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OPERATIVE TREATMENT OF PARTIAL EPIPHYSEAL CLOSURE CAUSED BY OSTEOMYELITIS

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During 1965-80 a total of 39 epiphyseal injuries were operated on according to the method described by A. Langenskiöld in 1975. The operation consists of surgical removal of the bone bridge between the epiphysis and the metaphysis and implantation of a free autogenous fat transplant in order to prevent new bone bridge formation.

In eight patients the bone bridge was formed as a sequel to osteomyelitis. Three of the bone bridges were situated at the distal end of the femur, three at the proximal and one in the distal epiphysis of the tibia and one at the proximal epiphysis of the humerus.

The patients were operated on using the same principles applied after trauma. No signs of activation of the infection occurred. The results of treatment show that if the bone bridge can be easily detected in the radiograms and if there is still some functioning epiphyseal cartilage left, the growth of the bone is as good as in patients operated on after fractures.

However, in patients with damage caused by the osteomyelitis, scar tissue in the epiphyseal region may lead to difficulties in estimating the amount of active epiphyseal plate. Thus the operative result in some patients may be better and in some cases worse than estimated preoperatively on the basis of roentgenological findings.

LONGITUDINAL GROWTH OF A TUBULAR BONE AFTER A LARGE SURGICAL DEFECT IN THE LATERAL PART OF THE EPIPHYSEAL PLATE

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Earlier experiments by the author have shown that regeneration of the central part of the epiphyseal plate

can afford a considerable amount of longitudinal growth of the bone if the bone bridge formation between the epiphysis and the metaphysis can be prevented using a free fat tissue transplant.

In the present experimental study the lateral third of the epiphyseal plate was removed in 38 rabbit femurs and replaced with fat tissue transplants. The growth was followed using roentgenology, histology and tetracycline labelling.

The results show that angular deformity developed in most cases but its degree was, however, about 10 degrees less, on average, if the defect was filled with a fat transplant. Other measurements of the bones show that a total of 10 per cent of the longitudinal growth was lost if the defect was not filled with fat tissue. If the bone bridge formation was prevented using fat tissue transplantation, the growth loss was only 5 per cent compared with the normal bone.

The tendency for angular deformity to occur means that in clinical patients where angular deformity already exists, a corrective osteotomy in connection with bone bridge resection might be feasible.

LANGENSKIÖLD'S OPERATION FOR FEMORAL EPIPHYSEAL ARREST

A case report

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Langenskiöld's operation for growth disturbances after epiphyseal injuries in long bones is briefly discussed.

The author's case is a 14-year-old girl who, at the age of 7, sustained Salter's type III fracture of her left distal femoral epiphysis. A bone bar bridging the physis developed, resulting in partial growth arrest and valgus deformity. Corrective osteotomy was performed but the deformity soon recurred.

Two and a half years after the injury Langenskiöld's operation was performed. In the 4½ year follow-up period since that operation, the growth in length at the physis has been mainly normal but the valgus deformity has not changed substantially. The patient has been spared further operations during this period but final corrective operative treatment is planned.

LEG LENGTHENING BY DISTRACTION EPIPHYSIOLYSIS

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The growth plate in children under the age of 10 is a relatively weak part of the long bone and can therefore be separated from it by distraction forces. Such distraction can be used to lengthen and/or straighten a limb. In order to prevent knee deformity in 2 patients with Blount's disease, causing progressive varus deformity and arrested growth, we used a double-frame system of external fixation. Simultaneous correction of the varus deformity was achieved as the leg was lengthened by 1 mm/day. No appreciable side-effects were noted. The generally recommended method involving osteotomies had proved inadequate in these cases. External fixation employed to achieve gradual epiphyseal distraction in strictly selected cases of Blount's disease with leg shortening may offer an alternative solution to the difficult therapeutic problems with which these patients confront us.

LEG LENGTHENING IN SEVERE LENGTH DISCREPANCY IN CHILDREN

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The material consists of six patients, five with congenital and one with postnatal shortening. The youngest patient was 8 years old, the oldest 14. The method consisted of osteotomy and gradual lengthening using the apparatus of Wagner. The femur was lengthened in one case and the lower leg in five cases. In four cases the osteotomy was transverse and was combined with plate osteosynthesis and bone transplantation. A long spiral osteotomy was performed in two cases. The fusion in these cases took place without additional procedures.

The lengthening of the femur was 14 cm, and of the lower leg between 3.5 and 9 cm (average 7 cm). An epiphysiodesis of the longer extremity was performed in four cases. The average calculated shortening caused by the epiphysiodesis was 4 cm. Numerous additional procedures, on average four per patient, were carried out. The final leg length discrepancy was less than 3 cm in all cases. Full weight-bearing was allowed 6–7 months after the osteotomy.

Complications consisted of one loosening of the fixation, two cases with angulation during lengthening, one case with skin necrosis and two cases with delayed union over 7 months. Union was obtained in all cases. There were no vascular or nerve complications and no deep infections.

It is concluded that the method is also useful in cases with relatively severe congenital shortening of the leg. It can easily be combined with epiphysiodesis. Simultaneous correction of deformity is possible. A relatively

long hospitalisation period and various special problems demanding numerous additional procedures make it a method which can be recommended in relatively rare cases where epiphysiodesis alone is not sufficient.

LEG LENGTHENING BY THE WAGNER METHOD

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Epiphysiodesis or shortening of the sound leg has been the conventional method of treating leg length discrepancy. This method has limited correction potential; it decreases the individual's height and sometimes results in faulty body proportions. Since 1975 we have adopted the Wagner leg lengthening technique instead. The method has been used in 20 cases with shortening of congenital or posttraumatic origin. Healing resulted in all cases, even though some healing disturbances requiring additional procedures did occur. Reversible partial peroneal paralysis was noted in 4 cases. Reduced knee joint mobility during the period of fixation in femoral lengthening was virtually restored in the subsequent course. Tibial lengthening caused no appreciable impairment of ankle joint mobility.

The Wagner technique offers an exact and safe method for femoral and tibial lengthening. Although the final results cannot be assessed until several months or even years have passed, they have the potential to be excellent if the patient's cooperation is gained from the start by providing adequate information.

OPERATIVE GROWTH ARREST DETERMINED BY ROENTGEN STEREOPHOTOGRAMMETRY

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During the last decades many reports have been published on clinical and experimental investigations of operative growth arrest. Complications such as varus-valgus deformity, loose staples, buried staples, broken staples, insufficient retardation and permanent growth arrest have been reported. Failures have been considered due to the staples, poor surgical technique or inadequate postoperative follow-up. Standard radiographical techniques are unable to detect complications in time.

In order to study the effect of growth arrest after stapling, according to Blount, and Phemister epiphysiodesis and to evaluate the early signs of problems, a roentgen stereophotogrammetric analysis was performed. Stapling during the latter part of the growth period results in immediate and complete growth arrest. Stapling at a younger age results in slower growth arrest and basal growth level probably as a result of widening and extrusion of the staples caused by the growth in

width of the bony epiphysis. Removal of staples results in normal growth in intact growth plates and normal closure. Phemister epiphysiodesis results in immediate and complete growth arrest. In conclusion roentgen stereophotogrammetry has been found suitable for checking the efficiency of growth arrest after Blount stapling and Phemister epiphysiodesis.

GROWTH DISTURBANCE AFTER SUPINATION ADDUCTION INJURY OF THE ANKLE IN THE CHILD

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From a prospective study of growth disturbance after ankle fracture in children, 9 cases, 5 boys and 4 girls, 6–14 years of age, with a supination-adduction injury are reported. The daily longitudinal growth could be determined by the roentgen stereophotogrammetric method 1 month after implantation of indicators. The error of the method is about 50 micrometers between examinations corresponding to about 1 micrometer of the daily growth. With a data program (KINEMA) rotation and translation of the bony epiphysis in relation to the metaphysis could be calculated with an accuracy of better than 1° and 1 micrometer, respectively.

One patient with a Stage I injury showed a transient growth stimulation of the distal fibula and of the distal tibia. KINEMA analysis showed a growth stimulation mainly laterally in the distal tibia.

Eight patients have a Stage II injury. In children below 10 years of age, one patient showed a growth stimulation in both the distal tibia and fibula. Two patients showed transient retardation localized medially. One patient showed a probably permanent growth retardation with a progressive varus deformity. In three children over 10 years of age a permanent retardation of growth in both the distal tibia and fibula was found. In this age group the remaining growth on the normal side was less than 8 mm. One patient showed normal growth post-trauma.

Eight of the nine children studied showed an abnormal growth post-trauma but in only one has the growth disturbance given problems of clinical significance.

REVASCULARIZATION AND HEALING OF NON-VITAL CORTICAL FRAGMENTS: A MICROANGIOGRAPHIC AND FLUOROMICROSCOPIC STUDY

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A triangular fragment was sawn out of the medial aspect of the rabbit tibia. After being boiled or frozen, the

fragment was replaced and stabilized with a 4-hole AO-miniplate.

The mode of revascularization and healing of the non-vital fragments did not differ greatly from the controls but there was a definite delay in healing. Some animals sustained microfractures postoperatively which were not discovered clinically. These preparations showed a poorly vascularized triangular fragment and the neighbouring main fragments had been subjected to marked resorption.

Thus, even seriously traumatized fragments can be incorporated provided good stability is achieved. If there is early instability, a non-vital fragment is poorly revascularized. When a fragment of this type is considered important for the retention of stability and distance in a comminuted fracture, it should be included in the osteosynthesis and accurately fixed.

EXPERIMENTAL RECONSTRUCTION OF THE CONDYLAR CARTILAGE DEFECT OF THE KNEE JOINT WITH FREE PERIOSTEAL GRAFT

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Earlier studies have shown the osteogenic and chondrogenic capacity of free periosteal-perichondrial grafts. In some of the studies the environment was found to influence the differentiation of the cells in periost-perichondrium. The enchondral ossification presents a cell of mesenchymal origin less differentiated than the osteoblast or chondroblast. The differentiation of this cell is dependent on the environment.

The purpose of this study was to show that the primitive mesenchymal cells in periost-perichondrium are so alike that the environment will determine whether the periosteum will differentiate into bone or cartilage. With special reference to clinical design, a defect in the condylar cartilage of rabbit knee joint has been reconstructed with a free periosteal graft. Microscopic examination revealed that hyaline-like cartilage was formed.

TREATMENT OF SPONDYLOLISTHESIS WITH FREE OSTEOPERIOSTEAL TRANSPLANTS IN YOUNG PATIENTS

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Our previous experimental and clinical studies have proved that free osteoperiosteal transplants have a strong osteogenic capacity in the proper environment.

In the present study we present the results obtained in the treatment of 36 spondylolisthetic patients under the age of 20 years. Fusion was performed using a posterior technique in 20 and a posterolateral technique in

8 patients. In 8 cases fusion was combined with removal of the loose lamina. In addition an internal fixation device was used in some patients. The observation time ranges at the present time from 1 to 4 years.

Clinical results show that 25 of the patients are symptom-free, 5 patients complain of low back pain after heavy exercise and 5 patients have frequent low back pain and radiating symptoms. Clinical results do not seem to depend on the degree of the olisthesis.

Clinical and radiological fusion was obtained in 31 patients (85 per cent). In 5 patients fusion could not be obtained. The frequency of non fusion was higher in the group where the posterolateral technique was used. Increase in slipping occurred in some patients despite fusion.

