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A Peculiar Characteristic Metatarsal Disease*

by

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(Tabulae XIX—XXII)

The material on which the present treatise is based has been collected during the last three years or thereabouts in which I myself have had the opportunity of examining 10 patients (5 in my private practice and 5 at the Roentgen Clinic at the *Rigshospital*) suffering from this particular metatarsal complaint. Roentgen pictures of 3 other patients also suffering from the said complaint have further kindly been placed at my disposal, one from '*Finsen's Clinic*' by the chief physician, Dr. REYN), another from the *Roentgen Clinic at the Bispebjerg hospital*, and a third from Professor FISCHER's private clinic. Ten of these thirteen patients were children, three adults. The immediately following statements refer to the not fully grown patients, the histories of whose complaints are so much alike that all of them are known if one is known. Afterwards I shall proceed to mention the cases of the three grown-up patients.

I shall begin by describing one of the histories:

A. L. V. a twelve-year-old girl. Family sound. She had herself never suffered from diseases which seem to stand in any relation to the present one; she had especially never suffered from rachitis or shown any symptoms of tuberculosis. In the summer of 1920 the patient, when walking, suffered from pain in a place corresponding to the 2nd right metatarso-phalangeal joint, although no traumatic cause could be proved. The pains never appeared when the foot was at rest, and were on the whole not marked enough to cause her case to be examined. When the pain, however, continued, a physician was consulted about three months after the beginning of the disease, and she was referred to me for an examination with roentgen rays.

The patient was of perfectly sound and indeed of fairly robust appearance, well grown considering her age, and showed no symptoms

* Read (in abbreviated form) at the II meeting of 'Nordisk Forening for medicinsk Radiologi' and in 'Dansk kirurgisk Selskab' 15 October, 1921.

of tuberculosis. The lung stethoscopy was normal. PIRQUET negative. Symptoms of disease were on the whole only to be found at the 2nd right metatarso-phalangeal joint round which there was an inconsiderable swelling without any sign of inflammation such as heat or redness of the integuments. There was some soreness on pressure, corresponding to the articulation, a slight pain with active and passive movements of the joint, which were somewhat limited in extent. No other joints were affected.

On November 18, 1920, *roentgen examination* of her feet shows pathologic changes in the said joint only, and the changes are as follows (Fig. 1): The articular surface of the capitulum strongly flattened, *capitulum* considerably distalo-proximally shortened, clumsy with somewhat irregular contours, here and there indented but everywhere sharply outlined (Fig. 2). The structure differs from the normal, showing in part irregular spotty rarefactions, and in part more condensed areas distally or proximally to the rarefactions. The *line of the epiphysis* is less distinct in this metatarsal bone than in the three other — fibular — metatarsals and the corresponding ones on the sound side. The *diaphysis* is perfectly natural without any thickenings or curves. The *joint fissure* corresponding to the flattening of the capitulum is slightly altered in shape, not clearly widened, at any rate not narrowed in. The base of the first phalanx shows no changes.

The patient's condition little by little improved so much that now she is almost quite well; and no treatment has been applied, she only used her foot as little as possible, was exempted from gymnastics and walked little. Now she can walk without any inconvenience worth mentioning, the tumour round the joint has passed away, there is no soreness on pressure, but there is a slightly diminished mobility in the joint, especially in respect to plantar flexion.

On April 9, 1921, the *roentgen examination* (Fig. 3) shows a still more flattened and clumsy capitulum which, without any distinction, is continued into the diaphysis which is thickened in its distal third by periosteal stratifications. The line of the epiphysis is now perfectly effaced in contradistinction to all the other corresponding ones which are still distinctly open. The clearings in capitulum are smaller, the condensed places more prominent.

On August 16, 1921, the *roentgen pictures* (Figs. 4 and 5) show a more intimate fusion of epi- and diaphysis, of whose homogeneous thickening the periosteal origin was no longer distinctly seen. The capitulum's structure approaches the normal, but there are still small, irregular, condensed areas. The articular fissure almost seems to be slightly widened, and on the dorsal side of the joint there is a faint shadow of about

the size of a hemp seed, presumably corresponding to ossifications in the capsule (fig. 5) but there were no remarkable alterations of the first phalanx.

