

and many children who fortunately escaped the latter, and are already being carried about upright, are attacked by rachitis of the thorax. Perceptible alterations are seldom observed in children under six months, while craniotabes may be present as early as the third month of life. The statement made in some of the text-books, that the pigeon-breast occurs from the first to the fourth year of life, is to be understood as meaning that children so old as four years may be observed with this disease. But, after the completion of the first dentition, rachitis never comes on in a child hitherto perfectly healthy.

The first symptom of rachitis of the ribs is a marked pain on touching or pressure of the thoracic walls. Nurses say that "the child cries every time we raise it up, if ever so tenderly." Usually such statements are not much heeded by the physician, because most of them are based upon prejudice and incorrect views. The frequency of these complaints, however, struck me long ago, and I have convinced myself that it is by no means a rare occurrence that children between five and ten months old suddenly cry out in pain when they are grasped with both hands under the axillæ and lifted up, and, as soon as they are laid down, become tranquil again. Nay, more, it is not even necessary to lift them up; slight pressure with the finger in the axillæ or on the thoracic walls generally, suffices to produce pain. If such a child is tenderly raised with one hand under the pelvis, and the other supporting the neck, it will remain as quiet as if it had been lying on the pillow, and in this manner, also, its bedding may be changed without giving it any pain.

At this time, little or no hypertrophy can be felt at the sternal end of the ribs, the boundary between the costal cartilages and the bone. The sternal ends of the ribs do not begin to appear bulbous and hypertrophied, so as to be detected by the finger, and later also by the eye, till after several weeks. Thus two uniform rows of buttons, the so-called rachitic wreath, appear on both sides of the thorax at a point corresponding to the end of the costal cartilages. These buttons, so palpable from without, project still more internally, forming large angular tubercles which encroach upon the cavity of the thorax.

The thorax always becomes deformed in those cases where these hypertrophies have existed for some time. The sternum, which likewise undergoes softening, is pushed off more and more from the spinal column, and arches outwardly; the xiphoid cartilage becomes extremely movable, and, projecting, forms a deep pit in the scrobiculus cordis. In the severest grades of pigeon-breast, the costal cartilages immediately behind the sternum run straight backward to meet the elongated transverse processes of the spinal column, and thus, at their anterior ends, the ribs form a concavity instead of a convexity.

The diameters of the thorax become smaller from side to side, and larger antero-posteriorly, as is shown by the delineation, Pl. V., Fig. 2. The transverse diameter of the thorax assumes the shape of a pear, whose apex is supposed to be at the sternum. The rachitic wreath is found chiefly from the second to the eighth rib, the false ribs are forcibly pressed outward by the liver on the right, and by the stomach and spleen on the left side. The abdomen, in consequence of the constant tympanitis, and a shortening and curving of the spinal column, is tumefied, and of globular form, and much encroached upon by the distorted thorax. The spinal column is curved most during the sitting posture, and the globular shape of the abdomen is also on that account most striking in this position. When these children are laid upon the belly, and in this position raised up, the external curvature of the spinal column disappears entirely, and assumes again its normal form. In neglected cases, and where the rachitis has existed for several years, a permanent arching—not an angular curving—of the dorsal vertebræ, laterally and posteriorly, may take place.

The origin of the pigeon-breast is explained, in part, by pressure of the atmosphere upon the soft ribs, and, in part, by the traction of the diaphragm, for which they serve as points of attachment. Having lost their firmness, the ribs are no longer able to withstand the constant dragging inwardly by the diaphragm.

From rachitis of the thorax there originate (1), *an alteration in the curve of the ribs*; and (2), *an arrest in the longitudinal growth of the ribs*, a still more serious result, which inevitably diminishes the pectoral space, and promotes that disease of the lungs known as acquired atelectasis, as has been already conclusively shown on page 299.

The prognosis depends exclusively upon the affection of the lungs. When a great portion of them is involved in the atelectic process, and has become impermeable, then, of course, a serious catarrh in the remaining normal tissue suffices to induce labored breathing, and even dyspnoea, suffocating attacks, and death. In this complication, in fact, we have the usual cause of death in rachitic children, as *Romberg*, *Guersant*, and others, have remarked.

C.—RACHITIS OF THE PELVIS AND OF THE EXTREMITIES.

The pelvis does not become deformed before the rachitic child is able to walk, and then it is the result of scoliosis, or of an inequality of the lower extremities, after the manner of a distortion of the pelvis in coxarthrocase. The important consequences of this alteration in the female are discussed sufficiently in detail in the standard works on obstetrics.