THE EFFECT OF THE ENVIRONMENT ON THE BEHAVIOUR OF FREE PERIOSTEAL GRAFTS

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In our earlier studies we found that a free periosteal graft from a rabbit tibia transplanted into a muscular bed forms bone enchondrally, i.e. through a cartilage interphase. Under some circumstances, in clinical practice, it would be beneficial if this process could be terminated in this cartilaginous phase, for instance when attempting to reconstruct cartilaginous defects of various origins in joint surfaces.

In this study a comparison was made between the proliferation of free periosteal grafts in four different types of recipient beds: in muscle, costal cartilage, ear cartilage, and synovial fluid of the knee.

The results revealed that vascularisation and bone formation occurred rapidly enchondrally in muscle. On costal cartilage a cartilaginous layer persisted between the formed bone and the rib. In ear cartilage osteogenesis was weak. Lastly, in synovial fluid, bone formation did not occur at all. In conclusion, the cartilaginous environment seems to play a conducive role in the proliferation of the osteochondrous cells of the periosteum.

EVALUATION OF SUBSTANCES STIMULATING LONGITUDINAL BONE FORMATION

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The development of synthetic bone growth stimulating substances would have great clinical importance in states of reduced bone formation, not only hypophyseal growth retardation but also delayed fracture union and osteopenia. Growth hormone (GH) is essential for skeletal growth, but is available in very restricted

amounts for administration. In the evaluation of new growth stimulating substances, GH as well as human serum and purified substances such as Somatomedin (SM) and digests of GH have been investigated.

One of the fundamental aspects of a growth stimulating substance for human clinical use is stimulation of longitudinal bone growth. For bioassay, tetracycline was used as an intravital marker of longitudinal bone growth in hypophysectomized rats (Thorngren & Hansson: *Acta Endocrinol. (Kbh)* **75** (1974) 653–682, **76** (1974) 35–52).

GH from different species stimulated bone growth with a dose-response effect. A plasmin-digest of HGH had an 80 per cent dose-response effect. Serum and plasma in total doses of 15 ml, 30 ml and 60 ml from normal persons did not stimulate longitudinal bone growth. Serum from patients with acromegalia in certain cases resulted in bone growth stimulation. The SM preparations were tested at total doses of 1 mg for SM-A and SM-B, but no bone growth stimulation was achieved.

LATE COMPLICATIONS OF THE MUSCULOSKELETAL SYSTEM INDUCED BY IMMUNOSUPPRESSIVE TREATMENT AFTER KIDNEY TRANSPLANTATIONS

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EFFECTS OF MASSIVE BLOOD TRANSFUSIONS ON PATIENTS WITH MULTIPLE INJURIES AND SEVERE BLEEDING

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During 1970–1977, 350 patients with multiple injuries received 10 or more units of blood because of severe bleeding. In 135 cases there was occult bleeding. The average age of the patients was 39 years, and the average amount of blood 31 units. Every sixth unit was given as fresh blood. The effects of massive blood transfusions on the mortality, complications, chemical changes and changes in the coagulation mechanism were analyzed.

Of the 350 patients, 64 (18 per cent) died. Of these, 26 died of cerebral injuries, 16 of intra-abdominal or thoracic injuries. In 4 cases a rupture of the aortic arch was verified, and one patient died of a heart infarction. Massive blood transfusions had no significant effects on the mortality. The grade of jaundice and the creatinine value increased, whereas the pH, BE and platelet counts decreased with the amount of blood given ($P < 0.001$). In cases with occult bleeding, a significantly

higher mortality ($P < 0.001$), more coagulopathies ($P < 0.001$) and more consumption coagulopathies ($P < 0.01$) were registered. On the basis of these results it is suggested that severe occult bleeding should be treated surgically by evacuation and ligation of bleeding arteries.

PREVENTION OF CLINICAL FAT EMBOLISM SYNDROME IN PATIENTS WITH MULTIPLE INJURIES

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Three different grades of fat embolism can be distinguished. The first grade, fat embolization, is signalled by skin petechiae and one or two mild signs. The second grade, fat embolism syndrome, is recognizable because of the presence of skin petechiae and other characteristic criteria, but the symptoms are harmless and disappear spontaneously without any specific treatment. The third grade, the clinical fat embolism syndrome, is a severe condition and the patient is in need of respiratory treatment.

During 1967–1974, 384 patients with multiple injuries and fractures of the long bones were treated conservatively, resulting in 84 cases of clinical fat embolism (22 per cent). During the same period, 245 patients were treated operatively with internal fixation of long bone and pelvic fractures. In 11 cases a clinical fat embolism syndrome was noted (4.5 per cent). These results indicated a more active treatment of patients with multiple injuries. Thus during 1975–1978, 211 patients with multiple injuries were treated operatively with internal fixation at the primary stage and only three clinical fat embolism syndromes were registered (1.4 per cent). There were also 6 cases with fat embolism syndrome, but the symptoms disappeared spontaneously within a couple of days. The difference between 384/84 (22 per cent) and 211/3 (1.4 per cent) is highly significant indicating that the development of a severe clinical fat embolism syndrome can be prevented in most cases by early operation.

HISTOLOGICAL CHANGES IN HALF-JOINT ALLOGRAFTS

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Sixteen biopsies of hemi-joint allografts were taken during the follow-up period of 2½ months to 8 years. The cartilage in the allograft changed during the first 12 months from having a preserved overall structure to fibrous cartilage. The bone trabeculae were acellular with loose fibrous tissue in between, and in 6 and 8 month preparations a few lymphocytes and plasma cells

were seen. New bone was not seen before 12 months; then the trabeculae consisted of both new and grafted bone side by side. From 3 to 7 years the fibrous cartilage became more cellular and in one of the 3 year and in the 7 year preparations foci of hyaline cartilage were seen. At 7 years the bone trabeculae were cellular with only small remnants of dead grafted bone.

APPLICATION OF FREE AUTOGENOUS FIBULA GRAFT IN THE TREATMENT OF AGGRESSIVE BONE TUMOURS OF THE DISTAL END OF THE RADIUS

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Six patients with benign or aggressive bone tumours in the distal end of the radius who underwent *en bloc* resection of their tumours, including the articular component of the radius, are presented. Reconstruction with an autogenous hemijoint graft using the proximal part of the fibula was performed. In one case the tumour was a low grade fibrosarcoma, in three cases a giant cell tumour grade 2–3 and in the remaining two a haemangioma. Four of the patients were women and two men. The age ranged from 23 to 39. Five to 12 cm of the distal radius was resected. In three cases the osteosynthesis was performed side to side and in three cases end to end. Postoperatively the duration of plaster immobilization was 8 to 16 weeks. The follow-up time ranged from 2 to 8 years and during this period none of the patients presented tumour recurrence. The range of motion in the radiocarpal joint was in each case normal or close to normal. All patients returned to work within 6 months after the operation.

ACRYLIC CEMENTATION IN TREATMENT OF BENIGN BONE TUMOURS

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The technique of acrylic cementation as the initial treatment after bone tumour evacuation is presented on the basis of the experience gained in 17 cases during the period 1977 to 1979. Eight of the patients were women and 13 men. The age averaged 32, range 14 to 58. The mean follow-up time was 15 months. The tumours were located in the cancellous parts of the femur, tibia, humerus and radius. Additionally, two of the tumours were in the talus and one in the os cuneiforme. In 7 cases the tumour was a cyst, in 7 cases a giant cell tumour, and there was one chondromyxoid fibroma and one enchondroma.

It would appear that acrylic cementation offers a

suitable means of treating evacuated benign bone tumours especially in locations where instant compression stress resistance is required.

EFFECT OF AGE ON BONE AND BONE MARROW BLOOD FLOW IN MAN

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We describe a noninvasive method for measuring regional blood flow in bone tissue and bone marrow. To calculate quantitative values of blood flow the two-exponential washout curves of ^{133}Xe from bone were measured and the tissue/blood partition coefficients associated with these two components were determined. The partition coefficient of the first component representing bone marrow was 0.95 ml/g. The partition coefficient of the second component representing bone tissue increased with the age of the person: $3.11 + 0.049$ (age) ml/g.

Bone-blood perfusion in the proximal femur of healthy persons was almost constant, 8 ml/100/min, between the ages of 20 and 55, decreasing thereafter with age.

EFFECTS OF OXYTETRACYCLINE ON MINERALIZATION OF BONE

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The metabolism of minerals and collagen in young rats receiving oxytetracycline was studied by employing double-isotope techniques (^{14}C -proline and strontium-85). The dosage of the antibiotic was adjusted to obtain plasma concentrations comparable with human therapeutic levels. Reduced mineral content, both absolute and compared to the collagen content, was observed in bone after oxytetracycline administration. The mineralization rate was reduced by the antibiotic, whereas no effect on the rate of collagen synthesis could be detected.

VITALITY OF THE FEMORAL HEAD AFTER FEMORAL NECK FRACTURE EVALUATED WITH TETRACYCLINE

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Fifty-two randomly selected patients who had sustained a femoral neck fracture were given 1000 mg of tetracycline on admission to hospital. At operation a

biopsy of cancellous bone was obtained from the head of the femur and analysed for the presence of tetracycline by fluorescence microscopy. These results were verified through microspectrofluorometric investigations.

Thirteen patients with fractures with minimal or no dislocation all showed evidence of tetracycline deposition in the biopsy preparations, whilst 9 patients out of 39 with a dislocated fracture showed absence of tetracycline.

Thus less than one patient out of five with a femoral neck fracture showed signs of total vascular insufficiency regarding the blood supply to the head of femur. This contrasts with the incidence of post-traumatic femoral head necrosis usually met with in the literature, between 25 and 40 per cent.

This discrepancy can be explained if also partial damage to the femoral head circulation can lead to femoral head collapse. However, it seems more likely that it is the nailing procedure which inflicts further trauma on the already threatened blood circulation. This suspicion is strengthened by the fact that several of the patients in this material with evidence of tetracycline in their biopsy specimens who have been submitted to a post-operative technetium scintimetry, show defective isotope uptake corresponding to the femoral head.

UPTAKE OF IN-113m IN THE FEMORAL HEAD AFTER FEMORAL NECK FRACTURE

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$^{113\text{m}}\text{InCl}_3$ was injected intravenously in 106 patients with femoral neck fractures. Indium (III) binds *in vivo* to serum transferrin. The activity values for serum and femoral head biopsies were used to calculate the ratio: cpm per g bone/cpm per g serum. The highest mean ratios were found in Garden type I and II fractures whereas the lowest occurred in type IV fractures. The differences between some of the groups were statistically significant. Thus, it may be possible to demonstrate differences in blood supply to the femoral head in groups with varying degrees of dislocation of the femoral head.

REPAIR OF FEMORAL FRACTURES EVALUATED BY THEIR STRENGTH, STIFFNESS AND DEFORMABILITY - A COMPARISON

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Fracture repair has been studied by mechanical methods in young and adult rats. At various intervals

after a standardized, left femoral fracture, both femora were tested in torsion until failure.

Already after 2 weeks, the fractures in young rats had reached the strength of their contralateral, intact bones. The fractures were, however, still clinically unstable at that time. The stiffness and the deformability of the fractures did not reach the corresponding values of the contralateral bones until about 5 weeks after the fracture. In adult rats, strength, stiffness and deformability of healing fractures reached values corresponding to those of their contralateral bones almost simultaneously, and after about 12 weeks.

In conclusion, fracture strength alone is an inaccurate means of evaluating fracture repair in young rats.