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The histories of the diseases and the roentgen findings in my first group of patients are, as already mentioned, of a very homogeneous character, and I think myself justified in representing their complaints as a well-characterized disease, the symptoms of which I shall mention. *The illness arises in perfectly sound individuals* who show no clinical symptoms of tuberculosis, syphilis or other diseases in the constitution. With only a few of the patients have WASSERMANN'S and PIRQUET'S reactions been tried; the former was always negative, the latter positive in several cases; but as it appeared negative in a few cases, and as the patients in whose cases it was positive showed no other clinical signs of tuberculosis, it may certainly (when connected with the perfectly satisfactory clinical progress of the disease and the roentgen picture) be justifiable to consider all connection between this disease and tuberculosis as out of the question. *The complaint arises before the growth is completed.* All the ten patients were girls at the ages between 10 and 14 years. *It begins spontaneously*, often gradually, rarely more suddenly as, for instance, after a walk; but I have been unable to ascertain any certain traumatic origin in any case, only in a single history of the illness is there a possibility of a trauma proper as cause, — the patient having hurt her foot a few months prior to the appearance of the symptoms, but between the time when the patient consulted a doctor and the trauma there was a period of about a month and a half entirely without any symptoms. The disease *begins with pains when walking*; in the vast majority of the cases in a place corresponding to II metatarso-phalangeal joint, the only case observed with another localisation is one of my own patients, where the III metatarso-phalangeal joint was affected. The pains are generally moderate, never found when the foot is at rest, and are consequently left unheeded in the beginning and most frequently several months pass before a doctor is consulted. In this respect it is very suggestive that only one of the 10 patients was placed in a hospital, all the others were ambulant. There is a distinct, though not strongly marked swelling *corresponding to the articulation concerned*, particularly on the dorsal side where there is further found a soreness on pressure, sometimes fairly marked — but never symptoms of inflammation of the integuments. *The movements in the joint*, especially plantar flexion, are generally somewhat limited, and passive movements to the extreme degrees accompanied by pain; in some cases movements

to the side were remarkably painful. *The general health of the patients is not affected*, the whole disease makes an extraordinarily mild impression, and in several cases it was without any real therapy brought to an apparent standstill, and improvement has appeared in all cases under observation. *The progress* is very chronic, may certainly take a couple of years and so little invalidity is generally left — mostly in the form of a slightly restricted plantar flexion — that the patient is not at all inconvenienced by it and can take long walks and bear other exertions, as, for instance, dancing. It is characteristic of this in common with several other foot complaints that the patients are indeed hampered in their walk, but bear cycling excellently, the foot being spared the weight of the body.

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With regard to the *roentgen picture of the disease*, I think I have seen it in all stages though not in one patient, yet I have in a few cases (thus in the one stated) had an opportunity of repeatedly examining the patient from a very early stage up to almost the last stage, and I think with certainty that I have ascertained the following:

The primary seat of the disease is undoubtedly the capitulum metatarsi which is always seen affected from the earliest beginning of the disease. There is more or less *flattening of the distal part of the surface of the joint*, making the capitulum more clumsy in shape and shorter distaloproximally than is normal. *The structure of the epiphysis* also shows changes; in the beginning of the disease indefinite condensed areas are found only in the middle of capitulum (fig. 6), corresponding to the place where the ossification in the epiphysis originates, a stage which presumably will comparatively rarely come under observation as the disease will scarcely offer any clinical symptoms to speak of so early. At a later stage the changes in the structure become much more distinct; besides growing condensations irregular rarefactions appear (fig. 1), very often a picture arises which resembles a compression — or a depression — fracture of the distal part of the surface of the joint which is seen to be condensed, flattened, more or less irregularly shaped, at the back bounded by a similar irregular rarefaction in the shape of spots or stripes, which again at its back is bounded by condensed areas (fig. 7). *The joint surface of capitulum* therefore often becomes undulating, *the contour of capitulum* uneven, in places indented, serrated, but not effaced, always strongly outlined (figs. 7, 13). *The joint fissure* naturally suffers changes too, most often it becomes widened in the middle, very often in toto, it is at any rate never narrowed in. *The diaphysis* is never changed at the beginning of the disease: in the course of the disease

