

NILS SILFVERSKIÖLD, STOCKHOLM:

CHONDROMALACIA OF THE PATELLA

Definition: Chondromalacia of the patella is a degeneration and softening of the patellar cartilage, often leading to the formation of cracks. On the basis of these changes typical morbid pictures usually appear, as retropatellar crepitation, synovitis and often osteo-arthritis; further, according to the degree of the process, increasing disablement in the form of pain, reduced powers of endurance, often recurrent swelling and effusion into the joint.

Pathology: The lesion begins as a rule in the middle of the patellar cartilage, growing larger gradually. The cartilage loses its normal blue-white shiny colour and becomes more yellowish. It later loses its normal elasticity and gets softer. If the process continues, the degeneration of the cartilage as a rule increases first centrally, cracks appear, which usually do not reach the bone, but merely the epiosseal layer of cartilage, which is more firm and fibrous. If such a knee-cap is exposed to traumatic injury (single and severe or chronic traumatism) the pathologic-anatomic changes progress; the softening of the cartilage increases, also the formation of cracks. As the greater part of the joint-cartilage is entirely lacking in blood vessels, the reaction does not come from the cartilage but from the nearest vascular tissues. In this manner there develops peripatellar synovitis, which at first is limited to the area around the patella, but gradually becomes an ordinary synovitis with hydrops. This hydrops increases on exertion and is reduced or vanishes with rest. If the process increases, there is peripatellar newformation of cartilage and osteophytes. In addition new

blood vessels are formed. The bone of the patella is exposed, usually centrally in the beginning. This bone becomes sclerosed, blood vessels from the cancellous tissue below are growing up towards the surface of the bone. Pannus with vessels develops from the periphery and grows in towards the center of the patella, bringing vessels with it. Injured hyaline cartilage can

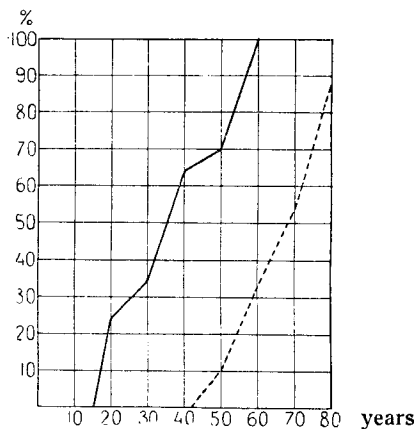


Fig. 1.

———— Chondromalacia } of the Patella in
 Osteoarthritis } different ages

never be healed with hyaline cartilage, because the hyaline cartilage is a highly differentiated tissue, which lacks vessels. But through the new formation of vessels a sort of healing takes place, the result of which at best is fibrous cartilage.

With the terminology, which is used in Sweden, we do not speak of osteo-arthritis until osteophytes are evident on the X-ray plates. Until the process is that far advanced, the disease may be called pure chondromalacia of the patella. From then on, the term should be osteo-arthritis. As far as I have found, most cases of osteo-arthritis begin in the knee-joint at the patella. We also find many cases where osteo-arthritis develops subsequent to chondromalacia of the patella, and in which the deforming arthritis often develops over a long period and reaches a rather advanced stage without the joint otherwise showing noteworthy signs of osteo-arthritis. If the deformation

is continued, the entire joint undergoes osteo-arthritis. I do not intend to discuss these latter cases.

I have carried out pathologic-anatomical examination of patella from 170 serial autopsies. Naturally one finds that the cartilage decreases in size with advancing age; and this decrease proceeds especially after the age of 40; and the cartilage gradually becomes more yellowish in colour, and acquires a velvety surface. Fig. 1 illustrates the frequency of chondromalacia of the patella and resulting osteo-arthritis at different ages. The rates of frequency refer to the autopsy findings mentioned. I have clinically, however, diagnosed cases of chondromalacia of the patella as early as at the age of 11 years.

