PART IV
DISEASES OF THE BLOOD

GENERAL DISCUSSION

The blood is one of the most complicated of the tissues of the body. It differs from ordinary tissue in that its cells are not formed within it, unless we should include the red bone marrow and the lymphoid tissues of the body as part of the blood system. The intercellular substance of blood serum is not derived from the activity of the blood cells, but is composed of the material poured into the blood through the lymphatic duct, absorbed from the digestive tract, picked up all over the body with a load of the products of cellular metabolism, and it contains dissolved within it the internal secretions, waste products and many highly complex substances which are being carried for the use of other cells of the body, or which are on the way to elimination.

The red blood cells of adult life are formed within the red bone marrow, and this is found plentifully within the ribs. The granular white blood cells are formed within the red bone marrow also; the hyalin blood cells are formed chiefly in the lymph nodes of the body and partly within the red bone marrow.

When this complex nature of the blood and the many sources of its various constituents are recognized, it is easily seen that the nature of the blood diseases and the causes of primary and secondary anemias must be extremely variable.

From the standpoint of the physician, the chief interest in the blood diseases lies in the fact that all the erythrocytes and all the granular cells are formed in the red bone marrow. This is found in the flat bones of the body; the skull, scapulæ, innominates and ribs are the most important areas of blood formation. Of these areas, the largest amount is found in the ribs. It must be remembered that the ribs receive nutrient arteries, veins and nerves by way of the foramina upon their lower edges. Man stands upright, and the weight of the thorax exercises a constant, though slight, pressure upon these vessels and nerves. The nerves are both spinal and sympathetic, as are the nerves of other vessels and active tissues. The spinal segments are subject to the effects of bony lesions, and thus these, as well as the effects of direct pressure, may be involved in the control of the blood-forming cells and the vessels which supply them.

In order to make good blood cells, the marrow must receive the materials from the blood brought to it. The necessary food ele-

ments must be taken into the body, properly digested, and absorbed and carried by the blood to the marrow; it is evident that anything which prevents the normal eating and digestion of food, the normal circulation of the blood, and the normal nervous control of the vessels and the intrinsic cells of the marrow, must inevitably affect the quality or the quantity of the blood cells being manufactured.

Infectious agents may be carried by the blood from one part of the body to another, as in arthritis; parasites may have the blood as their habitat, as in malaria; tumor cells, fragments of vegetations, and other foreign bodies may be carried in the current of the blood stream to various parts of the circulatory system, with serious or trivial effects upon physiological integrity. Thus is the blood an important factor in pathogenesis.

As the blood circulates through the body, it takes up various substances, the products of normal or abnormal metabolism. These exert various influences upon the blood cells in circulation, and also upon the hematopoietic cells in the bone marrow. These changes can be recognized from the study of the blood, and thus the blood is an important factor in diagnosis.

The blood serum contains within it organic and inorganic compounds of great complexity, including ferments whose number and function have been little studied. Some of these appear to be bacteriolytic, either directly or indirectly, while others digest foreign substances which gain entrance into the blood, or which result from thrombosis or other pathological states of the blood itself. The body is thus protected against disease, though this protection is not always adequate. The blood itself is an important factor in preventing disease and in promoting recovery.

The treatment of the blood diseases must be based upon these facts; and the only thing that can be done is to provide the marrow with good blood making materials, carried freely to the marrow and to provide that the drainage of the wastes from the marrow and from the blood itself shall be normal, and to remove anything which interferes with the normal nervous control of the tissues concerned in the feeding, manufacture, or cleansing of the blood.

CHAPTER XXIII

THE ANEMIAS

SECONDARY ANEMIA

The term anemia, which literally means "without blood," is now applied to a condition of the body in which the blood is low in hemoglobin. The blood may be low in hemoglobin, either because it contains fewer than the required number of red blood cells, each of which is itself reasonably normal, or it may be due to the fact that the individual cells carry too small an amount of hemoglobin, though the number may be almost or quite normal.

As the name implies, secondary anemia is due to the effect produced upon the blood by some disease of other organs of the body. These diseases affect the blood in varying ways, so that in a large majority of cases it is possible for an examination of the blood to determine the condition of many of the organs of the body and the source of origin of the disease. It is usually easy after a blood examination has been made to say whether there is present some primary disease of the blood, or the blood forming organs, or whether the entire blood picture is simply the result of a disturbed metabolism, or the disturbed function of diseased organs elsewhere in the body.

Anemia which is the result of sudden hemorrhage or of certain forms of malnutrition, has its hemoglobin diminished as the result of the loss of the red blood corpuscles. Anemia which is the result of slower chronic diseases, usually associated with disturbed circulation through the red bone marrow of the body, has usually a slightly diminished red cell count, but a large majority of the red blood cells contain less than the normal amount of hemoglobin. The amount of hemoglobin in each cell may, in some cases, be as low as one-fourth that present in a normal adult blood cell.

