PREVENTIVE AND CONSERVATIVE TREATMENT OF OSTEOCHONDROSIS DISSECANS

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Three different theories about the cause of osteochondrosis dissecans (o. d.) have been much discussed, especially around the twenties of this century. Its origin was considered to be traumatic by a number of authors, but this theory could not explain such features as heredity and symmetrical appearance and therefore has in its exclusive form only a few followers today. The thesis of its embolic origin has been discarded. More and more it has been accepted that a constitutional factor is very important in the development of this often rather crippling disease. To these attempts at explanation was added, relatively recently, Ribbing's theory, which reports the presence of an anatomical substratum connected with o. d. in the accessory ossification centres (ossicula, osseous nuclei) of the epiphysis, supporting constitutional but not excluding traumatic factors for the explanation of its occurrence. Brailsford also mentions the possibility of a connection between the epiphyseal ossicula and o. d.

Troell presupposed as early as 1914 the presence of a superficial osseous nucleus at the epiphysis of the medial femoral condyle, considering it as a possible cause of o. d. of the knee joint, but was not able to find it at that time. He thought also that its discovery would solve the theoretical difficulties in explaining the peculiarities of the disease.

In 1922 Lehmann published his theory of the constitutionally weak epiphysis and Löhr demonstrated in 1929 that regular changes can be observed at the capitulum radii in cases of o. d. of the elbow joint.

In 1937 Ribbing obtained radiological pictures very much resembling o. d. from several members of a family with hereditary disturbances of epiphyseal growth. Having had the opportunity of following the development of an o. d.-like state from the ossicula of the femur-epiphysis in one of the family, he later examined the epi-

physes of normal children of different ages, in searching for the appearance of ossicula. He published the results of these investigations in 1944.

He examined about 200 boys of different ages and about just as many girls, and found that, taking both groups as a whole (age 1 to 10 years), boys showed ossicula at the distal femoral epiphyses three to four times as often as girls. Ossicula were seen in 29 % of the boys. They are seen earlier and disappear much earlier in girls than in boys. In girls they are only occasionally observed after the age of 4 years, while in boys they disappear at the age of about ten. It would therefore seem to be a logical conclusion, that cases of ossicula seen at a later age may at least be considered as cases bordering on normality and should be watched in their further development.

If Ribbing's theory is right and the epiphyseal ossicula are the basis for the development of o. d. it should be possible to observe symptoms at an earlier age than around 15, that is to say, at a time when the ossicula are still visible in the x-ray pictures. One should therefore be able to see the danger of a developing o. d. and introduce preventive treatment of the disease, thus halting it.

The youngest case with symptoms which was described in the literature was, I found, aged 10 years (Støren). Most of the cases of juvenile o. d. in the knee have been observed in children from 12 to 15 years. As I shall demonstrate by my case histories, symptoms can also manifest themselves at a considerably earlier age. Locking of the knee-joint, for example, is by no means a rarity in small children. 6 months ago I had an opportunity of seeing a girl of two years, who showed locking symptoms in her right knee.

The mother brought the child to the first aid station (legevakten) because her right knee had given way spontaneously several times during the last week. Every time such an attack occurred the girl had fallen, touched her knee with her hand, and had cried. She was unable to stretch her knee for a few minutes afterwards and could not walk. Then she had walked again as if nothing had happened, until the incident repeated itself. These attacks had occurred quite frequently every day since they had started.

On examination nothing pathological could be detected in the knee. The child walked briskly until her right knee suddenly gave way and she fell, crying and covering the knee with her hands. The knee was held in about 30 degrees of flexion and could not be stretched by the cautious attempts to do so. A few minutes later all symptoms had disappeared and the girl started walking as before, until the same attack repeated itself while I was watching.

Radiological examination revealed ossicula at the femoral epiphysis of both knees, perhaps more pronounced at the right side (fig. 1).

I had the child put to bed for a week and prevented her from getting up with the help of a harness. Since then the attacks have subsided.

After 6 months an attempt was made to take new x-ray pictures. but it failed because of the restlessness of the child.