In this connection, perhaps, I ought to mention that patellar chondromalacia may be of familiar occurrence. Thus in my clinical material I have a family with 4 children, all female. All of them have chondromalacia of the patella of marked degree: two of them have been treated by me, and one of them will be shown here today. Also the mother has a definite degree of chondromalacia of the patella. In spite of careful inquiry, however, in other cases I have found very little suggestive of hereditary origin of the lesion.

Etiology and Pathogenesis: Apart from possible predisposition the etiology is traumatic. This is of value to remember. Many internists seem not to realize that both chondromalacia of the patella and osteo-arthritis are on the whole traumatic diseases. The initial traumatic factor often seems to be a violent fall on the knee-cap. During such a fall on an acutely bent knee, the injury is increased by the tension of the quadriceps. The result of such a violent initial trauma will be a considerable contusion of the patella. I shall now show a picture of such a lesion.

With further strain on the knee, such as renewed contusion of chronic trauma in the form of violent exercise, hard labour etc. the cartilage is worn, with the result that it gets more and more malacic, and especially in the center, where the nutrition is least good, it becomes fringed and lamellated. The following pictures show such changes. (2—5). The lamellae often acquire

a direction which points distally. On bending and stretching of the knee, retropatellar crepitations are produced by these changes. The mechanical strains from such a changed patella cause irritation, which produces the above-mentioned peripatellar hyperemia, as well as peripatellar synovitis, general syno-

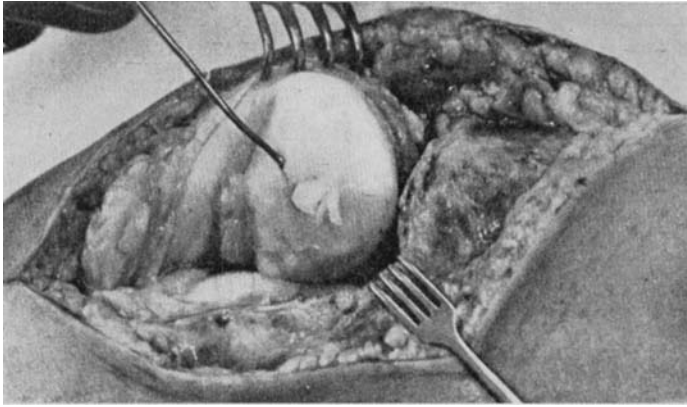


Fig. 2.

vitis and hydrops. As the lesions advance, osteo-arthritis sets in with its well-known clinical picture.

Clinical symptoms and their development: After the contusion of the patella there usually develop pain, swelling, hydrops etc. After a period of sufficient rest, these symptoms will disappear. If the contusion leads to chondromalacia of the patella, it becomes latent and needs not give rise to other symptoms than mild retropatellar crepitations. But if a new trauma or chronic traumatism of sufficient degree follow, the chondromalacia becomes clinically manifest. The clinical picture then becomes a series of exacerbations, directly related to trauma and periodic strain. With such a manifest chondromalacia the patients have pain in the knee, especially when they have been sitting with bent knees for a long period, as for example at a cinema-performance. With more severe troubles the patients are not able to remain sitting with bent knees for any time, but must get up and stretch their knees. Furthermore

the joint-capsule becomes swollen as a consequence of the synovitis and is distended by fluid. At this stage the patient generally seeks medical aid. The joint is then usually tapped, and the knees are immobilized in plaster of Paris or the patient is kept in bed. After a sufficiently long rest, the process passes

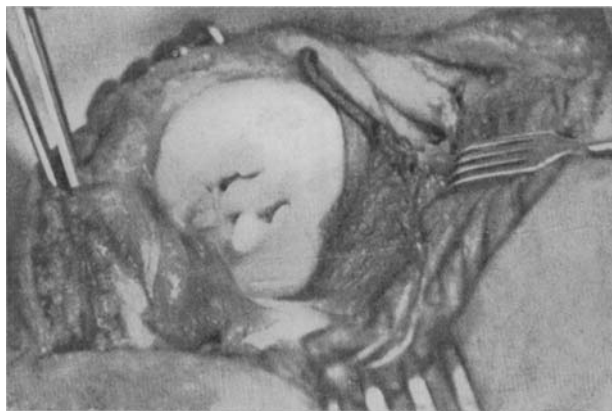


Fig. 3.