In secondary anemias a study of the white blood cells is of considerable importance. Pernicious anemia, as well as secondary anemia due to the action of non-inflammatory etiological factors, is characterized by a white blood cell count almost or quite normal, and in which the varying classes of white blood cells are about those found in normal adult human blood. In tuberculosis the white blood count shows an increase in the lymphocytes and decrease in eosinophiles. In the ordinary neuroses and in hysteria, the eosinophiles are increased and the polymorphonuclear cells are usually diminished. In nearly all secondary anemias due to the presence of intestinal parasites from the hookworm to the tape-

worm, the number of eosinophiles is very conspicuously increased. In secondary anemia due to purulent inflammations anywhere in the body, the number of neutrophiles is greatly increased. In all of these conditions the changes in the blood are of the degenerative type.

There is another form of anemia usually classed as secondary, in which the blood deficiency is of congenital origin. This is called a developmental type. While the underlying blood defect is congenital, these defects are often increased as the result of pathological conditions occurring at any time during the life of the individual. Congenital blood defects are recognized by the presence in the blood stream of immature or atavistic cell types. These include neucleated red cells, oval red cells, and poikilocytes. The white cell count shows an increase in the relative number of lymphocytes, amphophiles, myelocytes and mononuclear neutrophiles. When these cells are found in blood which is being examined for diagnostic purposes, the prognosis for complete recovery is made somewhat more grave, and in mental defectives complete recovery is scarcely to be expected.

Secondary anemias due to the presence of poisons may be pathognomonic. The basophilic stippling of the red blood cells in lead poisoning is characteristic. Toxins due to proteid decomposition, to the presence of bile in the blood, and to disturbance of the metabolism in constitutional diseases, injure blood cells more or less seriously. Naked nuclei, fractured cells, bloated forms, shadows, and poikilocytes are indicative of the presence of some toxin in the blood serum.

COSTOGENIC ANEMIA

(Burns anemia)

Costogenic anemia is a disease of the blood due to imperfect blood formation, resulting from deficient circulation and innervation of the red bone marrow, especially of the ribs, and characterized clinically by marked weakness, pallor, hemic murmurs of the heart, and other symptoms of anemia; by the low color index and the presence of immature and atavistic cells in the blood stream.

Etiology. The disease is due to disturbed activity of the hematopoietic organs, resulting from disturbed circulation through the red bone marrow, or from disturbed innervation of the vessels or of the active blood-forming elements.

Lesions affecting the circulation through the scapulæ, innominates, and skull are less important than lesions affecting the circulation of the comparatively much greater area of the red marrow in the ribs. The mobility of the thorax may be lessened, and undue pressure thus be brought upon the nerve trunks, the veins and the

arteries which enter the nutrient foramina of the ribs, by several different and various conditions. Perhaps one of the most frequent is the drooping of the thorax, which occurs in people whose muscles are atonic—who are weak from any cause, or whose daily lives do not include a sufficient amount of exercise. Partly because of faulty education in the line of self-control—which is wrongly interpreted as self-repression—partly because of improper clothing, and partly because of the stress of modern living, the ribs are allowed to droop more and more. Thus the circulation through the rib marrow is impeded, and thus the nerve centers in the spinal cord fail to receive their due and proper amount of stimulation from the joint surfaces and muscles.

Diagnosis. The onset is gradual, unless it follows some other disease. Weakness, insomnia or drowsiness, gas accumulations in stomach and intestines; tense, anxious expression; pale sallow skin —sometimes vascular dilatation may give rosy cheeks—slow digestion; and usually constipation, are present. The symptoms are not pathognomonic. The thorax is found rather rigid, with extremely small chest expansion in quiet breathing; rarely forced breathing gives a fairly satisfactory expansion. The intercostal muscles are usually hard, and show the intercostal depressions plainly. The urine shows lack of elimination; the quantity may be normal or slightly increased in twenty-four hours, with low sp. gr., sometimes 1002; low urea, low phosphates, low sulphates, less frequently low chlorides; no albumin, casts, or indications of organic disease. Excess of indican may be present; calcium oxalate is frequent.

The blood itself is rather characteristic. Coagulation time is increased; specific gravity and viscidity diminished; red cell count normal or only slightly diminished; hemoglobin 6 to 10 grams per 100 c.c. of blood (Meischer); 40% to 80% (Dare). The red cells are small, pale, vacuolated, sometimes nucleated. The white cell count is normal, slightly increased or slightly diminished. The hyaline cells are normal, or slightly relatively increased. (These, being formed in lymph nodes, tonsils, etc., are not affected by rib changes.) The mononuclear neutrophiles are relatively increased. The nuclear average of the polymorphonuclear neutrophiles is low. Vacuolated and atypical neutrophiles are often found. Basophiles, myelocytes and amphophiles may be found in considerable numbers. Nuclei in all granular forms present evidences of immaturity or degeneration—they may be swollen, vacuolated, extruded, ragged, or with variable staining reactions.

Treatment. The treatment is indicated by the etiology and diagnosis. Most important is the raising of the ribs, and the teaching of proper respiratory activities. Whatever is wrong with the patient's habits of living must be corrected. A diet which includes an abundance of green vegetables, meat, and fruits, with only a

moderate amount of starch and sugar, is best adapted to blood making.

