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Litzmann
...Contributions to the knowledge of osteo-
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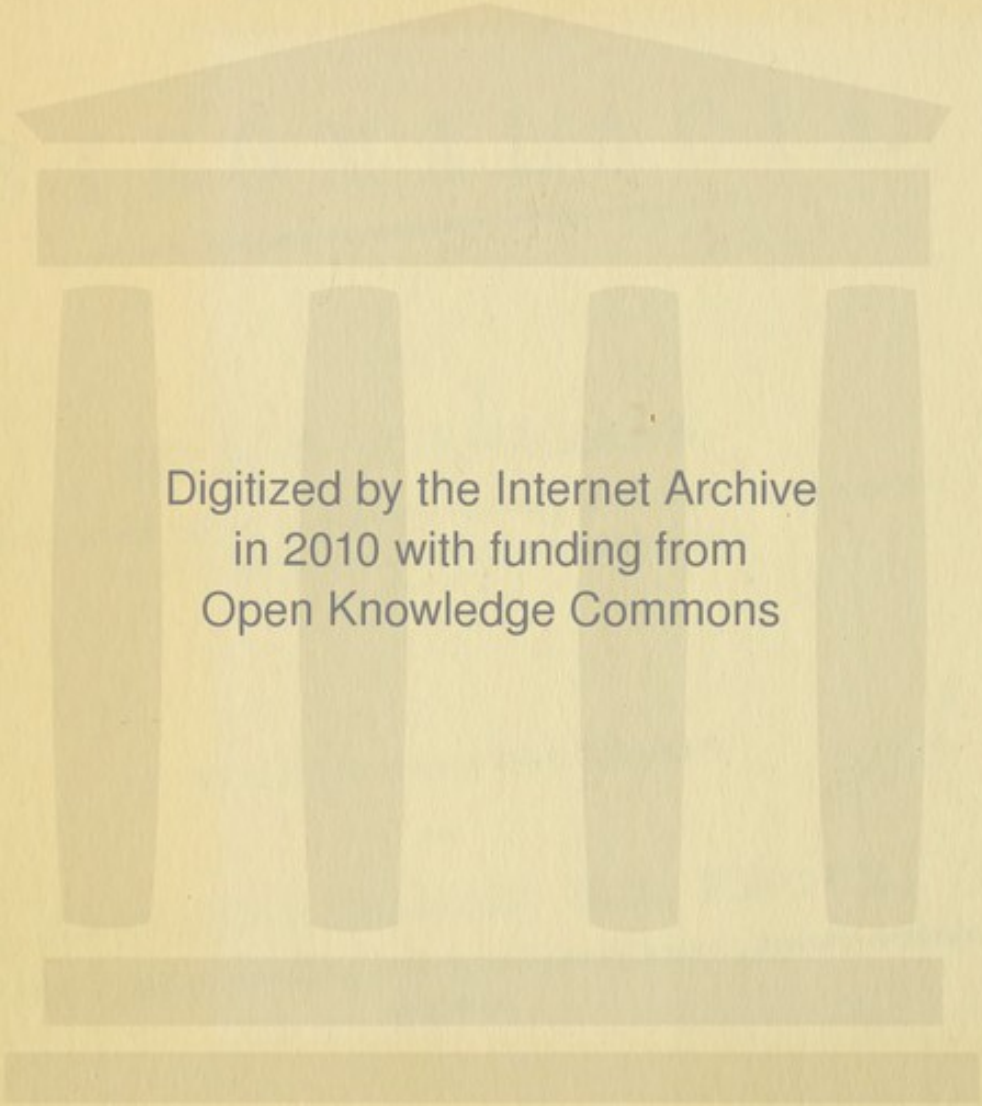

CONTRIBUTIONS

TO THE

KNOWLEDGE OF

OSTEOMALACIA.

BY

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TRANSLATED FROM THE GERMAN

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PREFACE.

THE great value and completeness of Dr LITZMANN'S Researches on Osteomalacia have led the Translator to think it well worthy of being rendered into English. He has therefore not only published this version in the *Edinburgh Medical Journal*, but now reproduces it in a separate form for the benefit of those who do not possess that monthly serial.

This work of Dr LITZMANN'S is entitled "Anhang: Beiträge zur Kenntniss der Osteomalacie," and, as its name implies, is merely an appendix to his valuable treatise on the forms of the pelvis. [Die Formen des Beckens, insbesondere des engen weiblichen Beckens, nach eigenen Beobachtungen und Untersuchungen, nebst einem Anhange über die Osteomalacie. Mit sechs lithographirten Tafeln. Berlin: 1861.]

The Translator needs scarcely to express, in name of his readers, as well as of himself, his gratitude to the eminent author. He has to record his thanks to Dr CHARLES WILSON for very valuable assistance in the translation.

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CHAPTER I.

OSTEOMALACIA CONSIDERED GENERALLY.

OSTEOMALACIA, anatomically considered, depends upon a softening of the osseous tissue, advancing from the centre towards the circumference, an osteoporosis, or eccentric atrophy (Curling).

The reticulated framework of the spongy substance becomes thinner and more delicate, wastes more and more; the medullary spaces are enlarged, and run into one another to form larger cavities. The compact cortical substance is more and more opened out by the disappearance of the bony tissue, its vascular and medullary canals become wider, and from the solid cortex is formed a spongy texture, with larger and smaller spaces. The cavities produced in this way become filled with a peculiar marrow, which is probably the result of a transformation of the dissolving osseous tissue itself (Virchow).

The attenuation of the bony structure attains different degrees; in the higher there remains only a thin external cortical layer—indeed, even this itself disappears to a greater or less extent—and the bone, in a certain sense, may be reduced to periosteum and marrow. The dissolution always begins in the centre of the bone; in short

bones, in the interior of the spongy substance; in flat bones, in the diploe; in long bones, in the spongy substance surrounding the medullary canal; and the change advances outwards towards the cortex. In the flat bones the inner spongy layer increases in bulk at the expense of the thinning layers of the bony cortex. Here and there the thinned external bony layer and the adjacent periosteum are pushed outwards in a swelling by the exuberant spongy tissue; occasionally gaps appear in the outer layer of bone, and the spongy substance of the diploe is laid bare in spots; frequently the rarefied diploe at last completely disappears, and the cortical layers of the bone are brought into contact with one another and cohere. The highest degree of the atrophy is observed in the long hollow bones of the extremities; by the progressive production of medullary spaces the medullary canal is more and more enlarged, and a spongy, loose, cortical layer, often thinned even to transparency, encloses a large-celled spongy tissue, or even naked medullary substance. Now and then there are observed indentations of the thin bony cortex, which project into the medullary cavity, and sometimes the medulla bulges out like a hernia, through holes in the outer cortex. In the extremest cases, the bones are changed into fleshy cords, on whose surface there are seen still adhering in some places thin, small, bony layers under the periosteum; or every trace of bony tissue may have disappeared, and only membranous sheaths of periosteum filled with medulla are to be found.