periosteal stratifications may appear at an earlier or later stage, but they are presumably comparatively rare. They very often cause a homogeneous thickening of the distal part, which then without a distinct transition is continued into the capitulum (fig. 4). The periosteal stratification is more rarely seen as an irregular thickening in the middle of the diaphysis (fig. 9). *Synostosis between the epiphysis and diaphysis* frequently takes place earlier than in the case of the corresponding epiphysis lines (fig. 3, 7). *Lasting deformation of the capitulum* always remains to a greater or smaller extent — often but slightly — but the structure again becomes perfectly normal, first the rarefactions disappear and afterwards the condensations are replaced by a normal structure (figs. 8, 9). *Atrophy of the bones* of both the metatarsals concerned as well as of the other bones of the diseased foot I have seen once only (fig. 6). During the later part of the progress *deformations* of the base of the first phalanx (fig. 9), reminding one of *arthritis deformans*, may be seen as a kind of secondary change, as well as shadow formations which must be considered due to ossifications in the capsule (fig. 5); but the joint fissure is never narrowed.

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Only very little is found on similar cases in the literature. KÖHLER¹ mentions in 1915 quite shortly that pathologic conditions may appear, causing a deformation of the capitulum metatarsi, but does not treat it further until in 1920 at the Roentgen Congress^{2,3} in Berlin, when he gives his opinion at some length on the basis of observations of six patients who suffered from pains in II metatarsal and II metatarso-phalangeal joint. Four of these patients were grown-up individuals (between 21 and 45 years), the others 10 and 16 years respectively; in the case of the latter whose roentgen pictures were given to KÖHLER by GRASHEY, the complaint was two-sided. In all cases the disease showed a markedly chronic and mild progress, and in none of the cases was it possible with certainty to prove any trauma as cause of the disease.

The roentgen findings are sketched out and KÖHLER describes the characteristic point in the roentgen pictures as follows: the base of the first phalanx has lost its regular round shape, is more oblong than is normal, the joint fissure is widened, the capitulum metatarsi is flattened and often highly irregular and rugged, it is shortened and is without any clear transition continued into the diaphysis which is homogeneously

¹ Grenzen des norm. u. Anf. des pathol. im Röntgenbild. II Aufl. 1915.

² Verhandl. der deutsch. Röntgenges. 1920.

³ Münchn. med. Wochenschr. 1920. Nr. 45.

thickened in its distal half, often also somewhat curved. Small detached shadows correspond to ossifications in the joint capsule.

WEIL¹ reports 2 cases. One is about a 25-year-old man who never before has shown symptoms of a similar description, but who in performing jumping exercises feels pains in his right II metatarso-phalangeal joint. The pains are very intense, so as almost to make walking impossible; tumour and soreness on pressure of the joint, as well as limited function, are observed. The roentgen picture shows a generally very thickened and curved metatarsal, at the distal end of which the diminished and highly deformed capitulum forms the extremity without any clear distinction; the joint fissure is well preserved, base of first phalanx somewhat deformed.

The second case is that of a 16-year-old girl where the complaint arises spontaneously, producing deformity of the capitulum, but no distinct changes in the diaphysis.

Further, FROMME², adding a sketch of apparently the same complaint, mentions it as a result of late rachitis in similarity with other complaints as coxa vara, genu valgum, CALVÉ-PERTHES's hip complaint and others, but does not treat more closely of its clinical or roentgen picture.