Prognosis. With efficient treatment and obedience, recovery should be thorough and permanent. If the case is neglected, or if the bad habits are too hard to be overcome, the patient is apt to live a subnormal individual, or a chronic invalid until some intercurrent affection terminates his days.

Prophylaxis. This is easy. It is only to use the ribs freely; to compel free breathing, especially under emotional tension of any kind, and to refrain from any habits of dress, breathing or living that lessen the respiratory excursions of the ribs.

CHLOROSIS

Chlorosis, "green sickness," is a disease of adolescent girls, characterized by anemia of an edematous type, circulatory disturbances of a nervous type, and a varying number of neurotic symptoms. The name "green sickness" refers to the peculiar yellow-green color of the skin.

The etiology is not known. Various theories refer to the presence of characteristics which may or may not be themselves due to some preëxisting etiological factor. The disease being found in its typical form only in young girls, especially those who suffer from menstrual difficulties, compels the view that disturbed secretion of the ovaries is an important etiological factor. A somewhat similar condition has been reported in adolescent boys.

That the disease is associated with the first wearing of corsets gives another theory of the cause of the disease. Constipation, often of a very severe type, is almost always present. For this reason copremia may be considered of etiological importance.

The heart is often of small size, and functional cardiac murmurs are often present. Aplasia of the blood vessels is frequent. This gives color to the view that a developmental defect, becoming evident only when the onset of the puberty changes necessitates considerable increased strain upon these organs, is the true cause of the disease. Gastric ulcer and exophthalmic goiter are frequent complications.

Tuberculosis and other diseases associated with poor nutrition either in the individual or in her ancestors increases the tendency to chlorosis. A direct inheritance of chlorosis is not rare—in the Pacific College Clinic a chlorotic woman was examined, whose mother, grandmother and great-grandmother had all suffered from chlorosis.

Chlorotic girls have always deficient mobility and usually localized lesions involving the mid-thoracic region. The most frequent

lesion is a slightly posterior and decidedly rigid condition affecting the third or fourth to the tenth or twelfth thoracic vertebræ, and the related ribs. The chest expansion in both quiet and forced respiration is diminished; rarely, after a girl has taken breathing exercises or calisthenics the forced expansion may be increased. But in all except rapidly improving patients the respiratory excursion is diminished habitually. The fact that diminished oxygenation is habitual is shown by certain symptoms of the disease, and also by the constant sighing usually noticed.

Diagnosis. The disease is of gradual onset. The girl becomes weaker and paler, and gives evidences of cardiac difficulty. Sighing, emotionalism, dyspnea, palpitation, headache, abnormal appetites—clay-eating, pencil and hair-chewing—a greenish tint around the eyes and mouth, lack of interest in work or play, usually without emaciation, sometimes with increase in weight, are characteristic. The diagnosis rests absolutely upon the blood examination. The typical "chlorotic cell" is a large erythrocyte, swollen, pale, and spherical. It is present in other diseases, but not so frequently nor so typically as in chlorosis. The total amount of blood is increased.

An average of eleven typical cases of chlorosis examined at the Pacific College of Osteopathy gives the following results:

Hemoglobin, 40% (Dare).

Erythrocytes, 3,780,000 per cubic millimeter; 84%.

Color index, .45.

Poikilocytes always present.

Chlorotic cells always present.

Microcytes usually present.

Normoblasts usually present.

Leucocytes, 8,500 per cubic millimeter, many atavistic forms present.

Lymphocytes, 37%, or 3,145 per cubic millimeter.

Neutrophiles, 58.8%, or 4,978 per cubic millimeter; many fractured.

Eosinophiles, 1.3%, or 110 per cubic millimeter.

Basophiles, .3%, or 26 per cubic millimeter.

Amphophiles, few.

Arneth's index was shifted slightly to the left: Neutrophile nuclear average, diminished.

Coagulation, time increased.

Viscidity, diminished.

Platelets usually diminished.

Treatment. The treatment rests upon the facts as already discussed. The correction of the rigidity of the thorax, the drooping ribs, the spinal lesions, is an essential factor in restoring health. The circulation through the abdomen must be kept competent.

The ribs over the liver and spleen must be raised, and deep breathing exercises compelled. The respiratory expansion in quiet and forced respiration must be measured with a tape, and the findings recorded. At intervals of a few days to several weeks, the measurements must be repeated, and progress noted. If no progress is found, the girl is failing in her obedience to the instructions given her.

The pelvic condition must receive whatever attention is indicated by the gynecological examination. In neurotic girls, especially, this must be postponed, unless immediately urgent, and must be made under all precautions to avoid nervous shock. Correction of innominate or sacral lesions may correct the pelvic disturbance with no further treatment of any kind. The love affairs must be investigated; pseudo-romantic imaginations, the reading of love stories and too great indulgence in moving pictures or theatrical performances, especially with strong love interest, are to be interdicted. Good, clean, wholesome discussion of the problems of life, duty, death, birth, marriage, religion, poetry and romance helps to overcome any effects of emotional repressions which may be active in perpetuating ovarian congestion and respiratory inefficiency.