In the tubular bones the process always begins first in the denser and more compact shaft, or middle portion, and extends thence to the more spongy ends. The lower extremities are, as a rule, more violently affected than the upper; the parts of the limbs nearest the trunk are usually found diseased in a higher degree than the more remote; in the spinal column the affection, for the most part, diminishes in intensity from below upwards. The bones least implicated are always those of the cranium and face. The teeth remain constantly exempt, except that, in consequence of softening of the alveolar border, they sometimes become loose and fall out. The cartilages also maintain generally their normal con-

dition; only in some few cases they are found to have become thinner, or more easily separable than is natural from the underlying bone.

The changes which the dissolving osseous tissue undergoes in its transformation into medulla have hitherto been but imperfectly made out. In the diseased parts the bone corpuscles are found enlarged and irregularly rounded, their canaliculi shortened and widened, and their interior filled with fat. Most observers find in this an indication that the softening of the tissue proceeds from the bone-corpuscles. Dalrymple alone is of opinion that the softening begins in the contiguity of the bone-corpuscles (in the medullary spaces and canals), and that the clianges in the dimension and form of the bone-corpuscles are secondary, and produced by absorption of the dissolved tissue in the neighbourhood. The dissolving osseous tissue appears, almost as a rule, to lose first its calcareous salts, and thereby to be softened; often perhaps continuing for considerable time in this condition before changing into medulla, at the same time partially retaining its form; more frequently experiencing a transformation into a sort of areolar tissue, which by and by becomes a fibrous connective tissue (Rokitansky, Weber, Lambl).

The new marrow, which fills the enlarged hollow spaces, exhibits very various characters, which depend partly upon the degree and duration of the morbid process, and partly also upon the nature of the ætiological influences. The difference is observed not only in different bones of the same individual, but also in different parts of the same bone. Often it is mixed up with the remains of the osseous tissue which has advanced more or less in the softening process. In consistence the marrow is sometimes quite fluid, almost serous; oftener it forms a viscid, oily, half-fluid, honey-like or jelly-like mass, or a soft pulp; not rarely it may be called fleshy, or compared in consistence with the parenchyma of the liver. The colour of the medulla is chiefly modified by the blood and fat contained in it: there are all intermediate shades, from the palest yellow or yellow-grey to the darkest red, brown-red, or black-

red. In the beginning of the disease it is always very rich in blood, and of a dark blue-red or red-brown colour. The blood is partly contained in the dilated vessels, and partly is extravasated, By the microscope may be recognised in the mass both abundant unchanged blood corpuscles and abundant groups of brown-red pigment molecules. Not unfrequently considerable clots of extravasated blood, advanced to different stages of metamorphosis, are found mixed with the marrow. The progress of the hyperæmia is, as a rule, indicated by a copious production of round granular cells, some having one, some having more than one nucleus. In the same situations are occasionally found small, simple, and laminated amyloid corpuscles (Rokitansky), rarely and exceptionally single caudate cells (Dalrymple). With the abatement of the hyperæmia the production of new cells diminishes, the elementary structures generally undergo fatty degeneration and break up, the marrow loses colour, becoming clearer and yellower, and in the extremest cases the bone seems, as it were, gradually to change into fat.

Chemical analysis of the diseased bones must of course yield results varying according to the stage of the disease, the degree of destruction, and the character of the ætiological influences. Speaking generally, the results hitherto gained in this way are of small value. As it is the rule that, first and chiefly, the mineral constituents of the bones are removed, so we find the quantity of these almost always diminished. Sometimes the carbonate, sometimes the phosphate of lime, appears to be resorbed in greater quantity. The chemical composition of the cartilage of bone shows no change. With the advance of the disease, however, more and more of this disappears, the bone being gradually replaced by medulla. By boiling, glutin is sometimes found in the organic substratum of such bones; but in bones very much destroyed no substance resembling glutin or chondrin can be any longer discovered. The fluids of the medulla have often an acid reaction, but this is not constant. C. Schmidt, in his case, found that the fluid contained in the centre of the hollow bones had an acid reaction, and on boiling

did not coagulate in the slightest. By chemical investigation he discovered that, besides excess of phosphoric acid, there was also lactic acid in combination with lime in the contained fluid. With this coincides a later observation by O. Weber. Virchow, on the contrary, found in a case of puerperal osteomalacia the soft jelly which filled the interior of the bones to be, in fresh sections, of strong alkaline reaction, and to contain a substance distinguishable from ordinary solutions of albumen by the precipitate which acetic acid *in minimo* produced at a low temperature, and by the solubility of the precipitate produced at a high temperature by nitric acid in the acetic acid solution. On one hand, it had relations to casein, and on the other it showed much resemblance to a substance which Bence Jones believed he had demonstrated, in the urine in the case of Macintyre, to be a hydrate of deutoxide of albumen. Unfortunately, Virchow did not examine his patient's urine. The urine seems to be the vehicle by which, in this disease, the dissolved osseous substance is removed from the body. In several cases where attention was paid to its condition, it was found remarkably rich in phosphate or carbonate of lime; on standing, it deposited a white, chalk-like sediment, which in one case became dissolved with effervescence on the addition of an acid. Sometimes it was in the intervals of freedom from pain, sometimes during the paroxysms of pain themselves, that the urine chiefly exhibited this condition. Frequently gravel and calculi were evacuated with the urine, or found in the kidneys after death.

