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FRACTURE OF THE KNEE JOINT

LATERAL CONDYLAR FRACTURE OF THE TIBIA

Poul S. Rasmussen (Gothenburg, Sweden)

Controversy still exists as to the best way of treating these fractures. Some surgeons take a very active attitude, suggesting open reduction in all cases with more than 5 mm depression of the joint surface, whereas others believe that a satisfactory result can be obtained in most cases by non-operative means.

On the basis of an analysis of 260 patients treated during the years 1959-1965, it is suggested that the decision of operative or non-operative treatment should be based not on the radiological appearances of the fracture, but mainly on the clinical findings.

I found 184 (71 per cent) lateral fractures in the series, with 37 split fractures, 84 compression fractures, and 63 combined split-compression fractures. The compressive element causes a depression of part of the lateral tibial plateau. This, in turn, in some cases upsets the lateral stability of the knee joint. Whether this happens or not depends on the extent and localization of the compression more than upon its depth. An anteriorly located compression makes the knee joint unstable in full extension, while a posterior compression produces instability in slight flexion. Even centrally located compressions and most compressions combined with a lateral split fragment often produce instability. Only the compression that produces instability in full extension—and this can be determined by clinical examination only—should be treated by open surgery.

Preliminary results to support these principles of treatment were reported and will be published in detail later.

FRACTURES OF THE TIBIAL CONDYLES

Georg Bakalim & Eero Wilppula (Helsinki, Finland)

The material comprises 196 personally followed patients with 197 fractures of the tibial condyles out of 291 cases treated in the Orthopaedic and Accidents Clinic, Helsinki, during the period 1962-1967. In 128 of the patients the fracture affected the lateral and in 38 the medial condyle. Bicondylar fractures of the T and Y types were present in 31. More than half the injuries were sustained in road accidents. 53 per cent were treated conservatively. Out of the displaced fractures 70 per cent had been treated by operation.

The results were assessed by the system of Hohl & Luck published in 1956. A correlation was found between the reduction and the end result. Therefore, efforts should be made to obtain a good reduction, often requiring operation, as severe cases cannot be repaired by closed reduction. Injuries to ligaments are common, and great attention should be given to their diagnosis and primary treatment. Insufficiency of ligaments was found at follow-up without condylar deformity in 26 cases and with condylar deformity in 14. Out of these cases only 4 had been diagnosed and sutured primarily. In the presence of condylar deformity, damage to the ligaments may occur later due to over-stretching. An exact reduction should therefore be the aim, also out of regard to the ligaments. Relatively long periods of immobilization were used, average 9.4 weeks, and this need not prevent acceptable functional end results, if active training of movements is controlled by the surgeon and quadriceps exercises are started during the period in plaster. The patients were not allowed weight-bearing for an average of 11.7 weeks. It was not possible to demonstrate any correlation between the length of the non-weight-bearing period and the end result.

A REVIEW OF 200 TIBIAL CONDYLAR FRACTURES

Hugh Dovey & Jan Heerfordt (Copenhagen, Denmark)

All cases were treated in Bispebjerg Hospital, Dept. M, Copenhagen, with a follow-up of 11/12-10 years.

62 cases were operated, mainly by Palmer's technique. Cancellous "Kiel" bone appears to be the ideal grafting material.

Early mobilization gave the best final mobility, and there was no evidence that it predisposed to lateral instability or valgus deformity. Immobilization in corrective plaster did not seem to correct the valgus tendency.

Permanent bony depression, increased valgus, and radiological osteoarthritis were directly associated, but clinical results were appreciably poorer only when the valgus exceeded 10°.

Clinical results after operation were rather less satisfactory than after conservative treatment, whereas radiological results were better after operation— independently of classification by fracture type or by degree of depression. In each group the operations have been done on the more serious lesions, so presumably something has been gained by operation.

Both clinical and radiological results were better in cases where the meniscus was retained.

X-rays frequently showed marked permanent depression despite a good clinical result, and arthrograms as well as autopsy specimens demonstrate that the joint surface is re-formed by fibrocartilage. It is possible that we attempt to achieve by operation a result that Nature herself can attain with less risk to the patient.

FOLLOW-UP ON 50 CASES WITH FRACTURES OF THE LATERAL TIBIAL CONDYLE TREATED PREDOMINANTLY BY OPERATION

Jan Heerfordt & Valther Mouritzen (Copenhagen, Denmark)

This study from the Department of Orthopaedic Surgery, Rigshospitalet, University of Copenhagen, is an appendix to the one reported above from Bispebjerg

Hospital (hereafter called the BBH series). The shortest follow-up period is 18 months. As in the BBH series we used Hohl's classification into types and Hohl & Luck's follow-up classification. The material comprises displaced fractures of the lateral tibial condyle. 122 cases of the BBH series may be assigned to the same group and were compared with the present material. The most essential difference between the two materials was found in the *group with > 10 mm primary depression*. All patients of the present series were treated by operation, whereas this was the case with only a little more than half the patients of the BBH series. The clinical results were somewhat better in the present series than in that from BBH. On the other hand, the *group with 3-10 mm primary depression* showed better results in the BBH series which included a smaller percentage of operated cases. With respect to the *primary* as well as the *persisting* degree of depression, the results were identical in both series. These findings would appear to indicate that it is rewarding to operate in the very severe cases and to abstain from operation in the milder ones. Incidentally, good and poor clinical results appear to be scattered rather capriciously over the series, whether or not operation had been performed, although the results seem to be to some extent dependent upon the *primary* severity of the injury. In the BBH series mobilization of the knees had on the whole been allowed earlier than in the present series, and a correspondingly better mobility had been obtained.

TIBIAL CONDYLAR FRACTURES

Ulf Lucht & Søren Pilgaard (Århus, Denmark)

A prospective investigation of 109 tibial condylar fractures from the period 1959-1968 was discussed. 47 per cent of the fractures were treated by operation. The follow-up examination indicates conservative treatment in non-displaced fractures and in fractures with a displacement of less than 10 mm. The grading criteria of Mason Hohl & J. V. Luck (1956) were used in assessing the functional and anatomical results. According to this grading there were 94 per cent excellent and good *functional* results in the group with a 3-10 mm depression, when they were treated conservatively, and 78 per cent excellent and good functional results, when they were treated by operation. The *anatomical* results were excellent and good in 59 per cent of the conservatively treated and in 61 per cent of the operated cases.

In the authors' opinion early active exercises are important for obtaining optimum results in fractures of the tibial condyles.

CONSERVATIVE TREATMENT OF TIBIAL CONDYLAR FRACTURES

Jørgen G. Ibsen & Niels Mossing (Glostrup, Denmark)

Out of 87 patients admitted with tibial condylar fractures to Surgical Department A of the Glostrup Hospital, Copenhagen, during the period 1958-1969, 71 with 72 fractures were seen after an average follow-up period of 5.2 years.

The treatment had been predominantly conservative. No patient was treated primarily in a plaster cast. Only 11 patients had osteosynthesis. Osteosynthesis was only performed in cases with one large, tilted fragment. Otherwise, the treatment was non-weight-bearing or traction with early active training of knee

joint function. The functional and anatomical results were classified according to the criteria of Hohl & Luck (*Journal of Bone and Joint Surgery* 1956: 38 A: 1001-18). An acceptable functional result (excellent + good) was obtained in 68 out of the 72 fractures, whereas the anatomical result was acceptable in 50.

It is concluded that the results obtained by the above-mentioned therapeutic principle are satisfactory and that in assessing the late results the radiological appearances need not be attributed with decisive importance.

OSTEOTOMY ON THE TIBIAL TUBEROSITY IN FRACTURES OF THE TIBIAL CONDYLE

Sven Olerud (Uppsala, Sweden)

In the more extensive tibial condylar fractures the usual lateral incisions often afford a poor intra-articular access. This restricts the possibilities of reconstructive procedures. In the cases of central depressions, the problem may be solved technically by osteotomy of the lateral condyle, a factor which greatly facilitates the reduction of the dislocated articular surface.

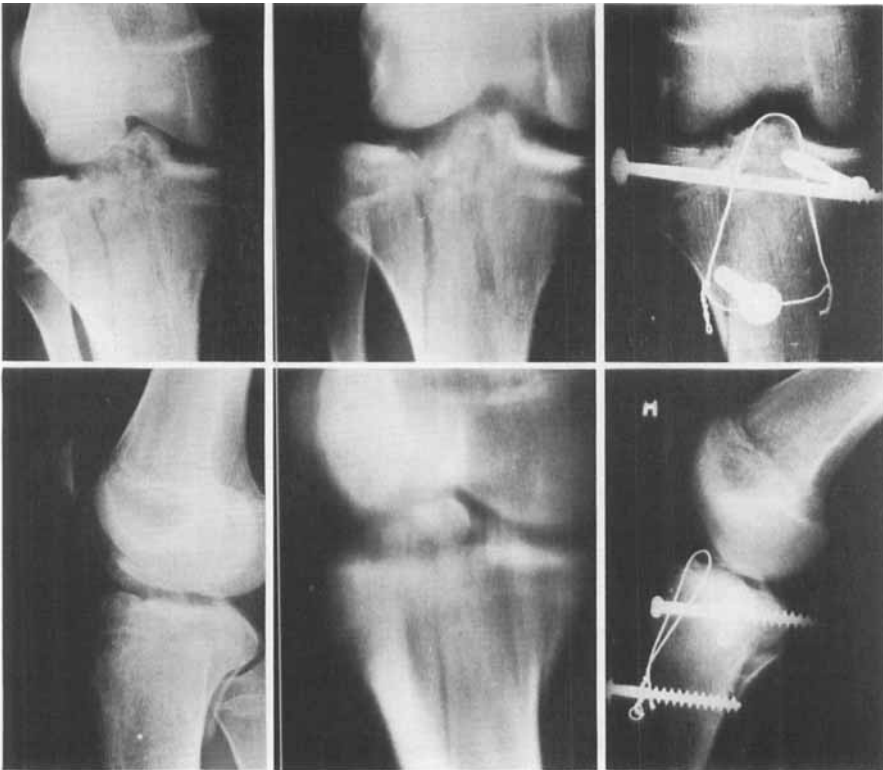


Figure 1.

Another possibility of a better approach is osteotomy on the tibial tuberosity, dividing the retinacula to both sides and reflecting the patellar tendon and patella. Thereby, the knee joint is rendered more easily accessible.

By the following 2 series of illustrations I merely want to call attention to the possibility of using such a technique.