The constipation is best met by enemas to secure immediate cleaning of the colon, followed by the correction of the thoracic, lumbar and costal lesions. The better diet, the breathing exercises, with the correction of the lesions as noted, should be sufficient. Enemas may be used, if anything further is necessary. Purgative drugs are urgently to be avoided. The abnormal appetites are best gratified in a modified way—lemons or grape fruit may be substituted for vinegar; a largely cellulose diet usually prevents an appetite for hair, while honey, candy, and other sweets with meals make it easier to stop the candy-munching habit between meals. The necessary iron is best given in the form of chlorophyll or hemoglobin. The juices of vegetables and meats may be given, if the foods themselves are not tolerated.

If the weakness is profound, the patient should lie quietly for half an hour after meals; if she is given to day-dreaming, her waking hours must be filled with useful employment, preferably something in which she can be interested, and which requires her entire attention. Change of scene may be wonderfully effective, especially if the usual love affair looms big in etiology.

Prognosis. Recovery is usually gradual and uneventful and complete. If the girl who has had chlorosis becomes subject to hemorrhages, accident, or other cause of secondary anemia later in life, her blood is apt to show some chlorotic characteristics. But, unless there is some very efficient cause of anemia, she is apt to live her life out without any ill effects from her chlorotic experience.

HEMOLYTIC ANEMIA

(Primary anemia; idiopathic anemia; pernicious anemia; Biermier's disease; Addison's anemia)

This is a disease of the blood characterized by rapid and progressive destruction of the blood cells, with rapid but insufficient regeneration, progressive weakness to death, and for which no cause has been determined.

Etiology. The cause of the disease in its typical form is unknown. The state of the blood cells ante-mortem, and the pathological findings at autopsy indicate the presence of some intense hemolytic poison, which acts not only upon the red blood cells, but also upon the nervous system, and to a less marked extent upon the other tissues of the body. Anemia, not to be distinguished from the idiopathic type, is sometimes due to the bothriocephalus latus, the ankylostome duodenalis, the necator americanus, and perhaps certain other intestinal parasites. The frequent presence of dry tongue, sore mouth, deficient hydrochloric acid in the gastric juice, and intermittent diarrhea and constipation, suggest a gastro-intestinal origin for the destructive toxins. Gastro-intestinal malignant neoplasms also may give symptoms and a blood picture greatly resembling that of idiopathic anemia; exhausting diseases, chlorosis, pregnancies, syphilis, malaria, in their more severe forms, may be followed by anemias of the pernicious type, though less certainly fatal. In some cases successive pregnancies may be associated with a milder anemia of this type; the intervals between pregnancies being characterized by almost or quite normal blood counts. Before the age thirty-five, more women have the disease; after thirty-five, more men.

Pathology. The autopsy findings are typical. The yellow or greenish skin is characteristic; the fat is of a brilliant orange color. The muscles have an unusually deep and brilliant scarlet; while the blood remains for days uncoagulated, and flows like pink-stained water. The red bone marrow fills the long bones, and penetrates them, as well as the flat bones, almost or quite to the periosteum. Irregular and variable areas of degeneration are found in the spinal cord and the brain. These correspond to the nervous symptoms present before death. Atrophy of the gastro-intestinal glands is almost constant.

Diagnosis. Only after exhausting every possible cause of secondary anemia is the diagnosis of pernicious anemia possible, since so many of the cases above mentioned present fairly typical blood pictures. The symptoms are fairly typical, but not absolutely so; the onset is very insidious; the disease is rarely suspected until the weakness and pallor have become profound. The deficient hydrochloric acid is sometimes recognized early, in the search for a cause for the gastro-intestinal symptoms. This deficiency persists through the course of the disease. At first there are dyspnea, weakness, palpitation of the heart, pallor, easy fatigue, and perhaps

some gastro-intestinal or nervous symptoms. This is followed by progressing weakness and cardiac symptoms, increasing diarrhea, nausea and vomiting, perhaps some submucous or subcutaneous hemorrhages. Pain is infrequent and never severe, unless there is some intercurrent affection. Paresthesias, ataxias, paralyses, amaurosis, may suggest some structural disease of the nervous system —the patient may first seek advice concerning the nervous system. The skin changes from waxy white or yellowish to a peculiar lemon yellow color, sometimes a greenish yellow is present; the conjunctivæ and mucous membranes are of the same tint. Emaciation is not marked; the apparent amount of fat may increase. Mental changes do not appear until the weakness is almost deadly, then there is somnolence.

Cardiac murmurs are often found; the pulse may be weak and rapid, or it may be full, "water hammer," like that of aortic regurgitation; though this lesion is rarely present. The urine shows the pigment in excess, excess of indican, sometimes excess of uric acid and urea. Albumin and blood are not usually present.

With progressive weakness and dyspnea, the patient finally becomes bedfast, and dies after more or less stupor and mild delirium. The termination may appear sudden; the patient may be walking, even upon the streets, until a very few days before dissolution.