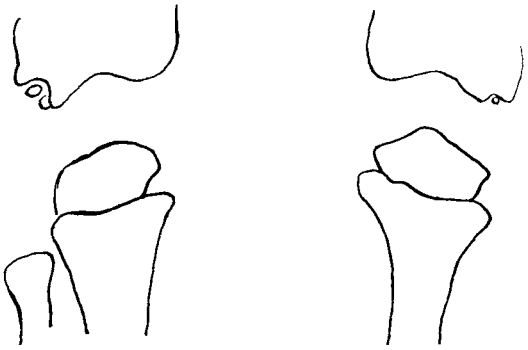

Fig. 1.

Considering the x-ray pictures and the quick disappearance of symptoms after a week of rest in bed, one is most inclined to seek the cause of the girl's troubles in an osseous nucleus with temporarily lowered vitality. A congenital discoid meniscus is also a possible explanation for the disturbances, but would most likely have caused symptoms for a longer time.

Taking into account the opinion of Ludloff, Ribbing, and others, that the ossicula and protuberances at the distal femoral epiphysis are the expression of an especially lively growing process, the thought occurred to me that the whole phenomenon of o. d. has also to be looked at in connection with Murk Jansen's law of the vulnerability of quickly growing cells. This states that the vulnerability of growing cells is proportional to the speed of their growing.

In a group of 20 boys from 3 to 11 years old, and 15 girls from 2 to 8 years (mostly 5 to 8 years), whose knees I examined radiologically in search of osseous nuclei, before I had read Ribbing's paper, I found that 14 of the 20 boys had distinctly visible ossicula, while among the 15 girls only 2 showed them. The ossicula were only visible with the special technique used for projecting the dorsal part of the femoral condyles. The rareness of ossicula in this group of girls may be explained by the fact that most of the girls were over 4 years old.

I examined all these children clinically and found that two of the boys had symptoms which were reminiscent of the ones which children suffering from osteochondrosis ischiopubica sometimes show, but that the symptoms were localized somewhat more distally round the knee-joint.

One of the boys aged 7½, said that he had pain in both knees, but especially on the left side. The pain was most pronounced towards evening and at night he was sometimes awakened by slight stabbing pains in his left knee.

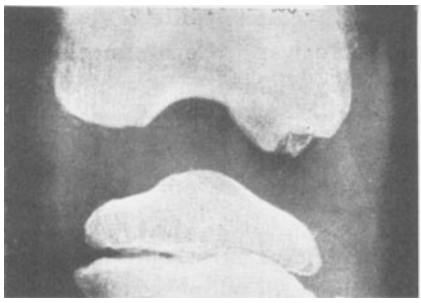

Fig. 2.

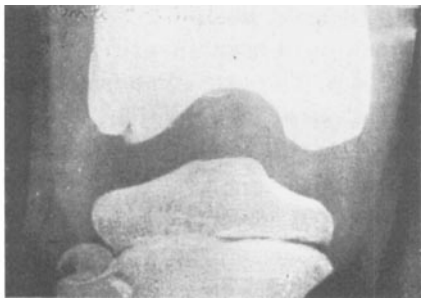

Fig. 3.

I found his left lateral femoral condyle distinctly tender dorsally on pressure, but nothing else pathological. X-ray pictures showed a rather large ossiculum at the site of the tenderness (fig. 2). His brother aged 4½ years, had the same ossicula but no pain. About 4 months later the boys were re-examined clinically and radiologically. In the meantime the older one was not permitted to partake in sports or gymnastics. His pain had become less and was mostly localized to the right knee at the second examination. There was no noticeable tenderness on pressure. The x-ray check showed that the ossiculum at the left knee had almost disappeared, while in the right knee it was still persistent. As before, his younger brother had no pain. X-ray pictures showed that his ossicula had disappeared.

The second boy aged 6½, had the same symptoms as the boy of 7½. There was however no pain on pressure. X-ray pictures showed large ossicula at the lateral condyles (fig. 3).

A third boy in this series, who also had large ossicula like the two above-mentioned boys, had so far felt no pain at all.

As the pre-state of o. d. (i.e. the ossiculum with decreased vitality) can probably slowly develop into a typical o. d., preventive treatment

is closely connected with the question of conservative treatment of the developed disease at an early stage.

Since the twenties of this century a number of spontaneous healings of o. d. have been reported (Ludloff, Kappis, Hellstrøm a. o.). Støren mentions in 1928 a case of o. d. in the knee-joint of a boy; the focus disappeared after an osteotomy of a knock-knee, that is to say, during the postoperative treatment in plaster of Paris. In spite of these observations treatment of the disease in its early stage by immobilization in plaster of Paris has apparently not been tried systematically.