RIGID EXTERNAL FIXATION OF OPEN TIBIAL FRACTURES

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From 1970 to 1979, 102 severe open fractures in 98 patients were treated with stable external fixation. Excluding two patients amputated because of vascular injuries, wound healing was satisfactory in all patients with no primary deep infection of the fracture. There were two late infections following secondary intramedullary nailing. All patients were able to start early range-of-motion exercises postoperatively. The average time in the frame was 3.3 months and the mean time until full weight-bearing without external support was 7.4 months. Ninety-four fractures were united within 1 year and all the fractures (the amputated cases excluded) had healed after 20 months. In assessable patients the final result was excellent or good in 79 per cent and acceptable in 21 per cent.

EXTERNAL FIXATION OF TIBIAL FRACTURES WITH THE HOFFMANN-VIDAL-ADREY OSTEOTAXIS

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The clinical benefits, results and complications of a material of 73 tibial fractures treated in the 7-year period 1971–77 were analyzed. During this period a total of 127 patients with fractures were treated by Hoffmann's osteotaxis method.

The most frequent indications for the osteotaxis were an open, unstable tibial fracture, grade II–III, and failure of the primary reduction.

The number of longitudinal rods used varied from 1–4. In comminuted fractures compression between the bone fragments was not always possible. The fixation time varied from 3–10 weeks, which is somewhat shorter than the time usually reported in the literature. The severity of the soft tissue injury and the comminution of

the fracture correlated with the complications, infections and delayed union. Deep pin hole infections, demanding trepanation as treatment, occurred in two patients.

This method is very suitable for the treatment of comminuted unstable fractures with contamination or with infection, tibial fractures of multitrauma patients and cases with an ipsilateral femur fracture. It allows the continued mobilization of the neighboring joints, and open treatment of the soft tissue injury, debridement, skin transplantation, trepanation etc. can be carried out effectively. The use of the osteotaxis method requires an experienced surgical team.

EXTERNAL FIXATION OF OPEN FOREARM FRACTURES

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Severe injuries of the forearm and wrist often include damage to skeletal, nervous and vascular structures and extensive skin defects. The Hoffmann device, mounted as a single-frame system between the metacarpal bones and the radial shaft, is extremely suitable in such cases to stabilize the bone injury. There is a high risk of infection in this type of injury, but external fixation permits repeated debridement and split-skin grafting. The Hoffmann fixation also permits early active exercises to mobilize adjacent joints.

Cases are presented with complex forearm injuries, including fracture, nerve injury and acute compartment syndrome, which were successfully treated according to the Hoffmann principle.

External fixation is suitable also for closed unstable forearm fractures and is a valuable complementary procedure in the treatment of unstable fractures with associated nervous and vascular injuries sutured by microsurgical techniques.

CHOICE OF SURGICAL PROCEDURE FOR GONARTHROSIS

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Symptomatic gonarthrosis never heals spontaneously. With progressive loss of first cartilage and then bone it runs a predictable course toward increasingly disabling pain and instability. In each case the exact stage of the condition as established by X-ray provides the basic information for the choice of surgical procedure. The age and general condition of the patient may modify this choice.

In the early stages osteotomy has been well documented by 5–10 year follow-ups to be the method of choice. This is provided full correction of the deformity has been achieved, the disease process has stopped

and even healing of cartilage has been demonstrated. However, the rehabilitation period following osteotomy is often a burden to patients over 70 years of age, and an arthroplasty may then be preferable.

In later stages of gonarthrosis with evident bone loss an osteotomy is unreliable as compared with endoprosthetic arthroplasty. In most cases of lateral arthrosis and in cases of medial arthrosis where the bone loss does not exceed 5 mm, the opposite compartment is usually not involved and a demi-arthroplasty of the Marmor type is then sufficient. In more severe arthrosis the bone loss causes such instability that the opposite compartment is involved secondarily and a bicondylar or total endoprosthesis is then indicated.

As compared with the hip, surgery for arthrosis of the knee should be done at an early stage; the chances are good that an osteotomy may provide a definite cure. In the intermediate stage of gonarthrosis the demi-type endoprosthesis has the advantage over the total endoprosthesis that the risk of severe complications is probably lower. The long-term result following surgery for gonarthrosis is very closely correlated with the accuracy of the preoperative evaluation, the choice of procedure, and the surgical technique.

OPTIMAL CORRECTION IN HIGH TIBIAL OSTEOTOMY FOR MEDIAL GONARTHROSIS

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For a lasting result the magnitude of the required angular correction at high tibial osteotomy must be accurately judged. A precise orthoradiographic method, the three-point technique, was devised for measuring the mediolateral instability and the varus/valgus deviation of the knee.

An instrument with high precision, the SAAB Jig, was designed to facilitate removal of a wedge of a pre-determined size. Ninety-nine knees were operated upon with or without 5° overcorrection of the varus deformity using random selection. The overcorrected group showed significantly better results ($P < 0.05$).

Loss of correction may occur while the osteotomy is healing. According to the patient's rating, a final correction of the varus/valgus deviation to between 3 and 7° valgus yielded the best result.

HIGH TIBIAL OSTEOTOMY IN MEDIAL GONARTHROSIS. A PROSPECTIVE STUDY

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In 1976 a prospective study of tibial osteotomy for medial gonarthrosis was started. Only patients who were

not too old (rarely over 65 years) with early medial gonarthrosis (Stages I–III according to Ahlbäck) were selected for the osteotomy. The aim was to obtain a permanent overcorrection in valgus which is known to give the best results and in earlier reports has only partly been achieved.

Fifty-two knees were operated on and followed up for more than 1 year. In 48 knees the desired correction was achieved with the mechanical axis in the centre of the knee or laterally. Loss of correction was seen in 35 knees; in 8 the loss was more than 4°. Forty-seven knees improved their pain-free walking distance and 31 became completely pain-free.

We conclude that adequate correction/overcorrection of the mechanical axis in medial gonarthrosis requires careful preoperative roentgenographic analysis and precise operative techniques. On the basis of our previous experience the favourable short-term results in this series of patients suggest that even in the long-term the majority of our patients should not need further surgery for their gonarthrosis.

SWEDISH MULTICENTRE INVESTIGATION OF KNEE ARTHROPLASTY

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In 1975 the Swedish Orthopaedic Association started a prospective multicentre investigation of all knee arthroplasties performed in Sweden. The main aim of this project is to identify complications with this type of surgery. On the basis of the project, it ought to be possible to make a more correct choice of endoprosthesis in different types and degrees of diseases. All orthopaedic units in Sweden have contributed; after more than 4 years nearly 4000 primary operations have been reported. The indication for the operation was arthrosis in 48 per cent, rheumatoid arthritis in 45 per cent, and other conditions in 7 per cent, notably osteonecrosis, tumour etc.

The project includes a report regarding preoperative and operative data, continuous reports of complications, a simple 1-year follow-up and a more complete 3-year follow-up according to the format recommended by the British Society. The central registration takes place in Lund with the aid of the university computer.

The 1-year follow-up reports have been received for 90 per cent of the first 2586 arthroplasties. There were complications in 10 per cent of these cases, with one-third deep infections and two-thirds mechanical loosening or other technical problems. The overall incidence of reoperation with a new endoprosthesis or arthrodesis was 6 per cent.

DETERMINATION OF CHANGES IN POSITION OF KNEE PROSTHESES BY ROENTGEN STEREOPHOTOGRAMMETRY

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Roentgen stereophotogrammetric investigations have routinely been performed in uni- and tri-compartmental knee arthroplasties. The X-ray investigation is done by symmetric convergent photogrammetry, where the central beams meet at right angles. The patients were examined immediately postoperatively before weight-bearing was resumed and again every 6 months. A smaller group was investigated at 6 week intervals for 6 months.

Significant movement and rotation can be registered with an accuracy of 0.1 mm and 0.2°, respectively. Most patients showed minor and two patients major changes of position after 1–2 years. There were no clinical signs of complications.

Even in comparison with a reproducible standardized X-ray investigation roentgen stereophotogrammetry is the best method of determining early loosening of an endoprosthesis. By this exact technique we aim to improve and further standardize postoperative X-ray investigations.

PERIOSTEAL AND PERICHONDRIAL GRAFTS IN RECONSTRUCTION OF JOINT SURFACES

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The reconstruction of joint surfaces in several more or less destructive conditions still remains a difficult problem in the field of orthopaedic surgery. In our previous experimental and clinical studies it has been found that free periosteal and perichondrial grafts maintain their osteo-chondrogenic potency and form cartilage and bone. The grafts also retain some features of their intracellular message but the osteo-chondrogenic cells are also able to adapt themselves according to environmental influences. We have now applied periosteal or perichondrial grafts to the reconstruction of the metatarsophalangeal joint (three patients), the femoral condylar cartilage of the knee (three patients) and the patellar surface (three patients). Periosteum was used in seven and perichondrium in two cases. The patients have been followed up for over a year and subjectively all have experienced improvement. Arthroscopy of the knee revealed a smooth articular surface. Biopsy from the grafted areas has revealed hyaline cartilage in three cases.

SUBCLINICAL KNEE JOINT DEGENERATION

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This investigation was performed to determine the radiological findings in knee joints of asymptomatic patients who denied any past or present joint distress. The study group consisted of 193 middle-aged persons selected only after a careful history had disclosed no previous or current symptoms of knee joint disease. The joints were classified as being normal or as showing some degree of degeneration.

Signs of degeneration were observed in 24 of the 193 patients studied (12 per cent). First-degree changes with reactive bone formation were present in 22 patients and second-degree changes in two with additional narrowing of the joint space, slight deformity and slight sclerosis, all bilateral and almost symmetrical.

RESULTS OF TIBIAL AND FEMORAL OSTEOTOMIES

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The examination concerns 122 women and 26 men, who were operated during 1973–1978. The average age was 70 years, the youngest being 42, and the oldest 86 years. There were 163 knees in all. Primary arthrosis of the knee joint was the diagnosis in 153 cases, and in 10 cases it was rheumatoid arthritis. The predominant deformation was varus in 133 cases and valgus in 30 cases. Supracondylar osteotomy was performed for valgus deformity in cases where the deviation exceeded 20°. Supracondylar femoral osteotomy was performed in 7 knees, and infracondylar tibial osteotomy in 156 knees. Mortality: 1 case of pulmonary embolus. During the examination period 12 patients died for various reasons. The results were evaluated by the method of MacIntosh & Welsh and were classified as good, fair or poor.

A total of 162 knees were examined after an observation period of ½ year. In this group the result was good in 95 knees, fair in 43 and poor in 10. Fourteen knees were still receiving treatment. After an observation period of 2 years 127 knees were examined, of which 80 were good, 25 fair and 22 poor. After an observation period of 3 years 82 knees were examined, of which 55 were good, 15 fair and 12 poor. The total sum of good or fair attained an average of 85 per cent of the knees examined. The presented results point in the same direction as the material previously published on this topic.

TRANSLATION IN MEDIAL GONARTHROSIS AFTER CORRECTION AND OVERCORRECTION BY PROXIMAL TIBIAL OSTEOTOMY

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Translation (subluxation) and angulation in medial femoro-tibial osteoarthritis is common even with only slight cartilage destruction when the varus deformity exceeds 7–8°. As translation may accelerate or account for the development of secondary osteoarthritis in the lateral compartment it may be essential to determine the degree of correction necessary to eliminate the translation.

Translation and valgus/varus deformity were measured on well-defined A–P radiographs of the whole lower limb, while sustaining the body weight.

Sufficient reduction of the translation was obtained only by an overcorrection of the varus deformity, but when this exceeded 5–6° valgus angulation was produced. Reappearance of the joint space, seen in some patients, was due to the elimination of translation.