Blood. The blood changes are remarkable. The hemoglobin is reduced to a very low figure (1.5 grams per 100 c.c. in one P. C. O. patient). Hemoglobin percentages of 20, (Dare) and even lower are frequently reported.

The red cell count is even lower than the hemoglobin percentage; the color index is thus above one, which is normal. A color index of 1.3 or 1.5 or even higher is not unusual. This factor is of value in diagnosis; while a high color index may be found in secondary anemia due to parasites, etc., yet in these the color index is almost never so high, so constantly, as in idiopathic anemia. The red cells include abundant poikilocytes, megalocytes, microcytes, normoblasts, and microblasts. Vacuoles, ring-like bodies, stippling, and other degenerated forms appear. The megalocytes are pathognomonic; the high color index is due to their abundance. Oval nucleated cells, like those of nonmammalia, are sometimes found. The finding of considerable numbers of megaloblasts shortly precedes death. Rarely these cells may be found in small numbers, and the patient live for some weeks or months; but if even a few are present the prognosis is very grave.

The white cells are not greatly changed, especially in the early stages. In most secondary anemias, the white cells share the disturbance; this is not so in idiopathic anemia; the number of the white cells, and their relations are not much different from the normal. Toward the close of life these assume many atavistic and

degenerated forms, but leucocytosis is not present, nor is there marked eosinophilia; this latter fact differentiates intestinal parasites fairly accurately. Myelocytes appear; these probably originate from the erythrogenic rather than the leukogenic areas. The platelets are reduced; viscidity, specific gravity, coagulability are all low.

Treatment. No adequate treatment of idiopathic anemia is known. The secondary forms require treatment indicated for the causative disease. In doubtful cases treatment for intestinal parasites may be given, and the feces closely watched. The anemia should promptly improve upon removal of the worms.

For the idiopathic cases, an urgent endeavor should be made to find out the source and nature of the hemolytic poison. Failing this, symptomatic treatment should be initiated; certainly this gives the patient his best chance of securing intermissions, and of living more comfortably; perhaps longer. The intestinal and renal and pulmonary activity should be maintained by the use of plenty of fresh air and fresh water. Free and plentiful water drinking should promote elimination to the greatest possible extent. The gastro-intestinal symptoms are best met by free drinking of water and fruit juices, milk and broths, and, if necessary by nutrient enemas. Friction baths promote skin activity; hot and cold bathing is to be advised with care. The patient is to rest much, especially in the recumbent position, in the open air as much as can possibly be managed. A warm climate is best. Give plenty of nourishing food. The green vegetables are best; if they cannot be eaten raw, give the juice pressed from the raw, ground vegetables. It should be freshly made daily, should be greatly diluted in hot or cold water, but ought not to be cooked, or put into boiling water. Use this scantily for a few days; half a teaspoonful with each meal is enough, at first. Increase after three days, gradually. Too hasty feeding of this concentrated juice may cause a sore mouth. Broiled beefsteak, other appetizing foods, eggs, milk, anything that is pleasant, nutritious, easily digested, and especially that which the patient wishes, in reason, is to be given him.

Spinal and costal lesions vary; there is usually some rigidity of the thorax; this should be corrected. Such lesions as are present, on the examination of each patient, are to be corrected. Care must be employed to avoid fracture of the long bones, especially in the correction of innominate lesions; the thinning of the bones, by the red marrow, may leave them extremely fragile. At each treatment the ribs should be freely raised, and held in that position through one to three long breaths. The liver is to be treated directly, and the lower ribs raised from the liver and spleen. Manipulation of the abdomen is best avoided, unless there is some urgent indication therefor.

Prognosis. Remissions may be hoped for; these may last for a year or more. Unless there is some remission, death may be expected within a year from the time of the diagnosis. In many cases, the disease progresses more rapidly. If an underlying cause is found, and removed, recovery may be expected rather promptly. In such cases, the blood-forming organs appear to retain some effects of their experience; such a patient, having any cause of anemia later, is apt to show blood cells characteristic of idiopathic anemia.

Prophylaxis. Since the nature and cause of the disease are unknown, the prevention of idiopathic anemia is impossible. The severe secondary types are to be avoided by early and unremitting attention to the causes of secondary anemia, especially to intestinal parasites.

INFANTILE ANEMIA. (Anemia infantum pseudoleukemia; pseudoleukemia of children; von Jaksch's anemia.) This is a rare disease of children under four years, characterized by greatly enlarged spleen, evidences of erythrocyte destruction, and increase in the white cells.

The etiology is unknown; it is usually associated with rickets or with some wasting disease, gastro-intestinal disorders, syphilis, or tuberculosis. The increasing wasting and pallor, with the enlarged spleen, suggest the diagnosis, which is proved by the blood examination. The red cells diminish to 3,000,000 or less, while the white cells may rise to 100,000 or more. Poikilocytes, stippled red cells, vacuolated and nucleated erythrocytes are found. The white cells retain their normal proportions for a child of that age.