The first case is that of a 17-year-old patient who sustained a severe knee injury (Figure 1) when falling off his moped. The large fragment of the lateral condyle is depressed. The injury comprises mainly the central parts of the knee joint, with an oblique position of the joint surface fragment. This is distinctly apparent from the tomographic exposures, and in the central pictures a large anterior fragment with attachment of the anterior cruciate ligament is seen to be separated from the eminence. By the technique mentioned a very good exposure of the central parts of the joint was obtained. After the fracture surface had been cleaned, the lateral condyle could be placed almost accurately *in situ*. By a cerclage wire the fragment of the eminence as well as the attachment of the anterior cruciate ligament could be united. The radiological result of the reconstruction was extremely satisfactory. The osteosynthesis was considered stable, so that the advantage of immediate mobilization could be utilized. Three months after the accident the patient had practically recovered: the knee joint is entirely stable in the frontal and in the sagittal planes and the flexion range is 0-125°.

The next case is that of a 42-year-old man who had fallen off a ladder and sustained a bicondylar depression fracture. The entire condylar area is displaced about 45° backward, the lateral condyle is depressed by more than 1 cm, and the medial condylar fragment by 3-4 mm. By drilling and screwing, it was ascertained that the presupposition for a good basis of a tibial tuberosity screw was present. We therefore embarked upon osteotomy of the tibial tuberosity, opening the knee joint anteriorly. This created a favourable condition for a more exact reconstruction of the tibial condyles. Postoperative X-rays show that both condylar plateaus are reduced to an almost exact position.

This technique involves a considerable exposure and of course a risk of not succeeding in satisfactorily fixing the tibial tuberosity fragment. Therefore, it should perhaps be reserved for special indications in which it affords an excellent access.

DISCUSSION:

B. G. Weber (St. Gallen, Switzerland)

The discussion whether shaft fractures should be treated by closed methods or by open reduction and internal fixation is still going on.

It is easier to make the decision in cases of fractures involving joints on the basis of the following calculation. On the left side there are the items requiring restoration, on the right the different kinds of treatment with the results to be expected:

| | Primary fixation in plaster | Functional treatment | Open reduction + plaster fixation | Open reduction + rigid fixation + functional treatment |
|---------------------------|-----------------------------|----------------------|-----------------------------------|--|
| Union of fracture gaps | + | + | + | + |
| Restoration of function: | | | | |
| mobility | — | + | — | + |
| power | — | + | — | + |
| Restoration of congruence | — | — | + | + |

Note that only the last-mentioned therapeutic possibility offers the best chances of full recovery, but only provided that the surgeon is experienced and the hospital conditions in favour of a low infection rate.

Olov Lindahl (Linköping, Sweden)

The great question to the patient with fracture of the tibial condyles is whether he is going to have pain on function, or even at rest, after the fracture has united. We do not yet know whether conservative treatment or operative treatment (both of the best quality with immobilization) affords better results. Müller's table is a kind of propaganda for operation, but does not pay regard to pain and aching. These symptoms may easily be imagined to be on the whole more common following operative than following conservative treatment.

Sten Friberg (Stockholm, Sweden)

Dr. Rasmussen mentioned in passing the desirability of avoiding an intraarticular procedure. I am not sure that this is the right attitude. The intraarticular changes are often greater than the clinical examination would lead one to believe. For instance, I have seen cases in which the meniscus was completely detached, lying as a cord at the bottom of the depression.

In answer to the chairman's question I should nevertheless like to warn against meniscectomies except on decisive indications. It is true that slalom skiers and football players can return to their sport soon after meniscectomy. However, at the site of the meniscectomy, osteoarthritis will often appear in 15–20 years. In considering the indications for meniscectomy it must be borne in mind that the lateral meniscus is more important than the medial one to articular congruence. The surface of the lateral tibial condyle is saddle-shaped unlike that of the medial one which is biconcave.

Lastly, I should like to point out that according to analyses of insurance materials, meniscectomized patients are to a marked extent receiving disablement pension, i. e. having a disablement of 10 per cent or over.

Hugh Dovey (Copenhagen, Denmark)

Concerning the problem of removing the meniscus, our results show that it should be retained if possible. In our entire series there was only one patient with

symptoms that could possibly be attributed to a meniscus lesion, and these symptoms were not severe enough to warrant treatment.

In the operated cases, both clinical and radiological results were better in cases where the meniscus had been retained, and the two autopsy specimens showed definite thickening of the meniscus which formed a cushion covering the fracture surface to which it was effectively anchored by fibrous tissue.

SUPRACONDYLAR, INTRAARTICULAR FRACTURE OF THE FEMUR.

RESULTS OF OPERATIVE RECONSTRUCTION

Sven Olerud (Uppsala, Sweden)

Supracondylar intraarticular fracture of the femur is difficult to deal with, and opinions concerning its treatment are divided. Neer et al. (1967), on the basis of a material of 110 cases, still recommend conservative treatment, since internal fixation had given a very poor result in almost 50 per cent of their cases. Since 1965 we have adjusted a surgical procedure for this type of fracture in the University Hospital, Uppsala, Sweden.

Our experience is based upon a material with a 1-5 year follow-up, comprising 15 cases in the age range 15-77 years. 6 were females. The causes of the fracture were road accidents in 11 cases, ice hockey in one, and falling on stairs in 3. 7 out of the 15 fractures were open, the shaft of the femur penetrating the quadriceps muscle. Moreover, 4 patients had multiple injuries.

The classification used by Neer and his associates was also used for the present material:

- Group 1: Wedged fracture with separated condyles, but without major displacement: 2 patients.
- Group 2: Separated condyles and considerable displacement of the metaphyseal fracture, to the lateral or medial aspect: 5 patients.
- Group 3: Separated condyles, but in addition to a metaphyseal fracture also a femoral shaft fracture, often comminuted: 8 patients.

5 of the fractures—all open— were treated immediately by operation. After initial traction therapy, 9 were operated upon within one week, whereas one patient did not have the operation until 3 weeks after the accident.

The operative treatment aimed at exact reconstruction and stability of the fracture. Thus, all the cases had osteosynthesis by an AO angular plate combined with a screw. Adequate exposure of the distal end of the femur was obtained by osteotomy of the tibial tuberosity, elevating the patella and the extensor apparatus. The operative method is apparent from the following series of illustrations.

A metaphyseal defect arising at the reduction was filled with a cancellous bone graft in 6 cases, 5 of which had open fractures.

Early postoperative mobilization was practised. Weight bearing was allowed at the end of about 3 months.

Complications: Infection occurred in 3 cases. All responded to adequate antibiotic therapy and surgical procedures. *Pseudarthrosis* occurred in one case, but following bone grafting consolidation was obtained. *Re-fracture* occurred at the junction of the femoral shaft and the metaphysis after removal of the plate in one case.

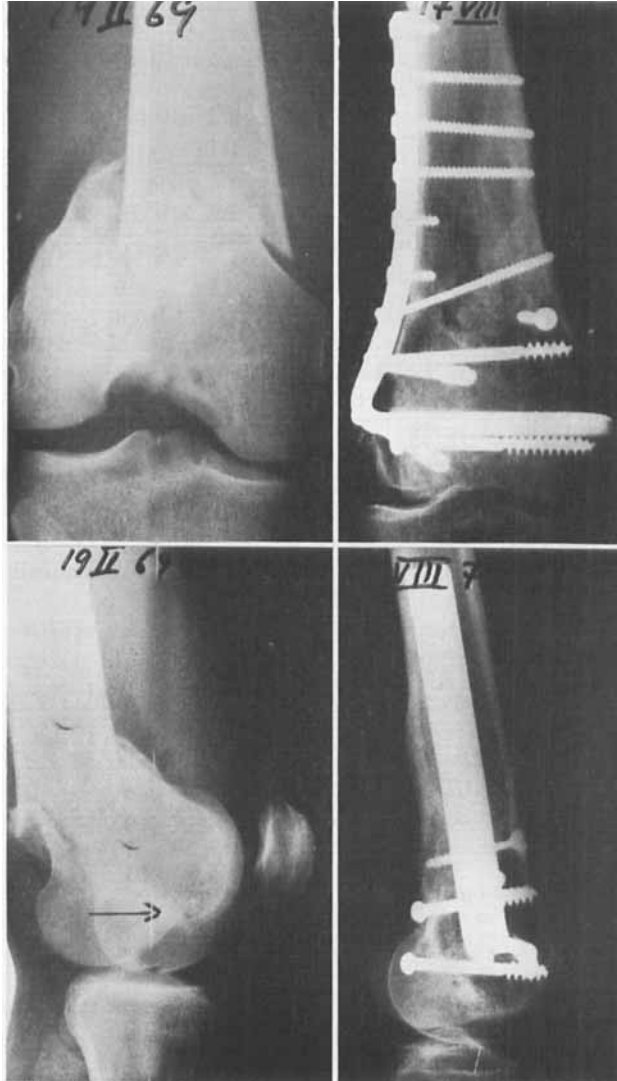


Figure 1. Intracondylar fracture of the femur with a metaphyseal comminuted fracture zone. The lateral condyle is fractured also in the frontal plane, showing a displacement of several mm of the articular surface. Internal fixation has resulted in an exact anatomical reconstruction. The defect occurring in the course of the reduction has been filled with a cancellous bone graft.

Results: The majority of patients have obtained an extremely good function. However, four of the oldest patients use a stick, but only out of doors. One of the infected patients has greatly restricted mobility of the knee joint and thus does not walk stairs normally. All 15 patients are free of pain in their daily work. However, 4 report pain on exertion and another 3 feel changes in the weather. 7 patients have an almost normal range of mobility, i. e. more than 125°, 5 have 90–110° mobility, 2 have 70–80°, and one (one of the infected cases) has a range of only 25°. 4 patients show objectively a slight instability of the knee joint. One patient exhibits a $\leq 5^\circ$ varus deformity, one a $\leq 5^\circ$ valgus deformity, and one patient only has a shortening of 2 cm.

According to the criteria of Neer et al. (1967) of the end results, this operatively treated series shows, despite the complications, an excellent result in 12 cases, a good result in 2, and an unsatisfactory result in one case.

Our experience of operative treatment in supra-intracondylar fracture of the femur is extremely positive. Unlike Neer et al., we recommend stable internal fixation. With access to suitable osteosynthesis material and a satisfactory technique it seems possible to achieve success even in very severe fractures of this type (Figure 1).

Reference: Neer, C. S., Grantham, S. A. & Shelton, M. L. (1967) Supracondylar fracture of the adult femur. A study of one hundred and ten cases. *J. Bone Jt Surg.* 49-A, 591–613.