There is no doubt that a number of cases have been operated on under the diagnosis of o. d., while presenting in reality a pre-state of the disease. In opening the knee joint in juveniles, quite a few surgeons have been surprised to find that there was little or nothing to be seen. The osteochondrotic body, seemingly dislocated at a previous radiological examination, was surrounded by a layer of more or less intact cartilage on inspection.

Several factors give rise to disappointment in the operative treatment of o. d.

Single or multiple recurrences of loose bodies after operation are no rarity. Another factor is arthrosis, which develops or increases after operation and becomes more pronounced with the more extensive encroachments, as Løhr's and Von Staa's papers demonstrate. In these publications one finds that practically all the cases which were operated on by removing the more or less loose bodies and chiselling off the focus (bed) from which the body had separated, showed bad final results because of pronounced arthrosis. If the loose body only was removed, arthrosis developed to a lesser degree.

As long as the loose body has not separated completely from the focus and necrosis is not complete, there always seems to be at least in young individuals the possibility of fusion with the epiphysis, if the joint is immobilized.

Treatment by immobilization in plaster of Paris can only be of practical value if it leads to the healing of the condition in a reasonably short time, that is to say, in a shorter period than that in which spontaneous healing is observed, secondly, within a period in which immobilization will not do any definite harm to the function of the joint, and thirdly, only if a high percentage of healing can be accomplished by its application. The cases of spontaneous healing, published so far, show that the time of observation mostly lasted years before the osteochondrotic focus disappeared from the x-ray pictures. Only a very few took merely months to heal, the shortest time mentioned by Løhr being four months in one case.

Von Staa, in following-up cases of slumbering o. d. for several years by x-ray examination, was able to observe the development of loose bodies without any symptoms. Before locking occurs in later life, after the silent development of loose bodies, by no means all cases of o. d. give clear symptoms. If therefore slumbering o. d. is discovered we seem to be justified in doing all that can be done to make it disappear. As it seems possible to achieve this in a relatively short time by immobilization only, there is no reason why it should not be tried.

CASE HISTORIES

3 cases of ossicula of the distal femoral epiphyses follow; two of them with locking symptoms.

Case 1. Boy, 11 years old.

A few hours before examination he went skiing; during this his left knee suddenly gave way, causing a hard fall. At once severe pain in his left knee developed. He had to be transported to the first aid station (legevakten). No pain or trauma had been experienced in the knee before this accident.

On examination the dorsal part of the left medial femoral condyle was rather tender on pressure. The surface here felt slightly uneven. Knee movements had full range, but were slow because of pain.

X-ray pictures showed an accessory osseous nucleus at the dorsal part of the left medial femoral condyle (fig. 4a).

Plaster of Paris bandage was applied from the toes to the major trochanter. Rest in bed for a fortnight before walking was permitted. Change of plaster bandage after 6 weeks.

X-ray check showed partial disappearance of accessory nucleus.

New plaster of Paris bandage was applied from the ankles to the trochanter, removed after 5 more weeks.

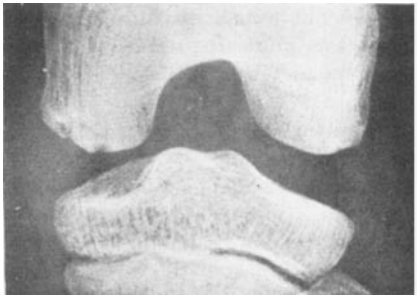

Fig. 4a.
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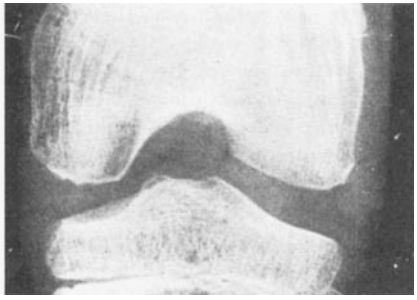

Fig. 4b.
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An x-ray check, made a few days later, as soon as the patient could bend his knee sufficiently, showed complete disappearance of the accessory nucleus (fig. 4b).

Clinical and radiological examination four months later showed normal conditions at the left knee-joint.

Case 2. Boy, 6 years old.

When the boy left his bed one morning, he suddenly could not stand on his left leg, because of acute pain in his left knee, which he was unable to stretch completely. The day before he had complained for the first time of slight pain in his left knee.