Only KÖHLER enters into close consideration as to the course of the disease, which he thinks is as follows: the primary point is a prolongation and thickening of the distal half of the diaphysis, traumatically a flattening of the distal part of the capitulum takes place, involving the articulation in the process, and changes appear in the joint capsule and first phalanx, reminding one of an arthritis deformans with well preserved joint fissure. In his attempts at explaining the real nature of the suffering, KÖHLER, naturally, especially considers the thickened and prolonged diaphysis, and he dismisses, certainly correctly, the idea that tuberculosis or syphilis might be the cause; the whole clinical course and the roentgen pictures absolutely go against it. The same applies to osteomyelitis. KÖHLER also considers arthritis deformans localised to this one joint improbable, also because the joint cartilage in such so chronically progressing arthritis would be involved and cause the joint fissure to be narrowed in. I cannot quite agree with him there. We very often in 'hypertrophic' forms of arthritis deformans, accompanied by considerable deformations and osteophytic formations, see the condition exist through many years without any narrowing of the articular fissure.

KÖHLER concludes his statements by declaring the nature of the disease enigmatic and falls back upon very problematic and theorizing explanations of a possible primary hypertrophy of the diaphysis.

¹ Fortschr. a. d. Geb. d. Röntgenstr. B. XXVIII. H. 2.

² Deutsche med. Wochenschr. 1920.

WEIL seems after the observation of his first case to agree with KÖHLER's view as to the primary seat of the suffering in the diaphysis, but he is as unable to find any sufficient explanation of the changes in the latter, and thinks it may possibly be a result of an old fracture or 'foot-tumor which, indeed, is not found among soldiers only'.

In one of KÖHLER's and both of WEIL's cases there has been an opportunity of making histological examinations where resection of the joint was undertaken, but no light was thrown on the nature of the complaint in this way, as only strong connective tissue was found in the capsule as well as new ossifications both in the latter and in the joint bones. No sign of tuberculosis was found. When describing the resection preparation from one of his grown-up patients, WEIL remarks that, as far as it was possible to judge, it seemed a question of a process long ago concluded, and KÖHLER's observations in a few cases where, by means of roentgen examinations at an interval of many years, he finds the roentgen pictures perfectly similar, seem also to indicate little change in the process of the disease throughout the years when found in grown-up patients.

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In my opinion KÖHLER's view of the process of the disease is quite erroneous, probably because he has been unfortunate enough to observe it (or rather its last stage) in grown-up patients. He has not had the opportunity, as I have to a great extent, of seeing the earliest stages. Indeed, I do not doubt that what KÖHLER describes in his grown-up patients is the result of the condition which I have seen in its origin in my ten not fully grown patients. It seems quite unnatural to me that two different complaints should exist in this very joint, and there is scarcely any doubt that the changes described by KÖHLER may be the last stage of a complaint, the origin of which took place unheeded at a much earlier age than that at which KÖHLER had it under observation. There seem to me to be sufficiently convincing features in this and analogous diseases which bear out the correctness of the views stated here. KÖHLER himself thinks that it is the same condition he describes in his four grown-up and two not fully grown patients, as he states that the disease is found in patients 'between 10 and 45 years'. He has not seen what seems to me the right thing, that the origin of the disease is always found before the completion of the growth, most often at the age of 10—14 years.

As to the *primary seat of the complaint*, I consider it without any doubt to be the capitulum. In the cases of all my patients of the first group the already mentioned characteristic changes, deformation and changes in the

structure, were found in the capitulum. In one of these patients, examined only for the first time about six months after the beginning of the disease, was perhaps also a faint thickening of the most distal part of the diaphysis, in all the other cases the latter was normal. In the case I have reported in detail I have shown how such a thickening of the diaphysis can appear in the course of the disease, and an earlier examination of the above named case would certainly have shown natural conditions in the diaphysis.

The pathologic changes in the articulation must be considered as arthritis secondary to the disease in the capitulum. In none of my not fully grown patients were there any changes at the first examination in the first phalanx or shadows which might be due to ossifications in the capsule, while at later stages I have been able to prove such changes. In fig. 9, which shows the picture of a patient whose disease was brought to a temporary standstill at any rate, deformation of the base of the first phalanx is distinctly seen, and fig. 5 shows the shadow of ossification of the capsule. We thus see how out of the original disease in the capitulum the changes can develop secondarily, which KÖHLER describes as characteristic of the disease described by him both with regard to the diaphysis and the articulation.