The affected bones are distinguished, particularly throughout the first stages of the disease, through their abundant quantity of blood. In the commencement, the volume, especially of the flat bones, is observed to be somewhat increased. Later, in consequence of interstitial absorption, the volume generally diminishes more and more, because a part of the softening tissue is dissolved and removed, without any compensating addition being made. The diminution of bulk is most easily observed in those bones which are subjected to strong pressure, particularly the vertebræ, which have the appearance of being more or less compressed and distorted. The bones

of the lower extremity, after long duration of the disease, and even although they have themselves continued unaffected by the disease, are generally contracted in bulk, through concentric atrophy, in consequence of continued disuse. The weight of the diseased bones is determined not only by the greater or less loss of bony substance, but also by the fluid contents. In the fresh state they are frequently heavier, when dried generally lighter, than normal; often, however, particularly when very rich in fat, they are also, even when fresh, so light as to float on water.

As the disease advances in the bones, their power of resistance is more and more lost, so that under their ordinary burden they yield, bend, become angulated or break. In the higher degrees they may without difficulty be cut with a knife, even without grating. The diminished power of resistance depends partly upon the extent to which the firm, calcareous bone-tissue has disappeared and been replaced by a soft, limeless structure, and partly upon the greater or less infiltration of the tissues. So long as an osteoporotic bone possesses even an attenuated scaffolding of bony substance containing more or less lime, a connected network of bony spiculæ and fibres, or a cortex, though a thin one, of compact bone-tissue, it will bend at an acute angle, or break, under the influence of even slight forces. If the lamellæ and spiculæ of bone substance are, however, very thin, the bone, if highly infiltrated, is to a certain degree flexible, and breaks only under increased bending. Drying always renders the bones more brittle and fragile. Several days of immersion in water restores to the dried bones their former flexibility (Planck). The more the connexion of the parts of the framework of the structure is interrupted, and, instead of continuous bony lamellæ or an interdependent network of bone-fibres, there remain only isolated fragments of bone, held together by a soft limeless texture, a sort of connective tissue or marrow, or should even every trace of firm bone-tissue have disappeared, and the bone be reduced to periosteum and marrow, the greater naturally becomes its flexibility. Such bones have lost all their elasticity, and may be bent and kneaded like wax; indeed,

in Bevan's case they were called "as limber as a rag." Still, there are not yet sufficient grounds to justify the adoption, with Kilian, of two different forms of the disease—an osteomalacia fragilis, and an osteomalacia cerea—corresponding to the two different degrees or kinds of diminished power of resistance in the diseased bones. Not only do the two extremes, having no distinct limits, as we have seen, pass into each other through intermediate forms, but they may also present themselves, either simultaneously or successively, in the same individual, or alternate with one another, according to the greater or less infiltration of the morbid tissues. In individual cases, indeed, sometimes the one and sometimes the other form may predominate. There are cases recorded where patients have suffered seventy fractures or more, one after the other. The ribs, the clavicles, the bones of the extremities, and the branches of the pubic bone, seem to be especially liable to be broken. The fractures are sometimes complete, sometimes incomplete. The severed bones remain often ununited, or the union takes place incompletely; in other cases they unite in the usual way by the formation of a callus, which, sometimes after a longer, sometimes a shorter period, becomes ossified, and in the end may even attain a greater solidity than the neighbouring bones. In the case of Goodwin, it was believed in the lifetime of the patient that the bones of the arm were broken; but investigation on the dead body showed that the indications of fracture were produced by a softening which, though circumscribed, penetrated through the whole thickness of the bone, with complete destruction of the compact cortex. The supposed fractures had been similarly produced without the application of violence from without, after acute pains had continued in the parts for a longer or shorter time; several times was an apparent reunion followed by a recurrence of separation, with reappearance of the pains.

In recent times there has been an ever-increasing tendency to regard osteomalacia from an anatomical point of view as a chronic inflammatory process in bone, a periostitis (H. Meyer), a parenchymatous ostitis, or a degenerative ostitis (Virchow). It remains

for future inquiries to pursue the investigation of the forms of this process in their individuality, for it evidently does not exhibit merely graduated differences, and particularly to mark out exactly the different ætiological influences and their modes of action, and to determine the power they exert over the progress of the disease.

CHAPTER II.

THE OSTEOMALACIA OF CHILDBEARING WOMEN.

OSTEOMALACIA occurs most frequently in women within the childbearing period of life, after pregnancy or parturition.

Among 131 patients, of whom mention is made in the appended biographical references, are to be found 85 women, who became ill either during pregnancy or in childbed, or in whom at least the course of the disease was modified by pregnancy, labour, and childbed. In two of them, however, who never again conceived after being taken ill, the puerperal origin of the disease is doubtful.

The majority became affected between the twenty-fifth and thirty-fifth year; none were under twenty years old, and very few above forty. All had already borne children before the invasion of the disease, with the exception of 4, of whom 2 became ill in a first pregnancy. Thirteen had borne once; 13 had borne twice; 15 had borne thrice; 6 had borne four times; 9 had borne five times; 5 had borne six times; 5 had borne seven times; 1 had borne eight times; in 14 the number of previous births is not given.

The commencement of the disease occurred in most in the period of pregnancy or of childbed. Nineteen took ill during pregnancy, of whom 6, according to express statements, did so in the first half of pregnancy; 33 became ill in childbed; in 14 a considerable time had elapsed after the lying-in; 2 became ill before the first conception; in 17 the time of falling ill is less distinctly given. One may well believe that in reality the foundation of the disease was already laid during pregnancy even more frequently than appears from these data, and that in more than one case the first

symptoms of the affection were either overlooked or misapprehended by the physicians or the patients.

The disease appeared almost always to take its origin in the bones of the pelvis, and particularly so in all cases where it arose as a sequence of pregnancy or of childbed. Frequently it remained confined to this part. The statements, certainly, regarding the extent of the disease are not to be regarded as entirely trustworthy; for investigations were not always extended over all parts of the skeleton, being mostly restricted to only those bones which could be without difficulty recognised as affected by the disease, in consequence of bendings or fractures having already occurred. Besides, some contributions are so superficially drawn up, that they can scarcely be used in the resolution of this question. According to the data before us, only in 6 cases were all parts of the skeleton affected; in 2 cases all except the bones of the head; in 70 cases the affection had confined itself to the bones of the trunk. There were described as diseased,

The bones of the pelvis,	. . . . .	82 times.
„	spinal column, ...	46 „
„	thorax (ribs, sternum, clavicles, shoulder-blades), . . .	26 „
„	lower extremities, . . .	15 „
„	upper extremities, . . .	10 „
„	head, ...	7 „

The diseased bones exhibited the changes of texture already described in their different gradations, according to the degree and the duration of the lesion. In recent cases they were always found congested with blood. The highest degrees of destruction occurred comparatively seldom, and for the most part only over a limited extent. Several times the previously softened bones had again acquired their normal solidity, where in the course of the disease an arrest or a cure had occurred. This process of cure of the bones, however, has not been anatomically well investigated.