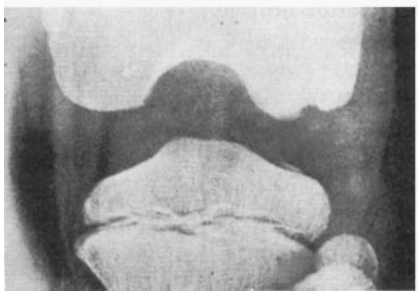

Fig. 5a.
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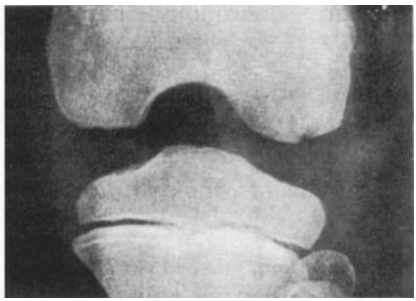

Fig. 5b.
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On examination the left knee was slightly swollen and was tender at the dorsal part of the medial femoral condyle. Intra-articular fluid had slightly increased. The knee could not be stretched completely.

Radiological examination showed an ossicle at the dorsal part of the left medial femoral condyle, which looked as if it was slightly dislocated medially (fig. 5a). No ossicles were seen at the right femoral condyles.

Plaster of Paris bandage was applied from the toes to the major trochanter and the boy was not allowed to put weight on the extremity for a fortnight.

6 weeks later the bandage was removed.

Radiological examination gave the impression that the ossicle had partly fused with the epiphysis.

The corresponding part of the femoral epiphysis was, however, still tender on pressure. The patient was therefore not allowed to put weight on this extremity for a further 4 weeks. After this time the knee was clinically normal and the X-ray picture showed that the ossicle had united completely (fig. 5b).

Case 3. Boy, 8 years old.

The day before examination the patient had fallen and hurt his right knee. Had felt no pain before in either knee.

On examination a slight excoriation in the region of the patella and slight tenderness of the patella itself were found.

X-ray pictures showed an ossicle at the dorsal part of the right lateral femoral condyle. (No pain on pressure in this region.)

The patient was advised to return for examination in two weeks, but did not turn up until asked by letter 5 weeks later. He said that he had no more pain in his knee and his father confirmed that he found him perfectly normal and had never observed any limping.

On pressure the dorsal part of the right lateral femoral condyle was now distinctly tender, which was not so immediately after the accident.

A new X-ray picture showed the ossicle as before.

Because of the possibility of a lesion of the ossicle demonstrated by the tenderness at this site, a plaster of Paris bandage was applied from above the ankles to the major trochanter. It was removed 6 weeks later.

Radiological examination after that time showed that the ossicle had disappeared.

At the follow-up examination several weeks later the knee was clinically completely normal. (No pressure point.)

2 cases of developing o. d.

Case 4. A boy, 12 years old.

Suddenly had symptoms of locking in his right knee, while walking downstairs. No definite trauma. Never had pain in his knees before.

Examination on the day of the locking showed slight hydrops in the right knee and rather pronounced tenderness at the dorsal part of the medial femoral condyle, which felt uneven on its dorsal surface. Complete stretching of knee impossible.

X-ray pictures revealed typical o.d. of the medial femoral condyle, with the loosened body still in its bed (fig. 6a).

After 3 days of rest in bed the knee obtained full extension. A plaster of Paris bandage was applied from the toes to the greater trochanter. Walking was permitted after a fortnight. 6 weeks later the bandage was taken off. Radiological examination showed initial fusion of the nucleus. New plaster of Paris was applied from above the ankles to the trochanter for 6 more weeks. After removal of this second bandage an X-ray check showed a marked tendency of the focus to fusion with the epiphysis. An X-ray check 5 months later revealed complete fusion (fig. 6b). Clinically the knee showed no pathological findings. A new radiological check 1½ years after the beginning of the treatment, showed normal conditions, in spite of the fact that the knee had sustained a heavy accident 4 weeks before this last picture was taken.