DISCUSSION:

Bent Barfod (Århus, Denmark)

The described approach obtained by drilling the tibial tuberosity and reflecting the patella and quadriceps muscle affords an excellent approach to comminuted fractures of the distal end of the femur. Treatment of the fracture by the AO system and fixation of the tibial tuberosity by a screw gives stability enough for movements of the knee joint to be instituted immediately. However, frequently there are large lacerations of the quadriceps muscle which have to be sutured. In my opinion, this indicates immobilization for about 3 weeks. Thereafter, there may be such tight adhesion of the muscles to the site of the fracture that the quadriceps has to be released by operation.

OPERATIVE TREATMENT OF PATELLAR FRACTURES

Juhani Nummi (Haukilahti, Finland)

248 operated cases among 707 patellar fractures treated in the Clinic for Orthopaedics and Traumatology, Helsinki University, Central Hospital, during the years 1961–1967 are presented. 112 cases were operated upon by reconstructive methods, 112 by partial excision, and 24 by patellectomy. Postoperatively the patients were immobilized in plaster and taught quadriceps exercises.

Complications occurred in 11 per cent, including one death. Slight wound infection was most common. 4 patients treated by cerclage sustained re-fracture.

The period of disability, mean 121 days, was shortest after partial excision. One year postoperatively 74 per cent of the patients, mainly those treated by recon-

struction, still had complaints. Patients with a long immobilization period had most complaints, especially limitation of movement.

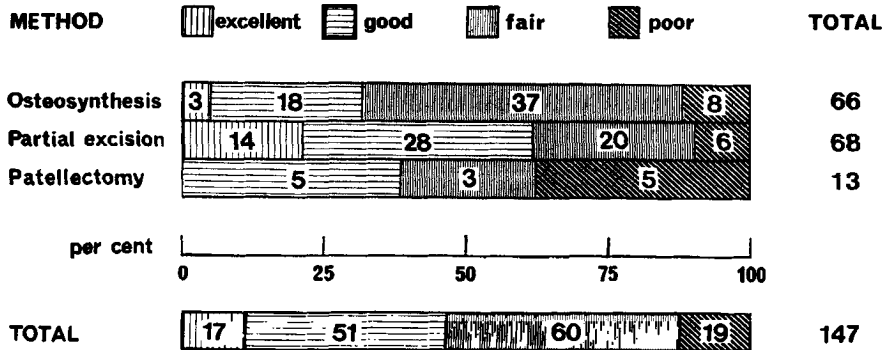
In 19 cases bone necrosis developed, all but one after cerclage. The convalescence was delayed and arthritic changes developed later, but all cases united.

At follow-up examination 1-8 years later 155 cases were seen.

19 were disabled or able to do only light work. 14 per cent had no complaints, 56 per cent were satisfied, but had minor complaints, 30 per cent were dissatisfied and had more severe complaints. Arthritic changes had developed in 76 per cent.

The end results (see figure) were best after partial excision, unsatisfactory after reconstructive methods, and most unsatisfactory after cerclage.

RESULTS IN DIFFERENT METHODS OF OPERATION



DISCUSSION:

K. Harry Sørensen (Odense, Denmark)

I should like to warn against primary patellectomy in comminuted patellar fractures, as the torn extensor apparatus is difficult to suture. There is apt to be tension, leading to limitation of movement. Instead, cerclage should be performed, even though the joint surface cannot be made smooth. After union, patellectomy may be performed secondarily. At that time, the extensor apparatus has healed. It is our experience that patellectomy is very rarely indicated, even after comminuted fractures (cf. *Acta orthop. scand.* 34, 198, 1964).

POSTERIOR CRUCIATE LIGAMENT—RECONSTRUCTION BY TRANSPOSITION OF THE POPLITEAL TENDON

Bent Barfod (Århus, Denmark)

A new method for reconstruction of old ruptures of the posterior cruciate ligament. The tendon to the popliteal muscle is detached from the lateral femoral condyle and transposed into the intercondylar fossa where it is fixed to the femoral attachment of the posterior cruciate ligament (Figure 1). A patient who had this operation was seen after a follow-up period of 3½ years. He had satisfactory function, and in particular no difficulty in the form of unlocking the knee from an extended position.

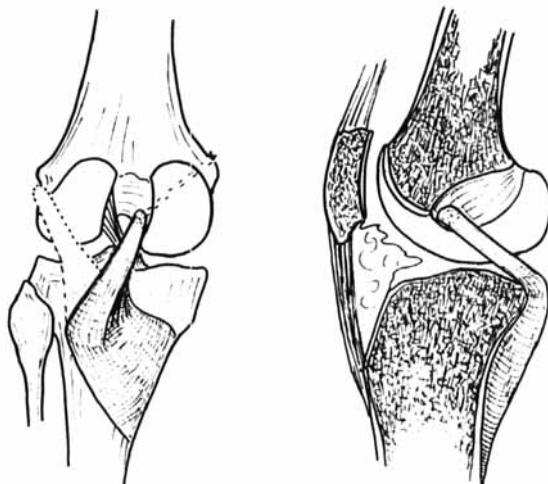


Figure 1.

OPERATIVE TREATMENT OF RUPTURE IN THE MEDIAL COLLATERAL LIGAMENT OF THE KNEE

Arne Øster, Kaj Okholm & Johs. Hulgaard (Århus, Denmark)

A total of 56 knees with rupture of the medial collateral ligament were treated, all by operation, in the Orthopaedic Hospital, Århus, during the period 1956-1967. Of these knees 50 were seen at follow-up.

The rupture affected predominantly youngish persons (84 per cent under 40) of the male sex (94 per cent). The most common cause was sport (72 per cent). Lateral instability, tenderness, and oedema at the ligament were the main symptoms and signs. As a rule, it was the deep ligamentous layer which was ruptured, but in nearly half the cases both the deep and the superficial layers were ruptured and most often in the proximal part. A meniscus injury was present in about 30 per cent and injury to the cruciate ligament in almost half the cases.

At follow-up 2½-13 years after the operation all the patients were working. 20 per cent of the athletes had given up their sport because of the injury. 20 per cent of all the patients had complaints in the form of occasional pain or a feeling of instability in the knee. The poorest results were recorded among patients who had the operation at a late stage and at an age over 40. Among the poor results many had atrophy of the thigh. The common injuries to the cruciate ligaments contributed to the persisting symptoms from the knee.

SURGICAL TREATMENT OF OSTEOARTHRITIS OF THE CARPO-METACARPAL JOINT OF THE THUMB

Andreas Weilby (Hørsholm, Denmark)

A total of 48 cases have been treated, with improvement of the pain in 44.

Technical complications: 2 cases of mild dystrophy, 2 cases of injury to a

branch of the radial nerve, 2 cases of Kirschner wires drilled into the carpal canal, and 2 cases of broken wires in bones.

The operations were as follows:

Arthrodesis of the carpo-metacarpal joint of the thumb (18 operated, 3 re-operated). Bandage worn for more than 3 months. Bony union in 12, fibrous ankylosis in 6. Good stability in the carpo-metacarpal joint of the thumb, restricted mobility of the thumb as a whole, and normal strength of grasp.

Complications: Inadequate position in 2 cases, progressing osteoarthritis in the joint between the greater multangular bone and the navicular bone in 2 cases (milder in 5).

Indication: Young patients, sequelae of fractures, and heavy work.

Contra-indications: Osteoarthritis between the greater multangular and navicular bones, stiffness of the distal interphalangeal joint and in the metacarpophalangeal joint.

Excision of the greater multangular bone (17 operated cases). Bandage for 6 weeks. 5 patients had varying degrees of carpo-metacarpal instability. Mobility in the joint 75 per cent of normal. Appreciably reduced strength in movements of the 1st metacarpal bone and in grasping.

Complications: Instability in the first carpo-metacarpal joint (counteracted by tightening the capsule, shortening of the abductor pollicis longus, and fixation of the 1st metacarpal bone in an abducted position by a Kirschner wire).

Indication: Patients with light work who want good mobility, stiffness of the interphalangeal and metacarpophalangeal joints of the thumb, adduction contracture of the thumb, osteoarthritis between the navicular bone and the greater multangular bone.

Contra-indication: Heavy work.

Alloplasty (Swanson prosthesis) (13 operated cases, 2 prostheses removed). Bandage for 6 weeks. Better stability in the carpo-metacarpal joint of the thumb, and better mobility than following excision of the greater multangular bone. Strength in movements in the carpo-metacarpal joint and in grasping almost normal.

Complications: 4 cases of dislocation, subluxation and dislocation of the prosthesis out of the shaft of the metacarpal bone. (Counteracted by bandaging in an abducted-extended position which also secures a correct position.)

Indication: As that for excision of the greater multangular bone.

Contra-indications: Pre-existing contracture of the 1st web space.

DISCUSSION:

Bent Barfod (Århus, Denmark)

This condition is not uncommon, but it is difficult to decide which treatment is best. There is invariably more or less degeneration of the carpo-metacarpal joint capsule, and on the background of the named dislocations of the Swanson prostheses it was asked whether the capsule had been strengthened in the course of the operation, for instance by a piece of the abductor pollicis tendon.

ARTHRODESIS OF THE WRIST

K. Rechnagel (Copenhagen, Denmark)

During the period 1962-1968 a total of 60 wrist arthrodeses were performed in the Orthopaedic Hospital, Copenhagen, partly for pain or contracture, and partly in order to stabilize the wrist in cases of various pareses.

The standard technique is an ulnar approach, resection of the head of the ulna, and fixation by a bone graft, as a rule from the iliac crest.

In cerebral palsy arthrodesis was performed by wedging the radius into the carpus in order to obtain shortening.

With few exceptions all the patients have been relieved of pain. In osteoarthritis and lunate malacia 17 out of 22 patients are back to normal work; 4 are not working because of other diseases. In spastics the result was almost exclusively cosmetic improvement.

A graft from the iliac crest is better than one from the ulnar bone, 4 out of 14 ulnar grafts having failed, while all 31 with iliac grafts united.

Twelve of the patients definitely did not have carpo-metacarpal union, but only 2 of them had mild pain when working, so that it does not seem to be necessary to carry the arthrodesis as far as the base of the metacarpal bones.

