducing the dislocation which often exists and putting the finger in a splint.

Club-hand is a deformity of the hand due to absence of one of the carpal bones.

Genu Valgum, or Knock-knee, is an abnormal growth of the inner condyle of the femur. This condition is brought about by an interference in the nutrition to the outer condyle and outer part of the bone. Spinal lesions interfere with the nerve supply to that part of the bone, or interference with the blood supply may also cause the deformity, or it may be brought about by a general condition of malnutrition. The improvement of the general nutrition of the body and the correction of local lesions will be attended by the correction of the deformity, providing this treatment is commenced reasonably early. Where this fails, which may happen in long standing cases, an osteoplastic operation, such as removing a wedge-shaped piece of bone from the internal condyle, will be found to give relief.

Genu Varum, or Bow-legs, may be an inherited condition, or it may be brought about by encouraging the child to stand before the bones of

FIG. 112.



Genu Varum.

the legs have properly ossified. It may occur in rickety children, or conditions of malnutrition. Bony lesions likely account for some cases. These bony lesions either act directly upon the nerve and blood supply, or bring about a contraction of the muscles, which interferes with the nutrition to the inner side of the bones of the upper and lower leg. The external condyle often grows too long, or there may be bowing of the femur and tibia. Improvement in the general health often markedly benefits the condition. The correction of any bony lesions, reduction of dislocations, or improvement of the general health, will be attended by lessening of the deformity.

Club-foot is a condition where the bones of the tarsus assume an abnormal relation with the bones of the leg. It is accompanied by contractions of the ligaments, fascia, and muscles of the foot and leg, together with distortion and twisting of the bones of the tarsus. It may be congenital, or acquired.

A. Congenital Club-foot may be produced by one of the following conditions: 1. Spastic contractions of the muscles, due to lesions affecting the nerve centers governing the foot. 2. Malposition in utero. 3. Alteration of the tarsal bones, due to interference in the blood supply.

B. The **acquired form** is produced by the following conditions: 1. infantile paralysis—nearly all of the cases of acquired talipes, or club-foot, are produced by infantile paralysis. 2. Injury. 3. Spinal lesions which bring about weak ligaments, disease, and fascial contraction.

Varieties.—The varieties of club-foot are:

- | | |
|-----------------------|--------------------|
| 1. Talipes varus. | 4. Talipes valgus. |
| 2. Talipes equinus. | 5. Talipes cavus. |
| 3. Talipes calcaneus. | |

Combinations of these may occur in the form of:

- | | |
|---------------------------|-----------------------------|
| 1. Talipes equino-varus. | 3. Talipes calcaneo-valgus. |
| 2. Talipes equino-valgus. | |

Talipes Varus is the most common form of club-foot. In this condition the tibialis posticus and anticus muscles, together with the tendo Achillis, are found contracted, while the peronei muscles are correspondingly relaxed. The foot is twisted so that in walking the outer border of the foot first comes in contact with the floor. The sole of the foot looks, in mild cases, downward and inward, but in pronounced cases the foot may be turned so that the sole looks directly upward, while the back of the foot is directed downward. If the condition persists, the abnormal position of the foot affects the blood supply to the bones, and pressure upon the bones in an abnormal position results in their irregular development, so that they become deformed. The ligaments become contracted, and these often form the chief obstacle to reduction, even if the muscles could be readily relaxed. In the congenital variety, the deformity is readily reduced. If allowed to persist, it will result in extreme deformity. Talipes varus *per se* is not common, but is very common when associated with equinus, so that equino-varus is the common condition. The acquired equino-varus is nearly always the result of infantile paralysis, and that amount of recovery can be expected commensurate with the recovery of the part of the spinal cord affected. The withdrawal of the nerve supply and the interference in the blood supply prevent the proper development of the foot.

FIG. 114.



Congenital Talipes Varus.

FIG. 113.



Acquired Talipes Varus.

Talipes Equinus is rare, and is either due to paralysis of the extensor tendons or to a spasm of the muscles forming the tendo Achillis. The heel is drawn up, while the foot is extended.

FIG. 115.



Talipes Equinus.

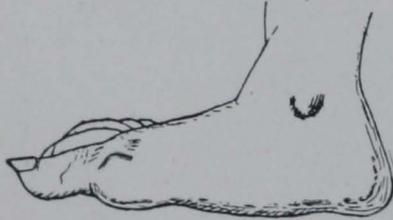
FIG. 116.



Talipes Equino-calcaneus.

Talipes Calcaneus may be congenital, or acquired. When congenital, it is due to contraction of the extensor tendons, and when acquired it is due to infantile paralysis of the calf muscles. In this condition the foot is abnormally flexed upon the leg and the patient walks upon the heel.

FIG. 117.



Talipes Valgus.

Talipes Valgus, or flat-foot, may be due to several conditions: 1. Weakening and yielding of the ligaments of the bottom of the tarsus. 2. Supporting heavy weights for some length of time. 3. Rheumatism and gonorrhoeal affections of the ligaments, together with sprains and rachitic conditions. 4. Paralysis of the tibialis anticus and posticus muscles. 5. Badly set

Pott's fracture. The arch of the foot sinks down and is lost. In the acquired form, the patient is badly crippled and the foot is longer and broader than normally. The astragalus and scaphoid bones form projections on the inner side of the foot.