KNEE ARTHROPLASTY WITH MARMOR AND TOTAL CONDYLAR PROSTHESES FOR GONARTHROSIS

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Three prospective series were presented:

A. 107 uni- and bicompartamental arthroplasties with a 4-year follow-up time. B. 33 medial unicompartmental arthroplasties operated on the basis of strict indications using a positioning jig and followed up for 2 years. C. Total condylar tricompartmental arthroplasties followed up for 1–1½ years.

In series A late complications leading to failure occurred in 16 knees (15 per cent) while in series B only in 2 out of 33 and in series C in 1 out of 33 knees. Failures in series A occurred mainly in knees operated during the introduction period, in retrospect interpreted as more or less obvious technical errors in the selection of patients and the surgical performance. In unicompartmental arthroplasty the failed knees could be revised or converted to Total Condylar arthroplasty with good results in most cases. Only one infection occurred in the 173 operated knees.

It seems that knees with unicompartmental disease stages II–IV according to Ahlbäck and minor tibial subluxation can be safely treated with a unicompartmental prosthesis while almost all knees with severe arthrosis can be treated with the Total Condylar prosthesis. Full stability, good alignment of the extremity and congruence between the prosthetic components are best accomplished by precise operative technique with the help of guiding instruments.

MARMOR KNEE ARTHROPLASTY: A PROSPECTIVE STUDY WITH 3–4½ YEARS FOLLOW-UP

Results and complications

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To be published in *Acta Orthopaedica Scandinavica*.

THE BONE-CEMENT INTERFACE AFTER UNFAVOURABLE LOADING OF THE MARMOR PROSTHESIS

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To be published in *Acta Orthopaedica Scandinavica*.

OPERATIVE TREATMENT OF PATELLAR CHONDROMALACIA USING THE DYONICS SHAVER

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During 1978–79, 32 patients were operated on using the Dyonics intra-articular shaver under direct arthroscopy control. Both knees were operated on in two patients. All patients complained of a painful and disabling patellar chondromalacia. The patients were re-examined postoperatively at 6-month intervals and the follow-up of the patients is still in progress. The average observation time is now 14 months.

The result was estimated as excellent (the patients were totally symptom-free) in 26.5 per cent, good (symptoms provoked by strenuous exercise only) in 50 per cent and satisfactory (better than before the operation) in 17.6 per cent of the patients. In two patients (5.9 per cent) the result was considered unsatisfactory.

The results were slightly better in cases where the degree of the chondromalacia was considered mild. No worsening of the results in connection with a longer observation time was seen in this series.

The operation which was carried out under general anaesthesia was well tolerated and no complications occurred. The debris that was removed from the articular surface was examined histologically.

RECONSTRUCTIVE SURGERY IN MALUNITED SUPRACONDYLAR FRACTURE OF THE FEMUR

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Varus or valgus deformity, ventral or dorsal angulation, shortening, instability and impaired knee mobility are frequent complications following supracondylar femoral fractures. An active surgical approach can do much to reduce the resulting functional impairment. Excision of scar tissue, excision of adhesions and cleaning of the joint, osteotomies and resurfacing may be performed either separately or in combination. All these procedures involve extensive surgical exploration of the knee joint, and immediate postoperative exercises to train mobility are imperative. Retention of an epidural catheter for repeated anaesthetics will allow active but painless exercises from a few hours after operation and throughout the following 3 days.

In a small series of 6 patients treated along these lines considerable improvement was obtained. Deformity was reduced and the average increase in mobility at the knee joint was 90°.

KNEE ARTHROPLASTY STUDIED WITH REPEATED MUSCULAR STRENGTH MEASUREMENTS AND GAIT ANALYSIS WITH THE GAIT-ANGLE DIAGRAM TECHNIQUE

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To be published in *Acta Orthopaedica Scandinavica*.

LATE RESULTS AFTER OPERATIVE TREATMENT OF CHRONIC DISLOCATION OF THE PATELLA

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From 1946 to 1979 a total of 99 patients were operated on because of dislocation of the patella. Fourteen patients had bilateral dislocation which meant a total of 113 knees. The present follow-up study consists of 93 knees in 80 patients. The follow-up time varied from 1 to 36 years (mean 10.2 years). Patients were examined clinically, radiologically and by measuring the muscle power of the knee. Seventy-five per cent of the patients were women. In most cases Hauser's operation was used; Krogius' method was used in young patients with open epiphyseal lines. Sixteen per cent of the patients needed reoperation and 22 per cent were operated on because of some other knee diagnosis. In some patients

it was evident that the diagnosis of patellar dislocation had not been made primarily.

The operative result was classified as excellent in 16.1 per cent, good in 31.2, satisfactory in 49.5 and unsatisfactory in 3.2 per cent of the patients.

The results show that symptoms in the patellofemoral joint persist after operative treatment of the dislocation and in some cases are even worse than preoperatively. On the other hand, a good operative result is not lost after a longer observation time.

THE RELATIONSHIP BETWEEN THE INTRA-ARTICULAR PRESSURE OF THE KNEE JOINT AND THE INTRAOSSEOUS PRESSURES IN THE FEMUR AND THE TIBIA

An experimental investigation in dogs

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The series includes 12 mongrel dogs, 6 with preserved and 6 with closed epiphyseal plates. Under general anaesthesia simultaneous pressure measurements were performed in the femoral artery, the knee joint and the tibia and femur adjacent to the knee joint. The intra-articular pressure was increased with increments of 5 cm H₂O. This caused an increase in the femoral intraosseous pressure, while the tibial intraosseous pressure remained unchanged. The pressure increase in the femur was most pronounced in dogs with preserved epiphyseal plates. It is suggested that the rise in the femoral pressure was caused by obstruction of the venous drainage. This was evidenced by anatomical studies and intraosseous phlebography.

THE INTERNAL STRESS PATTERN IN THE PROXIMAL TIBIA

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In a photoelastic study of the proximal tibia in varus or valgus knees the stress trajectories were concentrated on the condyle on the convex side, and a recessive singular point was found in the other condyle. A photodensitometric study was done on cancellous bone cylinders taken from the medial and lateral condyle in normal knees (autopsies) and from osteoarthrotic knees with valgus or varus deformity. The mean ash weight (mg/cm³) of the cancellous bone tissue was in the 9 normal knees 179 in the medial condyle and 158 in the lateral. In the 6 varus knees it was 162 in the medial and 314 in the lateral condyle.

The variation in the quality of bone structure in the proximal tibia, related to varus or valgus deformity of the knee, could be expected to have some influence on

the prognosis of joint alloplasty, because the bone structure on the convex side of the deformity may be too weak to withstand the stress transmitted by a weight-bearing endoprosthesis.

FIXATION AND STABILIZATION OF OSTEOCHONDRAL FRAGMENTS IN THE KNEE

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A series comprising 31 patients, 16 of whom were adolescents and 15 adults, with osteochondritis dissecans of the femoral condyle were operated on using transfixation and stabilization of the fragment by means of autogenous bone transplants. In 90 per cent of the cases the focus was located in the medial condyle, and in the remaining cases laterally, totally or partly on a weight-bearing joint surface. In all these cases the fragment was preoperatively estimated to be unstable and in some, the fragment was freely movable in the joint.

A follow-up was performed 2–18 years postoperatively. Two thirds of the patients were symptom-free at that time. In the remaining cases even preoperative symptoms had decreased.

The adhesion of the fragment was noted 2–6 months postoperatively in all cases. In 16 per cent an incongruity was found between the fragment and the condyle surface due to unsatisfactory surgical techniques.

Resorption of the extremity of the bone transplant in contact with the joint was seen in 89 per cent of the cases. No re-operation or removal of fixation material was required. The method can also be used for the transfixation of fragments in other joints.

SURGICAL TREATMENT OF FRACTURES OF THE PATELLA

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A series of 100 fractures of the patella, treated by surgery during the years 1972–1974, was analysed. Cerclage fixation was used in 29 patients, screw fixation in 19, partial patellectomy in 35, total patellectomy in 10 and marginal or upper pole extirpation in 7 patients.

At follow-up (mean observation time 11 months) attention was paid to radiological findings, range of knee movement, state of the quadriceps muscle, duration of working incapacity and subjective symptoms.

The result was considered excellent in 27 per cent of the patients, good in 51, fair in 15 and poor in 7 per cent. Patients under 40 years of age had better results than the older ones ($P < 0.01$) and so had office work-

ers compared with manual workers ($P < 0.05$). Cerclage wire, especially tension band fixation, gave results superior to those of screw fixation ($P < 0.02$). No statistically significant influence of the length of the immobilization time on the result was noted.

ANTEROMEDIAL TRANSPOSITION OF THE TIBIAL TUBERCLE FOR CORRECTION OF PATELLAR INSTABILITY

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A long oblique osteotomy through the tubercle and the anterior crest of the tibia, with maintenance of the medial periosteal and the distal bony anchorage, was performed in 30 patients. As the osteotomy is inclined 30–45° to the frontal plane, medial transposition automatically lifts the patella tendon insertion anteriorly. Anteposition increases the extension lever arm and reduces the patellofemoral compression force and thereby reduces pain. Fixation with a compression screw yields excellent stability which promotes functional after-treatment and early ambulation without a plaster cast.

Thirty-five knee joints with unstable patellae were stable at follow-up 2 years postoperatively. Whereas the degree of pain was only partially relieved, stable anatomical realignment of the patellae was seen in axial view X-rays taken with and without quadriceps contraction.

CLINICAL EXPERIENCE OF LACHMAN'S TEST AND THE ANTERIOR DRAWER TEST IN ANTERIOR CRUCIATE LIGAMENT INJURY

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The clinical diagnosis of anterior cruciate instability is contingent upon demonstration of a positive drawer sign. Torg (1976) described Lachman's test as a specific diagnostic test for anterior cruciate ligament instability. This test is performed with the knee flexed 15 degrees. A comparative study of the anterior drawer sign and Lachman's test were performed in 107 patients with and without general anaesthesia. Forty-five patients had acute anterior cruciate ligament tear; 39 had a positive Lachman test and 15 had a positive anterior drawer sign. Sixty-two patients had an old anterior cruciate ligament tear; 60 had a positive Lachman test and 59 had a positive anterior drawer sign.

LOSEE'S SLING AND REEF OPERATION FOR ANTEROLATERAL ROTATORY INSTABILITY OF THE KNEE

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Eight patients were operated on for anterolateral rotatory instability of the knee using Losee's reconstruction. Indications for operation were: history of sudden, painful giving way, positive Slocum's test where the patient recognized the giving-way-subluxation as the main complaint, and ability to move the externally rotated tibia through a full range of knee motion without subluxation.

In the reconstruction a strip of the iliotibial tract attached to Gerdy's tubercle was prepared. This strip was threaded through the lateral femoral condyle from the lateral centre of rotation, through the lateral head of gastrocnemius and the arcuate ligament, beneath the lateral collateral ligament and back to Gerdy's tubercle.

After a follow-up of 7 to 16 months, seven knees were subjectively stable, one patient had experienced two episodes of probable subluxation. Slocum's test was negative in all knees.

POSTERIOR CRUCIATE INJURY IN FLOATING KNEE

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In 1977-79 four knee ligament injuries, combined with ipsilateral femoral and tibial fractures, were treated. All patients were young males injured in motorcycle accidents. The fractures were stabilized over a period of 8 days using intramedullary nailing and osteotaxis. The knee ligament injuries were: posterior cruciate - 4, medial side - 2, lateral side - 1, and anterior cruciate - 1. For diagnosis, testing under anaesthesia and arthroscopy were used. The diagnosis of knee injury was made at 7 months in one case, primarily in two cases (with avulsion fragments), and at 1 month in one case.