The treatment is that of the causative disease, plus that for other secondary anemias. The **prognosis** is as good as that of the primary disease, whose course it seldom modifies.

SPLENIC ANEMIA. (Banti's Disease.) This is an infectious disease of the spleen and the blood-forming organs, characterized by extremely rapid increase in the size of the spleen, rapidly developing anemia, and death.

The anemia due to long-continued malarial invasion, associated with large spleen, is sometimes called splenic anemia—it is not properly so called, though malaria may predispose to the true form of Banti's disease. The same is true of rachitis and syphilis, which are often given as causes of the disease.

Diagnosis. The spleen is very much enlarged and is painful. The red bone marrow shows inflammatory changes. The lymph nodes may or may not be enlarged. Weakness and emaciation are the first symptoms, then splenic and hepatic enlargement, then hemorrhages, jaundice, ascites, and death. The blood shows the chlorotic picture—red cells, 3,000,000 or less, hemoglobin reduced much more greatly, with a color index of one half or even lower. Leucopenia is usual.

Treatment. The usual treatment for anemia should be given, plus raising the ribs, and the correction of anything found in the structure or the occupation of the patient that might interfere with the circulation of the spleen or the red bone marrow. Recurring hematemesis should suggest the propriety of removal of the spleen.

GAUCHER'S DISEASE. (Large-celled splenomegaly.) This is a rare hereditary disease, affecting females mostly. It is characterized by enormous splenic enlargement; a brownish discoloration of the skin; tendency to hemorrhages in mucous membranes and skin; thickening of skin and conjunctivæ;

and fairly good blood and health. The blood examination distinguishes it from other diseases with which it might be confused. The spleen contains a remarkable number of very large endothelial cells, whose origin and function are unknown. The treatment is that of splenic anemia. The prognosis is good for life and comfort, but recovery from the chronic state is not to be expected. Improvement may occur. It may develop into Banti's disease later, with death.

POLYCYTHEMIA. This is a rare blood disease, most often found in middle aged Jews, either men or women. It is clinically characterized by vertigo, headache, gastro-intestinal symptoms, cyanosis, and splenic enlargement. The blood count gives the diagnosis—red cells may reach 10,000,000, but may not be so high; hemoglobin may reach 20 g. per 100 c.c. of blood—about 150% of the normal. The color index is usually about .75, the white cell count is about normal, though the mononuclears may be slightly increased. The total amount of blood is increased. Several slight variations in type have been reported. No satisfactory treatment has been found; venesection gives temporary relief; splenectomy is advised. The prognosis is bad, and death occurs with toxic symptoms, or from hemorrhage.

CHLOROMA. (Green tumor.) This is a rare disease, characterized by a sarcomatous growth in the orbital bones and tissues. It contains a greenish pigment, whence the name. The spleen and lymphatic nodes are often enlarged; there is a gangrenous stomatitis; pain in and around the eye and mouth, deafness, and a very severe anemia. The blood picture may be that either of pernicious anemia, or of acute lymphatic or myelogenous leukemia. X-rays have delayed the growth of some of the tumors, and are without benefit to others. No other treatment has been found of any use. The disease terminates in death in a few months, with symptoms of malignant cachexia.

BLASTOMYCOTIC ANEMIA. Infection of the blood by certain of the smaller yeasts has been studied in the laboratories and clinics of the Pacific College and of the A. T. Still Research Institute. The infectious agent gains entrance through abrasions in the skin; other modes of entrance may be found on further study. Predisposing causes include malnutrition and excessive carbohydrate diet. Diminished alkalinity of the blood has been present in the cases studied.

The symptoms vary according to the organs most seriously involved. Pulmonary invasion suggests tuberculosis; the recognition of the yeast in the blood and sputum, with the absence of tubercle bacilli and the more indolent progress of the disease give the correct diagnosis of blastomycosis. The presence of yeast in the sputum alone is not significant. The skin is often the seat of peculiar dry scabby sores. Invasion of the joints causes vague pains suggestive of rheumatism, but not associated with as marked inflammatory changes. The systemic symptoms include sighing, malaise, weakness, evanescent slight chills and feverishness, insomnia and drowsiness and other symptoms suggestive of autointoxication, but without furred tongue, foul breath or evidence of gastro-intestinal disturbance.

Treatment consists in promoting nutrition and elimination and blood formation, as in secondary anemia. The organism disappears from the peripheral blood under treatment and good hygienic conditions, but tends to reappear under adverse nutritional states.

CHAPTER XXIV

THE LEUKEMIAS

ACUTE LYMPHATIC LEUKEMIA

Acute lymphatic leukemia is a rare disease, characterized by sudden onset with high fever, rapid and pronounced increase in the lymphocytes, the rapid development of emaciation, dyspnea and early death. **Etiology** is unknown.

Diagnosis. The early symptoms are atypical. They are weakness, emaciation, insomnia, sometimes edema, and other symptoms characteristic of cancerous cachexia. The lympathic glands all over the body and the spleen undergo marked and rapid increase in size.

