

author that Dr. Parry's estimate is much too high for this country as a whole, although it may have been correct for the limited area of his observation. The disease, although more prevalent among the children of the squalid poor, also occurs among the well-to-do classes. Certain bodily states of the parents may exert a very baleful influence on the constitutions of their offspring, of which rickets may be regarded as an example. An innate tendency to rickets is a result of marriages of consanguinity, or of those too old, or of the feeble and cachectic. While Sir William Jenner holds that rickets is not inherited, he strongly insists on the influence of the health of the mother on the development of rickets in the child.\* All the causes of every kind, which depress the bodily powers of the mother, increase the tendency to the production of rickety children. While the bodily condition of the mother is much more intimately concerned than that of the father, the effect of any given cachexia is much more certain and disastrous when both parents are affected. The rickety constitution may also be inherited. Numerous illustrations of this fact have been collected, and it is generally admitted by authors, but is denied by Jenner. After birth, the hereditary tendency is brought into an active condition by faulty alimentation and unhygienic surroundings. Rickets also occurs in the inferior animals.† The recent observations on "the influence of certain specific irritants upon osteoplastic tissue" have thrown great light on the production of rickets. These specific irritants are phosphorus and lactic acid. If to the action of these, when introduced into the economy, is added a deficiency in the amount of lime-salts contained in the food, or an inability to appropriate that received, there will be produced the state of rickets. Lactic acid is abundantly formed in the intestinal canal of the infant, and acts as an irritant of the osteoplastic tissue, while at the same time it is a solvent of the lime-salts, and thus effects their elimination.‡

**Pathological Anatomy.**—The distinctive lesion of rickets is a peculiar alteration of the osseous tissue of the body. The long bones are thickened at their epiphyseal extremity; the bones generally are softened, the flat bones are thickened; various deformities result from the action of mechanical causes, as, for example, deformities of the chest, distorted spine, bent legs, etc.; arrest of growth, not only of the bones themselves, but of all associated parts; related lesions in the pericardium, lungs, and capsule of the spleen; and morbid alterations in the nutrition of the brain, spleen, liver, lymphatic glands, and muscles, etc. (Jenner). Besides these changes, the bones are found in a

\* "Medical Times and Gazette," May 12, 1860, "A Series of Three Lectures on Rickets."

† "Die Rachitis bei Hunden," von Dr. W. Schütz, Virchow's "Archiv," Band xlvi, s. 350.

‡ Senator, *op. cit.*

highly hyperæmic condition, which extends to the periosteum, subperiosteal tissue, and the medulla. The most characteristic changes are those occurring at the junction of the epiphysis with the diaphysis. Calcification of the proliferating cartilage corpuscles goes on irregularly, and the medullary spaces extend beyond the line of calcification. Hence the epiphysis contains cartilage irregularly interspersed in the ossified portions, and the medullary spaces are irregularly bordered by cartilage and by bone. The periosteum is equally changed. Besides an intense hyperæmia, already mentioned, this membrane is much thickened, closely adherent to the bone, and its cellular elements, rapidly proliferating, are being converted into bone-cells. When flat bones are cut across, they are seen to be highly congested, and present a reticulated structure under the periosteum (Senator). The result of these changes is, that the bones are so soft that they can be easily cut, and bent with a slight force. Chemical examination has disclosed important changes.\* When the disease is far advanced, the animal matter does not furnish chondrin or gelatin, and gluten has been obtained from it. Jenner finds that while the bones of healthy children yield thirty-seven parts of animal and sixty-three of mineral substances, the bones of rickety children yield about seventy-nine parts of animal and twenty-one parts of mineral matter. Besides the alterations of bone, which are essential, there occur lesions in other organs, some of which are accidental, as the intercurrent diseases; and others seem to have the relation of effect, as chronic diarrhœa, enlarged mesenteric glands, fatty degeneration of the liver, and enlarged spleen.