RECURRENT EFFUSION IN THE KNEE JOINT
FOLLOW-UP ON 41 CASES

Veijo Vahvanen & E. V. S. Koskinen (Helsinki, Finland)

The series comprised 41 patients showing recurrent mono-articular effusion of the knee joint. The onset of the disease was "subacute" and the causes obscure. Obvious injuries, infections, or other diseases of bone or cartilage were excluded. The series was classified into different diagnostic groups on the basis of clinical examinations in hospital. Attention was mainly directed at the aetiology and the results of operative and conservative treatment in cases of doubtful synovitis. In 7 cases (17 per cent) the histological appearance of the synovial membrane

Table 1. Treatment in the different diagnostic groups.

| Group | Synovectomy | Arthrotomy etc. | Osteotomy | Conservative |
|---------------------------------------|-------------|--------------------|-----------|--------------|
| Doubtful synovitis | 6 | 2 | 0 | 11 |
| Effusion and osteoarthritis | 1 | 3 | 4 | 1 |
| Traumatic effusion | 3 | 2 | 0 | 5 |
| Rheumatoid synovitis | 2 | 0 | 0 | 0 |
| Pigmented villono- dular synovitis | 1 | 0 | 0 | 0 |
| Total | 13 | 7 | 4 | 17 |

Table 2. Results in 37 followed cases.

| | Good | Fair | Poor | Total |
|------------------------|-----------|----------|-----------|------------|
| Operative treatment | 12 50% | 5 21% | 7 29% | 24 100% |
| Conservative treatment | 6 46% | 4 31% | 3 23% | 13 100% |
| Total | 18 49% | 9 24% | 10 27% | 37 100% |

Table 3. Results in operatively and conservatively treated cases in the different diagnostic groups.

| Group | Operative treatment | | | Conservative treatment | | |
|---------------------------------------|---------------------|------|------|------------------------|------|------|
| | Good | Fair | Poor | Good | Fair | Poor |
| Doubtful synovitis | 5 | 2 | 1 | 4 | 0 | 3 |
| Effusion and osteoarthritis | 2 | 3 | 3 | 0 | 1 | 0 |
| Traumatic effusion | 3 | 0 | 2 | 2 | 3 | 0 |
| Rheumatoid synovitis | 2 | 0 | 0 | 0 | 0 | 0 |
| Pigmented villono- dular synovitis | 0 | 0 | 1 | 0 | 0 | 0 |
| Total 37 cases | 12 | 5 | 7 | 6 | 4 | 3 |

resembled that seen in rheumatoid arthritis. Operative treatment was used in 24 cases (59 per cent), conservative treatment in 17 (41 per cent) (Table 1). Among the conservatively treated cases the end result was poor in 3; 4 patients were lost to follow-up. The results of operative treatment were good in 12 cases (50 per cent), fair in 5 (21 per cent), and poor in 7 cases (29 per cent) (Tables 2 and 3). The operative methods were synovectomy (13 cases), debridement or some minor procedure (7 cases), and osteotomy (4 cases). Synovectomy was successful in 8 cases (62 per cent), while the result was poor in 5 (38 per cent). The results of synovectomy would probably be even better in a series selected on stricter indications. The diagnostic and therapeutic problems were discussed.

A CLINICAL AND SEROLOGICAL STUDY ON THE EFFECT OF SURGICAL SYNOVECTOMY IN RHEUMATOID ARTHRITIS

Jørgen Sommer (Odense, Denmark)

This investigation comprises 64 patients with active rheumatoid arthritis who underwent, during a 2-year period, surgical synovectomy of one or more joints, on the average 2 large and 3 small joints, in the Department of Orthopaedic Surgery O of the Odense Hospital.

Immediately before the operation the patients had a complete clinical examination, including the status of their joints and X-ray examination of all joints. Moreover, all had preoperative serological studies.

Postoperatively the patients had serological studies 1, 2, 3, and 4 weeks, serological and clinical studies, including the complete joint status 3, 6, 12, and 24 months after the operation, on the last occasion with X-ray examination of all joints. The last patient was operated upon in November 1968, so that for a small part of the material the study has not been completed.

It may be concluded that so far the local effect of surgical synovectomy in active rheumatoid arthritis has been good. Mobility has improved, the pain, capsular swelling and accumulation of fluid have subsided or disappeared, and strength has increased. However, the disease progresses in the unoperated joints (active as well as inactive) and partially also in the operated joints, though more slowly. Accordingly, we are now more reserved in using surgical synovectomy for rheumatoid arthritis.

PYROPHOSPHATE SYNOVITIS

Göran Sundén & Anders Bjelle (Lund, Sweden)

The concepts articular chondrocalcinosis and pseudoarthritis were discussed, and a new terminology was suggested.

The condition is much more common in an orthopaedic clientele than is apparent from the current literature. The cases encountered since New Year 1969-1970 in the Lund University Clinic were reported. Certain tendencies in the symptoms and signs in this group of patients were discussed.

DISCUSSION:

Bo Nilsson (Malmö, Sweden)

Is there any proof that synovectomies will, in the long run, affect the progression of rheumatoid changes in the operated joints?

E. Hjalmar Larsen (Copenhagen, Denmark)

The originally positive attitude to synovectomy is cooling off in some quarters. Control materials would be of interest. Some measure of control is available, e. g. in cases with bilateral arthritis of the knees. It is encouraging to note how often the patients ask for the same operation on the other side.

The variations in the views may be due, *inter alia*, to different operative techniques. It is presumably decisive to the late result to make the synovectomy

radical. Thus, in the knee the synovial membrane must be removed from the posterior aspect and from below the menisci. In some joints it is difficult to attain a truly radical operation.

At any rate, we can agree that it has not proved harmful to remove the diseased synovial membrane which has a tendency to erode the articular cartilage.

HIP ARTHROPLASTY. COMPLICATIONS AFTER TOTAL HIP REPLACEMENT BY ROTATION ENDOPROSTHESIS

B. G. Weber (St. Gallen, Switzerland)

Total hip replacement has been used at the Department of Orthopaedic Surgery of the Cantonal Hospital, St. Gallen, Switzerland, since 1961. On the average, 450 operations are performed annually in the treatment of osteoarthritis of the hip joint: osteotomies, fusions, total hip replacements.

In two series 1220 total hip prostheses have been implanted (161 to March 1967: 455, Mueller; April 1967 to July 1970: 765, Weber).

In the course of this period three main problems have arisen:

1. Infection.
2. Anchorage.
3. Wear.

1. Infection

According to Charnley's findings, sterility conditions in our conventional theatre are in disfavour of asepsis. Agar plate cultures, exposed at different times throughout the day and night, show different quantities of bacterial growth: few colonies during the resting time, numerous colonies during the operative programme. In the air there are only *Staph. albus* in variable concentrations and saprophytes of equal quantity throughout the day.

In 50 per cent of "sterile" wounds, immediately before wound closure, the same bacteria are found, but together with *Staph. aureus*, one-third as often as with *Staph. albus*.

Infected total hip prostheses showed the same bacteriology as the non-infected wounds, except that a small number were contaminated with streptococcus. All these infections appear to have been airborne, at the time of the operation.

The first series of 528 total hip replacements reported by Mueller, including the above-mentioned 455 cases from St. Gallen, showed at the end of 1967 an infection rate of 5 per cent. In the summer of 1970, however, the infection rate had risen to 7.5 per cent, as further late infections had appeared.

In our own series of 765 total hip replacements from 1967 to July 1970 the infection rate is 2.5 per cent.

Both series are from the same hospital, operated upon in the same theatre, and subjected to the same conditions with one exception:

As no sterile enclosure was available, we have tried to increase the patients' resistance by means of an active vaccination with polyvalent vaccine, prepared from the current strains of staphylococci.

Table 1 shows the infection rate from 1967 to 1970 in relation to vaccination:

Table 1.

| Year | Total | Infection | Per cent | Vaccination |
|-----------|-------|-----------|----------|-------------|
| 1967 | 124 | 11 | 10 | 0 |
| 1968 | 155 | 3 | 2 | 133 |
| 1969 | 310 | 4 | 1.3 | 300 |
| 1970 | 176 | 1 | 0.6 | 176 |
| Jan.-July | | | | |
| | 765 | 19 | 2.5 | 609 |

The more consistently the vaccination was done prior to the operation, the more uncommon was infection.

Analysis of the 19 infections shows:

| | |
|-----------------------------|----------|
| Without vaccination | 14 cases |
| With incomplete vaccination | 3 cases |
| With full vaccination | 2 cases* |

- * In 1 case streptococci and in 1 case coli septicaemia from cholecystitis.

The items shown in Table 1 encourage us to go on using vaccination and to search for scientific proof of its efficiency.

2. Anchorage

14 out of 765 total hip prostheses have worked loose. Table 2 shows the possible reasons for loosening:

| | |
|---------------------|------------------------------------|
| Deficient implant | 4 |
| Heat damage | 4 |
| Failure of material | 2 |
| Unknown | 4 = 14 cases of the present series |
| McKee | 2 |
| Teflon | 1 = 3 further cases |

Deficient implants are those which show high friction between the components (4 Protek McKee types with sliding bearings).

Heat damage, coagulation of bone collagen because of too large an amount of bone cement, is believed to be responsible in 4 instances of loosening.

Failure of material: One fracture of a Protek stem and one dislocation of a Protek socket out of the cement bed.

In four cases the reasons for loosening are unknown.

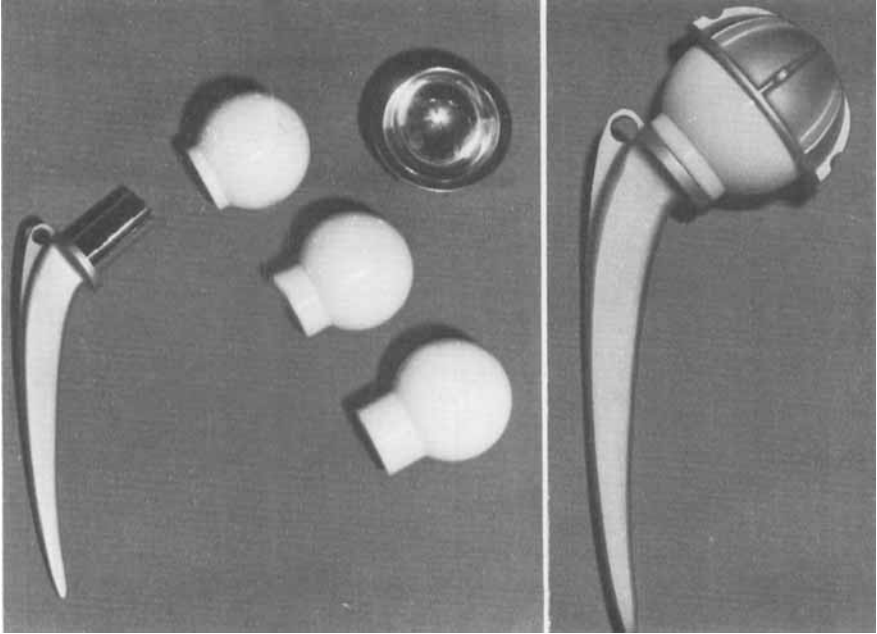


Figure 1.

Two McKee originals showed high friction between the components. One earlier case with a teflon socket showed gross loosening of the acetabulum.

Total hip replacement with ideal congruence seems to provide sufficiently low friction to exclude loosening due to impact between the components. Other implants of poorer technical quality, however, are prone to loosening.