If the disease be, as usual, developed as a sequence of pregnancy or of childbed, and attack first the bones of the pelvis—often, indeed, not extending beyond them—then we may well seek for the

most probable cause of it in the increased physiological activity of the pelvic genital organs, which induces a pathological sympathetic action in the membranes of the bones. In individual cases we may perhaps take also into consideration the mechanical shocks offered to these parts in the act of parturition. The lesion evidently commences with the characters of a local inflammatory irritation. Two cases have occurred to me, where women in the last months of pregnancy and in childbed exhibited the distinct signs of a slowly advancing inflammation of the bones of the pelvis, and particularly of the branches of the pubic bone, without any external cause being discoverable; the bones were painful under movement and pressure; their power of resistance was however not perceptibly diminished, nor could I detect any bendings in them. Bodily rest, salt-water baths, and the internal use of iron, produced a complete cure. I may regard these cases as illustrating the first and slightest degree of the disease.

How far alterations in the metamorphosis of the tissues of pregnant and lying-in women contribute to the production of the disease, is a question that cannot at present be decided. It lies on the surface to reflect that there is an increased demand for calcareous salts for the osseous system of the fœtus. According to Leuchs (*Journ. f. pract. Chemie*, Bd. xxv., Heft 1), hens having a deficiency of lime-containing nourishment either lay eggs without chalky shells; or they produce them at the expense of their own proper osseous system, their bones become soft, the animals can no longer stand, get bent together, and die. C. Schmidt seems inclined to attribute a certain importance to the production of milk-sugar in the organism. He had, as already related, discovered lactic acid (as an acid salt of lime) in the fluid filling the interior of diseased bones. The case occurred in a young woman who was taken ill evidently in consequence of deep grief. Schmidt leaves it undecided whether in this case the inflammation in the medullary cavities of the bones was caused by the production of the lactic acid, or whether the latter made its appearance secondarily. At any rate, the production of lactic acid remained local, the lactic acid had not circulated in the blood,

the bones of the upper extremities were normal, the teeth of a pure white colour. Probably, in consequence of the mental affection, the nutrition had been altered as it is in the last days of pregnancy, or in and after childbed; the carbo-hydrates consumed (gum, starch, sugar) had been changed into sugar of milk, which, arrived at the seat of disease, had been subjected to a complete fermentative process, the lacteal fermentation. At the same time, there is no explanation here of how the inflammation of the bones is induced, or how the change of the first atom of sugar takes place into lactic acid. But the production of lactic acid in the bones is not at all a constant phenomenon in puerperal osteomalacia.

All injurious influences, by which the body is weakened, and impoverishment in the blood of solid ingredients is produced, appear to favour the coming on of the disease. Among them are repeated pregnancy and childbed in rapid succession, too frequent or too long continued nursing, a life of poverty, with privation, sorrow, and care. Strong nutritious diet, the use of iron, of quinine, and of the like, exert for the most part a beneficial influence upon the disease, while the so-called antiphlogistic treatment, as a rule, increases the evil. In several cases chills, residence in damp localities, unhealthy dwellings, are mentioned as occasional causes. A combination of these circumstances may account for the frequency of osteomalacia in individual districts,—for example, in Sottegem in East Flanders, when it gave opportunity to Hoebecke for so strikingly great a number of cæsarean sections. According to the judgment of a commission appointed for the investigation of these circumstances, the place with its vicinity rests on moist ground, the inhabitants of the poorer sort live in miserable hovels, poorly clad, with bad beds, and exposed to the inclemency of the weather and privations of every kind.

The influence of new pregnancies and childbeds upon the still subsisting disease has been usually unfavourable.[1] Aggravation

[1] [In a case which came under my care some years ago, the disease commenced in a first pregnancy, in which delivery at the full time was effected by the long forceps. In a second and last pregnancy, the pelvis, the only part

during pregnancy is expressly mentioned in 26 cases; aggravation during childbed in 21 cases. But the data are far from being complete. Besides, in the same individuals, in different pregnancies and childbeds, its relations were not always the same. In 8 cases, pregnancy produced no remarkable change, and of these there were 4 in which the disease had previously come to a stand-still. But there are also 7 cases mentioned where the disease diminished during pregnancy, and 11 cases where improvement occurred in childbed. In individual cases the cause of the improvement might be sought in the enjoyment of greater comforts, and in suitable medical treatment; in others, perhaps pregnancy and childbed had themselves, by exciting the appetite, and otherwise, given the impulse to an improved nourishment of the body. Results of a like kind are observed in similar circumstances in chlorotic persons. During labour, in 15 cases, an increasing softness and flexibility of the bones of the pelvis was partly directly observed, partly concluded to exist from the passage of the child at length taking place through a pelvis contracted in the highest degree. It must be attributed to the greater infiltration of the bones, and be accounted one of the appearances of general hyperæmia and porosity in the pelvic genital organs. Even in the earliest part of childbed an increased pliability of the pelvic bones was detected in 2 cases.