**Symptoms.**—Rickets begins during the intra-uterine life, and the characteristic changes have been recognized in the fœtus. The usual period of its first symptoms is from the fourth to the seventh month. It is a disease of early life. The cases occurring within the first and second year greatly exceed all of the subsequent life. When the initial symptoms begin, there is a period of several months during which the nature of the case may remain in doubt. The first symptoms are connected with the organs of digestion, and are such as may arise during the course of many chronic diseases. It is observed that the child wastes, but this change is attributed to indigestion, there being more or less diarrhœa and vomiting, the stools and the matters vomited having an acid reaction. The stools are also light in color, because of the absence of bile, and have an odor of decomposition. The appetite is wanting entirely, or is capricious, and vomiting is frequent. Besides wasting, the child grows dull, listless, and peevish; there is some fever present, and intense thirst is experienced, the child swallowing enormous quantities of water. If the child has begun to walk, it soon becomes too feeble, and prefers to sit or lie quietly, and

\* "Ueber Osteomalachia und Rachitis," von Dr. F. Ruloff in Halle, Virchow's "Archiv," Band xxxvii, s. 433.

is equally indisposed to any exertion as to any amusement. Pains in the limbs, especially about the joints, are complained of. The pulse is quick and irritable, and the superficial veins are swollen. The anterior fontanelle remains open and does not diminish in area. These symptoms do not indicate the nature of the disorder which is now developing, but certain signs of high significance make their appearance after a variable period of intestinal troubles and impaired nutrition. To Sir William Jenner we owe the credit of having emphasized the importance of these symptoms. The first is profuse perspirations of the head, neck, and upper part of the chest, appearing chiefly while the child is asleep, but at the same time the abdomen and extremities are dry and hot. The next symptom is a feeling of burning heat, especially in the lower limbs, impelling the child to kick off the covering and keep the legs exposed to the external air in cold weather. The third symptom is tenderness of the whole body. The rickety child does not play and toss its limbs about in all directions, but it keeps as motionless as possible, and cries out when it is taken up, or moved, or pressed on. At this period, also, the urine is abundant, and deposits a copious sediment of the lime salts. The child at this period begins to have a peculiar, a characteristic appearance. It is languid, wasted, its countenance wearied, depressed, and aged, the face has grown broad and square, the hair is thin, dry, and dead, the fontanelle is open widely, the muscles are wasted and flabby, and seem unable to support the body erect, the head sinks between the shoulders, and the abdomen is swollen and protuberant. Now appear the changes in the bones which unmistakably indicate the nature of the case. The extremities of the long bones swell and have a knobby appearance; they yield to the weight of the body or the action of the muscles and bend, those of the lower extremities forward and outward and the femurs forward, and, if the child is walking, outward also. At a more advanced age, the curvature of the lower limbs is different; the knees approximate by bending of the femur and tibia in a curve whose concavity is toward the middle line of the body, and the feet are turned away from each other, so that the child walks on the ankle and inner side of the foot; or the bending is in the opposite direction, both limbs bent like a bow, the child walking on the outer surface of each foot, and the knees widely separated. The spine-curves are determined by the child's walking or not walking. In the former, the natural anterior curvature of the cervical spine is greatly exaggerated; the face is turned upward and the head falls back, and if the muscles are very weak the head is not supported by the neck-muscles, but flops about idly. The other, or posterior curve of the child in arms, commences at the first dorsal and extends to the last dorsal. It may be so great as to be mistaken for angular curvature, and Jenner proposes to differentiate by simply extending the child; but, in old cases, the vertebra