The posterior cruciate reconstructions were: three primary reinsertions, two gastrocnemius transfers and one Trillat's postero-medial advancement. One slight posterior drawer sign and PLRI, and two insignificant restrictions of movement were recorded (follow-up 6 to 33 months). In conclusion, a high degree of clinical awareness is advisable when treating a floating knee. Early stabilization of fractures makes optimum testing and treatment of the knee injury possible.

STUMP MUSCLE TRAINING IN BELOW-KNEE AMPUTEES

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Following amputation the muscles of the stump atrophy which may influence the connection between the stump and the socket. The stump muscles have therefore been subjected to a systematic training program. The amputees have carried out daily isometric stump muscle contractions against a resistance consisting of a tourniquet surrounded by a conical tube. The results of the training have been evaluated by clinical examination, tourniquet test, isokinetic strength testing, computer tomography, plethysmography, and volumetry. Twenty below-knee amputees participated in the training for 10 weeks. The training resulted in improved isometric strength in the stump muscle and in improved venous emptying. The amputees experienced improved prosthetic function and that the stump became firmer and more muscular. This training method may complement the training of amputees with prosthetic problems.

THE EFFECT OF TEMPORARY PASSIVE MOBILIZATION OF A JOINT DURING AND AFTER AN IMMOBILIZATION PERIOD

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Osteoarthritis develops consistently in animal joints following an immobilization of sufficient duration. The aim of this study was to discover if temporary, careful or forcible passive exercise of the rabbit knee during and after an immobilization period of 5 weeks can prevent the joint changes that always follow a standard method of immobilization. This investigation showed that passive careful exercise of the knee during and after the immobilization period usually was of no benefit and was sometimes harmful. The forcible exercise was consistently injurious as regards stiffening, thickening and the development of degenerative changes of the knee.

EARLY ASSESSMENT OF PROGNOSIS IN PERTHES' DISEASE

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A new method for early prognostication of Perthes' disease is presented based on a review of 69 roentgenological examinations performed during the first year of the disease (27 patients with unilateral hip involvement). A simple mathematical function that takes account of changes in the proximal femur as well as in the pelvis was constructed with the aid of descri-

minant analysis in a computer. The function expresses the prognosis numerically as an index which in 80 per cent of the cases predicts the outcome of the disease with a 95 per cent probability.

PERTHES' DISEASE: A PROGNOSTIC EVALUATION ACCORDING TO CATTERALL

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The roentgenograms of 263 patients with unilateral Perthes' disease treated by a wheelchair regimen were reviewed by the two authors independently in order to compare the prognosis estimated by Catterall's criteria with the healing results described by various parameters.

We found a strong correlation between Catterall's classification and healing as regards the epiphyseal quotients, but less correlation with the spherical shape of the head.

Forty-two patients healed with irregular heads according to Mose's template method. Thirty of these patients belonged to Catterall's groups 3 and 4, but 12 (28.6 per cent) belonged to groups 1 and 2.

We found the prognostic value of Catterall's classification decreased in the older age groups.

Eleven patients had to be reclassified during the first year.

RESULTS FOLLOWING WHEELCHAIR TREATMENT OF PERTHES' DISEASE

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A total of 290 children with unilateral Perthes' disease have been treated at home in wheelchairs for an average of 2 years. Together with three other groups of similar patients, also having non-weight-bearing treatment, a total of 564 cases have been analysed.

Of this number, 443 healed with a spherical shaped head, thus avoiding later osteoarthritis. Age was found to be the most important factor as regards spherical healing; the degree of fragmentation had a marked influence and early treatment some influence but sex had none.

Wheelchair treatment resulted in 84.4 per cent spherical heads, thus equalling the rate after traction treatment in hospital beds. A sitting regimen where the femoral head is kept in the acetabulum is a practical and satisfactory method when weight relief is necessary for Perthes' patients.

LATE RESULTS OF CALVÉ - LEGG - PERTHES DISEASE TREATED WITH ONE YEAR'S BED REST

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Fifty-nine patients with C-L-P disease were primarily treated with 1 year's bed rest during the years 1936-1954. The follow-up time has been from 11 to 37 years, average 20.4 years. The results were approximately the same as for other materials treated with non-weight-bearing.

The prognosis seemed to be clearly better if the patient acquired the disease before the age of 7 years. Early treatment gave some improvement in the results.

INTERTROCHANTERIC VARUS OSTEOTOMY IN THE TREATMENT OF PERTHES' DISEASE

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The results of the treatment of Perthes' disease previously applied at the Orthopaedic Hospital of the Invalid Foundation, a Thomas splint, were good in only about 50 per cent of the 165 cases followed up (Edgren: *Acta Orthop. Scand.*, Suppl. 84, 1965). Between 1969 and 1975, 67 patients were treated by varus osteotomy. Of these, 11 were bilateral cases, making a total of 78 hips. A control group consisted of 41 patients and 52 hips treated conservatively during the same period. The hips were graded according to Catterall's schema preoperatively.

The mean observation time was 6 years. The average age of the patients was 7 years and 8 months at the time of osteotomy. This means that the operations were performed at a late stage of the disease. With osteotomy good results were achieved in 5 hips out of 7 in group II, in 19 hips out of 32 in group III and in 12 out of 39 in group IV. In the conservatively treated series the results were good in 27 hips out of 29 belonging to Catterall's groups I and II. In group IV there were 11 hips with only one good result.

The investigation indicates that with osteotomy the results improve in Catterall's group IV. There are, however, still about 30 per cent poor results in group IV. Earlier osteotomy and a prolonged non-weight-bearing period after surgery may improve the results in this group.

CONSERVATIVE VERSUS OPERATIVE TREATMENT OF COXA PLANA

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The radiographic results after femoral derotation and varisation osteotomy in coxa plana were evaluated in 47 hips. These results were compared with those obtained after conservative treatment (Thomas' splint) in 45 hips.

Evaluation of the results as regards epiphyseal quotient, joint surface quotient and general assessment of the radiographs (Catterall) did not show any differences between operative and conservative treatment (regression analysis). Highly significant correlations ($P < 0.001$; $r = 0.78-0.54$) existed between the results and the primary degree of necrosis (Catterall). Weak correlations were found with age ($0.05 > P > 0.01$). No correlations existed between the results and sex or side.

In the group subjected to osteotomy the results expressed as epiphyseal and joint surface quotients were not influenced (regression analyses) by the time from diagnosis to operation, the preoperative height of the epiphyses, the degree of varisation and derotation at operation, the residual subluxation of the epiphyses after operation or the postoperative angle between the epiphyseal line and the acetabulum.

OSTEOCHONDritis DISSECANS FOLLOWING PERTHES' DISEASE

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A series of 17 patients where osteochondritis dissecans developed after Perthes' disease is presented. The patients were treated conservatively using Thomas' splint. Age at the onset of symptoms was 8 years on average, ranging from 4 to 11 years. Fifteen of the patients were boys, two girls. Four patients had bilateral Perthes' disease and in one of them bilateral osteochondritis dissecans was seen. The average age of the patients at follow-up was 32.5 years, ranging from 20 to 43 years.

The lesion caused minor symptoms in most patients but in three patients the fragment dislocated and resulted in a loose body and osteoarthritis. A radiologically established osteochondritis dissecans healed spontaneously in one case.

Conservative treatment is recommended in most patients especially at a younger age. Removal of the fragment from its bed may increase the risk of secondary osteoarthritis and cannot be recommended. Fixation of the fragment may be useful in selected cases.

The number of patients in whom osteochondritis dissecans develops after Perthes' disease seems to be greater than assumed previously in most reports. In our

material this combination was seen in 6 per cent of all the cases of Perthes' disease.

EXPERIMENTAL GROWTH DISTURBANCE OF THE ACETABULUM AND DISLOCATION OF THE HIP

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The aim of this study was to clarify the mechanism of acetabular growth and the role of dysplasia in the development of experimental subluxation of the hip. Experimental acetabular growth disturbance was provoked in growing rabbits. A wedge resection was performed extra-articularly at the site important for the development of the acetabulum, i.e. the acetabular shelf including the triradiate epiphysis. The rabbits were 3 weeks old at the time of the operation. The growth of the hip was followed roentgenologically at regular intervals. During the time of observation a disturbance of acetabular growth was seen which later progressed to subluxation or luxation. In this experimental series the developmental changes were reflected not only in the acetabulum and the head of the femur but also in the ilium, pubis, and ischium. With the method applied acetabular growth disturbances can be consistently induced.

CHIARI OSTEOTOMY IN THE TREATMENT OF SUBLUXATION OF THE HIP IN ADOLESCENTS

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The series comprised 17 patients and 18 hips with primary or residual congenital dislocation. Only two hips had not been treated previously. There were in addition three hips with paralytic subluxation after poliomyelitis and two hips with subluxation due to Perthes' disease.

The mean age of the patients was 13 years and the mean observation time after surgery 6 years. A transplantation of bone from the iliac crest to the acetabular roof was performed in connection with the osteotomy in 10 cases and 1-3 years later in 4 cases. The results were better in the cases having transplantation of bone. If preoperatively there was deformity of the femoral head the results were poor. The results were satisfactory in 8 out of 18 hips with congenital subluxation and congruity between the joint surfaces was achieved. The results were poor in all three cases of subluxation after poliomyelitis but satisfactory in the two cases of Perthes' disease.

A Chiari osteotomy may offer satisfactory results in subluxation of the hip in this age group provided that

the femoral head is not deformed. A transplantation of bone to the acetabular roof to achieve congruity of the joint surfaces is recommended.

ANTEROLATERAL ROTATIONAL INSTABILITY IN THE ANKLE JOINT

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RUPTURE OF THE LATERAL LIGAMENTS OF THE ANKLE. PLASTER CAST OR OPERATION?

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TRANSACETABULAR APPROACH TO THE HIP JOINT

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TROCHANTERIC AND SUBTROCHANTERIC FRACTURES

*A controlled comparative trial of Ender nailing and
McLaughlin osteosynthesis*

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To be published in *Acta Orthopaedica Scandinavica*.

PROPHYLACTIC INTRAMEDULLARY NAILING IN OSTEOGENESIS IMPERFECTA

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The material consists of 7 patients. All were sporadic cases. Three different types were differentiated. The age at operation ranged between 2 months and 10 years; three of the youngest patients were under 8 months old. All had fractures at birth. The four oldest patients had 10–40 fractures in their anamnesis. The lower extremities were nailed in all but one patient.

Altogether 24 bones were nailed primarily. Rush pins were used in the younger and Kuntscher nails in the older patients. Multiple osteotomies were usually necessary. The follow-up period was 3 months to 4 years.

Four of the six patients with nailed lower extremities became able to walk. Two of these had lost this capacity because of a vicious circle caused by fractures and osteoporosis. A pneumatic orthosis was found useful in the rehabilitation of these patients. The upper extremities of one child with lethal O. I. were nailed, with the result that the child lived for 2 years without problems from the nailed extremities, though with continuous problems from the lower extremities.

It is concluded that intramedullary nailing is technically possible, even in infants. Multiple closed or open osteotomies are preferable to a Sofield type of operation. Children with recurrent fractures and the early stages of deformation benefit from the nailing, irrespective of the type of the disease. Changing the nails as the child grows is relatively easy if deformation has been prevented by early primary nailing.