Rachitis of the *extremities* is first recognized by a bulbous enlargement of the epiphyses of the radius and ulna at the wrist-joint. Its appearance at these points is at a somewhat later date than at the ribs, usually during the last months of the first year of life. The degree of the rachitic affection is always most distinctly recognized at the wrist-joint, because here the epiphyses, in the normal condition, are distinctly seen, and, on account of being superficially situated, are easily examined.

In the cadaver, the lower extremities are found as severely affected with rickets as the upper; but, since important hypertrophies about the knee and ankle-joints occur even in healthy children, rachitis produces in them no such striking alterations of form as are seen in the wrist-joints. Of course, if the disease has reached the stage of deformity, the rachitis of the lower extremities will also be recognized in the gait, and it will not be necessary to even undress the child to see it. The protuberances on the ends of rachitic long bones in reality represent their longitudinal growth. New cartilage is constantly formed on the epiphysis; but no ossification of the newly-deposited mass takes place, and thus the soft cartilage is pressed out by the contiguous bone, and by the traction of the muscles into unnatural breadth. Hence the bulbous enlargement constantly increases, for new cartilage is continually deposited.

A comparatively diminutive state of all the cylindrical bones results from this cessation of the longitudinal growth, and is most evident perhaps in the ribs, and resulting, as has been stated, in the production of the acquired atelectasis. The shortening of the lower extremities is still noticeable years after recovery from the rickets, and such children are always smaller in stature than their healthy companions of the same age.

The simple curvatures straighten again in the course of years; the pigeon-breast may dilate again completely, and the crooked sternum may become straight. The inflections, however, leave behind them alterations of form which are permanent.

As regards the functions of the rachitic lower extremities, they are very much retarded. Such children do not learn to stand till the second or third year, and to walk still later. Occasionally it happens that children, who were able to stand before they were attacked by rickets, do not recover this ability until many months later.

Few diseases interfere with a child's use of its limbs for so long a time as rickets. Children may have been ever so sickly, in the first year of life, from almost any other disease, but, so soon as they rally, if they do not become rachitic, commence to acquire the use of their limbs, and at eighteen months, at the latest, begin to stand.

I was once able to observe accurately the origin of the inflections. A child, four months old, was attacked by convulsions. I carefully examined its body, and found all the tubular bones straight; still a rachitic wreath and hypertrophied epiphyses at the wrist-joints were perceptible. During the night the convulsions grew worse, and on the following morning one forearm and one tibia, both at the lower third, were bent at an obtuse angle, and the parts around were somewhat swollen and excessively painful. The fractured ends, of course, did not crepitate, nevertheless they were movable to a high degree. The denomination "fractured ends," strictly speaking, is not applicable to this condition, for no complete solution of continuity, but only a simple bending of the bones, occurs.

Besides these especially characteristic signs of alteration of the bones, others no less constant also occur in other organs. With the appearance of the rickets, or some time before, excessive cephalic, and afterward general perspirations, invariably come on, as a result of which numerous affections of the skin become developed. Actual sudamina, or, still oftener, the so-called sudamina rubra, very small, opaque vesicles with red areolæ, appear, and are so close to each other that often the entire body and the flexures of the extremities appear reddened, rough, and uneven. Later, when the patients begin to grow lean, the skin fades in color, becomes covered with a furfuraceous, squamous exanthema, and the secretion of the perspiration ceases almost completely.

The ligamentous apparatus, especially the capsule of the hip-joint, is extremely feeble and relaxed, so that children are able to touch their faces with the feet, and have an especial predilection for putting their toes into the mouth.

As relates to the respiratory organs, spasm of the glottis, mention of which has already been made, when speaking of craniotabes, very frequently occurs, and, in addition, constant bronchitis, which, on account of the increasing carnification of some parts of the lungs, becomes severely aggravated.

The digestion may, indeed, remain undisturbed during the entire disease, but, when diarrhoea supervenes, the disease, going on in the bones as well as in the system generally, becomes materially aggravated. It is a remarkable phenomenon that even young children, laboring under an intense form of rachitis and loss of appetite, tolerate cod-liver oil, and during its use get a better appetite and digestion.