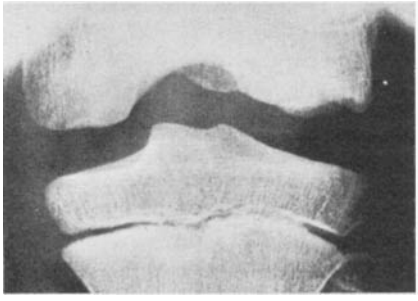

Fig. 6a.
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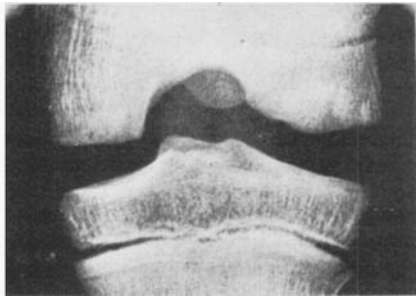

Fig. 6b.
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Case 5. Girl, 20 years old.

During the last year she had had slowly increasing pain in the right elbow joint and loss of full extension. Never had symptoms of joint-locking. No distinct trauma was remembered.

On examination the right elbow showed 10 to 15 degrees of permanent flexion. Was especially tender at the radial part of the joint. No swelling or other signs of inflammation.

X-ray pictures revealed an osteochondrotic focus in the capitulum of the humerus (fig. 7a).

Immobilization in plaster of Paris was advised. The patient first rejected this treatment, but was ready to take it one month later because the pain had increased.

The plaster of Paris was removed after 5 weeks. An X-ray check showed possible initial fusion of the focus.

The patient was advised to put the arm into a sling and to use it very little. Permanent flexion of the elbow had diminished to about 5 degrees.

4 months after the start of treatment X-ray examination showed that the focus had disappeared (fig. 7b). One year later clinical and radiological examination showed 5 degrees of permanent flexion and slight arthrotic changes due to the former o.d., but nothing else pathological.

One case of fully developed, but slumbering o. d.

Fig. 7a.
Date of picture 13.2.48.

Fig. 7b.
Date of picture 22.5.48.

Case 6. Girl, 21 years old.

Sprained her right ankle half an hour before examination. Always became easily tired on her feet and had a tendency toward spraining her ankles.

Radiological examination revealed an o.d. at the medial superior edge of the trochlea of the astragalus. A symmetrical focus was found at the left astragalus too, but no other foci could be detected (fig. 8a).

A plaster of Paris bandage from the toes to below the knee was applied, because of the combination of trauma and o.d. in the right anklejoint. After 6 weeks the plaster of Paris was removed and an Unna's paste bandage was applied and removed again 4 weeks later.

An X-ray check 4 months after the beginning of treatment revealed, however, no definite signs of improvement. There were no clinical symptoms (fig. 8b).

As the focus showed signs of necrosis, radiologically, fusion could not be expected in so short a time. It remains to be seen whether this relatively short treatment by immobilization will bring about a change favouring fusion at a later stage. A difference between the treated and the untreated side will have a certain significance, if discovered later.

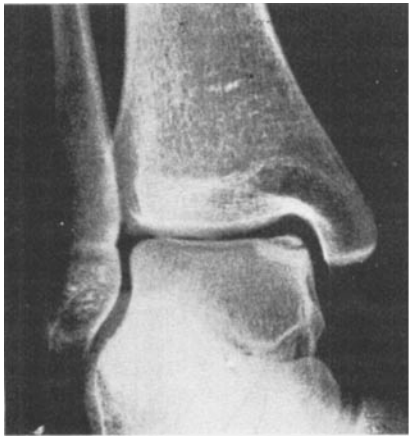

Fig. 8a.
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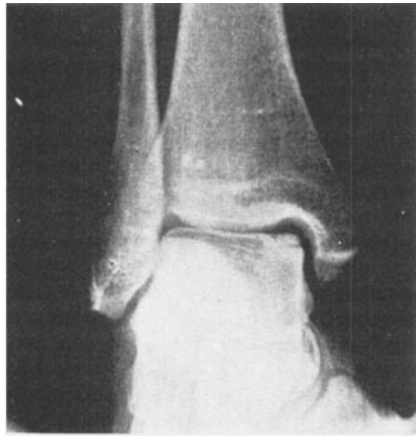


Fig. 8b.
Date of picture 30.3.50.

CONCLUSIONS

Among the 6 case histories presented, three show that there probably exists a prestate of o. d. which gives rise to the same symptoms as o. d. The pathological substrate of this pre-state probably consists in osseous nuclei in the epiphyses with decreased vitality. The condition can be clinically observed and treated successfully by immobilization in plaster of Paris. O. d. can therefore probably be prevented, if its (pre-state) development is discovered in time.