over into a clinically latent state; but if the subsequent functional strains are increased too rapidly or otherwise become too great, the knees swell again. In this way it may happen, that the knee will have to be punctured again and again, and the patient will have to endure periods of immobilization. Such knees do not stand the direct weight-bearing during kneeling, nor deep knee-bending. With more advanced lesions the patients are not able to walk far, without the development of swelling and pain. If the process has gone very far, conservative treatment will not help. If the lesions have advanced to osteo-arthritis of different degrees, the characteristic clinical picture, which we all recognize, will be present.

Diagnosis: In spite of the fact that a good deal is written about chondromalacia of the patella in the scandinavian literature, actual knowledge in regard to this disease is not widespread even here. Although at several congresses I have shown typical serial pictures from photos taken at operations, ex-

perienced surgeons afterwards have said to me: "Chondromalacia of the patella does not exist." And they have assured me, that they have never seen a single case. Against this I would like to say: "Chondromalacia of the patella is the most common

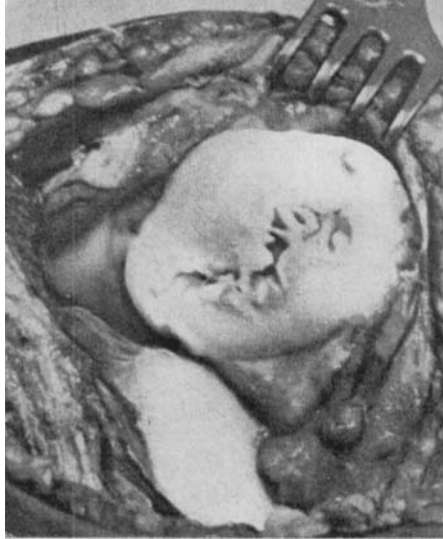


Fig. 4.

of the internal derangements of the knee-joint." On the basis of my pathologic-anatomic studies, I would like to add, that the patellar cartilage is that tissue in the human body, which probably is the first to age. Doctor *Aleman* in Stockholm, who was particularly interested in chondromalacia of the patella and performed several hundreds of arthrotomies on the knee, paid close attention to the patellar cartilage and found, that about $33\frac{1}{3}$ % of the patients have chondromalacia of the patella as early as at the age of twenty. I should like to write a paper on chondromalacia of the patella and call it "Patella crepitans", in order to draw more attention to the question of the diagnosis of chondromalacia of the patella. Of greatest importance in regard to the diagnosis are the retropatellar crepitations. If a patient, who has not yet reached the age of 30,

complains of pain, swelling and crackling in both knees, he has no doubt in most cases bilateral chondromalacia of the patella. The crepitations are sometimes so strong, that they may distinctly be heard, for example when walking up and down stairs. The patients compare the cracklings with the sounds

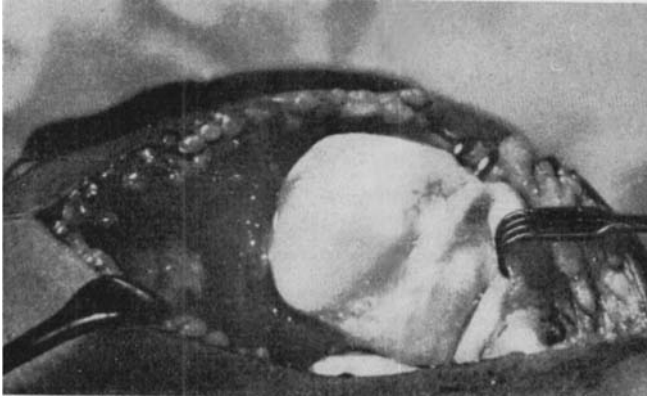


Fig. 5.