A few words more concerning the connection of the disease under consideration with *tuberculosis* and *scrofula*. Rickets was formerly called "scrofula of the bones," and it was regarded as one of the many localizations of the scrofulous cachexia. *Rufz* was the first to prove,

by the histories and autopsies of twenty rachitic patients, that the majority of them were not in the least scrofulous, and, since that time, we learn more and more to regard rickets as a sui-generis disease.

Rickets, according to my extensive observation on many hundreds of cases, is an independent affection, which, under certain conditions, and at a certain age, may almost voluntarily be induced in every child—more in one, less in another. Scrofulous children do not acquire it oftener than healthy ones: so the fact, as it occurs here in Munich, that rachitis and scrofula but rarely occur together in the same person, must be accepted as proof that in this country the majority of rachitic children are not scrofulous.

Etiology.—Remarkably few positive data are known concerning the causes of rachitis. In a great number of cases, the possibility of its being inheritable is not to be ignored. I know several families the children of which, notwithstanding all possible care, and the most rational prophylaxis, always become rachitic at a certain age, and suffer from it for years. In these cases, the father and mother usually display the peculiarly-shaped rachitic head, with its boldly-projecting tuberosities of the frontal and parietal bones. *Elsässer* and others also furnish us many positive instances on this point. The previous existence of syphilis, on the part of the father, has often been confessed to me, though cured. Rachitis in children of wealthy families may probably be explained in this manner.

In other instances it is developed with remarkable rapidity after acute diseases, such as measles, pneumonia, intestinal catarrh, etc.

Of external causes, there is only one that can be maintained with certainty, namely, the want of fresh air, and this is unanimously stated by observers as the most frequent cause. This also explains the reason why rachitis occurs most frequently, and is most intensely developed, in the spring of the year, less so in the fall.

Long confinement in closed and badly-ventilated rooms during the winter has caused it. Enjoyment of fresh air in the open street or public place in the summer cured it. Rachitis, for the same reason, is less frequently met with in southern climates.

Prognosis.—As a simple alteration of the bones, rickets is never dangerous, and, in many instances, is arrested, and a final recovery takes place, after the conclusion of the first dentition. Its complications, however, are extremely pernicious, and by these the greater portion of the rachitic children are carried off.

Spasm of the glottis is apt to supervene at the very commencement of rachitis, when the soft occiput is as yet barely noticeable, and destroys the majority of children it attacks. It will be entirely impossible to prevent the degeneration of some pulmonary lobules, if

the rachitis of the thorax makes much progress, for the lungs constantly increase in bulk, while the chest does not expand in proportion; on the contrary, it even becomes smaller by the projection of the sternal ends of the ribs inwardly. When this degeneration, or carnification, or acquired atelectasis, involves a large extent of lung-tissue, severe dyspnoea and a mild catarrhal affection of the remaining normal tissue ensue, which almost invariably lead to death.

Lastly, the curvatures and hypertrophies of the long bones may result in permanent deformities, shortening of one or the other extremities, contraction of the pelvis, and displacement and serious disturbances of the functions.

Treatment.—A countless number of remedies were employed in this disease before the introduction of cod-liver oil, and cort. aurant., rad. gentian rub., herb. absinth., rasura lig. quassiae, calam. aromat., cinchona, colombo, and the preparations of iron, were the ones most highly recommended. Externally, baths, affusions, and fumigations, with all possible aromatic herbs and their preparations, were employed. Later, dyers' red (madder) came into use, principally recommended by *Feiler* and *Wendt*. Part of this red substance, as is known, becomes deposited in the bones, and it cannot be denied that it possesses a direct influence upon them; but the alteration of color effects no increase in the calcareous deposits.

Meisner believed he had observed that vaccination arrested the progress of rickets, but *Rufz* emphatically, and with justice, denies it. *De la Fontaine* entertained the same views with regard to scabies!

The idea occurred to some that there was a real deficiency of bony substance, and they attempted to introduce it through the alimentary canal. *Wurzer* experimented in this direction with phosphoric acid which proved perfectly fruitless, and lately *Bencke* proclaimed phosphate of lime as an antirachitic. The reports of the experiments, wherever instituted with it, are not by any means favorable, and it is now very generally abandoned.

Finally, in the year 1824, *Schütze*, *Schenk*, and *Tourtual*, in Germany, called the attention of the profession to cod-liver oil, while the French physicians became acquainted with it five years afterward through *Brétonneau*, who was informed of it by a lay person from Holland. Since that time the favorable reports of ol. jecor. asell. have accumulated in such a manner that all the remedies heretofore used in this disease have been supplanted by it.