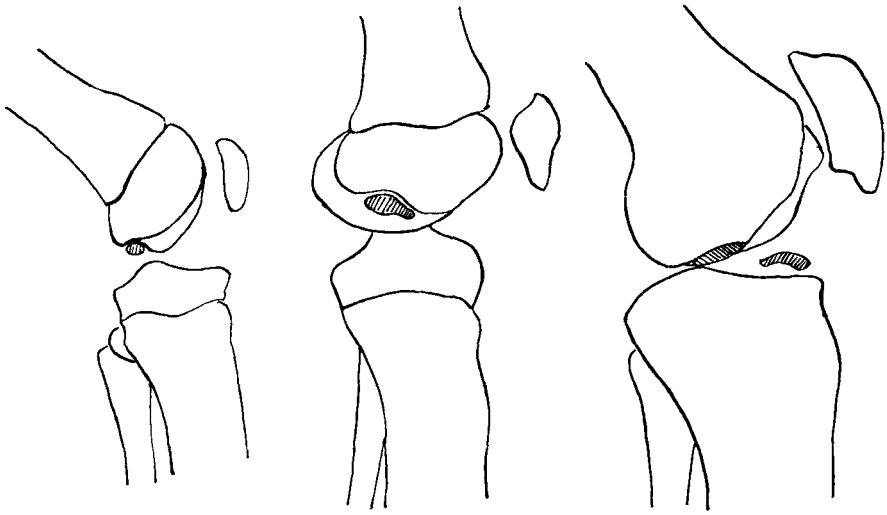
In younger persons furthermore it seems possible to cure the developed o. d. by immobilization from 6 to 12 weeks, if the loose body has not been dislocated or only slightly so, and if no complete necrosis has taken place.

A very important factor in the prevention of o. d. is radiological examination. It should never be omitted if there is the slightest suspicion of the presence of the pre-state of this condition. Further systematical examination will perhaps show whether it is possible to make a radiological diagnosis of an ossicle with diminished viability.

Among the 20 boys examined by me at random for ossicula at the

distal femoral epiphyses, 3 had especially large ossicles and two of these had a certain amount of pain. Ossicles persisting after the age of 4-5 in girls and after 10-11 in boys should be looked upon as being not quite normal.

There is another interesting feature, which reveals itself on comparison of the x-ray pictures of ossicula with the developed o. d. in the lateral view. It shows that the ossicle is probably pushed forwards



a
6 years old.

b
12 years.

c
38 years.

Fig. 9.

during epiphyseal growth. While the ossicula at the age of 6 (in boys) are to be seen at the dorsal part of the femoral condyle (in the lateral view) and therefore are relatively protected, at the age of 12 the osteochondrotic focus is to be seen just about in the middle of the circumference of the femoral condyle. At this age it lies in the line of gravity and is therefore, and because of its greater liability to be strained by knee movements, more exposed to trauma than at an earlier age. The earliest cases of o. d. reported in the literature occur about the age of 12. In adults the osteochondrotic focus is to be seen mostly, though not always, at the front part of the femoral condyle (fig. 9 a, b, c).

For practical reasons one may divide o. d. into different stages.

1. The pre-state (in children only).
   a. Without symptoms—has to be watched clinically and radiologically, if persisting after the age limit.
   b. With slight symptoms—should be treated by partial or com-

plete immobilization. Duration depending on result of radiological examination.

c. With locking symptoms—without, but possibly also with slight subchondral displacement of the ossicle (fig. 5 a)—should be treated by complete immobilization.

2. The state of partial necrosis (of the ossicle).
   a. Without symptoms (slumbering)—the best way of treatment is probably immobilization in order to get fusion as soon as possible, to avoid silent development of loose bodies and progress of arthrosis.
   b. With slight symptoms—should be treated by complete immobilization.
   c. With locking symptoms and no or just slight displacement—should be treated by immobilization (fig. 6 a).
3. The state of complete necrosis without and with displacement.
   a. Without symptoms (slumbering)—treatment not necessary.
   b. With slight symptoms—immobilization can be tried if there is no displacement. If there is displacement and mobility, the loose body should be removed. If there is displacement without pronounced mobility, treatment depends on the localisation of the loose body and the condition of the joint.
   c. With locking symptoms and (or) pronounced arthrosis—loose bodies should be extracted and the arthrosis should afterwards be treated by an *arthrosis-bandage* or x-ray treatment, depending on the joint itself (localisation, mechanical conditions). In very serious cases of arthrosis due to o. d. the question of arthroplasty or arthrodesis may arise.