The commonly accepted notion that puerperal osteomalacia is the worst form of the disease, and admits of no cure, is not confirmed by the cases referred to. The disease had, as will be seen, generally a local origin; remained frequently limited to the pelvic bones and lower part of the vertebral column; and comparatively seldom spread more extensively over the osseous system. The destruction, when compared with that of the other forms of osteomalacia, reached its highest degree comparatively seldom, and then generally only

distinctly deformed, had become much more contracted than it was at the time of the previous confinement, and delivery was effected by the induction of premature labour and the use of the forceps. Rheumatic pains and shortening of stature were the chief symptoms of the disease, which disappeared after her second and last confinement.—J. M. D.]

over a smaller extent. The worst cases partly befell women in whom repeated pregnancies and childbeds produced always renewed exacerbations of the disease. Very extensive and intense attacks of the disease also occurred in women, who, after its coming on, had no more children, or to undergo only one or two more labours; but in some of these cases there were doubts as to the puerperal origin of the disease, or there were evidently other morbid causes co-operating, as syphilis, privations of every kind, grief, sorrow, and so on. Where the disease developed itself in consequence of pregnancy or of childbed, without the co-operation of other injurious influences, there was, under favourable circumstances, with suitable care and treatment, and especially if the patients were preserved for an adequate length of time from a renewed conception, not very rarely observed to be improvement or even cure; the pains disappeared, the power of walking returned, the bones that had become softened became again firm, only the curvatures and their immediate consequences remaining. Of the 85 cases recorded there are only 16 in which decided improvement or cure is noted. Even when their pregnancy recurred again, it for the most part passed over without the disease returning. Among 60 cases which terminated fatally, only in 13 did the mortal result happen independently of labour, after long continuance of the disease (two to ten years), in consequence of exhaustion or asphyxia coming on; in the remaining 47 cases the patients died of the consequences of confinement, or in the act of parturition itself; and in 8 of them the disease was already in progress towards cure:

After cæsarean section,	32
After rupture of the uterus,	5
(In one of these gastrotomy was performed.)	
In labour—undelivered,	4
After natural labour,	2
After symphysiotomy,	1
After labour terminated by the forceps,	1
After perforation of the fœtus,	1
After a mismanaged labour,	1
	47

Most of the women further underwent, during the disease, either one or several labours. There were, namely:—

With no more confinements,	6
One confinement,	29
Two confinements,	20
Three „	20
Four „	2
Five „	4
Seven „	1
Eight „	1
Nine „	1
An unknown number,	1
	85

The influence of the disease upon the pelvis is illustrated in the following table.[1] Of 79 women who conceived, during the existence of the disease, there had—

No other natural labour,	38
One natural labour,	21
Two natural labours,	8
(Of these one was an abortion.)	
Three natural labours,	6
(Of these one had an abortion, and another a premature labour and two abortions.)	
Four natural labours,	5
(Of these one had one, and another two abortions.)	
Six natural labours,	1
(Of these one was a premature labour and one an abortion.)	
	79

[1] [For an account of the peculiarities of the malacosteon pelvis, and the mechanism of its production, the reader is referred to the body of Dr Litzmann's work, and to the following papers by the translator, where further references will be found:—"The Os Sacrum considered as forming part of the Vault of the Pelvis, and on its Function in the Development of the Lateral Expansion of that Cavity,"—*Edinburgh Medical Journal*, August and September 1855; "Notes on the Formation of the Ricketty and Malacosteon Pelvis,"—*Edinburgh Medical Journal*, April 1856. —J. M. D.]

Perforation, in the course of embryotomy, was performed in twenty-one labours of sixteen women, namely:—

In the 1st labour after the disease began, in	4
„ 2d „ „	5
„ 2d and 3d labours,	1
„ 3d labour,	2
„ 4th „	1
„ 4th, 5th, and 6th labours,	1
„ 5th labour,	1
„ 6th, 7th, and 8th labours,	1
	16

Cæsarean section was performed upon forty women, as follows:—

In the 1st labour after the disease began, in	17
„ 2d „ „	12
„ 3d „ „	6
„ 4th „ „	1
„ 5th „ „	2
„ 8th „ „	1
„ 9th „ „	1
	40

Rupture of the uterus during labour occurred in seven women, among whom was one in whom cæsarean section had been performed in the previous labour:—

In the 1st labour after the disease began, in	3
„ 2d „ „	2
„ 3d „ „	2
	7

Among these seven women were three on whom gastrotomy was performed, and in two instances with a successful issue.

In labour four women died undelivered.

In the 1st labour after the disease began, in	1
„ 2d „ „	1
„ 3d „ „	2
	4

The artificial induction of premature labour was performed on two women, in both in the third pregnancy after the invasion of the disease.

Symphysiotomy was performed on one woman in the second labour after the attack of the disease.

The disease began generally with more or less acute pains. They were sometimes vague and general, sometimes they were concentrated specially in the region of the loins and sacrum, around the hips and pelvis, in the lower extremities, more rarely in the upper part of the spinal column, in the shoulders and nucha, in the breast, or in the arms, most rarely in the head. Sometimes they were dull, deep, burning; sometimes tensive, pulling, tearing; sometimes pricking, sometimes piercing, or accompanied with a feeling of breaking in pieces, or as if one were twisting or filing the bones. Individual patients complained of a feeling of deadness, of coldness, or numbness in the extremities, while, at the same time, every attempt to move them caused acute pain. Frequently at the beginning of the disease, the pains occurred only intermittently, becoming afterwards unceasing. In some they became worse at night; in others a sweat usually broke out about midnight, followed by a remission of the pains. Every movement and contact of the diseased parts increased the pains; several patients were even unable to endure the pressure of the weight of the body in a sitting position. These pains certainly arose partly in consequence of local irritation of the nerves in the inflamed bones with the tension and squeezing to which they were subjected on pressure and movement in the softened tissues; partly they had a central origin in the irritation of the spinal marrow, if its bony coverings were the seat of the disease.

In addition to the pains, there was very soon, as a rule, observed a diminution of the power of motion. Standing and walking became difficult, the gait insecure, tottering, dragging; soon the patients could no longer stand or walk, but must constantly sit and lie; often they could continue only in certain situations or postures in which the flexors usually maintained the predominance; in several cases, as the disease extended, there disappeared the power of moving the upper extremities, and the head sunk down upon the breast; in one case swallowing, even, was rendered difficult in a

high degree. Sometimes it was chiefly pain that hindered motion or made it impossible; in other cases the parts appeared to be really more or less paralyzed, even before they lost their mechanical efficiency through want of solidity, perhaps in consequence of compression of the spinal cord, or of the motor nerve-roots by diseased vertebræ. On post-mortem examinations, in cases where the disease had lasted for a long time, the muscles of the paralyzed parts were often found atrophied with fatty degeneration; but this atrophy was merely secondary, and produced by the long-continued inaction. In other cases the muscles had maintained their normal strength, and no remarkable change of texture could be discerned. As soon as improvement commenced, the power of motion generally returned more or less completely.