that come from walking on splinters of glass, or breaking bones of birds. A woman has told me that her husband never wants to walk with her on stairways, because he cannot bear the crackling of her knees. The best way of observing the crepitation of the knee is to bend and stretch the weight-bearing knee and palpate the patella with the fingertips. It will then be found, that these crackles are entirely retropatellar and do not come from other parts of the knee-joint. In hydrops there are often no crackles until after the puncture. Retropatellar crepitations and the history are as a rule quite sufficient for the diagnosis. Other clinical symptoms are: Peripatellar tenderness on palpation, severe pain on kneeling.

Treatment: Contusion of the patella should be treated in the way mentioned. In mild cases of clinically manifest chondromalacia of the patella, it will be sufficient to prescribe the following regimen: The patient ought not to be anxious about his knees, but on the other hand he must remember not to over-

strain them. In moderate degrees of chondromalacia of the patella protective conservative treatment and more strict regimen with rest, immobilization and perhaps one or more punctures. If such conservative measures over a long period are not sufficient, an operation is indicated. The following points in regard to operation are based partly on my experience with patients, which have refused operation, partly on experiences with operated cases and from follow-up examination of these patients. I do not operate upon cases of a high degree of general osteo-arthritis of the knee-joint. In such cases I instead advice a lenient therapy, until the troubles have disappeared, and then very carefully increased training-treatment, until the patients reach the modest optimum, which in such cases can not be exceeded without punishment. Then the patients are instructed to keep to the following *modus vivendi*: A modest middle course between rest and slight efforts, combined with daily, easy active exercises. I do not believe in any other therapy for these cases.

The operative techniques is a longitudinal incision medial to the patella, with stretched knee, rotation of the patella, so that its cartilaginous surface is accessible. Excision and smoothening of the seat of chondromalacia of the patella with a sharp knife. Sutures. Plaster bandage for 10 to 14 days. Carefully increasing active movements, at first without and later with weight-bearing. The stay in the hospital will on an average last about 3 weeks. The training-treatment ought to be slowly increased for months. The patients may do light work after about 6 weeks, hard work not until after several months. It is of importance that the muscles of the knee get completely trained.

More cartilage than necessary should not be extirpated. Those cases, where small excisions have been done, are usually practically free from symptoms or even better.

I treat in a special manner pronounced chondromalacia of the patella of high degrees, which has developed into an osteo-arthritis, limited mainly to the patella and to the *facies patellaris femoris*, with exposed bone and large osteophytes. The osteophytes are chiselled off, and the posterior surface of the

patella is sawn away, so that the cut surface shows red spongiosa. This surface is covered with a thick free fascial transplant from the fascia lata. This graft is carefully sutured and folded into the synovialis around the patella. I shall today show you two such patients. Their further treatment must of course consist of a slower and more protracted increase in the intensity of the training-treatment. It should be added, that in operation for chondromalacia of the patella, osteophytes are always chiselled and filed off.

I have done altogether about 70 operations during a period of about 10 years. About 10 of these cases must be excluded, because I have operated them as consulting orthopedic surgeon at different hospitals and have not written up the clinical records myself. From the other 60 patients I have picked out 17. Three of these 17 have been operated this year and thus the observation period is much too short. The other 14 have not been cases of pure chondromalacia of the patella. The history has not been typical, the diagnosis has been uncertain as to the existence of an injury to the meniscus or as to whether there was a meniscus rupture or other internal derangement. In these cases chondromalacia of the patella has been an accidental finding, more or less pronounced.

43 cases remain. All these I have recently either examined myself, or they have received an explicit formula of questions, which they have answered. The findings as to this group of 43 patients are briefly as follows. The oldest patient has been 57 years of age, the youngest one 13. Thirteen have had bilateral lesions. Twelve of them have had osteo-arthritis, revealed by X-ray pictures or operation, three of a marked degree, two of a moderate degree and the rest of a slight degree. In most of these cases the changes in cartilage have been marked; in 5 they were moderate.