and intervertebral disks have undergone permanent changes and can not be moved. Lateral and outward curvature of the spine also takes place; but these forms are less common, because those that are usual are mere exaggerations of normal curves. Important changes occur in the formation of the thorax. The ribs, being softened, yield to the atmospheric pressure, the sternum is projected forward, thus increasing the antero-posterior diameter of the chest. The ribs are bent posteriorly to an acute angle, and a groove is formed along the junction of the ribs with their cartilages, extending from the first to the ninth or tenth rib, but farther down on the left side. Owing to the position of the heart, the chest-wall of the præcordial space, supported also by the liver, spleen, and stomach, does not recede and hence is apparently more protuberant. Similar curves occur in the upper extremities, but they are determined by the age and the muscular actions imposed on these members. The head of the rickety child appears larger than that of a healthy child of the same age; but this is only apparent and not real, the difference being due to the wasting of the face and neck in the former. If the rickety child is under two years, the fontanelle, which normally closes by this time, is widely open, and remains open till the third year or longer. The vertex has a flat shape, the forehead is large and square, and the parietal bones are expanded. The bones of the face—the upper jaw and the malar—cease to grow, while the frontal and ethmoidal sinuses expand, and hence the greater prominence of the latter. The process of dentition is either delayed, or it is entirely arrested, or the teeth, if formed, decay and fall out.\* The pelvis, as the chest, acted on by the weight of the body and by the muscles attached to it, is deformed in various ways. The sacrum and pubis may be approximated, or the iliac bones may be distorted inwardly, or the outlet may be changed in form and narrowed by the sacrum bending forward. The gastro-intestinal disorders, which precede the osseous changes, continue during the development of the latter. Emaciation goes on at the same rate, the abdomen enlarges still more, the muscles waste and grow weaker, there is less and less disposition to voluntary exertion, the perspirations are more free, the thirst increases, the bowels become more irregular and the evacuations more unhealthy, containing little or no bile, are fetid, the food often passing unchanged. The pains in the bones increase in severity, and their growth ceases entirely. Progressing in this way, after a variable period, the case is terminated by some intercurrent malady, or by the development of some one of its natural sequelæ, or by restoration to health.

**Course, Duration, and Termination.**—Cases of rickets of so acute a character as to run through their course in a few weeks have been de-

\* Dr. Samuel Gee, "St. Bartholomew's Hospital Reports," vol. iv, 1868, p. 69, "On Rickets." He gives the case of a boy of three years, who had cut only eight teeth.

scribed. In its ordinary form, rickets is an essentially chronic malady, and lasts from months to years, often many years. When the disease begins very early, the changes are more extensive and severe; but those cases are more slow in progress which begin during or subsequent to the second year, and they are hindered in growth by more or less prolonged periods of improvement, during which the bone affection subsides and the intestinal disorders cease for the time, to be resumed when the exacerbations come on. Those cases beginning after the first dentition pursue a milder course, and, if properly managed, end in recovery, but with the deformities and arrested growth of the period of the disease at which arrest occurred. Recovery may take place in those cases occurring the first year of life. When such a favorable course is to be pursued, the teeth, which had been tardy in making their appearance, come through and do not decay, the swelling of the bones subsides, the appetite improves, and the nutrition becomes more active. Various complications arise. Among the most common are catarrh of the bronchial tubes, broncho-pneumonia, capillary bronchitis, congestion of the lungs, and pleural effusion. Jenner strongly insists on the dependence of *laryngismus stridulus* on rickets, or a rickety constitution. The gravity of slight affections of the thoracic organs is much increased because of the diminished capacity of the thorax. Enlarged spleen is present in two thirds of the cases proving fatal. Enlarged lymphatics also may be associated with it, and important changes in the blood take place, a very severe anæmia resulting. Chronic hydrocephalus may also occur as a complication, and death is not unfrequently caused by convulsions. Protracted diarrhœa, ulceration of the intestine, and amyloid degeneration of organs, may also appear during the course of unfavorable cases.

**Diagnosis.**—When rickets is fully developed, a question of diagnosis can scarcely arise. The only disease with which it may be confounded is inherited syphilis. Rickets does not appear, as does syphilis, during the first days of life. The “snuffles” and cutaneous lesions do not belong to rickets; enlargement of the epiphyses of the long bones does not belong to syphilis. Local deformities, which may simulate the changes wrought by rickets, are distinguished by the fact that the latter are general and not local.

**Treatment.**—The most important remedies for rickets are hygienical and dietetic. Good air, warm clothing, daily bathing, and a nutritious diet, are essential. If the child is nursing, the milk of the mother should be carefully examined. If she is the subject of syphilitic infection, or of a cachexia, the child should be removed, although the milk may seem to be entirely healthy. No rickety child should be “raised by hand,” if practicable to avoid it. If, however, it can not be nursed, a proper diet becomes then a subject of high importance. Good cow’s milk, diluted by one third to one fourth of lime-water, is