Talipes Cavus or Equino-calcaneus is a condition of abnormal increase of the arch of the foot and is produced in some cases by contractions of the plantar fascia, while in other cases by spastic conditions of the peroneal muscles.

Treatment.—Manipulation, begun early, will cure a large number of the cases of club-foot. In congenital club-foot, the treatment should be instituted immediately after birth. Whatever dislocation is found

should be reduced. This is important. The blood and nerve supply to the weak muscles should be encouraged. If the condition is due to a spasm of certain muscles, this spasm can be relieved by removing the spinal lesions irritating certain nerve roots causing such spasm. If the condition has persisted for a long time, and the spasm of the muscles can not be relieved, tenotomy of these muscles may be done with advantage. Applying a plaster cast, with or without tenotomy, in all cases, and holding the foot in normal position, is bad practice. Where the deformity persists *in spite of manipulation*, a plaster cast may be applied, or the foot may be held in normal position by means of some apparatus which can be adjusted as required and can be removed for the purpose of treatment. Strips of adhesive plaster, passed across the sole of the foot and carried up along the side of the leg, will suffice to hold the foot in normal position in some cases of talipes varus. These may be removed at the time of treatment. Many cases may be cured without

application of any deformity apparatus. In old cases, where the patient has walked on the foot and it is believed that the bones are malformed, the prognosis should be guarded. The case may be improved, but may not be cured. Operative treatment is likely necessary. Where tenotomy will not correct the deformity, the fascia and ligaments should be divided so as to permit the foot to be returned to its normal position. Where the foot can not be returned to its normal position after subcutaneous

division of tendons and fascia, tarsotomy may be performed with advantage. This operation, if properly done, offers hope of fair recovery of the deformity. Even in old cases, after several unsuccessful operations, manipulative treatment will be found of great benefit. It must not be expected that the deformed bones can be cured by manipulative methods, but further deformity can be prevented by proper treatment. In talipes cavus, the subcutaneous division of the plantar fascia may give relief. In flat-foot, or **pes planus**, the fitting into the sole of the shoe of a steel spring which will assist in raising the arch of the foot, will be found of advantage. In equino-varus, tenotomy of the tendo Achillis, together with both tibial muscles, should be done, while in talipes equinus, tenotomy of the tendo Achillis will be sufficient.

Hallux Valgus, or **Varus**, is a partial dislocation of the great toe outward, or inward. It most often occurs in old men. The cause is from wearing narrow shoes, or wearing a shoe which presses against the end of the toe and weakens the inner metatarso-phalangeal ligament. The bone is usually displaced inward, and because of pressure upon the

FIG. 118.



Imprint of a normal foot.

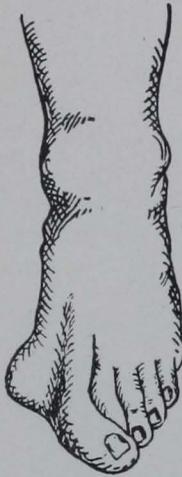
FIG. 119.



Imprint of the foot in pes planus.

head of the first metatarsal bone, bursitis follows. This bunion is frequently an extremely painful condition. It may be successfully treated by reduction of the dislocation. It may be necessary to hold the dislocated toe in position by means of an apparatus for straightening the toe. Continued reduction and manipulation, together with properly fitting shoes, will cure the ailment, unless in very old people.

Fig. 120.



Hallux valgus, with the formation of a bunion.

Hammer-toe is a condition of contraction of the plantar fibres of the lateral ligaments. A bunion forms on top of the toe. Probably amputation of the toe is the best treatment.

Metatarsalgia (Morton's Disease).—This disease is a partial dislocation of one or more of the metatarsal bones, implicating certain nerve fibres, which cause intense pain. The disease may be diagnosed by grasping the foot and compressing it transversely. This occasions great pain. The disease may be associated with flat-foot, and is produced by wearing a shoe that is too narrow. The pain is on the outer and inner side of the little, or fourth toe, or about the neck of the fourth metatarsal bone. Manipulation for reduction of the subluxation and a properly fitting shoe will give relief.

Coxa Vara is a disease in which there is abnormal bending of the neck of the femur, usually laterally. It is said to occur most frequently between twelve and twenty years of age. Likely the disease is rachitic. The disease is frequently diagnosed as dislocation. The neck of the femur gives way and the trochanter ascends above Nelaton's line. The condition is frequently greatly improved by treatment, indicating that it is due to an interference in the nutrition of the neck of the femur. It may be brought about, more or less, by partial dislocation, or the existence of certain spinal lesions. It may require the assistance of the x-rays to determine the condition.

Flail-Joints.—Abnormal looseness of joints following infantile paralysis, or prolonged pressure upon a nerve to the joint, is called flail-joint. The condition is most common in the hip, knee, and ankle. When the condition is produced by dislocations, or spinal lesions, the dislocation should be reduced and the spinal lesions corrected, together with encouraging the blood supply and increasing the tonicity of the ligaments and muscles. Where cases have persisted for years, there is not much hope of recovery.