My second group of patients, including the three grown-ups, seems to me a good supplement to my first group. In two of the cases (male patients) there had never been symptoms of any metatarsal disease neither during growth nor later, and it was quite incidental that an abnormality was discovered at a roentgen examination. One had pains in his right foot without it being possible to discover anything pathological at the roentgen examination, but at a comparative examination of the left foot (fig. 10) there was found a diffuse moderate thickening of the whole diaphysis, a clumsy-looking flattened capitulum, and consequently a somewhat irregularly shaped joint fissure. The other patient was examined for a fracture of the second right toe (fig. 11) and as an additional finding considerable changes in the metatarso-phalangeal joint are found consisting of deformations of both joint ends, especially of capitulum metatarsi which is very rugged and clumsy, ossifications of the capsule, strongly extended joint fissure, and diffusely thickened metatarsal. In spite of these changes the patient had felt no inconvenience.

With regard to the third patient the history of her disease forms in a way the connecting link between my two groups. It is a 27-year-old woman who, when 12—13 years old, spontaneously had trouble in a place corresponding to II left metatarso-phalangeal joint; she felt some pain when walking, but so little that it was quite neglected and no physician was consulted; the pain disappeared without any treatment

in the course of a year. Not until she is 27 years old does the pain return and is again so slight that she does not seek a physician, and it is indeed her position as a nurse, with easy access to a roentgen examination, that causes her to be examined, and (fig. 12) at the examination great changes are found in the said joint, a clumsy deformed capitulum metatarsi, considerably widened joint fissure, and a slight deformation of the base of the first phalanx. That the complaint of this patient and that of the two others is of the same character, and that its origin goes back to an age before the completion of growth, I think must be considered more than probable, and the disease can accordingly progress quite unheeded in the first as well as at later stages.

The fact that a disease, which may involve such considerable anatomic changes, exists without any symptoms should not cause much astonishment, when it has been repeatedly seen how little inconvenience it causes, and in that respect it is indeed not without analogies. Its similarity with CALVÉ-PERTHES's hip trouble was noticeable to me from the very first case I saw, and the more cases I have seen the more have I been convinced of the relationship between the two complaints. The whole clinical course of these two diseases has striking points of similarity; both are found during the period of growth, *cause little intense symptoms only*, no strong pain, comparatively slight disturbance in the function, have a chronic progress and generally, without any special treatment, result in a spontaneous cure, as a rule with very slight or no restriction of movement. Also the roentgen picture shows in many respects a characteristic uniformity. In both cases the disease originates in the epiphysis with a flattening, and other changes in the structure very much alike, still in case of the metatarsal trouble as great changes as in the hip complaint are presumably never found. In both a more or less widened joint fissure is observed, the thickened collum femoris may remind one of the thickened metatarsal, and further a more or less marked deformity of the joint head (and joint cavity) is found when cured, very often without corresponding clinical symptoms. If we consider the pictures (figs. 13, 14) of the metatarsal complaint and the initial stage of a CALVÉ-PERTHES's hip-disease, the points of similarity are obvious.

Not infrequently roentgen examination of the hip-joint in grown-up patients shows deformities which very probably may be referred to a CALVÉ-PERTHES's disease begun at an early age and progressing without leaving any symptoms; also here can we thus find points of similarity between the two diseases. In the after-effects, too, analogous circumstances are found. SUNDT¹ thus quotes instances of pronounced arthritis deformans coxae which must be considered secondary to a CALVÉ-PERTHES's

¹ SUNDT: *Malum coxae CALVÉ-LEGG-PERTHES*. Christiania, 1920.

hip complaint, and he asserts, certainly correctly, that not a few cases of arthritis deformans coxae in comparatively young people are of this origin, agreeing with PREISER's view that it is the incongruity between the joint surfaces that disposes to the arising of these deformed types of arthritis. When not all patients suffering from these complaints which involve deformity of the joint extremities get an arthritis deformans, it must indeed be presumed that an individual disposition must be found to cause the latter. Circumstances seem to me to remind one of the development of traumatic arthritis, and the roentgen pictures of these diseases indeed highly resemble this form of deforming ('hypertrophic') arthritis.