A large quantity of bone cement favours loosening. Since we started using a small amount of cement and cooling during polymerization, no further cases of loosening have occurred.

3. Wear

In our material and in Mueller's (as far as we can assess the cases from occasional follow-up) no wear is to be seen so far, neither in the Charnley type nor in the McKee type arthroplasty. It is important to mention that the prostheses used are Mueller's modifications, produced in Switzerland (Protek). Not only these conventional types, but also our own rotation trunnion-bearing prosthesis, implanted during a period of 2½ years in 510 instances, have shown most encouraging results. In 4 of these cases the prosthesis was removed one or two years after insertion. At technological testing the wear *per annum* was found to have been 3/100 mm. The congruence of the joint surfaces was not impaired at all.

Figure 1 shows the design of this prosthesis.

Our prosthesis is designed with regard to wear: the plastic only is subject to wear, not the metallic components. After wearing for an unknown period only

the plastic heads will have to be replaced, and the cemented distal components can be left *in situ*. This would make the exchange of a worn artificial hip joint a minor operation.

4. Mortality

Six patients out of 765 with total hip replacements died during the follow-up period, all of cardiovascular causes at an average age of 67 years. No fatal or less serious complications occurred during the operation itself.

5. Dislocation

Four replaced hips out of 765 had dislocated within three weeks after the implantation. All could be reduced under general anaesthesia, and there were no recurrences after a bed rest of three weeks.

6. Nerve damage

| | |
|-------------------------------------|---|
| Seven patients showed nerve damage: | |
| Peroneal nerve palsy | 4 |
| Femoral nerve palsy | 2 |
| Sciatic nerve palsy | 1 |

These damages have regressed, but not always completely. They are caused by a rough technique and not sufficiently careful insertion of the Hohmann retractors during the operation.

Summary

Our experience of complications to total hip replacement can be summarized in the following recommendations:

1. The infection rate may be lowered by increasing asepsis in the theatre. Active vaccination with polyvalent staphylococcus vaccine seems to be effective.
2. The rate of loosening can be controlled by the use of prostheses with low friction and by avoiding large amounts of bone cement. Small amounts of cement prevent heat damage to bone collagen. Cooling during setting is logical.
3. Wear depends on many factors and is inevitable, as every machine shows wear. Therefore, the exchange of worn prostheses should be easy. In this respect the trunnion-bearing type or prostheses based on similar ideas may have the best chance of extending the indication for total hip replacement to younger individuals.

A film was presented to show the trunnion-bearing total hip replacement: the prosthesis, the special instruments (guides for the metallic components, reamers, retractors), the operation, the after-treatment, and early results.

PRELIMINARY RESULTS OF TOTAL HIP REPLACEMENT IN SOPHIES MINDE ORTHOPAEDIC HOSPITAL, OSLO

Pål Benum (Oslo, Norway)

After 82 total hip replacements (17 McKee, 3 Mueller, and 62 Weber prostheses) the following complications occurred:

1 deep and 1 superficial infection, 1 perforation of the femur, 1 peroneal nerve damage, 1 peripheral arterial embolism, 1 loosening of a McKee prosthesis.

Out of 64 patients seen 3 months after the operation, 61 were satisfied, 1 was suffering from severe pain, and 7 felt slight pain.

The average range of movement was found to be: flexion + extension: 83°, abduction + adduction 36°, rotation 33°.

The influence of some factors upon the postoperative range of movement was studied:

The type of prosthesis, McKee or Weber, did not seem to be of any importance. The preoperative range of movement was undoubtedly of some importance. The average flexion + extension postoperatively for the different groups was: 0-30°: 73°, 30°-50°: 77°, 50°-70°: 84°, 70°-90°: 100°, 90°-: 103°. The few poor results were found within the first two groups. Patients with a fused hip on the opposite side had a lower average range of flexion + extension than patients with a mobile hip on the opposite side (70° as compared with 90°, preoperative difference 6°).

A variation of the lateral inclination of the acetabular component of the Weber prosthesis within 30-60° does not seem to be of any importance to the range of flexion + extension and abduction.

TOTAL HIP REPLACEMENT BY THE METHOD OF MCKEE-FARRAR

Stefán Haraldsson (Härnösand, Sweden)

During a period of 18 months 102 total hip replacements have been done by the McKee-Farrar prosthesis at the Orthopaedic Clinic, Härnösand, Sweden.

Modifications of the original procedure: Moore's posterior approach, posterior to the ilio-femoral ligament which is of importance to hip stability. No screws in the margin of the acetabulum, at least six 12 mm wide and 1 cm deep holes are drilled into the acetabulum. The holes are undermined. Operative period: about 1 hour.

Ambulation and full weight-bearing on the day after the operation. Walking trained from the 2nd day. Discharge at the end of 3-4 weeks.

Ten patients had the operation on both sides, including two with fixed deformities who had both operations in the same stage. Average age 67 years. Operative diagnoses: 80 hips osteoarthritis, 18 sequelae of femoral neck fracture, 4 rheumatoid arthritis.

Complications: Two patients, who were already being trained in walking, died 10 and 15 days respectively after the operation, both of pulmonary emboli. Two patients had dislocation of the prosthesis immediately after the operation, but no relapse after reduction. One patient sustained an intertrochanteric fracture in the course of the operation, but it united without complications. Two deep infections with fistulation from the hip joint appeared 10 and 5 months respectively after the operations. There were no complications in the form of myositis ossificans or injuries to the sciatic nerve.

Preliminary follow-up is available for 80 hips after periods ranging from 1-18 months. 95 per cent have been completely or almost completely relieved of pain, and all are better (Figure 1).

McKEE-FARRAR ARTHROPLASTY 80 HIPS

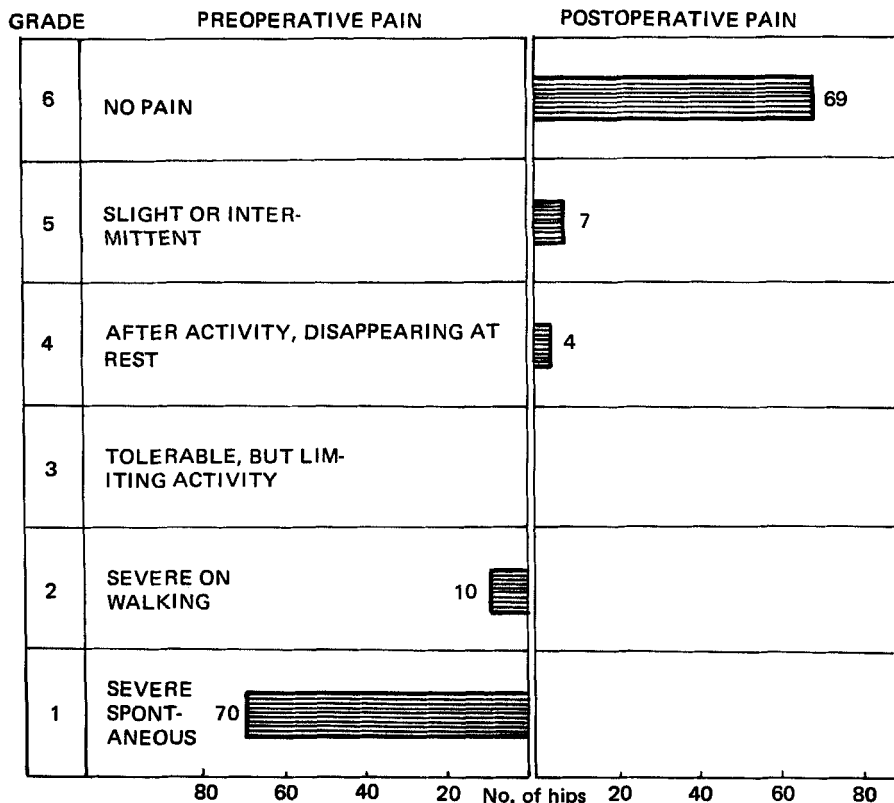


Figure 1.

The postoperative walking ability had improved in 93.8 per cent (Figure 2), and 71.3 per cent of the hips have an improved range of mobility.

The primary results are considered better than following other hip joint operations on the same indications. The posterior approach reduces the soft-tissue injury, shortens the operative period, permits bilateral operations in the same stage, early weight-bearing, and facilitates re-operation, if required. As various aspects concerning the long-term results are still unknown, we must for the time being reserve the method for elderly patients, with the exception of special cases. In such cases the patients must be prepared for the possibility of having to undergo re-operation later, if the total prosthesis does not keep for a sufficient length of time.

McKEE-FARRAR ARTHROPLASTY 80 HIPS

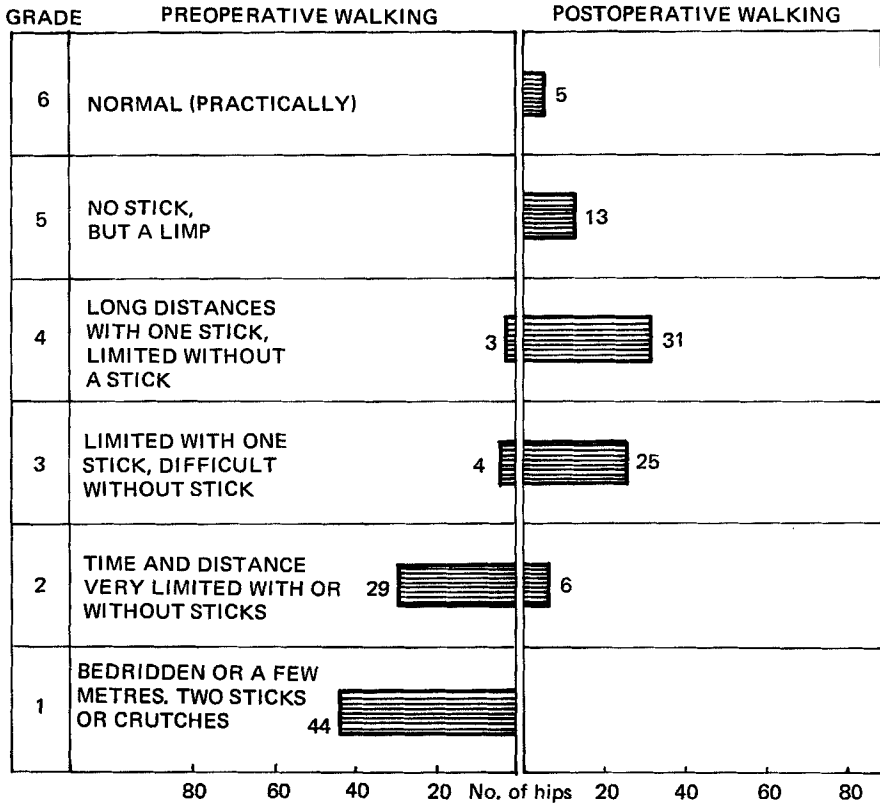


Figure 2.