the most suitable aliment. In the absence of this, condensed milk may be substituted. Should these disagree, as shown by the passage of a great deal of casein in the evacuations, barley-water with one fourth cream added is an excellent substitute. The various substitutes for mother’s milk or infant food, offered for sale, are of doubtful propriety, since they usually contain an excess of starchy food, or are prepared on false principles, or based on theory. The points to which medicinal treatment should be directed are the disorders of digestion, the acidity of the evacuations, the absence of bile, and the waste of the lime salts. Lime-water should be given freely with the milk, or carbonate of lime in small quantity may be stirred in the milk. Pepsin in full doses is highly serviceable, and, if there are vomiting and diarrhœa, it may be given with bismuth. Pepsin, with diluted muriatic acid in small quantity, is also useful, the acid acting the part of an anti-ferment, and preventing the formation of lactic acid. Brandy, reënforced as to its astringency by a few drops of tincture of catechu, is a most efficient remedy also, both to counteract the depression and to act as an anti-ferment and an astringent. Cod-liver oil is the most efficient remedy against the constitutional condition. Moreover, cod-liver oil improves the digestion and changes the character of the evacuations. It may be given in an emulsion with lime. The dose should not exceed half a drachm to one drachm, three times a day, but it should be kept up faithfully for a long time. Small doses of iron, the carbonate saccharated, the most easily digested, or the acetated tincture, or the bitter wine of iron, should be persistently administered.

#### LYMPHADENOMA.

**Definition.**—By *lymphadenoma* is meant a dyscrasic affection, characterized by enlargement of the lymphatic glands and of the spleen, and by progressive anæmia. It is also called *Hodgkin’s disease*, because it was first described by Dr. Hodgkin in 1832,\* and is known as “malignant lymphoma,” “lympho-sarcoma,” the name given it by Virchow, and “pseudo-leukemia,” as named by Cohnheim.

**Causes.**—Little is known as to the influences producing the disease. It is not hereditary; it may come on without obvious cause in an individual in apparently perfect health; it is three times as frequent in males as in females, and is more common in youth and old age than in the middle period of manhood, but it may occur at any age.

**Pathological Anatomy.**—The changes peculiar to this disease are found in the lymphatics and in the spleen. In advanced cases, all the glands of the body, superficial and deep, are diseased, and the adenoid

\* “Medico-Chirurgical Transactions,” vol. xvii, 1832, p. 68, “On some Morbid Appearances of the Absorbent Glands and Spleen,” by Dr. Hodgkin, presented by Dr. R. Lee, read January 10 and 24, 1832.

tissue in the course of the lymphatic vessels takes on an overgrowth. The cervical, axillary, inguinal, retro-peritoneal, bronchial, mediastinal, and mesenteric are in turn affected, and in the order named. Usually both sides, but sometimes only one side, is affected. The size of the glands affected ranges from a filbert to a hen's-egg, and when a group of glands is enlarged to the maximum the whole collection forms an immense tumor, which may have the dimensions of a child's head. At first each gland is separate and freely movable; at length the whole group forms a solid mass; but other glands in other situations may still remain mobile. The growth may ultimately penetrate the capsule and extend into surrounding tissues, and may even perforate a vessel. The solidification of a group of glands is also brought about by inflammation of the surrounding connective tissue. The pressure of the enlarging glands may cause atrophy of neighboring structures and interfere with the functions of organs. Two kinds of changes are noted in the glands: some are hard and others soft, but those which have been soft may become hard. Sometimes it is the large, sometimes the small, glands that are hard. On section of an affected gland, the difference between cortical and medullary parts has disappeared; the color is whitish or grayish, with here and there a spot of hyperæmia. The soft glands contain a great quantity of lymph-corpuscles (or cells strongly resembling them), which gradually displace the septa of the gland, and thus give to its cut surface an homogeneous appearance. In the harder glands, the firmness of structure is due to the development of fibroid tissue, which takes place in the septa, in the reticulum, and in the walls of the capillary vessels. Finally, the cells atrophy and disappear before this growth of fibrous tissue. The spleen is enlarged in three fourths of the cases, but slightly enlarged in many of these, the increase in size being due to simple hypertrophy in a few instances, and to disseminated growths in the majority. These growths may be the size of peas, distributed through the organ, or may occur in larger nodules, looking like suet, as Hodgkin was the first to say. These masses are not inclosed in a capsule, but are surrounded by compressed splenic pulp. They do not often pierce the capsule of the spleen, but, if large and numerous, do compress the splenic pulp, which atrophies.\* These splenic growths correspond closely with the growths in the lymphatic glands, and consist of the same cells and fibroid tissue; and infarctions are also encountered.† In some cases, the marrow of bones has undergone changes; it becomes converted into a reddish-gray, soft, almost fluid material, due to the predominance of lymphoid cells, and other and larger cells, with compound nuclei. This alteration of the marrow of bones is not unlike that which occurs in

\* Virchow, "Die Krankhaften Geschwülste," zweiter Band, s. 735, Fig. 203.