PROVOKED HIP DISLOCATION STUDIED BY CRYO-SECTIONING

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A method has been evolved for biomechanical studies on autopsy specimens comprising the pelvis and the femora. The pelvis is firmly fixed to a stand and a constant load is applied to the femora. Hereby the femoral head dislocates at a decreasing rate during the following hours. At the end of the experiment the specimen is frozen while still under load. Then one hip is studied by serial cyro-sectioning and the other by dissection, and the findings are compared.

The study has proven that dislocation can be provoked by rather moderate forces, that the deformation is related to time, and that the load used does not macroscopically damage the ligaments or the capsule.

PROGNOSIS FOR REHABILITATION AFTER HIP FRACTURE IN THE ELDERLY

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A statistical investigation using multivariate techniques was made of the rehabilitation outcome of 103 consecutive elderly hip-fracture patients, all admitted from their own homes. A stepwise linear discriminant analysis was used to estimate the probability of a given patient returning home. At discharge from hospital certain factors, i.e. ability to walk 2 weeks post-surgery, living with someone, general medical condition, and type of fracture, were found to be most important for a

direct return home. At 1 year after the hip fracture the prefracture ability to visit someone and the age of the patient were of greatest prognostic significance for having returned home and remained there. The accuracy of the prediction was more than 80 per cent correct at discharge and 86 per cent correct at 1 year.

MULTIPLE JOINT RECONSTRUCTION IN RHEUMATOID ARTHRITIS

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Patients operated on in the years 1974–1978 were reviewed. The majority had very destructive seropositive rheumatoid arthritis and a few Bechterew's disease. Together with rheumatologists the reconstructive and postoperative treatments were planned before the patients were admitted to the orthopaedic department. Some patients returned to the rheumatology department for further rehabilitation after surgery.

Many of the patients initially had a posterior fusion C1–C2 under local anaesthesia for luxation, followed by joint reconstructions ½–3 months later. Knees and hips were most frequently replaced and, in selected cases, ankle and elbow. An interval of 3 weeks was preferred for bilateral reconstructions, starting with the most painful joint. Combined anterior hip and knee reconstruction on one side shortened hospitalization.

By systematic, rational reconstructive treatments the prospect of life in a wheelchair could be eliminated without increasing the risk of complications.

SOFT TISSUE TUMOURS: DIAGNOSIS, CLASSIFICATION AND PROGNOSIS FROM THE PATHOLOGIST'S POINT OF VIEW

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The sixties and seventies has been a period of reappraisal of the definitions and nomenclature as regards various tumours and tumour-like lesions in the soft tissues, and new soft tissue tumours have been described. Examples of the latter are malignant fibrous histiocytoma, clear-cell sarcoma and extraskeletal Ewing's sarcoma. Pseudosarcoma constitutes an important group and can simulate clinically and patho-anatomically a malignant tumour. Histochemical, enzymatic and electron-microscopical examination has yielded new knowledge about the structure and chemical composition of soft tissue tumours and improved the diagnosis. There are malignant soft tissue tumours with unknown histogenesis, which nevertheless have been well described and defined thanks to their characteristic histological appearance, e.g. alveolar soft tissue sarcoma. Correlating histological and microangiographic examination of operation specimens is a morphological

technique which has helped to improve our understanding of the preoperative angiographic picture and increased our knowledge of the vascularization of soft tissue tumours. For studies of the influence of different morphological and clinical variables on the prognosis multiple analysis is indispensable.

CLINICAL DIAGNOSIS AND SURGICAL TREATMENT OF MALIGNANT SOFT TISSUE TUMOURS

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A diagnostically uncertain mass in the trunk, arm or leg should be suspected to be a malignant tumour until proved otherwise. The history and the clinical and radiographic findings usually provide helpful guidance for the diagnosis. In many cases valuable information about the exact location of the tumour in relation to important anatomical structures can be obtained by angiography. Surgical treatment should be based on a careful preoperative planning. If the tumour is located intra- or intermuscularly the engaged muscle or muscles should be removed from origin to insertion together with the fascial confinement on all sides (sometimes also periosteum or bone). Biopsy should be done only by the surgeon who has to plan and perform the curative operation, and the biopsy route should be selected so that its inclusion in the surgical specimen does not result in unnecessary loss of function. Under favourable conditions much function can be preserved if the tumour is radically removed without previous incisional biopsy.

RADIO- AND CHEMOTHERAPY OF SOFT TISSUE SARCOMAS

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The role of radiotherapy in the treatment of soft tissue sarcomas has so far not been clearly defined. Overall about 50 per cent of patients treated with conventional radiotherapy obtain an objective tumor regression. Radiotherapy should be considered in patients with inoperable soft tissue sarcomas. Postoperative radiation is recommended when surgery has been non-radical. Preoperative radiation has so far not been evaluated.

With adriamycin as a single drug or in combination with other cytostatics (cyclophosphamide-vincristine-adriamycin-DTIC, "CYVADIC") objective responses are obtained in about 50 per cent of patients with advanced disease. Clinical trials have been started with the aim of investigating whether chemotherapy given as an adjuvant to the surgical treatment will prolong survival.

CT IN THE DEMARCATION OF SOFT TISSUE TUMORS

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Computed Tomography (CT) has in most reports been found to be superior to other methods in delineating the extent of soft tissue tumors, but the accuracy of this new method has not been proved.

In seven non-resectable tumors of the thigh histopathological examination of anatomic cross sections was correlated with the corresponding CT scans. CT accurately delineated the extent of benign and highly differentiated neoplasms.

In the tissues surrounding poorly differentiated tumors of the thigh there was edema demonstrated by CT as a decrease in muscular attenuation and an increase in fat tissue attenuation. Therefore inhomogeneity in attenuation of the tumors made it difficult or impossible to delineate the extent of these tumors.

SOFT TISSUE SARCOMAS IN THE EXTREMITIES: A CLINICOPATHOLOGIC AND PROGNOSTIC STUDY

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The material consisted of 240 patients with sarcomas of the soft tissues of the extremities entered in the Finnish Cancer Register during the years 1960–69. The histological preparations were re-examined in all these cases. The material was not homogenous. Local excision was performed in 152 patients (63 per cent), wide excision in 44 (18 per cent) and primary amputation in 24 cases (10 per cent). Of the 231 patients followed up, 44 per cent had one or more local recurrences, 46 per cent had distant metastases and the 5-year survival was 53 per cent. If the tumours were small (<5 cm), located in superficial soft tissues and did not invade vital structures, the 5-year survival of the patients was 65 per cent. If the tumours were large (>5 cm), deeply located and/or infiltrating vital structures, the 5-year survival of the patients was 31 per cent. The role of postoperative irradiation treatment is open. If soft tissue sarcomas are treated without a rational treatment program the results are suboptimal. Therefore these rare cases should be centralized into clinics with greater experience in their treatment.

RESULTS OF FUNCTION-PRESERVING SURGICAL TREATMENT OF SOFT TISSUE SARCOMA

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Ninety-seven patients who received their primary and definitive treatment under uniform conditions from 1956 to 1976 were studied; the minimum follow-up time was 3 years. Host and tumour properties and different diagnostic and surgical procedures were studied in relation to local recurrence, metastasis and survival. Preoperative incisional biopsy was as a rule avoided. This permitted less margin in the transverse plane thus saving muscular function. Eighty-three per cent of the 90 patients with extremity lesions underwent local extirpation. The overall local recurrence rate was 21.7 per cent; after radical extirpation it was 7.9 per cent. The overall 5-year survival rate was 59 per cent. Factors with proven influence on the prognosis were: control of the primary tumour, the malignancy grade and the location. Tumours less than 5 cm seemed to have a better prognosis. Sex, ESR, age, duration of symptoms and the tumour depth had no influence on the prognosis.

STUDIES OF FUNCTION AFTER RESECTION OF HIP AND KNEE MUSCULATURE

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The function after well defined resections of hip and knee musculature was studied in 46 patients with a mean age of 51 years. The investigation comprised clinical examination, muscle strength measurements (both isometric and isokinetic) and the history of functional capacity. Despite a significant strength reduction after removal of various combinations of hip muscles the functional capacity was surprisingly little impaired. After removal of all major hip abductors the strength reduction was only about 50 per cent as compared with the unoperated side, so hypertrophy of the remaining muscles seemed to have taken place. Resections of the quadriceps muscle reduced the isokinetic knee extension strength more than the isometric. The strength had to fall below 50 per cent to cause moderate impairment of function. After removal of all the hamstrings the knee flexion strength was about 35 per cent of the normal, which caused moderate impairment of function.

ULTRASOUND AND THE SIZE OF THE LUMBAR SPINAL CANAL: PRECISION AND ORIGIN OF ECHOES

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A new approach for depiction of the lumbar spinal canal was introduced by Porter et al. in 1978. The ultrasonic gray-scale B-scanning technique was used and the width of the spinal canal was measured from the picture of the echoes arriving from the canal.

This present investigation was undertaken to clarify the structural origin of the recorded echoes and to determine the precision of the measurements. Ten fresh lumbar spine segments were measured by a static ultrasound scanner using a 2.25 MHz transducer.

We found contrary to Porter that the strongest and most easily measured echoes defined the boundaries of the spinal fluid room.

With ultrasound a useful measurement of the width of the lumbar spinal canal can be obtained.

THE VALUE OF SONOGRAPHY FOR EVALUATION OF PATIENTS WITH CLINICALLY SUSPECTED SPINAL STENOSIS

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The current method of evaluating patients with clinically suspected spinal stenosis is lumbar myelography with positive contrast. The method of measuring the lumbar spinal canal using sonography has been demonstrated recently. A comparison between measurements obtained at sonography and measurements made on myelography films would show the value of ultrasound for the diagnosis of spinal stenosis.

Twenty patients were examined with myelography and with sonography according to the method described by Porter. Forty-five measurements were obtained. There was a correlation between the shortest ventrodorsal distance at the level of the intervertebral spaces on the myelography films and the corresponding measurement at sonography. A distance at sonography of more than 14 mm excludes spinal stenosis according to criteria used when evaluating myelographies.

DEGENERATIVE LUMBAR SPINAL STENOSIS

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Sixteen patients fulfilling the criteria for degenerative lumbar spinal stenosis (midsagittal diameter of the spinal canal on standing myelograms less than 11 mm, degenerative spondylosis, unimpaired peripheral circula-

tion) were operated on because of severe leg pain. Thirteen of them were evaluated 13–48 months after surgery.

The operation consisted of decompressive laminectomy at all stenotic levels and resulted in complete or almost complete relief of back and leg pain in 77 per cent (10/13) of the patients. The walking distance rose postoperatively in 73 per cent (8/11) of the patients with severe claudication pain.

Four of the patients have also had a total hip replacement done subsequent to the spinal operation. The combined total results were excellent and good in all these cases.

RESULTS OF DECOMPRESSION FOR LUMBAR SPINAL STENOSIS

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The assessment of 95 patients operated on for lumbar spinal stenosis was mainly made by an independent person to eliminate bias. The follow-up period ranged from 1 to 4 years.

The definition of the results is based mainly on the subjective information. Our classification differs somewhat from that of other authors. The result was excellent or good in 67 per cent, fair in 17 per cent, and poor in 16 per cent of the cases. The correlation between the result and the neurological situation either before or after the operation was insignificant. The degree of stenosis shown on the myelogram does not predict the success of the treatment. However, there is a tendency for poorer results in cases of developmental stenosis. Otherwise good and poor results are equally distributed among all etiological groups. One half of the patients with a poor result had a central stenosis. The other half had both central and lateral entrapment. A greater number of laminectomies does not increase the patient's risk of a poor result.