I add from my own experience some roentgen pictures of grown-up patients who, in my opinion, suffer from the after-effects of a CALVÉ-PERTHES's hip-disease, pictures which seem very well to illustrate the relations described above.

The first one (fig. 15) is of a 20-year-old girl who was in Professor SCHALDEMOSE's department at *Rigshospitalet* with the diagnosis of arthritis deformans coxae, sin. There is a slightly deformed caput with perfectly normal structure and regular contours, but caput is subluxed upwards and laterally in the flattened joint cavity from which it is divided by a well-preserved somewhat widened joint fissure and there are no new ossifications. The roentgen picture of the other hip is perfectly normal. This patient never had symptoms of hip trouble till about 6 months before arrival at the hospital, when she began to feel pain in her left hip when walking, and showed a slight limp after exertion; no pains are felt when at rest. When the patient does not exert herself her walk is quite natural without any limp; mobility in the hip is found to the full extent with only a tightening and painful feeling with extreme movements. The points of similarity between the story of the disease and the roentgen picture of this patient and the circumstances of a metatarsal complaint which causes only slight changes seem unmistakeable to me.

With regard to this special form of deformation of the hip-joint, I have met it several times in patients who never before have shown symptoms in connection with the hip, and I do not think that there is any doubt that it has its origin in a CALVÉ-PERTHES's complaint which has progressed without symptoms. The patients have always been referred for examination with suspected arthritis deformans, and have always been fairly young individuals (under 35—40 years).

Fig. 16 shows the final stage of a previous hip trouble in a 20-year-old man who, 6—8 years earlier, was treated for a tuberculous coxitis, and for three years was treated partly with extension, partly with bandaging. As will be seen, there is a more marked change than in

the preceding case, there is a deep joint cavity, well-preserved joint fissure, a beak-shaped deformed caput, a thick, clumsy collum femoris, and varus-position, but no osteophytic formations, and no signs of previously existing real destructions. A picture recently taken, five years after the present one, shows exactly the same condition, it is evident that a standstill was reached in the process of the disease long ago. Also the history of the disease indicates that, as the condition of the patient has not altered for many years, he does not feel ill but is somewhat invalid; there is some shortening of the extremity concerned and some restriction in the functions of the joint. The patient's original disease was scarcely a tuberculous coxitis, as such a complaint lasting for 3 years would certainly have caused a different deformation of the joint, a more irregular shaped caput, reparative ossification, narrowed joint fissure; it is far more reasonable to presume that it was a CALVÉ-PERTHES's condition which we know can cause changes similar to those described.

The last picture (17) is of a 56-year-old man who, at the age of 12, was treated for coxitis with confinement to bed, extension and bandaging for about a year. The treatment caused such a perfect cure that later he bore service as a soldier well, and on the whole was well till about 14 years ago, when he got a pain in the joint, was treated with vaseline injections for arthritis deformans, which cured him so well that not until a year ago had he any more symptoms. The roentgen picture now shows an enormously magnified mushroom-shaped caput sitting on a short thickened collum, articulating with the markedly flattened joint cavity and with well-preserved joint fissure. Also in this case I think a mistake has been made in the diagnosis of the original disease which was presumably a CALVÉ-PERTHES's hip condition and not tuberculosis. Both the history of the disease and the roentgen picture speak against the latter disease, as the existing deformation and the well-preserved joint fissure do not resemble the changes we generally find in connection with cured coxitis.

It seems to me that the histories of the disease of these three patients and their roentgen pictures offer so many points of similarity with the conditions found in the case of patients suffering from the metatarsal complaint described by me, that it cannot seem laboured, when comparing this with the analogies I have pointed out before, to place the two diseases in a close relationship to each other. That the metatarsal complaint causes more rarely such great changes as the hip complaint seems certain, but should not indeed cause any surprise, being presumably due to the fact that a considerably greater weight rests on the hip-joint than on the metatarso-phalangeal joint.