Results of the Treatment: Few patients recover sufficiently to be able to endure any efforts of utmost strain. I therefore give them the advice to increase their exercise gradually up to a high degree, but they are warned against excessive exercise. I have divided the improved cases into 3 different groups. In

the first group I place those, who are free from discomfort. These are, for example, able after proper training to go skiing 20 miles in the mountains, but they cannot go 30 miles without symptoms. They may be able to work all the day for example as sailors or as servants having to run up and downstairs all the day etc. They have no pains or swelling, and their condition has become stationary. The number of those, thus free from discomfort is 17, or 40 %. The second group of patients walk without trouble in their daily work and can stand considerable exertion, though less than the first group. The number in this group is 11, or 26 %. The third group of patients go without trouble in their daily work and are able to stand moderate exertion. Their number is 15, or 34 %. No patient is unimproved or worse than before. Summarizing the results of the operations it may be said, that all of the patients have been improved to a marked degree and about 40 % to an exceedingly high degree. Operations undertaken on the above-mentioned indications may be considered to be a treatment of great value. The knees of all these patients show no hydrops and no swelling on normal exertion. On exertion 34 % feel pain and develop swelling, but these phenomena disappears again after one or two days.

I have had some patients who in spite of my advice refuse operation, and I have followed them for years. In their daily walking they are not troubled very much, but even on moderate exertion their old difficulties return with protracted periods of hydrops etc. I am going to demonstrate such a patient, whom I have been observing for 7 years and who wishes to be operated upon next year.

Finally I would like to show you some of my patients and give you a brief summary of their histories.

DISCUSSION

H. Sundt, Stavern:

In contrast to practically all other authors, the speaker was of the opinion that *in chondromalacia of the patella the synovitis is the primary lesion and that the changes in the cartilage*

are secondary phenomena. Clinically, indeed, we find in these cases a synovitis that often is associated with hydrops.

On the performance of arthrotomy we meet again and again with a synovial membrane that has undergone a quite considerable hypertrophy, which now is surrounding the patella like a wall, extending here and there in over the cartilagenous surface of the knee cap. Something similar applies in a good many cases also to the articular surfaces of the femur. Furthermore, the synovial membrane is often thickened quite considerably back of the inferior ligament of the patella. To me it seems, one cannot help getting the impression that synovitis is the primary lesion, and that the most frequent, comparatively small changes in the patella and articular surfaces of the femur are secondary phenomena. In cases, where the reverse appears to have taken place, the explanation may possibly be that the synovial changes have been regressing while the cartilaginous have been progressing. And, as you know, there is no regeneration of this cartilage.

The pathogenesis was assumed to be as follows: The injured synovial membrane produces an *abnormal* synovial fluid, and as the articular cartilage to a large extent receives its nutrition from the synovial fluid, an abnormal composition of the latter will cause nutritional disturbances in the cartilage and lead on to its degeneration.

The diagnosis is an *operative* and *histological* diagnosis.

As to the etiology, it is not to be denied that the traumatic injury plays a great rôle. Leaving out of consideration here the cases reported by *Büdingen* a great many are still to be regarded as directly traumatic lesions. From the literature the speaker had collected 52 cases of primary chondromalacia of the patella, including his own cases. Of these 52 patients 39 give a history of traumatic injury. At any rate, this lesion may be said to *originate largely after traumatic injury.*

Whether the injury be the direct cause of the disease is very questionable, however, and the speaker thinks that this question is to be answered in the negative. The speaker pointed out that the lesion often is bilateral, that it appears especially

within a certain age-group, and most often in women. In 57 cases, including those the speaker had treated operatively, 21 patients were men, and 36 women—*i.e.*, women made 63 % of these patients.