RESULTS AND TREATMENT OF COMPLICATIONS TO McKEE-FARRAR TOTAL HIP ARTHROPLASTY

Erik B. Riska (Helsinki, Finland)

66 McKee-Farrar hip arthroplasties were performed on 58 patients, average age 67 years, during 1967-1970. All the patients were operated upon by the same surgeon. Two patients were under 50 years of age, 25 were over 70 at the time of the operation. Two had the operation in 1967, 27 in 1968, 22 in 1969, and 15 in early 1970. The larger type of endoprosthesis was used in 42 cases, the smaller size with a short neck in 11 cases, and the type with a long neck in 13 cases. No prophylactic antibiotic treatment was given. 34 patients were treated prophylactically by anticoagulants.

After the first operation the result was excellent in 45 cases (Figure 1) good in 6, fair in 5, and poor in 10. The result was excellent in all cases with the smaller size of endoprosthesis. Deep infection occurred in one case, thrombo-

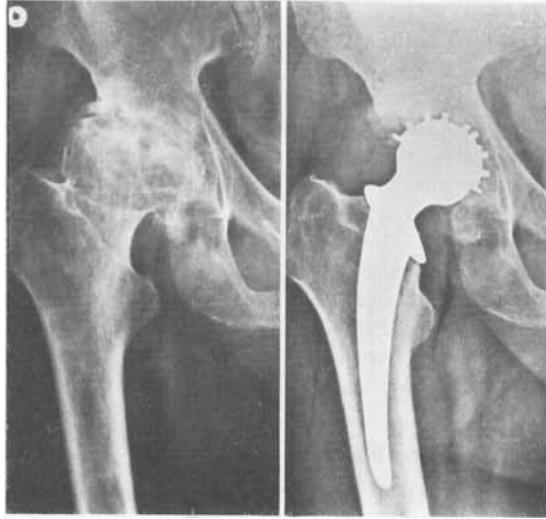


Figure 1. Osteoarthritis in a 65-year-old woman 15 months after a McKee-Farrar arthroplasty with the smaller size of endoprosthesis with a long neck.

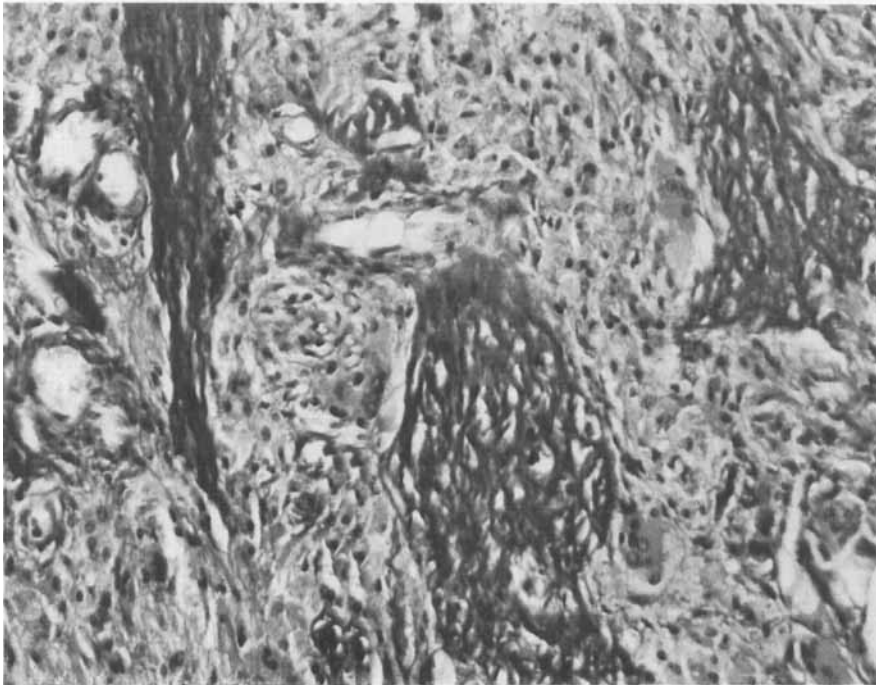


Figure 2. Tissue between the bone and acrylic cement 16 months after the replacement operation. Van Gieson $\times 200$.

phlebitis in 9, loosening of the cup in 7, loosening of both components in 7, a late fracture of the femoral shaft in 2 cases, and myositis ossificans-like tissue around the hip joint in 2 cases.

In the infected case the endoprosthesis was removed. The patients with post-operative thrombophlebitis were cured with anticoagulants. In 5 cases re-fixation of the cup was done—with good results. In 3 cases both components were re-fixed, and in four cases a new endoprosthesis of smaller size was inserted—with a good final result in 6 cases. Late fractures of the femoral shaft were treated by AO osteosynthesis.

According to the histological examination of the tissue between the bone and acrylic cement, the fibrous tissue was necrotic, containing a few giant cells and necrotic bone fragments, but no signs of infection could be seen (Figure 2). Loosening of the cup or of both components in six cases was due to technical errors, but no definite explanation could be given in the remaining 8 cases.

RING'S TOTAL HIP REPLACEMENT

I. Adorjan, V. Mouritzen & K. Rechnagel (Copenhagen, Denmark)

In the Orthopaedic Hospitals in Copenhagen and Kolding, Denmark, 60 hip joint alloplasties by the method of Ring have been carried out since 1967. As the results of this operation have so far not been reported by others than Ring himself, we felt justified in submitting an analysis of the first 46 operated hips and report on the technical difficulties and complications.

Ring's prosthesis differs from other total prostheses in being fixed purely mechanically (i. e. without cement). The acetabular component is securely screwed and countersunk into the iliac bone, whereas the femoral component is, in principle, an ordinary Moore prosthesis.

Out of 41 hip joints seen at follow-up, 3 showed good results, with less pain or none, better walking ability, and better mobility. In cases where contracture had been present it had been relieved. Eight patients still had some pain, but had on the whole been relieved of pain at rest.

Two prostheses have been removed, one because of infection and one because of a poor technique, the acetabular component having been placed in a transverse position. It is important to place this component in a steep position, parallel to the weight-transmitting column of the iliac bone.

So far, Ring's prosthesis has proved a good alternative to the cemented types, but we still do not know the long-term results.

TOTAL HIP REPLACEMENT BY THE METHOD OF RING

Karl-Erik Olsson & Hilding Wetzenstein (Stockholm, Sweden)

During the period January 1968 to June 1969 a total of 53 hips were operated upon at the Orthopaedic Clinic of Norrbackainstitutet, Stockholm. Of these 53 hips, 39 were from unilateral and 8 from bilateral cases.

The postoperative follow-up period averaged 1.5 years and the average age of the operated patients was 68 years.

In the unilateral cases the indications were pain at rest and on weight-bearing in 70 per cent and pain only on weight-bearing in 30 per cent.

The diagnoses were osteoarthritis and sequelae of malunion of femoral neck fractures in 80 per cent, dysplasia, coxa plana, etc., in 20 per cent. Postoperatively and during the first postoperative months external wound infection occurred in 4 cases and thrombosis (clinically diagnosed) in 6.

22 patients have obtained distinct improvement, relief from pain, and improved walking ability, and the same applies to another 6 in whom, however, the walking ability is not quite so good. In 9 the pain is unchanged after the operation. Among these latter cases 3 had deteriorated after having enjoyed a good result for 1.5 years. Primary cementing of the femoral component of the prosthesis does not seem to result in less pain or in a better prognosis. However, the pain has been eliminated following re-operation cementing a loose femoral component.

All the patients subjected to bilateral operation had had severe pain and very poor walking ability prior to the operation. All were assessed as improved at follow-up.

DISCUSSION:

Langenskiöld (Helsinki, Finland)

Why keep the patients in bed for 4 days after the operation instead of allowing weight-bearing at once?

M. Foss Hauge (Oslo, Norway)

What is the nature of the contact between the cement and the bone? Can an inorganic material be "glued" to an organic one?

L. G. Hallén (Falun, Sweden)

Out of 130 total hip replacements (first McKee-Farrar, later Charnley) 3 developed infections, 3 inexplicable walking pain, and 3 sciatic pain, one at the end of 2 months and the other one at the end of 8 months. One was subjected to operation, and an exostosis was found to have caused the pain which was relieved after its removal. What is the cause of socket loosening?

I. Alvik (Oslo, Norway)

The patients should be ambulated on one of the first postoperative days, but should wear a boot with a cross bar when lying down, to control the rotation of the leg.

E. Thomasen (Århus, Denmark)

I am against this boot—it prevents the mobility of the leg.

Knud Jansen (Copenhagen, Denmark)

There is no definite conclusion from the papers. In my opinion, the patients should use crutches during the first 3 months, while reconstruction of the bone is taking place. The problem of shock absorption is probably of importance with regard to the loosening of the cups.

B. G. Weber (St. Gallen, Switzerland)

In 765 cases we have had only one fatal embolism. 2-3 per cent developed haematomas, but they were evacuated a few days after the operation.

John Charnley (Wrightington, England)

Felt that deep venous thrombosis was a disease different from embolism. Fatal embolism is very rare. Did not feel that it was of any importance whether the patient was kept in bed for 4 days.

There is no direct contact between the bone and the cement, only a moulding of the bone. As for the generation of heat, it only acts as pasteurization! The bone becomes sterile and well-suited for ingrowth of new bone.

McKee requires anteversion to prevent flexion blockage, but then there is an increased risk of dislocation and loosening.

IMMEDIATE EFFECT OF OSTEOTOMY ON THE INTRAMEDULLARY PRESSURE IN THE FEMORAL HEAD AND NECK IN PATIENTS WITH DEGENERATIVE OSTEOARTHRITIS

Carl C. Arnoldi, Rudolf Lemperg & Håkan Linderholm (Umeå, Sweden)

Recently Arnoldi, Linderholm & Müssbichler (to be published) demonstrated a considerable hypertension in the bone marrow of the proximal part of the femur in patients with advanced stages of degenerative osteoarthritis of the hip joint. Simultaneous examinations by means of intraosseous phlebography indicated that the high pressure is due to impaired venous drainage from the femoral head and neck.

The present study is concerned with the immediate effect of intertrochanteric osteotomy and denudation of the femoral head—as performed in Smith-Petersen cup arthroplasty—upon the intramedullary pressure in the proximal part of the femur.