A rarer symptom were cramps, especially in the muscles of the extremities, which were usually produced or increased by moving or touching the diseased parts. The contractions were generally clonic, more rarely tonic. In one patient the head was drawn stiffly backwards in the attacks, and the fingers spasmodically closed. Occasionally the spasms increased during pregnancy. One patient suffered after the third month of pregnancy from general convulsions, which gradually made more frequent attacks until they ceased with the first incision in performing cæsarean section.

In most patients a diminution of stature was observed, sometimes even in a very early stage, more frequently, however, not till after a prolonged continuance of the disease. The shortening affected the trunk almost exclusively, and was often very considerable. Individual patients shrunk gradually to the extent of half-a-foot or a foot, and even more. The shortening was not always caused by observable curvatures of the spine; it must then be ascribed solely to compression of the vertebræ, and depression of the spinal column into the pelvis.

Respiration was in many cases disturbed. Shortness of breathing, suffocative paroxysms, painful cough, not unfrequently with bloody sputum, formed often grounds of complaint. These evils naturally augmented during pregnancy. They increased in pro-

portion as the disease made progress, and not unfrequently contributed to the production of the fatal issue. In cases where the disease affected the bones of the thorax itself, they must never have been absent. The impeded motion of the thorax, the unequal compression of the lungs in consequence of the deformity of the chest, and the unchangeableness of position, with increasing weakness of the heart's action, are sufficiently intelligible.

In the beginning fever was almost never observed. On the other hand, with the advancing disorder, a slow fever, occasionally with an intermitting type, became developed. Several patients complained much of an interior burning heat, so that even in winter they desired to have an open window. In most cases the skin was dry and parched; others had abundant and sometimes only partial sweats. Gradually the nourishment of the body came to suffer; the appetite was lost, the patient grew emaciated, and the weakness increased to complete exhaustion. In this manner, after long years of suffering, wasted and suffocated, all perished for whom improvement was not reserved, or for whom an early end had not been prepared by an unfortunate confinement. The mental functions continued undisturbed till shortly before death, even in those cases where the cranial bones had been affected.

CHAPTER III.

OSTEOMALACIA UNCONNECTED WITH CHILDBEARING.

Among the remaining 46 patients there were 35 individuals of the female and only 11 of the male sex. Of the former only 2, who became affected in advanced age, had previously been once confined; most were unmarried, none conceived while the disease lasted.

Ten were affected before the twentieth year (7 women, 3 men); 8 between the 20th and 25th year (6 women, 2 men); 5 between the 26th and 30th year (all women); 5 between the 31st and 40th year (3 women, 2 men); 3 between the 41st and 50th year (2 women, 1 man); 4 between the 61st and 70th year (3 women, 1 man); 1 between the 71st and 80th year (a woman); in 10 the time of becoming ill is not given (8 women, 2 men).

The extent of the disease was in general greater than in puerperal osteomalacia, destruction advanced more frequently, and in greater extent, to the highest degrees. In the majority of cases the bones of the lower extremities were among the parts earliest affected. In 21 cases all parts of the skeleton were diseased, and in 6 cases all the bones except those of the head.

There were mentioned as affected,—

The bones of the pelvis,	. . . . .	40 times
„	spine, ...	40 „
„	thorax, ...	37 „
„	lower limbs, ...	36 „
„	upper limbs, ...	30 „
„	head, ...	24 „

The symptoms in general corresponded with those of puerperal osteomalacia. In individual cases the pain in the beginning of the

disease was remarkably slight, and increased only with the advance of the disease; in other cases the reverse occurred, and the bones which at first were painful could at a later stage be moved and bent without any sensibility, indeed, in one case even a portion of the cortex of the bone was removed without pain after incision with the knife, and an insensible fleshy or liverlike mass was laid bare in the interior of the bone (Thomson). In one patient the affection of the bones of the head was accompanied by headache and delirium, which afterwards gave place to chronic insanity (Solly).

Only in 4 cases (3 women, 1 man) was an arrest of the symptoms, amelioration, or cure observed. In 3 cases (all women) the issue is not stated. In the remaining 39 cases (29 women, 10 men) the disease ended fatally, mostly under symptoms of slow fever, extreme exhaustion, and asphyxia. Death occurred within the 1st year in 3 patients (all women); after 2 years in 2 (women); after 2 to 3 years in 4 (2 women, 2 men); after 3 to 4 years in 6 (4 women, 2 men); after 4 to 5 years in 2 (1 woman, 1 man); after 5 to 6 years in 2 (women); after 8 years in 1 (man); after 8 to 9 years in 2 (1 woman, 1 man); after 10 years in 1 (woman); in 16 patients (13 women, 3 men) the duration of the disease is not given.

The following forms of the disease may, with some security, be distinguished according to the ætiological influences, so far as they may be discovered from the communications quoted:—

1. *Rheumatic Osteomalacia.*

Five cases (3 women, 2 men), of which 2 occurred before the 20th year (1 woman, 1 man).

Here there are mentioned as causal injurious influences: residence in cold, damp, sunless rooms, or in the open air in insufficient clothing, sleeping on a cold, damp bed, sudden wetting of the body when heated; and in part, besides these, insufficient and bad food.

The extent of the disease was very great. Only in 1 case did the bones of the head remain altogether exempt from it; in the other four the disease affected all the bones of the skeleton. Im-

provement was noticed in only 1 case; the remaining 4 ended fatally, after the destruction had partly reached the highest degree.

2. *Syphilitic Osteomalacia.*

Six cases (3 women, 3 men), of whom one (a woman) was affected before the 20th year.

The patients had, before the commencement of the bone disease, suffered from syphilis for a longer or shorter time; had, in part, used mercury, and had lived in the most unfavourable conditions, in cold, damp, ill-ventilated houses.

In 3 cases the disease extended over all parts of the skeleton; in 2 cases the bones of the head, and in 1 case the bones of the upper extremity remained exempt from it. All the cases proved fatal. Post-mortem examination showed in all a far-advanced destruction of the bone tissue.

3. *Senile Osteomalacia.*

Five cases (4 women, 1 man).