The diagnosis rests upon the onset with high fever, the enlarged lymph nodes, and the result of the blood examination. The red cells are not materially changed early in the disease; later they undergo the changes characteristic of secondary anemia of the toxic type. The most remarkable finding is the great number of lymphocytes. At first these are all small, but later the large lymphocytes are greatly increased and considerable numbers of basophilic hyalin myelocytes are present. The total white cell count rarely exceeds 100,000 perhaps with 99.5% of lymphocytes. The blood picture in the very last stages of acute lymphatic leukemia is not to be distinguished from that in acute splenomedullary leukemia.

The most marked change in the **urine** is the presence of considerably increased amounts of uric acid and other purin bodies.

The **course** of the disease is rapid and death is to be expected within a few months to two years after the first symptoms are noted. It is improbable that any treatment can interfere with the course of this disease.

The symptoms may be relieved by **treatment** adapted to the condition of the patient upon examination. The most important factor in the care of these patients is to make the diagnosis accurately and give whatever directions are necessary as to the general care.

CHRONIC LYMPHATIC LEUKEMIA

(Chronic lymphadenoid leukemia; chronic lymphadenosis)

Chronic lymphatic leukemia is now known to be somewhat less rare than was earlier supposed. It is a disease of the lymph nodes of the body, characterized by a slow development of cachexia. The symptoms of chronic rheumatism—weakness, dyspnea, and

pain—develop slowly, and the condition is likely to be mistaken for rheumatism. The excessive uric acid in the urine is characteristic, both of chronic lymphatic leukemia and of gout or rheumatism. Rather early in the disease the lymph nodes of the body are slightly enlarged; the spleen is usually slightly enlarged.

Only the blood examination can give the **diagnosis.** The red cell count and the hemoglobin are usually about normal; the actual number of the neutrophiles is about normal; the small lymphocytes are increased, reaching about 10,000 per cu. mm.; the large lymphocytes are increased proportionately with the small. The disease may at any time show an acute exacerbation, when the symptoms characteristic of acute lymphatic leukemia occur, and this may result in the death of the patient. The total white cell count may run up to 500,000, with 60% or more small lymphocytes.

The relation between chronic lymphatic leukemia and acute lymphatic leukemia appears to be somewhat as that between the benign neoplasms and the malignant neoplasms. In chronic lymphatic leukemia, as in the presence of any of the benign tumors, the life of the patient is not markedly shortened; death is usually due to some intercurrent disease.

Treatment. No satisfactory treatment has yet been outlined. In any case, the diagnosis should be made carefully from the study of several blood counts. Whatever improvements can be made in the diet and general hygiene should be made and the symptoms relieved according to the condition of the patient as found upon examination.

ACUTE SPLENOMYELOGENOUS LEUKEMIA

Acute spleno-medullary leukemia is a disease of the spleen and red bone marrow, characterized, clinically, by the rapid development of high fever, cachexia, pallor, edema and very rapid enlargement of the spleen and sometimes of the lymph nodes.

The **etiology** of the condition is unknown. It usually appears in young people. The increase in the white blood corpuscles may be remarkable. Remissions are rare, during which the white cell count may drop almost to normal and the symptoms may be relieved to a certain extent. Usually, however, the condition of the patient grows steadily worse and death is likely to occur in a few months from the onset of the first symptoms.

The red cells vary from 3,000,000 to 5,500,000, with hemoglobin about 4.5 gr. per 100 c.c, or about 34% of the normal. The total leucocyte count may run very low, 1,500 per cu. mm, but is usually high, to 500,000 per cu. mm. Of these, myelocytes are most abundant, reaching 99% of the total white count, in some cases.

CHRONIC SPLENOMYELOGENOUS LEUKEMIA

(Lienteric leukemia; spleno-medullary, or myeloid leukemia)

This is a disease of the blood and bone marrow, characterized clinically by insidious onset, vague symptoms leading progressively to death; and by the occurrence of large numbers of granular leucocytes, especially mononuclear forms, in the blood.

Etiology. The cause of the disease is unknown; it may follow malaria, syphilis; wasting infectious disease, as typhoid; pregnancy in women or the climacteric in either sex. A blow over the spleen has been reported in some instances; gastric or intestinal ulcers, and stomatitis may precede the diagnosis; but not necessarily the beginning of the disease.

Lesions affecting the ninth and tenth thoracic vertebræ are constant.

Diagnosis. The symptoms are vague; the onset is insidious and slow. Weakness and dyspnea, irregular fevers, speedy fatigue, occasional diarrhea, pallor, nervous irritability, priapism, insomnia with tendency to drowsiness, all without wasting, perhaps with increase of body weight, an especially large abdomen, are the usual symptoms. The diagnosis must be made upon the blood examination.