† Langhaus, Virchow's "Archiv," Band liv, s. 512.

leucocythemia. The large follicles at the base of the tongue enlarge to a considerable extent, and the adenoid tissue of the intestinal mucous membrane and of the tonsils takes on the same kind of change as the lymphatic glands. One tonsil may ulcerate, while the other is enormously enlarged. The changes occurring in the adenoid tissue of the solitary glands and of Peyer's patches may result in great thickening of the intestine walls, but do not encroach on the lumen of the bowel.\* The liver is invaded in a considerable proportion of the cases by minute lymphoid growths, varying in size from a pin-head to a pea, and having the same composition as those of the spleen. In other cases the adenoid tissue is not disseminated in isolated masses, but accompanies the portal vessels occupying the interlobular spaces, and sending processes into the acini. One third of the liver may be thus occupied.† Fatty degeneration may coincide with the lymphoid disease in the liver, adenoid growths occur in the kidneys also, and chiefly in the cortex. The growths are of small size—from a pin's-head to a pea—and are disseminated in the inter-tubular spaces. They cause atrophy by pressure, and initiate parenchymatous degeneration with the usual consequences. The same growths are rarely found in the ovaries and testes, and often in the thymus. The lungs may be attacked by contiguity of tissue from the diseased bronchial glands, or by the vessels. The growths found in the lungs are small, grayish, and firm, and are often mistaken for tubercles (Gowers ‡). More or less effusion occurs in the thorax, and sometimes, but rarely, lymphoid growths are found in the sub-pleural tissue, and in the substance of the diaphragm. Sometimes the heart is small; again it is far advanced in fatty degeneration; only rarely have the characteristic adenoid growths been detected in the substance of the organ. Murchison § records an adenoid growth of the dura mater above the foramen magnum, and Mosler one above the foramen opticum.

Symptoms.—There are two groups of symptoms: those due to the disease, *per se*; those due to the interference by the growths in the functions of various organs. As regards the first group there are two distinctive symptoms—the enlarged glands, and the anæmia. The cervical lymphatic glands are, in a majority of cases, the first to enlarge, and the others, as a rule, follow in the order which has been already given. In a few instances a febrile attack accompanied the initial trou-

\* Moxon, "Transactions of the Pathological Society," 1873, p. 101. Murchison had made the same observation in a case of the same kind, "Pathological Transactions," 1870.

† Wilks, "Guy's Hospital Reports," 1865, "Cases of Lardaceous Disease and Allied Affections," p. 128, "Peculiar Enlargement of the Lymphatic Glands."

‡ Dr. W. R. Gowers, Reynolds's "System," vol. iii, American edition, article "Hodgkin's Disease." The author has to express his indebtedness to this elaborate and exhaustive memoir for valuable information.

§ "Transactions of the Pathological Society," 1870, p. 372. A full history of the disease follows.