The patients were from 60 to 80 years of age. The disease showed itself, as usual, with more or less acute pains, loss of power of motion, etc. Death occurred after the disease had lasted from 2 to 6 years. The bones of the trunk were in every case affected. In 1 case the disease had, in addition, attacked the bones of the extremities, in another the bones of the head, and in 2 cases every part of the skeleton was affected. The diseased bones were mostly characterized by increase of blood in them. They were osteoporotic in a high degree, yet the rarefied tissue was still generally covered by a thin bony cortex.

4. *Neurotic Osteomalacia* (Virchow).

Six cases (4 women, 2 men), of whom 3 were affected before the 20th year (2 women, 1 man).

Here the disease evidently became developed in consequence of profound lesions of the central organs of the nervous system. One of the patients had suffered for years from insanity, another from chronic hydrocephalus, which was produced by a fall on the head at two years of age; the other 4 were of weak intellects, and of these 2 had had continued convulsions in early childhood.

The remaining statements are very incomplete. The bones of the trunk appear in all the cases to have been diseased, while the bones of the extremities, even of the lower, and of the head, were not always affected. The changes also of texture were apparently less far advanced than in the previously named forms.

As being closely allied, there probably should be included here the cases of C. Schmidt and of Macintyre. The former, as has been already stated, related to a woman of 22 years of age, who became ill in consequence of a profound affection of the mind, and died nine months afterwards; the bones only of the lower extremities and of the pelvis were affected. Macintyre's patient was a merchant, 43 years of age, who, overtaken by excitement of mind and temper, labour and sorrow, became exhausted. He died after the disease had lasted 3 years. The lesion was confined to the bones of the trunk.

In the remaining 22 cases the ætiological influences are either not given at all, or the statements on this head are so deficient and imperfect that no conclusion respecting them can be arrived at.

CHAPTER IV.

CASE OF PUERPERAL OSTEOMALACIA.

Frau St. in H., 35 years of age, had ten years ago borne a child for the first time. During pregnancy she had complained of dragging pains in the right thigh. Labour was natural, and terminated within eight hours; only the expulsion of the child was a little delayed by the large size of the head.

After the end of five quarters of a year she was pregnant for a second time. From this pregnancy she reckoned the beginning of her disease. She suffered much from dragging pains in the back and in the limbs, and for the first time she perceived that her stature diminished. Different modes of treatment were adopted without result. Labour terminated easily and quickly. Both children are alive.

During the childbed the morbid process evidently made rapid progress. Only for a few weeks could the patient look after her household duties; the pains increased, the spinal column became more and more bent, progression soon became impossible, and she was forced to sit or lie by turns.

While in this condition she again became pregnant before the end of six years. It remains a question whether or not the pelvis had already become contracted in the previous pregnancy. At the commencement of this pregnancy, according to the declaration of the husband, the proportions as to roominess were about the same as formerly. The child presented the feet during labour. The midwife could not succeed in delivering the head. A physician who was called in (and who has since died) did not come till after

several hours had passed, and completed delivery without having recourse to instruments.. The child was, of course, dead. At the ear and back of the nose only were traces of bruising observed. Probably the bones of the pelvis were separated from one another by the child.

The lying-in woman made a tedious recovery. Under the use of cod-liver oil, of a full diet, of Bavarian beer, and such like, with exposure as much as possible in the open air, the disease appeared to be arrested. The pains disappeared, and in more recent years she could even walk short distances without crutches. No attention was paid to the condition of the urine during the whole of the disease.

About the end of July last year, menstruation re-appeared for the last time, and soon symptoms of a new pregnancy made their appearance. At the beginning of December the mother felt the first movements of the child. The affections that had formerly occurred did not, however, return. With the exception of slight pains in the stomach, from which she had suffered for a long time, her health continued undisturbed, and, in consequence, she looked forward with confidence to the approaching labour.

On the 4th April 1857, about four weeks before the normal end of pregnancy, I saw this pregnant woman for the first time. Originally of high stature, she had now collapsed to the extent of a head and more, in consequence of the curvature and sinking of the vertebral column. Her face was of a slightly livid colour. The development of the muscles, as well as of the subcutaneous adipose tissue must always have been only slight. I found in the upper dorsal region a considerable posterior curvature (Kyphoscoliosis), with the convexity to the right, which, in the lumbar region, was counterbalanced by an anterior curvature (Lordoscoliosis) with the convexity to the left. The bones of the lower extremities were straight and relatively long, the ankles clumsy. The uterus projected so far forwards over the pubic bones, that it lay entirely in front of the anterior iliac spines; in sitting it rested between the thighs, and its long axis made an angle with the axis of

the pelvis. When I raised it with the hands I could recognise through its thin walls a large round part of the child, the head, above the left horizontal branch of the pubes, and in the fundus on the right side the feet of the child. The sacrum appeared to be very much curved backwards beneath the driven-in lumbar region; the alæ of the ilia were folded, like a channel, from before backwards; the distance between the anterior superior spinous processes of the ilia measured 10 inches, the greatest distance of the cristæ, 11 inches; the external conjugate could not be measured in the standing position on account of the pendulous belly. The opening of the pelvic outlet was directed backwards, the arch of the pubes greatly narrowed, the two limbs of it being, at the narrowest point in the neighbourhood of the pubo-ischiatic synostosis, so approximated to each other, that I could only push the point of the index finger between them; above this contraction the interval became so widened as to permit the penetration of the finger, as was also the case posteriorly between the ischiatic tuberosities. I felt how the anterior wall of the pelvis was pointed forwards beak-like, the sacrum bent upon itself, and its promontory pushed down along with the lower lumbar vertebræ into the pelvis. There was only the interval of a finger's-breadth left between the point above the left acetabulum and the lumbar spine lying opposite to it and above it. I could reach neither the os uteri nor any presenting part of the child. The bones of the pelvis were not tender on pressure, and showed throughout no flexibility, although both husband and wife thought they had remarked that the degree of narrowing was not always the same.