Judging by all criteria it seems natural to refer the two diseases to the category of conditions to which the roentgen examination was the first to draw attention, and reveal as characteristic of the time of growth — (though at various ages), namely, besides the two already mentioned, KÖHLER'S disease in os naviculare pedis, SCHLATTER'S in tuberositas tibiae, and finally the disease in the epiphyses of the vertebrae in the arcuate kyphosis described by SCHEUERMANN, all conditions which almost always used to be suspected of being of tuberculous nature, but where the peculiar appearance of the roentgen picture has caused it to be proved with certainty that they are quite without any connection with tuberculosis, which is also confirmed by the general mild progress of the disease.

There has been little occasion for undertaking pathologic-anatomical examinations both of the hip complaint and the metatarsal complaint, and in the few cases where by resection there has been occasion to do so the histological examination, as already mentioned, has not been able to contribute to the solution of the question of the nature of the disease, accordingly conclusions must be drawn on the basis of the clinical progress and the roentgen finding, conclusions that must bear a strongly theoretical stamp.

A discussion of the very difficult question of the innermost nature of these complaints (constitutional anomalies of growth, insufficiency of endocrine glands, late rachitis etc.) fall outside the frame of this little article, but indeed it is probably correct to assume a common cause which, in certain places of predilection, in places of ossification, creates a locus minoris resistentiae, and the inevitable daily small traumas may then cause the onset of the symptoms; real traumas are rarely found to be the cause.

That the metatarsal disease is almost always found in the 2nd metatarsal may perhaps be due to the fact that the latter is the longest, and accordingly more exposed to small injuries than the others. As already mentioned, I have only in one case met. the disease localised in III capitulum, and in all previously published it was the II capitulum that was affected. KÖHLER has, however, possibly once seen III metatarsal affected, as he mentions that he has seen such a capitulum deformed in the same way as is found in the disease of II metatarsal, but as he did not find changes in the diaphysis too he did not think that the disease belonged here, a conclusion which is certainly not correct.

Of the 22 patients (my 13¹ and 9 previously published cases) 15 were women and 6 men; in one case no sex is stated and the supremacy of

¹ During the printing I have had occasion to examine case no. 14 and 15, also in young girls of 12 and 16 years.

women is chiefly due to the fact that 11 of my 13 patients were women. In 14 the condition was right-sided, in six left-sided, in one double-sided, and in one nothing to that effect was stated.

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In conclusion I shall only in a few words mention the treatment, which, according to my experience, need be very slight, as it seems necessary only to let the patients spare the foot as much as possible, i. e. only let them walk little, no dancing, gymnastics or the like, whereas they seem to bear cycling well. All patients whom I have attended sufficiently long to form an opinion have either been cured or are recovering through this rather negative treatment. The cure may possibly be hastened by treatment with thyroïdin which indeed in certain cases of CALVÉ-PERTHES's hip-disease seems to have an effect in that direction. The secondary arthritis deformans may perhaps, judging by KOEHLER's and WEIL's articles, give an indication for resection of the joint, but it is indeed possible that, when one once has realised the certainly generally very mild progress of the disease, one will only very rarely need to resort to operative treatment, and it will at any rate never be necessary except at the later stages (in grown-up patients).

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Post scriptum. The discussion in 'Dansk kirurgisk Selskab' in connection with my paper causes me to add the following remarks.

From one quarter (the chief physician, Dr. FALBING) it was maintained that the condition described by me was possibly quite an ordinary traumatic arthritis. I cannot, however, admit the correctness of this assertion. The structural changes which are found in the epiphysis from the very first appearance of the complaint are never to be seen in connection with traumatic arthritis, and, as I have mentioned, a deformed arthritis need not appear, and it is perhaps only in the rarest cases that it is seen, often only a slight deformation of capitulum is found, but not the roentgenologic criteria of an arthritis deformans i. e. the osteophytes.