Blood. In the early stages the red cells and hemoglobin remain almost or quite normal. Later, both are reduced; the hemoglobin first and most rapidly; the color index is usually less than 1, and is sometimes very low (.5 or even less). With diminution of the hemoglobin, poikilocytes appear. Later microcytes, normoblasts, vacuolated, spherical and granular red cells appear; toward the end, megalocytes and megaloblasts appear; the latter presenting immature and atavistic characteristics. The most important changes are in the white cells. The total count is from 15,000, in the early stages, to 500,000 or more in the later stages (more than 800,000, in one P.C.O. clinic case). The increase is in the granular cells, especially the neutrophiles. The eosinophiles are absolutely increased, sometimes relatively; the basophiles are increased both relatively and absolutely; amphophiles are usually fairly abundant. The pathognomonic finding is the presence of considerable numbers of myelocytes. These are usually of the neutrophilic variety, and may make up 25% of the total white count.

Basophilic, eosinophilic and amphophilic granular myelocytes are found; near the termination of the disease, basophilic myelocytes of great size, resembling those of the acute leukemias, may be found.

During the progress of the disease, periods occur when the actual count is almost or quite normal; occasionally leucopenia occurs. The myelocytes and atavistic forms rarely disappear, how-

ever, and in doubtful cases the blood count should be repeated at intervals of a week or a few weeks until the diagnosis is clear.

The **spleen** is enlarged in every case, though its size is subject to considerable variation. It may extend into the pelvis and to the right iliac crest; the abdomen is the size of that of full term pregnancy. The liver is also larger than normal. Lymph nodes are sometimes enlarged. Hemic murmurs may be found; the pulse is full and compressible.

The **urine** shows excess of uric acid and other nuclear derivatives.

Hemorrhages may appear upon the mucous membranes or subcutaneously. Death may be due to internal hemorrhage.

Treatment. The correction of the lesions of the ninth and tenth thoracic, raising the ribs, and the study and correction of other causes of poor circulation through the abdominal viscera is of most importance, and has seemed to be effective in the early cases reported; it is important that complete histories with blood reports should be kept of such cases. In the late cases, symptoms are relieved and life apparently prolonged and made more comfortable, as the result of corrective measures. The patient must be warned against overexertion. An abundance of fresh air, a plentiful mixed diet, and quiet living are essential to the greatest improvement. Extirpation of the spleen has been followed by relief in some cases, by immediate symptoms of acute leukemia and speedy death in others, and by a period of relief, followed by later acute leukemia and speedy death in still other cases. Death from shock may occur as the immediate result of the operation.

Prognosis. In early cases, with comparatively low counts, recovery may be hoped for; in later cases, recovery is doubtful but improvement is to be expected; after the white cell count exceeds 200,000 and myelocytes are abundant, especially if hyaline forms appear, death is probably inevitable in a few months. Even in these cases, however, remissions with months of fairly good health may be hoped for. Death is preceded by some days of great weakness, dyspnea, often orthopnea. The mind remains unclouded until increasing weakness leads to unconsciousness.

HODGKIN'S DISEASE

(General lymphadenoma; pseudo-leukemia)

Hodgkin's disease is sometimes called pseudo-leukemia. It is characterized by very rapid enlargement of the lymph nodes of the body and of the spleen, usually without leukemia.

The cornybacterium granulomatis maligni is supposed to be the specific infectious agent.

The **diagnosis** rests upon the generalized enlargement of the lymphatic glands and the blood examination. An increased amount of uric acid is present in the urine. The symptoms are vague and not usually severe. A slight weakness, occasionally dyspnea, together with some rheumatoid symptoms, are all that are usually present. Fever may be present, irregularly, rarely above 100.

The blood shows no constant changes. Excess in the large mononuclear cells and the myelocytes are frequent. Platelets are increased. Masses detached from the pseudopodia of the megalocaryocytes have been described. (Bunting.) Increase in the white cell count usually appears after the disease is well advanced. Rarely marked leucocytosis appears early.

The **progress** of the disease is slow and death is usually from some intercurrent affection. In some cases a rapidly developing anemia and cachexia, increasing fever, and hemorrhages cause hasty death. Rarely lymphatic leukemia develops from Hodgins disease; in some such cases it is probable that the first diagnosis was faulty.

Treatment is commonly unsatisfactory. The symptoms may be met as they arise, with a fair degree of success.

LEUKANEMIA. Leukanemia is a disease of the blood, characterized by an increase in the white blood cells in toto, associated with rapid deterioration of the red cells, similar to that observed in pernicious anemia.

The disease is rapidly fatal, and no satisfactory treatment has yet been found for it.

APLASTIC ANEMIA. This is a disease of youth or young adult life, more frequent in women than men, in which the anemia seems to be due to defective blood formation. Autopsy shows the red bone marrow shrunken and atrophied. It begins insidiously but rapidly, with increasing weakness and dyspnea. Hemorrhages upon the mucous membranes and skin, and into internal organs may suggest scurvy.

The red cells and hemoglobin are about equally reduced; no normoblasts, megaloblasts, or poikilocytes, or other indication of hurried blood formation are present, nor do the red cells show stippling, unequal staining or other indications of toxin presence. The granular leucocytes are diminished greatly, while the total lymphocyte counts remains practically normal.

The course rapidly goes on to death, under the treatment medically indicated. No reports have been made by osteopaths.