Table 1. Intramedullary pressures in the femoral head and neck before and after intertrochanteric osteotomy (first series).

| n | Head pressure, mm Hg | | | Neck pressure, mm Hg | | |
|---|----------------------|-------------|-------------|----------------------|-------------|-------------|
| | Before | After | Difference | Before | After | Difference |
| | osteotomy | | | osteotomy | | |
| | Mean | Mean | Mean | Mean | Mean | Mean |
| | (Range) | (Range) | (Range) | (Range) | (Range) | (Range) |
| 5 | 74.7 | 50.1 | 24.6 | 60.0 | 32.4 | 27.6 |
| | (58.1-88.7) | (37.0-59.7) | (17.0-28.5) | (43.3-70.2) | (12.7-43.3) | (20.9-40.0) |

Intramedullary pressures were determined by means of two metal needles introduced into the bone marrow. One needle was placed with the tip in the femoral head, the other one with the tip in the neck. Pressure measurements were

performed before and after osteotomy or femoral head denudation. In the latter procedure cartilage and cortex were removed and cancellous bone laid bare in a window measuring four by four cm.

Five patients were examined before and after osteotomy and four patients before and after head fenestration. All patients showed abnormally high pressures before the operation. The result of both procedures was an immediate and significant fall in pressure at both points of measurement (Tables 1 and 2).

Table 2. Intramedullary pressures in the femoral head and neck before and after fenestration of femoral head (second series).

| n | Head pressure, mm Hg | | | Neck pressure, mm Hg | | |
|---|----------------------|-------------|------------|----------------------|-------------|-------------|
| | Before | After | Difference | Before | After | Difference |
| | fenestration | | | fenestration | | |
| | Mean | Mean | Mean | Mean | Mean | Mean |
| | (Range) | (Range) | (Range) | (Range) | (Range) | (Range) |
| 4 | 49.8 | 38.0 | 11.8 | 40.2 | 22.6 | 17.6 |
| | (37.7-64.4) | (23.3-59.0) | (5.4-14.3) | (31.4-55.5) | (13.3-38.8) | (11.5-25.9) |

In our opinion the severe rest pain characteristic of advanced osteoarthritis is due to the abnormally high intramedullary pressure. The immediate relief of pain after osteotomy or Smith-Petersen arthroplasty may be due to the reduction of pressure.

CALVÉ-PERTHES DISEASE

MACRO- AND MICROSCOPIC OBSERVATIONS

E. Hjalmar Larsen & Inge Reimann (Copenhagen, Denmark)

The treatment of Calvé-Perthes disease by intertrochanteric osteotomy was associated with arthrography and inspection of the femoral head together with histological examination of a biopsy taken as a wedge of the articular cartilage including part of the ossification centre from the anterior aspect of the femoral head.

Fourteen hip joints have been examined in different stages.

In the early stages of the disease more or less scattered necrosis of the bone was found together with irregular proliferation in the basal part of the articular cartilage. In the later stages there was remodelling of the bone, partly by osteoblastic apposition and partly by irregular endochondral ossification. The non-ossified articular cartilage was found to be thicker than normal. In the later stages large islands of cartilage were frequently observed, situated inside thick formations composed of necrotic and new-formed bone tissue. This is taken to correspond to the radiological picture of the fragmentation, while the thick bone formation seems to give rise to the radiological picture of sclerosis. On the other hand, there were no cases of collapse of the articular cartilage or trabecular bone.

On arthrography and on gross inspection it was noted that even late in the

fragmentation stage there was only little or no contour disturbance of the femoral head.

The examination did not include the epiphyseal plate or the metaphysis where the primary and perhaps most pronounced changes might be expected.

It is concluded that the deformity of the femoral head seen radiologically in the late stage of Calvé-Perthes disease is caused by irregular ossification of the previously non-ossified articular cartilage during the revascularization which follows upon the primary necrosis. On the other hand, the observations do not indicate any mechanical collapse of the head. In the treatment of this disease, therefore, adjustment of the position of the femoral head, in order to secure a maximum of contact with the acetabular wall and thereby induce a spherical shape during re-ossification, seems to be more logical than treatment which primarily aims at relief from weight-bearing.

DISCUSSION:

Hans Bohr (Refsnæs, Denmark)

In connection with Hjalmar Larsen's paper on biopsy specimens in Calvé-Perthes disease, densitometric studies of the femoral head were reported. These studies revealed that during the early stage of condensation there is generally a question of only relative sclerosing as compared with the surrounding bone, there being no difference in the density of the femoral head on the diseased and the unaffected side. In the course of the subsequent three months, however, the density of bone increases on the diseased side, without there being signs of bone compression. This indicates that new-formation of bone is taking place in the femoral head.

LEGG-CALVE-PERTHES DISEASE

Jørgen Lauritzen (Århus, Denmark)

Ambulatory treatment by non-weight-bearing, using a wheel chair and a strap keeping the hip joints flexed, has been practised at the Orthopaedic Hospital, Århus, in all cases since 1957. 114 consecutive unilateral cases were studied. In 19 of the patients the treatment had not been properly carried through. The patients treated in wheel chair were compared with 82 ambulatory patients treated by Thomas splint, 79 treated by strict bed rest in hospital, and 113 treated by bed rest with intermittent traction. The cases treated by Thomas splint and by poorly performed wheel-chair therapy showed fewest spherical femoral heads. Traction therapy and correct wheel-chair therapy gave the most favourable results.

Factors of great importance in attaining a spherical shape in primary healing, and thereby a good prognosis, are also the patients' ages and the degree of necrosis. Those whose treatment is started latest show on the whole the most severe degrees. No therapeutic method had afforded particularly good results in patients over 8 years of age. Sex and radiological stage at institution of treatment are of importance in attaining good epiphyseal quotients, girls and patients treated late showing the poorest results. Proper performance of wheel-chair therapy was independent of social and housing conditions.

A 4-YEAR PROSPECTIVE STUDY OF TWO DIFFERENT THERAPEUTIC REGIMENS FOR NEWBORNS WITH CDH

Hans Emnéus & Kåre Undeland (Uddevalla, Sweden)

The authors have followed two different lines in treating newborns with CDH. Emnéus treated his infants with a von Rosen frame for only 6 weeks and in doubtful cases did not hesitate to use over-treatment for 6 weeks. Undeland treated his patients with a von Rosen frame for 12 weeks and in doubtful cases examined his infants under anaesthesia to be able to exclude the stable hips. The material comprises 140 newborns out of the 17,000 from the maternity wards of the hospitals in Uddevalla, Kungälv, Lysekil, Strömstad, Vänersborg, Trollhättan, and Bäckefors during the years 1965–1969. Of these 140 infants 76 had obvious CDH and the remainder doubtful CDH. If only the obvious cases are included, the frequency is 0.45 per cent. 82 cases of the material were treated by Emnéus and 59 by Undeland. All the patients now have normal hips, with one exception in which there is a suspicion of dysplasia of the acetabulum, but no dislocation.

| Definite cases treated for 6 weeks Emnéus | Doubtful cases treated for 6 weeks Emnéus | Definite cases treated for 12 weeks Undeland | Doubtful cases examined under anaesthesia Undeland |
|--|--|---|---|
| 35 | 47 | 33 8 41 | 24 8 16 |

The last column of the table means that of 26 doubtful cases examined by Undeland under anaesthesia, 8 were found to have definitely unstable hips and were treated with a von Rosen frame for 12 weeks. The remaining 16 had no treatment at all, but were followed during their first year of life.

Conclusions. Clinical investigation using Ortolani's test during the first week of life is the method of choice. Radiography is not necessary until the age of 4–6 months. In doubtful cases over-treatment may be given or the infants may be examined under anaesthesia, so that the definitely unstable hips may be selected. Six weeks of treatment in a von Rosen frame is sufficient.

ENDOPROSTHESIS MADE OF CERAMIC.

AN EXPERIMENTAL STUDY ON RABBITS

Erik B. Riska (Helsinki, Finland)

The ceramic endoprosthesis was made of kaolin, feldspar, and sand with alkaline aluminium silicate at the Arabia China Factory, Helsinki. The heat tolerance of ceramic is over 1300°C, compression tolerance 5000 kg/cm², bending tolerance 1000 kg/cm² when made by machine, but less than 1000 kg/cm² when made by hand. Ceramic is resistant to alkalis and acids, electrostatically inactive, and not subject to corrosion.

Replacement operation was performed on 19 rabbits aged 8–10 months, in 15 of the experimental animals under fully sterile conditions. The follow-up periods

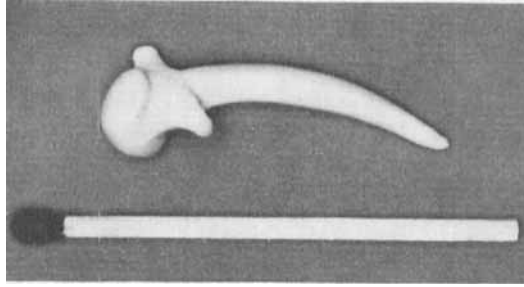


Figure 1. Ceramic endoprosthesis for the rabbit hip.



Figure 2. X-ray of rabbit hips, with the ceramic endoprosthesis on the left, ten days after the replacement operation.

ranged from 2 to 8 months. The study was based on clinical, radiological, and histological examinations, the contralateral hip joint serving as control.

The experimental animals stood the operation well under intravenous Nembutal anaesthesia and moved freely on the day after the operation and during the follow-up period. The range of movement of the hip joint was good. On X-rays practically no reaction was seen around the endoprosthesis (Figure 2). According to the histological examinations the endoprosthesis was surrounded in the femur by bony tissue without any giant cells or signs of infection. Ceramic showed firm tissue adherence with bone growth adjacent to the stem without interposition of

soft tissue. This suggests good tissue tolerance and biological inactivity of the ceramic material.

LASÈGUE'S SIGN IN PATIENTS WITH LUMBAR DISC HERNIATION

Erik Sprangfort (Umeå and Härnösand, Sweden)

The author has performed a complete analysis of 2,504 lumbar disc operations by automated data processing. The study comprises approximately 50 variables per operation.

This report is a survey of information obtained on Lasègue's sign or the straight leg raising test.

In 2,157 patients with confirmed lumbar disc herniation, Lasègue's sign was positive in 96.8 per cent. The incidence of the sign decreases with the level of herniation in the cranial direction.

When the sign is correlated to the age at operation, the incidence decreases constantly with age. The negative correlation to age is repeated in both positive and negative operations (Figure 1), in both sexes, and at both the common levels (L4-L5 and L5-S1).