The chief physician, Dr. WESSEL, suggested that the primary feature in the disease was perhaps an epiphysiolysis which might arise as unnoticed as the well known fractures of the metatarsals that also chiefly are found in II metatarsal, and that the changes seen in capitulum were secondary, the clearings perhaps atrophy of bones. Nor do I think this explanation sufficient. When we consider the comparatively frequent epiphysiolysis at radius, and perhaps especially at caput femoris, epiphysis deformations may indeed be seen arising secondarily, especially

at the latter, but one never sees the structural changes described, nor condensations and clearings, which latter certainly cannot be considered atrophy of the bones which they do not resemble at all, they are undoubtedly expressions of anatomic changes. With regard to the periosteal stratifications they are indeed very well known at epiphysiolysis, but they are very rare in this metatarsal condition at the early stages, and it is indeed only by considering the latter that one can hope to make conclusions as to the origin of the disease. Secondly, there may evidently appear heavy deformations also of the diaphysis, as in WEIL's case, but nothing is known as to the stage at which they appear, and in none of my cases has there been the least sign of even the slightest shifting in the epiphysis line.

I will not say, however, that there cannot coincidentally with the capitulum abnormality be an additional abnormality in the epiphysis line, and what might indicate that, as Professor SCHALDEMOSE pointed out, is the too early synostosis formation found in many cases, and that at any rate in one of my grown-up cases a shortening of II metatarsal was found (fig. 12). This makes the similarity between the metatarsal disease and CALVÉ-PERTHES's hip-disease still greater. Indeed, in the latter case, no too early synostosis between caput and collum is found, but, on the other hand, by the irregular ossification an apparent growth of the epiphysis line into caput and collum, but I think indeed that both these conditions may have arisen through pathological conditions in the epiphysis line, and that the disturbances thus in one case involve irregular ossification, in the other too early ossification. That the early synostosis may involve shortening is, as mentioned, seen in one of my cases; and if with this in view we examine KÖHLER's cases we cannot, as far as the sketches allow us to judge of it, feel at all convinced that KÖHLER's explanation of the prolonged diaphysis is correct. I fancy that the incorrectness of his explanation may be due to the point that it is not possible, as he himself admits, definitely to show the transition between capitulum and diaphysis. If a shortening of diaphysis is found, it is probably due either to the too early synostosis or the shortened capitulum, or a combination of both these points, for, as already often mentioned, I have not been able to find any primary change of the diaphysis in very early cases.

Whether the thickening of collum femoris, as seen in CALVÉ-PERTHES's disease, is of the same periosteal origin as the diaphysis thickening in the metatarsal disease, I do not know, as I never have seen periosteal stratifications in cases of the hip-disease, but the idea of the homologous character of the thickening does not seem unreasonable to me, as the growth in thickness of the collum which belongs to the diaphysis arises

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

from the periosteum. It may therefore be the case that the thickening here is just growing so evenly that the periosteal origin is not noticed as is the case with the growth of other tubular bones, whereas for some unknown reason the periosteal proliferation in the metatarsal disease may become so marked that it appears as such.

Summary

A metatarsal disease arising during the period of growth (at the age of 10—14) is found which almost always is localised to the 2nd metatarsal.

The disease falls into the category of diseases to which belong CALVÉ-PERTHES's hip-disease, KOEHLER's disease in os naviculare pedis, SCHLATTER's disease in the tuberositas tibiæ, and the spinal disease described by SCHEUERMANN.

The primary starting point is the capitulum metatarsi, that is, as in the other cases, in an epiphysis; secondarily, arthritis deformans-like alterations may appear in the joint as well as thickenings of the diaphysis; often the last stage is, however, only a more or less marked deformation of the head of the joint itself.

The progress of the disease is mild, the symptoms not infrequently so slight as to be left quite unheeded, and a thorough treatment is but seldom necessary.

The changes are therefore not infrequently found only by an accidental roentgen examination, and the latter gives (as is also the case in the abovementioned diseases) such characteristic pictures that the diagnosis will thereby be established.