If large ossicula or slumbering o. d. are discovered in a hurt joint (sprain), the safest line of treatment is probably prophylactic immobilization of the joint for a few weeks. Case 3, where the boy showed definite tenderness of the ossicle, 4 weeks after an accident, points in this direction.

Case 6 probably shows the limits of conservative treatment by immobilization in so far as it most likely fails in the presence of a completely necrotic body. As the diagnosis of this state will not always be easy and certain, as fig. 6 a shows, in cases of doubt the patient should be given a chance to be cured by conservative measures.

If a loose body has been removed by operation, the danger of recurrence may be lessened by partial immobilization of the joint from 4 to 6 weeks. The encroachment itself may have a mobilizing effect on hidden multiple foci; this must be overcome by immobilization.

SUMMARY

The author reports 3 cases of children aged 6 to 11 years, two of them with symptoms resembling o. d., in whom the radiological examination showed accessory osseous nuclei at the distal femoral epiphyses and 3 cases of typical o. d. aged 12 to 21 years. All the patients were treated by immobilization in plaster of Paris. In all but one, fusion occurred in the course of about 3 months. He suggests that in the first group of patients a pre-state of o. d. exists characterized by clinical symptoms and the presence of osseous nuclei in the x-ray pictures. He holds the opinion that these cases support Ribbing's theory of the connection between the nuclei in the epiphyses and the development of o. d. Preventive treatment of o. d. seems therefore possible. The second group of cases shows that conservative treatment of early cases of o. d. will probably give good results.

RESUME

L'auteur rend compte de 3 cas d'ostéochondrite disséquante chez des enfants âgés de 6 à 11 ans. Dans deux cas l'examen radiographique montre la formation de noyaux osseux accessoires de l'épiphyse du fémur. Il est également rendu compte de 3 cas d'ostéochondrite typique chez des malades âgés de 12 à 21 ans. Ces malades ont été traités par le repos, en bandage plâtré, et chez tous sauf un les noyaux osseux se sont résorbés ou ont disparu en l'espace d'environ trois mois. L'auteur estime que dans le premier groupe des enfants malades, les symptômes indiquent un stade précoce de l'ostéochondrite qui se caractérise justement par une formation accessoire de noyaux osseux visibles sur la radiographie. Il estime par ailleurs que ces cas viennent appuyer la théorie de Ribbing selon laquelle il existe un rapport primitif entre la formation de noyaux accessoires de l'épiphyse et le développement de l'ostéochondrite. Le traitement prophylactique de l'ostéochondrite disséquante devient donc possible. Le 2ème groupe de malades montre que le traitement conservateur à un stade précoce de l'ostéochondrite donne vraisemblablement de bons résultats.

ZUSAMMENFASSUNG

Der Verfasser referiert 3 Fälle von Kindern im Alter von 6 bis 11 Jahren, 2 von ihnen mit Osteochondrosis dissecans-artigen Symptomen, in welchen die Röntgenuntersuchung akzessorische Knochenkerne der distalen Femurepiphysen zeigten. Ausserdem berichtet er

über 3 Fälle von typischer osteochondrosis dissecans im Alter von 12 bis 21 Jahren. Alle Patienten wurden mit Ruhigstellung in Gipsbandagen behandelt und in allen Fällen ausgenommen einem, kam es zur Verschmelzung oder zum Verschwinden der Knochenkerne oder der Herde im Verlaufe von ungefähr 3 Monaten. Der Verfasser ist der Meinung, dass die Symptome in der ersten Gruppe von kindlichen Patienten ein Vorstadium der Osteochondrosis dissecans darstellen, das durch die Symptome und die im Röntgenbilde nachweisbaren akzesorischen Knochenkerne charakterisiert ist. Er ist ferner auch der Meinung, dass diese Fälle Ribbings Theorie von dem ursächlichen Zusammenhang zwischen den akzessorischen Kernen der Epiphysen und der Entwicklung von o. d., unterstützen. Prophylaktische Behandlung der O. d. ist deshalb möglich. Die zweite Gruppe von Fällen zeigt, dass konservative Behandlung von O. d. in einem frühen Zeitpunkt wahrscheinlich gute Resultate gibt.

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