Some reasons for the poor results are the following: insufficient decompression – 6 cases, lack of fusion – 7, arachnoiditis – 1, symptoms caused by conditions other than spinal stenosis – 4 cases. Fusion in some selected cases may have improved the result. Three technical complications occurred.

ANALYSIS OF OPERATED CASES WITH LUMBAR SPINAL STENOSIS

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The relationship between preoperative symptoms (claudication, back and leg pain and mixed symptoms), myelographic findings and the radicality of the operation was studied. The extent of the surgical procedure was determined by computerized tomography.

The material consisted of 27 cases (22 males and 5 females). Good results postoperatively were achieved in 16 cases; in 11 cases the condition was unchanged or worse. Those with claudication did not seem to obtain better results than those with more atypical symptoms.

All patients with good results showed a positive myelography (AP < 10 mm) but this was also the case in 63 per cent of the "poor groups". Redundant roots were seen in 37 per cent in cases with good results, but also in 27 per cent in cases with poor results. As to the extent of the operation 75 per cent of those with good results and 27 per cent of those with poor results had a total facetectomy performed.

RESULTS OF OPERATIVE TREATMENT FOR NARROWING OF THE LUMBAR SPINAL CANAL

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A total of 85 patients were treated surgically for lumbar spinal stenosis at the Orthopaedic Hospital of the Invalid Foundation in Helsinki. The average age of the patients was 56 years (ranging from 28 to 78 years). Preoperatively back and leg pain were the most common complaints; neurogenic claudication occurred in 52 per cent of the cases. Neurological deficits were found in 56 per cent. The diagnosis was based on the history, clinical picture and myelography performed with a water-soluble dye. According to the X-ray findings 33 per cent of the patients were considered to have developmental stenosis, while the narrowing in the rest was mainly degenerative in origin. The average post-operative follow-up time was 31 months. Results were estimated to be excellent in 16.5 per cent, good in 47.1 per cent, fair in 18.8 per cent and poor in 17.6 per cent.

BIOPHYSICAL PROPERTIES OF NORMAL BONE

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Entire canine diaphyseal bones were studied under torsion to determine whether diaphyseal bone undergoes plastic deformation prior to final fracture. The torque moment as a function of the twist angle was registered. A high-speed film technique was used to record the final fracture process. The fracture propagation speed was calculated. A reduction of bone stiffness was registered following cyclic loading and unloading. An assumed change in the geometry of the bone could be verified with the Acoustic Emission technique. Stress waves generated by crack formation were only observed in the non-linear load deformation phase. The propagation speed of cortical fractures was calculated to be >340 m/s, which is incompatible with plastic deformation in macroscopical parts of the bone.

Torsional fracture of entire canine diaphyseal bone is a two-stage process: 1) An increasing number of small cracks are formed during the non-linear phase. 2) Final fracture results from the sudden propagation of one or more of these small cracks.

BONE CHANGES AFTER EXTERNAL FIXATION

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The elasticity of the external fixation device allows the bone to take normal physiological loads, thus making it possible to study experimentally the axial stresses in the form of compression and distraction on the bone.

Histological changes in bone are slight. Cortical resorption is seen, but not to the extent that cancellous transformation takes place; the changes do not depend on the length of the immobilization period. The histology reflects the local reaction of the bone to the transfixing pins, which also correlates with changes in the torsional strength of the bone.

POROUS IMPLANTS

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The possibility of employing implants with a porous surface has received increasing attention in recent years. Various investigations have shown that both implants of titanic alloys and ceramics become anchored to adjacent bone by invasion of bony tissue into surface pores.

Experimental studies with porous ceramics implanted into the tibial condyles in sheep (Benum et al., *Acta Orthop. Scand.* 1976 and 1977) revealed ingrowth of bony tissue to a depth of 3–4 mm. The bony bridges between the implants and the surrounding bone were particularly well developed in regions of maximal stress. This is interpreted as a sign of active adaption of the bone formation to actual stress.

The risk of fractures of the bony bridges between porous surface implants and the adjacent bone due to the discrepancy of the modulus of elasticity of the implant compared to that of bone must be taken into consideration in the potential use of porous surface implants.

RESORPTION OF THE FIBULA IN EXPERIMENTAL RIGID OSTEOSYNTHESIS OF THE TIBIA

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The effect of rigid and flexible medullary nail osteosynthesis on standard tibial fractures in 94 rats was compared. After flexible osteosynthesis the callus formation was abundant with a calcified uniting callus at 4–6 weeks. After rigid osteosynthesis the callus formation was scanty, and the fracture line disappeared relatively late, at 4–6 weeks. The fibular fractures did not heal after the rigid fixation; instead there occurred a partial radiological and histological resorption. Apparently the stabilizing effect of the rigid osteosynthesis in the tibia is unnecessarily strong, with a disturbing influence on the biomechanical role of the fibula.

PRELIMINARY RESULTS OF HIP SURGERY WITH WAGNER'S RESURFACING PROSTHESIS

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During 1977–79, 25 patients (30 hips) with rheumatoid arthritis, pelvispondylitis or osteoarthritis of the hip were operated upon with Wagner's resurfacing prosthesis. Mean age was 37.5 years. Only negligible technical problems were encountered during the operation. Loosening of the femoral cup required reoperation with good results in one case. One superficial postoperative infection occurred.

Follow-up included assessment of relief of pain, range of motion and occupational fitness, and roentgenological examination. All patients were free of pain and satisfied with the result. Fourteen had returned to work. Twenty reported unrestricted walking capacity. Range of motion was substantially increased in all cases.

On the basis of our preliminary results it is recommended that this type of hip surgery be continued. It should frequently be considered as an alternative to conventional total hip replacement.

OPERATIVE TREATMENT OF VERTEBRAL FRACTURES IN THE THORACO-LUMBAR SPINE

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Between 1971 and 1978, 325 patients with vertebral fractures in the thoraco-lumbar spine without and 206 patients with spinal cord injuries were treated, 146 operatively. Of those with spinal cord injuries, an anterolateral decompression of the spinal cord with

stabilization of the injured segment of the vertebral column was undertaken in 56 cases.

In all 56 cases there was a compression of the spinal cord from the front. In 16 cases the vertebral fracture was a comminuted bursting-type, in 9 cases wedge shaped, in 17 cases a triangular fragment of the vertebral body was loosened and displaced posteriorly into the neural canal, and in 14 cases a fracture-dislocation caused the spinal lesion. The classification of neural function of Frankel and associates was used to grade the spinal cord function. In 18 cases the paraplegia was complete before surgery, in 5 cases the sensory loss was incomplete, in 23 cases there was no motor power of practical use below the injured segment and in 10 cases useful motor power with incomplete sensory loss was registered.

Eight patients made a complete recovery, 31 a good recovery, and 6 were improved. In 8 patients no improvement was noted. Two patients developed pressure sores and one patient died 1 year after the operation of uraemia. Twenty-two patients out of 55 achieved normal bladder function and 25 out of 54 normal function of the anal sphincter.

RUPTURE OF THE ULNAR LIGAMENT OF THE METACARPOPHALANGEAL JOINT OF THE THUMB

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Fifty-one chronic injuries resulting in abduction instability of the metacarpophalangeal joint of the thumb were operated on, the time from injury to operation being 8 weeks to 5 years. The ligament was repaired in 29 cases. In 22 cases arthrodesis of the joint was carried out because of a primary unsuccessful operation or arthritis of the joint.

The patients have been followed up for an average of 6.9 years. Of the 29 patients with ligament repair, 23 were satisfied. Six patients were not satisfied, 4 having a disabling instability and 2 complaining of pain and stiffness of the joint. Stress X-rays revealed that only 15 of the 29 patients had a stable joint. All the patients with arthrodesis of the joint were satisfied, having a painless and well-functioning joint.

FRACTURA COLLESII SEQUELAE

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One hundred complications after Colles' fractures were reviewed. The complications were related to the time that had passed from the date of the accident to when the patient was first examined by a hand surgeon. The patients could be divided in six groups:

Within 1 month of the accident: 6 patients with

oedema and diminished range of movement of the fingers. One to three months after the accident: 18 patients with diminished range of movement of the fingers, tendon rupture or nerve compression syndrome. Three to six months after the accident: 27 patients with decreased pronation/supination. Six months to one year after the accident: 21 patients with diffuse wrist pain. More than 1 year after the accident: 22 patients with pain localised to the capitulum ulnae. One month to one year after the accident: 6 patients with changes similar to those found in reflex dystrophy.

FREE VASCULARIZED BONE GRAFT IN THE TREATMENT OF PSEUDARTHROSIS

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The present paper describes the use of vascularized free fibular grafts with adjacent muscle tissue for long-standing pseudarthrosis of the long bones in four cases. In one additional case a free composite skin-subcutis-bone graft was taken from the anterior iliac crest. It was transplanted to bridge an infected pseudarthrosis of the tibia and to heal a soft tissue defect of the leg.

The fibular graft was taken together with the nutrient artery of the fibula and the corresponding vein; in two cases the peroneal artery had to be resected because of shortness of the nutrient artery. The main artery of the graft was anastomosed end-to-end with a suitable artery of the receiving region. One or two venous anastomoses were done to secure circulation through the graft. In the case of the cancellous bone-soft tissue graft the superficial and deep iliac circumflex arteries, taken with the graft, were anastomosed with the anterior tibial artery. The veins were united end-to-end with branches of the great saphenous vein.

The transplanted bone was fixed in its pre-prepared seat across the pseudarthrosis with nails or screws. Free cancellous bone grafts were added in all cases.

In all instances fusion was achieved, sometimes after additional minor operations.

POSTTRAUMATIC RADIO-ULNAR SYNOSTOSIS

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Four cases of posttraumatic radio-ulnar synostosis are reported. Following resection of the synostosis, the resulting tissue defect was filled by a free fat transplant to prevent the formation of hematoma and scar tissue. The operation resulted in considerable improvement in the range of forearm motion and in all cases there was a further increase of mobility postoperatively. No recurrence of the synostosis was noted.

SYNOVECTOMY OF THE ELBOW JOINT

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The purpose of this investigation was to analyse the results of synovectomy of the elbow joint, performed via an extended lateral incision, and to clarify the usefulness of transposition of the ulnar nerve in connection with this operative method. The series consisted of 54 synovectomies performed at the Hospital of the Rheuma Foundation in 1970–1975. Follow-up examination was carried out on average 6 years and 2 months after the operation. The series included only those patients who attended a follow-up examination. There were 39 female and 15 male patients. The mean age was 43 years.

The synovectomy had a favourable effect on pain and swelling, and the total range of movement was slightly increased. A reoperation was considered indicated in 7 cases.

Lateral synovectomy of the elbow joint performed through an extended incision is a suitable procedure for cleaning the elbow joint in rheumatoid arthritis. Transposition of the ulnar nerve is not indicated as a routine measure.

FATAL PULMONARY EMBOLISM IN TOTAL HIP REPLACEMENT

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A retrospective study of fatal pulmonary embolism (FPE) was carried out in a material of 1498 hips during 1968–1979. Dextran was given as thromboembolic prophylaxis. Sixteen patients died within 3 months. Autopsy was carried out in 88 per cent. The incidence of FPE was 0.6 per cent. Seven out of 9 patients died during the second and third week. Chest X-ray was negative following acute chest pain which was significantly more common ($P < 0.001$) in patients with FPE compared with a surviving group chosen at random from the whole material. Previous operations for gynecological and orthopedic reasons were also more common ($P < 0.05$) in patients with FPE, but no difference could be found between the groups concerning blood loss, amount of transfusion, sex, operated side, type of prosthesis or weight.