A great deal has been disputed concerning the active principle of the cod-liver oil. Some believe that it simply acts as a respiratory remedy through the fat it contains; others seek its effective-

ness in the traces of iodine and bromine, and still others in its oleic acids, and the admixture of decomposing particles of liver which are found in all cod-liver oils.

Since the experiments with pure fat, as well as those with minute doses of iodine or bromine, did not produce the desired effect, the last view seems therefore to be nearer the true one.

It is best to give the brown oil pure by itself in increasing doses, at first a teaspoonful, later a tablespoonful once or twice daily. Most of the children habituate themselves so well to it in a few days that they come to look upon it as a delicacy, and will drink several ounces of it at a draught, if they manage to get hold of the bottle. *Rachitis may be cured by the use of cod-liver oil alone*, even if the circumstances are in other respects *unfavorable*. To be sure, any possible improvement in the residence and nutrition will hasten the recovery. In this respect the following measures should be attended to:

Pure, fresh air is, above all things, necessary. In damp houses, which in winter are not ventilated for many weeks, children acquire rachitis very quickly, and in an intense form, and in these individuals cod-liver oil has only a slow and not a constant effect.

Zealous attention to the skin is to be mentioned as a second important adjuvant. The child should be bathed daily in an aromatic bath, and, in addition, the curved limbs should be washed every day with brandy.

Most of the young children, even with craniotabes, tolerate cod-liver oil very well; their restlessness is best palliated by douching the head with cold water, repeated every two or three hours. *Elsässer* recommends a pillow for the head, in which a pyriform hole is constructed, with the apex directed downward. It is a great comfort to the little patient. On account of the profuse perspirations, rachitic children should not be laid upon feather beds, but always on mattresses of horse-hair, straw, or sea-weeds.

Children who are still at the breast should be wet-nursed as long as possible, but, in addition to that, should be fed with broths. Cow's milk is the best nutriment for children up to the third year, and cannot be substituted by any other; it is to be given as plentifully as possible.

During the disease, an orthopedic treatment will hardly ever be of any benefit; not till after it has been cured can the proper machines and appliances be resorted to.

Great rachitic deformities, even in the adult, may sometimes be remedied by exsecting an accurately-calculated wedge of bone, and applying a proper apparatus.

(2.) TUBERCULOSIS AND SCROFULOSIS.—A great deal has been

disputed concerning the distinction between tuberculosis and scrofula. Some consider these two conditions as perfectly identical; others, again, assert that there is no resemblance whatever between them.

It all depends upon the point of view from which the comparison is instituted. If regarded from the anatomo-pathological point of view, it may be affirmed with certainty that coxarthrocace and scrofulous inflammations of the joints, spondylitis, the affections of the cornea and conjunctiva, otorrhœa, and scrofulous diseases of the skin, *are not usually due to tuberculosis of the affected parts*. But, in practice, the physician is continually witnessing the fact that the two diseases just mentioned are (1), by no means local troubles, but partly alternate with each other, partly occur simultaneously on different parts of the body; (2), that such children are *always* the progeny of tuberculous parents; and (3), that, after the disappearance of the scrofulous affections, which usually occurs about the commencement of puberty, these persons always become more or less intensely tuberculous.

In practice, then, the physician cannot do otherwise; he must assume the existence of an intimate connection between the two cachexiæ. But the pathological anatomist, who devotes his attention more to the morbid products than to their origin, may very well consider the produced alterations separately. Still, even pathological anatomy shows, in very many instances, the material connection between the two. In almost all infantile cadavers, which reveal any scrofulous lesions, or affections of the bones or lymphatics, there will also be found within, generally in the bronchial glands, one or more large, yellow, cheesy tubercles, which are to be looked upon as the root, as the starting-point, of the numerous peripheral scrofulous affections.

Having thus established the connection between the two cachexiæ, we may now pass on to their separate consideration: (A), tuberculosis, and (B), scrofulosis.

A.—THE TUBERCULOUS CACHEXIA.

Since, in the entire plan of this work, the diseases have been treated of according to the individual organs, and not according to the nature of the pathological alterations, tuberculosis has therefore already been frequently discussed; and, in order to avoid repetitions, we refer the student to the former sections. Tuberculosis of the lungs will be found described on page 309, that of the bronchial glands on page 311; of the brain, on page 339; of the ear, page 433;