The data given here might be suggestive of more remote etiological factors as playing a considerable rôle in the production of this affection as it is found in joints and in aseptic necrosis of bone. In the opinion of the speaker, these more remote causes played a disposing rôle, while the injury of a slight infection may be assumed to play the rôle of the *provoking* cause.

The speaker was not inclined to subscribe to the view that arthrosis deformans of the knee might be cut down by removal of the malacic cartilage. Arthrosis deformans is a constitutional disease the combating of which cannot be accomplished by means of a knife.

The speaker also mentioned that among all his operations on the knee-joint he was not able to remember any case in which he had seen detached lamellæ of cartilage from the patella as described, for instance, by Alemann and Øwre, as originating from the patellar cartilage until a few weeks after the operation performed on a woman, aged 21 years, with clinical symptoms of chondromalacia of the patella, and in the articular cartilage of whom he had found a number of small lamellæ of cartilage, partly attached like polyps to the synovial membrane, partly lying free in the cavity of the joint.

Microscopic examination of these lamellæ showed that they consisted of cartilage. The patellar cartilage showed merely a Y-shaped crack at its most prominent part, and hence it was difficult to say whether all the observed lamellæ might originate from the patella.

As to the treatment, when the patients entered the hospital soon enough for treatment with immobilization, the speaker employed this method—with a plaster cast for a month or two. If the symptoms were very annoying, or if they failed to improve on this treatment, arthrotomy was performed and the affected patellar cartilage was extirpated. On the whole, this

treatment gave excellent results; but it happened now and again that the symptoms would not quite subside, especially the retropatellar crepitation.

In a young girl with symptoms of bilateral chondromalacia of the patella, an operation was performed on the knee in which the process seemed most advanced. The patellar cartilage was found to be involved over a band-shaped area, measuring from $1\frac{1}{2}$ to 2 cm. in width, stretching clear across the cartilaginous surface of the patella, where the cartilage was uneven and studded with wart-like excrescences. Another part of the cartilage showed a fissure. The morbid cartilage was removed. After 10 months the patient returned for reexamination: She was feeling very well in the operated knee, and she was fully able to work. The only thing that troubled her now was an enormous crepitation in both knees that could be heard even at a distance of 18 metres.

S. von Rosen, Härnösand:

The genesis of chondromalacia of the patella might not be so simple as that. A hard blow or sharp impact against the patella may give rise to injury of the cartilage with secondary malacia. This, I think, is not to be disputed.

There is another cause of this lesion, however, which I think may require some mechanical explanation. I have observed three cases of loose joint after injury, among others, to the posterior cruciate ligament; and on operation they showed a markedly pronounced degeneration of the patellar cartilage. These patients presented a subluxation of the tibia depending upon the degree of the injury to the ligaments. In such cases of subluxation one will often notice how the leg is displaced anteriorly with regard to the femur when the muscles of the thigh are contracted. This naturally implies that the patella in each extension of the knee is pressing more or less hard against the patellar surface of the femur, so that the patella thus is exposed to an abnormal friction or, if you prefer, to repeated contusion. Accordingly, in these conditions one will often meet with marked crepitation from the posterior surface of the patel-

la, and in roentgenograms one may observe irregularities in the form of notching of the posterior surface of the patella as a sign of patellar chondromalacia.

In cases of subluxation of the patella, with lateral dislocation of the patella and of the extensor muscles of the knee, one finds not infrequently a limited area of chondromalacia of the patella at that point of the patella which in extension of the knee slides up and out over the lateral margin of the *facies patellaris*. In such cases the *facies patellaris* is often remarkably narrow. Even in these cases it seems obvious to assume a mechanical friction as the cause of the chondromalacia—the more so as damage to the cartilage even on the lateral wall of the patellar surface of the femur often is limited to the very area where the patella on extension of the knee slides up over this surface, and the damage to the cartilage is consistent in both places. As such conditions of subluxation, with or without valgus deformity of the knee, are quite common in adolescent girls, it may explain plausibly why chondromalacia of the patella is such a common phenomenon among women. When in these cases the knees begin to give trouble already in the young years, it seems rational, like *Frising*, not to limit the operative treatment to excision of the damaged articular cartilage but also carry out a plastic operation on the vastus muscle as a *Krogius* operation modified more or less according to circumstances.