Already, in the last days of April, she had a return of dragging pains in the region of the sacrum. These feelings were more acute on the evening of the 30th April, and on the 1st of May at one o'clock in the morning the liquor amnii flowed away with the first stronger pains. A telegraphic despatch to call me to the case was unfortunately so delayed that I only arrived at the house of the patient, accompanied by some of my colleagues, at half-past two o'clock in the morning. The pains had in the interval gradually

increased to such an intensity, that the house-physician, who was in attendance, was several times induced to give the parturient woman opium, from fear of the occurrence of rupture of the uterus. She had already, in the previous evening, been warned by her husband of the necessity of cæsarian section, and willingly gave her consent to it. I found her perfectly collected and prepared. She appeared much heated, the skin covered with sweat, the pulse only slightly accelerated, the thirst not great, the uterus only slightly painful. It appeared still to contain a small quantity of liquor amnii. The position of the fœtus was not changed; on the right side, towards which she lay with the back turned, I heard the fœtal pulse loud and distinct. On making an internal examination, neither os uteri nor any part of the child could be reached, as was formerly the case; in the pelvic bones there could not even now be detected the slightest yielding to pressure.

The patient was now, with a view to the operation, laid upon a table opposite a window, in an almost horizontal position, with the legs hanging down, and the feet supported by stools. The rectum was evacuated by a clyster; the catheter when introduced found the bladder empty. It cost some trouble to rectify the forcibly pendulous uterus, and in the attempt the bowels were pushed from the sides obliquely above the pubic bones forwards between the uterus and the anterior abdominal wall, and in spite of all exertions, by stroking, they could not be pushed back again completely. On this account, one of the assisting physicians, standing in front of the patient, encircling the uterus below with both hands, supported it, partly in order to fix it, partly to repress the intestines in that situation, at the same time that two others, standing at either side, kept it supported above. After the patient was chloroformed, I proceeded to the operation, standing on the woman's right side. By one incision in the linea alba, beginning a little to the left of the navel, and ending about an inch and a half above the pubic symphisis, the abdominal walls were divided. From their extreme thinness, I could not prevent the knife, in its second sweep, although carefully made, from penetrating slightly the uterine parenchyma, as I at once recognised

by the movability of the integuments over the smooth reddish-white peritoneal covering of the uterus, as well as by the spouting of a small artery. After the bleeding of this vessel was quickly stopped by torsion, I completed the incision. A small quantity of serum flowed from the open peritoneal cavity. The uterus pushed strongly forwards through the wound in the belly, and could only be kept back with difficulty. The cutting through of its wall, which was nearly an inch thick, at the upper angle of the wound, was accompanied by only moderate bleeding. At the bottom of the wound I saw and felt the yet uninjured placenta, raised it easily with the finger, and without much increasing the bleeding, as far as its lower border, and then completed the section downwards through the strongly resisting and slightly bleeding tissue, while at the same time the uterus contracted. Already during the incision the placenta was completely expelled above my hand through the upper angle of the wound; a hip of the child followed, and as I laid aside the knife, the child had already half-emerged through the wound. The releasing of the arms caused no difficulty, but then the uterus held the neck of the child so tightly encircled, that I found it necessary to enlarge the wound downwards; and even then it required some considerable exertion of strength to deliver the head. The child, a female, gave at first only slight signs of life, but completely recovered after its nose, mouth, and pharynx were freed of blood-clots, and after resuscitating measures were set about in the warm bath. Before the completion of the uterine section, the assisting physicians had already on both sides, with their fingers hooked and placed in the upper angle of the wound, secured the uterus to the abdominal wall, and held it firmly. The bowels, which after the extraction of the child advanced forwards on every side, and especially from below, were pretty easily replaced, the bleeding was stopped by the sprinkling of cold water, and thereupon the uterus contracted well. After a quarter of an hour the external wound was united by means of the interrupted suture (Knopfnath). On account of the great relaxation of the abdominal walls, there were placed some

superficial stitches, involving only the skin, between the principal sutures which included the peritoneum. During the operation the patient awoke from the narcotism. She had a calm expression, and soon inquired for her child. Later, a feeling of faintness came on, accompanied by retching. After she was properly cleaned, she was carefully carried to bed; to support the sutures, strips of gold-beaters' skin, spread with isinglass, were placed between the points, and the whole covered with a binder. Till the arrival of ice, the belly was covered with compresses, wetted in cold water, which were renewed every three or four minutes. When I left the patient, after an hour and a half, her condition could be called satisfactory under the circumstances. She had little pain, no nausea, the pulse was slightly accelerated, the compresses not very bloody on being changed.

In the first days after the operation, the accounts of the patient's condition were quite satisfactory. The fever was moderate, the belly little painful, the sleep tolerably calm, a rather considerable quantity of blood was excreted from the vagina, the discharge from the wound was slight. But in the third night fits of nausea began, with eructations and vomiting, the belly became distended and tender, the pulse small and quick, she vomited repeatedly, the meteorismus increased, the strength diminished more and more, and death ensued at the end of the fourth day, after a considerable bleeding from the wound had taken place.

At the sectio, only a look into the abdominal cavity was permitted. A large quantity of blood had flowed from the wound. Its edges had united downwards from the upper end for one inch and a half: in the middle of the incision, a small part of the omentum was protruded between the stitches; it was somewhat thickened, but not mortified. Higher up, the omentum was seen to be adhering to the peritoneum of the abdominal wall. After opening the wound, a considerable quantity of blood was evacuated, and no small number of blood-clots were found in the cavity of the belly. The peritoneal covering of the intestines exhibited scarcely any injection; only between the highest loops of small intestine

and the descending colon some slight adhesions were seen; nowhere any pus or sanies. The uterus, which was of the size of a child's head, well contracted, and lying entirely above the small pelvis, showed no signs of inflammation of its peritoneal covering. The incised wound, which stretched downwards from the fundus for a distance of from three to four inches, gaped greatly outwards, so that while its inner borders almost touched one another, the outer were separated to a distance of from one and a half to two inches. The surfaces of the wound appeared dark, but their tissues were neither purulent nor softened. The mucous membrane of the uterus appeared quite smooth and normal, except in the neighbourhood of the wound (the site of insertion of the placenta). The cause of death was evidently not the slight peritonitis, but must be sought in the exhaustion produced by the previous disease, the operative interference after a considerable duration of painful labour, and the secondary hæmorrhage.

CHAPTER V.

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[1] [The translator has, for reasons which he need not enter upon, preferred literal copying of this bibliographical chapter to any attempt at translation.—J. M. D.]

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