ble in the glands; in other cases the irritation of some glands, temporarily and from trivial causes enlarged, has led to the development of the general disease, but some kind of predisposition must have existed. The enlarged glands are firm or soft, and are painless unless nerves are pressed on. Anæmia may begin and be considerably advanced before the glandular enlargements, but it usually succeeds to them. The anæmia of lymphadenoma is like the anæmia of any cachexia. The functions generally are depressed, and we have, in addition, the weak heart, the breathlessness on exertion, and the pallor and feebleness belonging to this state. The number of white corpuscles in the blood is not in excess of the normal in the majority of cases, and is never considerably above normal in any case. The white-blood corpuscles are small, as a rule, and vary in size. The red corpuscles are reduced in number, and in some cases the number of small red corpuscles is large. According to Gowers, the red corpuscles, as counted by means of the hæmacytometer, may descend to sixty per cent. of the normal in a subject having still some color. Fever occurs in about two thirds (Gowers) of the whole number of cases. Fever may be present, also, as a symptom of some intercurrent febrile affection; but it is a part of the morbid process in young subjects. Although the course of the fever is irregular, three types are known: a continuous type with slight diurnal variations; a remittent fever, hectic in character; and a paroxysmal fever, with intermissions of entire cessation of fever for several days. The symptoms due to pressure are as various as the organs pressed on. The enlarging cervical glands and thyroid press on the carotids and jugulars, interfere with the intra-cranial circulation, producing at one time cerebral anæmia, at another time passive cerebral congestion. Deglutition may be interfered with by pressure on the pharynx and œsophagus, voice and breathing by pressure on the larynx and trachea. The glandular swellings in the chest produce all the symptoms of intra-thoracic tumors, by pressure on the cardiac branches of the sympathetic, on the recurrent laryngeal, on the pneumogastric and phrenic, on the great venous trunks, on the arteries, and on the trachea, bronchi, and œsophagus. Within the abdomen these tumors may compress the aorta and give rise to the symptoms of aneurism, the stomach, and cause nausea and vomiting, the portal vein and hepatic duct, and induce ascites and jaundice, the principal nerves, and arouse pain, and the great veins, producing œdema of the lower extremities. To enumerate all the symptoms which may be excited by the pressure of these enlarged glands would be to summarize the symptoms which may be expressed by any disordered organ.

**Course, Duration, and Termination.**—The course of lymphadenoma is chronic. The average duration of fifty cases collected by Gowers was nineteen months; of eighteen cases, the duration was less than one year; of fifteen cases, between one and two years. In the only case which

the author has had in his own charge, the duration was two years. In all cases the initial glandular enlargement—cervical usually—is followed after a certain interval by the general affection of all the glands. There may be quite an interval, sometimes years, however, between the local and systemic affection. The course of the disease may be influenced by complications. The anæmia may induce various acute inflammations—erysipelas, superficial abscesses, etc. Phthisis may occur, as in the author's case. Death is usually due to exhaustion, but it may be caused by pressure on the trachea and asphyxia, on the œsophagus and starvation, on the jugular veins, carotids, and convulsions and coma. Certain intercurrent affections may cause death, as pneumonia, œdema of the lungs, pleuritic effusions, etc.

**Diagnosis.**—The maladies with which Hodgkin's disease may be confounded are leucocythemia, with splenic and glandular changes, and scrofula. In splenic, glandular leucocythemia the changes in the glands succeed to those in the blood, whereas the glandular enlargement is the initial fact in lymphadenoma; and, further, in the latter, the relative proportion of white corpuscles is not increased in the majority of cases. From scrofula the distinction is made by the number, extent, and volume of the glands in lymphadenoma, by the extension of the enlarged glands over the body, by their permanence, by the anæmia, and by the pressure symptoms which affect so many organs. In scrofula the enlarged glands are found in one situation, and usually about the neck they suppurate; the symptoms are limited to the affected part, and there is neither anæmia nor pressure symptoms.

**Treatment.**—Recent experiences by Billroth and Czerny\* have demonstrated the curability of lymphadenoma by the internal and parenchymatous use of arsenic. Fowler's solution is usually employed, the dose by the stomach being increased to ten, fifteen, or twenty minims, thrice daily, according to the forbearance of this organ, and from one to five minims in distilled water injected into the enlarged glands. Wunderlich has reported a case improved under the use of iodide of potassium. The sirup of the iodides of iron and manganese has seemed to do good by improving the cachexia. Cod-liver oil is certainly useful as a nutrient and tonic, but it can not be regarded as curative. Electrolysis has been much commended, but thus far no successful cases have been reported. It is obvious that this plan of treatment could only be used in the case of the first enlarged glands. Extirpation of the diseased glands, when but few are affected, has been done, but, as great uncertainty must exist in regard to the nature of the malady and the relation of those glands first attacked to the subsequent development, the surgical operation can not be considered a desirable expedient.

\* "Wien med. Wochenschr.," No. 2, 1881.