F. Langenskiöld, Helsingfors:

One of the symptoms produced by chondromalacia of the patella, which to me seems rather important, is the attacks of locking of the knee-joint, most often fairly easy but sometimes rather troublesome, and then these symptoms may be suggestive of a loose body or a dislocated miniscus. Crepitation may be absent or, if present, it may be localized to the patella.

A few times I have seen chondromalacia of the patella concurrent with osteochondritis dissecans in one of the condyles of the femur—something I have not seen mentioned in the literature. It seems to me that it might be worth while to in-

investigate whether there might be any connection between these diseases.

H. Nilsonne, Stockholm:

In invalidity disablement insurance (covering occupational accidents) the diagnosis of chondromalacia of the patella has become more common in recent years, and hence it has been increasing in importance as far as insurance is concerned.

The institution of invalidity insurance is here faced by a social question that often involves considerable difficulties.

It is true that many authorities claim that chondromalacia of the patella is of traumatic origin. On the other hand, several circumstances suggest that patellar chondromalacia may be a constitutional disturbance.

As thus the etiology is rather obscure, we have to be fairly explicit in our requirements concerning the nature of the traumatic injury.

The standpoint adopted by the Royal Insurance Council in so far as it may be deducted from resolutions in recent years is about as follows: The traumatic injury must have been of a certain severity, and it must have given some immediate results. The traumatic injury must have hit against the patella (*i.e.*, a patellar concussion). Indirect injury, distortions with hæmarthrosis, do not afford a sufficient basis for the assumption of causal connection. The chondromalacia must have made its appearance within a length of time that may be looked upon as reasonable for the development of the necrosis of the cartilage.

G. Odelberg-Johnson, Vejbyslätt:

Silfverskiöld claims that hyaline cartilage does not regenerate. The normal wear of the articular cartilage is replaced through proliferation in the deep layers of the cartilage. Large defects in the articular cartilage, on the other hand, may be replaced only to a slight extent by hyaline cartilage, while such defects are made up chiefly by fibrous cartilage (Bauer & Bennett). The cartilaginous defect, however, which is partly of

hyaline type is produced anew in the organism in the callus of fractures (Cornil & Coudray, Leriche & Policard, Rigal & Vignal, J. Hertz). Pseudarthroses may show the presence of cartilage of fibrous type, cartilage of a transitional type, and cartilage of hyaline type.

O. Aleman, Stockholm:

My first assistant, Dr. Stig Karlson, is occupied at the present with a reexamination of my entire material of chondromalacia of the patella, operated cases as well as non-operated, ever since 1916. I hope that this investigation will add something to our knowledge about chondromalacia of the patella. While waiting for the final results I may perhaps be allowed to make a couple of remarks on some details.

As far as the etiology of chondromalacia of the patella is concerned we can present at present only some theoretical speculations. I subscribe to the view of a traumatic etiology and I look upon the rupture of the articular cartilage after traumatic injury to the patella as the primary lesion. From this damage the chondromalacia gradually develops—it may take a good long time, even years—as a lesion of the articular cartilage which in turn brings about a deforming arthritis.

One of the speaker asserted that the articular cartilage, like other tissues of the body, is capable of regeneration. This view, I think, may not be correct. Damaged or otherwise injured articular cartilage never shows any microscopic sign of regeneration. Spurious healing may take place through the production of connective tissue cartilage—something I have observed on rearthrotomy in a case where the cartilage had been excised before.

S. von ROSEN, HÄRNÖSAND:

CASE OF PATELLAR OSTEITIS

(Abstract is not submitted.)