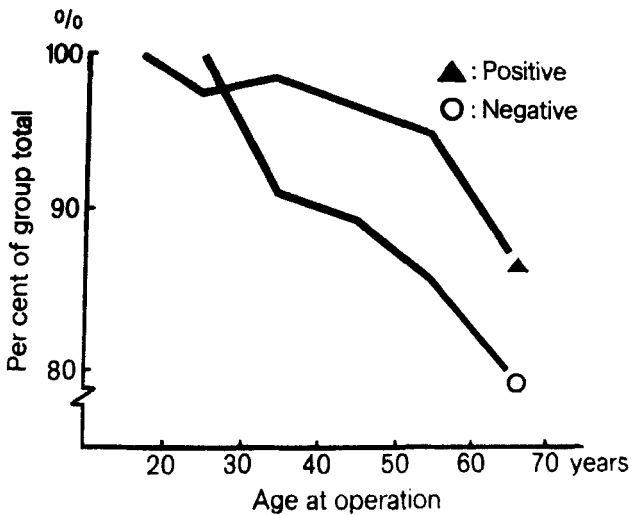
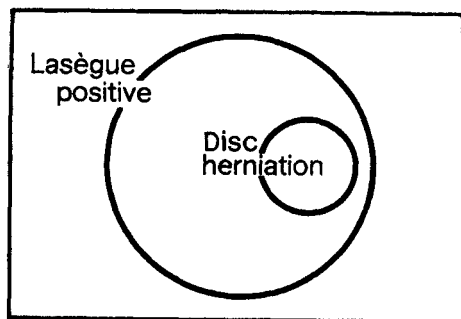
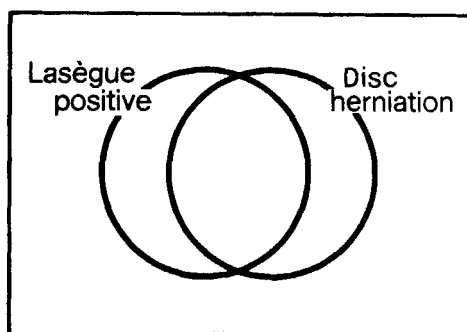


Figure 1. The incidence of Lasègue's sign by age and findings at operation.

The specific diagnostic value of the sign is estimated in Figure 2. Young patients have a pronounced propensity for a positive reaction to straight leg raising, and the sign has no specific value for the diagnosis of lumbar disc herniation. However, a negative Lasègue excludes the diagnosis with a high degree of probability in these age groups. After the age of 30 the Lasègue propensity decreases and the diagnostic value of the sign increases, but a negative Lasègue no longer excludes the diagnosis.



Age: under 30 years



Age: over 30 years

Figure 2.

KNEE AND QUADRICEPS FUNCTION AFTER FRACTURE OF THE FEMUR

Danilo Zdravkovic & Villiam Damholt (Odense, Denmark)

75 patients were investigated for knee flexion, difference in circumference of the thighs, and had isometric and dynamic measurement of quadriceps strength. The follow-up period ranged from 3-13 years. Over two-thirds showed a more than 20 per cent reduction of quadriceps strength. There was little correlation between the wasting of the thigh and the reduction of strength. Measurement of quadriceps strength is considered a relevant parameter in the follow-up of patients with fracture of the femur.

HEALING OF AVASCULAR ARTICULAR FRAGMENTS.

AN EXPERIMENTAL STUDY ON THE CANINE KNEE JOINT

Anders Wigren & Sven Olerud (Uppsala, Sweden)

The union of avascular articular fragments in the knees of adult dogs was studied by fluorescence microscopy after tetracycline and fluorescein labelling and

by microangiography after filling with Indian ink. In the knee joints avascular fragments of the tibial condyle were fixed by stable osteosynthesis. The course was compared with that of joints allowed to move freely and joints immobilized in plaster. It was not possible to demonstrate any difference between the bony union in the two groups. Union of the avascular fragment takes place by direct bone formation without any difference between the immobilized dogs and those that were allowed to move freely.

On the other hand, the dogs in plaster showed on the whole an increased ingrowth of vessels into the articular cartilage from subchondral bone. In some cases, the surface of the cartilage was even invaded by vessels proceeding through the osteotomy gap. These changes were not found in dogs allowed to move the knee during the experiment.

DIAGNOSTIC POSSIBILITIES OF DOUBLE-CONTRAST ARTHROGRAPHY IN DISORDERS OF THE KNEE

Henrik Schmidt (Nykøbing F, Denmark)

Since 1961 double-contrast arthrography has been used in the Radiological Department of the Central Hospital, Nykøbing Falster, Denmark, as a preoperative investigation in various disorders of the knee. The experience from 102 examinations, confirmed by operation in all cases, has been so encouraging that we want to call attention to this method as a valuable contribution to diagnosing "internal derangement" of the knee joint. The examinations were done by a modification of van de Berg & Crevecoeur's method under fluoroscopy with image amplifier and TV, using a double magnification as recommended by Croonenbergs & Rombouts as well as Zakrisson & Thoms. The examinations comprise serial exposure of each meniscus separately, general views in two projections, special exposures to visualize the cruciate ligaments, and axial exposures of the patella in Knutson's projection. The following disorders may be diagnosed, with fair certainty, by double-contrast arthrography:

1. Injuries to the menisci.
2. Injuries to the cruciate ligament.
3. Injuries to the collateral ligament.
4. Loose bodies (in the joint cavity and chondromatosis).
5. Osteochondritis dissecans.
6. Patellar chondromalacia.
7. Other destructions of cartilage.
8. Hoffa's disease.

There have been no complications to the investigations. The operations were already performed on the day after the X-ray examination.

A total of 10 erroneous diagnoses were made (9.8 per cent) relating to meniscus injuries, 5 positive and 5 negative. On Dijan's recommendation we have directed our attention particularly at the articular cartilages, and we feel that we are able to diagnose osteoarthritis even before osseous changes appear.

TIBIAL CONDYLAR FRACTURES WITH A PARTICULAR VIEW TO THE VALUE OF TOMOGRAPHY

Gunnar Schiøler (Copenhagen, Denmark)

In view of the importance of an accurate radiological diagnosis to the operative indication in treating tibial condylar fractures, the results of conventional radiography were compared with those of tomography in 65 depression fractures. The degree of depression will be seen in Table 1.

The value of tomography was illustrated by typical examples.

Table 1. Number of fractures.

| Depression in mm | 0-3 | 4-10 | more than 10 |
|--------------------------|-----|------|--------------|
| Conventional radiography | 31 | 23 | 11 |
| Tomography | 15 | 22 | 28 |

The value of tomography was illustrated by typical examples.

At follow-up all the patients had tomography. We feel that there is a relationship between an unsatisfactory functional result and major secondary osseous defects comprising the marginal parts of the joint surface. The size of these defects cannot be assessed without tomography.

It is concluded that examination and assessment of tibial condylar fractures are incomplete without tomography.

DISCUSSION:

Bent Barfod (Århus, Denmark)

Tomography is indicated to establish whether a fracture is present and partly to map the displacement of a known fracture. In traumatic haemarthron, where a fat level is demonstrable radiologically or as fat pearls in the aspirate, tomography should always be carried out with $\frac{1}{2}$ cm sections in order to detect the fracture which is bound to be present.

Postoperatively, tomography of the knee should be performed with the same care as preoperatively to evaluate the result. Otherwise one is fooling oneself.

X-RAYS OF THE LUNGS IN DIAGNOSING TRAUMATIC FAT EMBOLI

Knud Tophøj (Sorø, Denmark)

Six cases of traumatic fat embolism occurred in patients admitted to the Hospital for Orthopaedic Surgery, Sorø, Denmark, during the period 1965-1968. All the patients had one or multiple fractures sustained in road accidents.

The diagnosis of fat embolism was based upon the presence of tachycardia, tachypnoea, and hyperpyrexia as well as upon changes on X-rays of the lungs,

consisting in multiple, small, diffuse, bilateral lesions. These radiological appearances were present in all the cases.

On the basis of a post-mortem histological investigation of pulmonary tissue from two out of the six patients, I believe that scattered interstitial haemorrhages in the lungs cause the typical radiological appearances. This is also indicated by the fall in haemoglobin seen in cases of fat embolism. The radiographic changes subside in a week or two.

Patients who may be feared to develop traumatic fat emboli ought to be checked frequently by pulse and respiration counts and measurement of the temperature. If these values rise, I recommend chest radiography, e. g. at six-hour intervals, to confirm the diagnosis.

When the typical changes are found, the patient should be transferred to an intensive observation unit. A fall in oxygen saturation or an increase in the $p\text{CO}_2$ indicates tracheostomy and artificial respiration. Thereby deep coma in one of the patients was altered to a normal level of consciousness in three hours.

STABILITY OF LOWER-LEG FRACTURES TREATED BY HOFFMANN'S OSTEOTAXIS

Torben Ejning Jørgensen (Beder, Denmark)

A mechanical method of measuring the stability of lower-leg fractures in combination with Hoffmann's apparatus is described.

The method was applied to 40 lower-leg fractures. At the measurements the fractures were loaded by a bending factor of 5 kg on a 10 cm long arm on both sides of the neutral point. The resulting angle was measured. If quiet walking is to be tolerated, this angle must not exceed $\frac{1}{2}$ -1°.

The method was used for graphic description of the last part of the union of lower-leg fractures. This revealed, among other things, that minor traumas to lower-leg fractures during union delayed the union. The length of this delay could be estimated. The method makes it possible to establish the time of union and prognosis during the terminal phase of union.

CONTINUED EXPERIENCE OF LINCOCIN

Bernhard Paus (Sandvika, Norway)

Lincocin has been used for some 3½ years in the treatment of chronic pyogenic osteomyelitis, acute osteomyelitis, pyogenic arthritis, and soft-tissue infection. The results of 97 courses are reported. Follow-up period 6-36 months after relief of symptoms.

Out of 58 patients with chronic osteomyelitis, 51 were relieved of symptoms, but 11 relapsed. 8 of the latter patients had another course, after which 7 were relieved of symptoms. Out of the 7 patients whose symptoms and signs did not yield, 4 had Lincocin-insensitive microorganisms. All of them were relieved of their *Staph. aureus* and considerably improved clinically, but the infection by other microorganisms persisted. The remaining 3 had Lincocin-resistant microorganisms. In 2 of these cases it is possible that the staphylococci changed from sensitive to resistant.

The experience indicates that Lincocin medication should be continued for 2-4 months after the symptoms have been relieved, but in a reduced dosage.

All the patients with acute osteomyelitis and with soft-tissue infection were relieved of symptoms, and none has relapsed.

LATE RESULTS FOLLOWING OPEN REDUCTION OF TOTAL DISLOCATION OF
THE UPPER FEMORAL EPIPHYSIS

K. Harry Sørensen & E. Thomasen (Århus, Denmark)

To be published in *Acta Orthopaedica Scandinavica*.