LOOSENING OF THE FEMORAL COMPONENT IN HIP ARTHROPLASTIES – INFECTION OR BIOMECHANICAL FAILURE?

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A number of radiological and structural data were registered in 327 patients (214 Christiansen's hemiprostheses, 84 Christiansen's total hip prostheses and 29 Charnley total hip prostheses) shortly after the operation and at varying time intervals (median 18 months) postoperatively. Possible associations between these variables and migration of the femoral stem, in the medial and/or distal direction, were scrutinized by computer analysis based on log-linear models. Radiolucent zones at the bone cement interface, cement fracture, resorption of the calcar and cortical thickening were all radiological variables clearly associated with migration of the stem. Medial migration had a stronger association with cement fracture and cortical sclerosis than distal migration. Varus position of the femoral stem predisposed to medial migration. The frequency of infected hips during the observation period was 3.3 per cent. Infection was associated with distal migration, but not with medial migration. It is concluded that loosening of the prosthetic stem can be explained by infection and/or biomechanical/structural factors. Radiological signs which indicate a biomechanical failure may rule out infection as an explanation for loosening of the implant.

MECHANICAL LOOSENING OF FEMUR PROSTHESES IN THR

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During the years 1972–1974, 194 total hip replacements in 174 patients were performed according to the method of Brunswik; 159 of these were re-examined. Radiographic signs of loosening were observed in 60 hips (38 per cent), and of these 44 were painful – 19 requiring revision. The onset of pain and the radiographic signs of loosening seemed to correlate well in time. Pain became more frequent with increasing width of the radiolucent zone, and in cases with a zone of 5 mm or more, 90 per cent were painful.

Cement defects were correlated with loosening, whereas the position of the stem prosthesis could not be demonstrated to influence the process of loosening, which was most obvious during the first postoperative years.

FUNCTIONAL ANATOMY IN CONDITIONS WHERE AN ATLANTO-AXIAL FUSION MAY BE PERFORMED

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In fractures of the odontoid process, a concomitant injury to the anterior and posterior longitudinal ligaments determines the possible direction and degree of dislocation. In rheumatoid arthritis the atlas may dislocate anteriorly, posteriorly or inferiorly. Anterior dislocation is possible when the surrounding ligaments are injured. Posterior and inferior dislocation are possible in combination with bone resorption. Experimentally it is possible to dislocate the atlas anteriorly 5 mm when the transverse ligament is sectioned and 8–9 mm when both the alar ligaments also are sectioned. The longitudinal ligaments have also to be sectioned in order to produce a larger dislocation.

ATLANTO-AXIAL FUSION IN 60 PATIENTS WITH RHEUMATOID ARTHRITIS

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Sixty patients with rheumatoid arthritis have been treated with occipito-atlanto-axial fusion. In 49 a forward reducible dislocation was found, in 5 an irreducible, in 6 a downward and in one a backward reducible dislocation.

Indications were neck pain in 57, symptoms of spinal cord compression during flexion in 7, myelopathy in 12, and brain stem symptoms in 3. Additional indications were forward dislocation more than 10 mm (47), a McRae diameter of less than 12 mm (11), destruction of the lateral atlanto-axial joints with impending downward dislocation (6), and spinal block on functional Queckenstedt's test (18).

Brattström/Granhölm's operation was performed under local anaesthesia. In irreducible forward and downward dislocations the posterior arch of the atlas was removed and the foramen magnum was enlarged.

No patients had postoperative neurological complications. Three patients had a sterile fistula after the operation. Partial redislocation occurred in 6. A satisfactory result was obtained in 54 patients.

ATLANTO-AXIAL FUSIONS IN PATIENTS WITH RHEUMATOID ARTHRITIS

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During the years 1972–1979, 79 rheumatoid patients with dislocation in the cervical spine were operated on. Fifty of these had atlanto-axial fusion. The mean age

was 55 years (range 27–74). Tetraparesis, hemiparesis or monoparesis was found in 7 patients. The main preoperative symptoms in 43 cases were pain, numbness in the fingers, tic-movements in the extremities or trunk, and vertigo. Occipito-atlanto-axial fusion was performed in 13 and atlanto-axial fusion in 37 cases. Paralysis was partially relieved in 5 patients and completely relieved in one patient. One patient with tetraparesis died 1.5 months after the neck operation due to gastrointestinal bleeding. At follow-up 8 pseudoarthroses were found (16 per cent).

THE RESULTS OF POSTERIOR ATLANTO-AXIAL FUSION

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Since 1972, 37 patients (rheumatoid arthritis 26, trauma 7, os odontoideum 4) have been treated by posterior atlanto-axial fusion.

At follow-up examination at least 1 year after the operation, the clinical function in all cases was satisfactory. Radiological examination of the cervical spine in flexion and extension showed that stability had been obtained.

SURGICAL METHODS IN ATLANTO-AXIAL FUSIONS

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The pathological findings determine the choice of surgical method. In anterior dislocations, a steel wire is passed on both sides around the posterior arch of the atlas and then around the spinous process of the axis. In posterior dislocations steel wires are passed from above on both sides in front of the posterior arch of the atlas and then through a block of bone placed over the posterior arches of the atlas and the axis. The upper ends are then tightened around the spinous process of the axis. In inferior dislocations, a steel wire is passed through drill holes in the skull to the spinous process of the axis. A block of bone is placed between the skull and the axis. Bone chips and usually also methyl-methacrylate are added to all three types of fusions.

INDICATIONS FOR ATLANTO-AXIAL INTERLAMINAR FUSION

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Thirty-five patients had unstable odontoid fractures, 20 were high, 11 low, and 4 oblique. Thirteen patients had

pseudoarthrosis. Twenty patients had instability caused by rheumatoid arthritis, the mean distance from the odontoid process to the anterior arch of the atlas being 12 mm. Six had vertical dislocation and 15 had cord signs. The indications for operation on patients with rheumatoid arthritis were very restrictive. Six patients had an os odontoideum with a mean mobility between the atlas and axis of 15 mm. Four had cord signs. The symptoms resulted from trauma in 4 cases. Five patients had ligamentous lesions, unilateral dislocation of the atlanto-axial joint, hangman's fracture and chordoma of the axis.

ATLANTO-AXIAL INTERLAMINAR FUSION: THE ODENSE-TECHNIQUE

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With the patient prone and cranial traction established the neurosurgeon exposes the posterior aspect of the lamina of the atlas and axis, exposing their spongiosa. The orthopaedic surgeon shapes two grafts of iliac bone with grooves for the two laminae. The spongy bony prominence fits between them and the iliac crest grips the upper edge of the atlas. Corners are cut off for the axial spinous process.

Stainless steel wires passed anteriorly to the two laminae longitudinally on each side are tied behind the grafts, and a free end from each side is thereafter tied transversally proximal and distal to the axial spinous process. A felt-padded Minerva jacket is worn for 3 months followed by a plastic collar for 3 months.

RESULTS AFTER ATLANTO-AXIAL INTERLAMINAR FUSION

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Odense Hospital, Denmark

Sixty patients were followed up 1–5 years after the operation. All the fusions had healed, normally after 3 months, the healing being verified by tomography. X-rays during forward and backward bending, taken 6–12 months after the operation, demonstrated the stability.

The position of the odontoid process was improved. No bone infections, calcifications or broken wires were seen. There were no thrombo-embolic complications. Eight patients died 3–41 months after the operation for reasons not related to the operation.

At follow-up 14 had slight intermittent pain and 2 constant pain in the neck, possibly caused by the degenerative changes below the fusion. Five had slight radicular or medullary symptoms (decreased).

Before the operation 20 patients were receiving a pension. Thirty-three patients had returned to work.

ATLANTOAXIAL FUSION IN CHILDREN

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The main difficulty in fusion of the upper cervical spine in children is the weakness of the skeletal structures. Because the fixation cannot always be very stable a good postoperative immobilisation is important. The thinness of the cranial bone sets the lower age limit for skull traction.

The series consists of 6 cases, 3 with atlantoaxial and 3 with occipitocervical fusion. The patients in the first group were all 7 years old. Two were post-traumatic and one RA. The atlas was fixed to the axis with vitallium wire and fused with a bone block and chips. The occipitocervical fusion was performed in two cases with congenital malformation and in one post-traumatic case by fixing two bone blocks in the skull, at the arch of the atlas and axis.

Five patients were treated with skeletal traction and one with a Glisson's sling 4–6 weeks after the operation. Fusion was obtained in all cases. No complications were noted. The follow-up period was 9 months to 7 years (average 3 years). All patients were free of subjective symptoms. Torticollis was initially severe in all patients, but later almost disappeared in all except the RA patient. One patient with tetraparesis before operation was neurologically normal, and another was left with neurological symptoms. The range of movement increased in all but the RA patient during the observation period. At follow-up most movements were only slightly restricted in four patients, moderately in one patient and grossly in the RA patient.

No significant difference in the restriction of movement was seen between the two fusion groups.

THE HALO-VEST IN THE MANAGEMENT OF UNSTABLE CERVICAL SPINE LESIONS

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The Halo-vest technique has been used on unstable cervical spine lesions since 1976. So far 25 cases have been treated, 8 with dens axis fractures and 17 cases with presumably unstable traumatic cervical spine lesions. The treatment program has been 12 weeks in a Halo-vest and an additional 12 weeks with a soft collar. Twenty-four cases are fully healed radiologically. Pseudarthrosis developed in only one case of dens axis fracture. This patient also suffered from malabsorption. No additional treatment was necessary in this case. No serious complications have occurred during treatment. It has been possible to carry out the treatment mainly in the outpatient department, which means an important gain in medical rationalization.

HARRINGTON DISTRACTION INSTRUMENTATION AND ANTERIOR SPONDYLODESIS FOR VERTEBRAL RESECTION

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Cavernous haemangioma of the second lumbar vertebral body was diagnosed radiologically and histologically in a 25-year-old man. Computer tomography showed a reduction of the transsectional area of the medullary canal to one half. However, the patient had only slight radiating pain and no neurological deficits. Preoperatively he was given irradiation, 30 Gy (CRE = 1200 reu), while wearing a plaster jacket. During the operation 9 weeks later, the spine was first stabilized with Harrington distraction rods (from Th XII to L IV). At the same session, the vertebral body was removed. As a result of irradiation, the bone was largely necrotic and the bleeding was minimal. The intercorporeal fusion (L I to L III) was performed using two blocks of posterior iliac crest and part of the resected twelfth rib. Three weeks postoperatively, the patient was mobilized in the upright position without any complications. During 6 months follow-up, the postoperative studies showed the fusion to be progressing uneventfully and a wide medullary canal.

SPINAL INJURIES IN FINLAND 1969–1976

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Our investigation was based on the data regarding spinal injuries occurring during the period 1969–1976 collected by the National Board of Health and the Social Insurance Institution of Finland. The total number of patients with spinal injuries treated at Finnish hospitals during this time was 8502 (annual incidence 194–263 per million of the population). Spinal cord or nerve root lesions were found in 2015 cases (23.7 per cent), (annual incidence 44–63 per million of the population). In 1969, 200 persons per million of the population in the working age received a pension permanently or provisionally granted for spinal injury, and this figure increased steadily, being 390 in 1976. Cervical and thoraco-lumbar spinal injuries were most frequent in the age group 20–29 years. There was an even decrease of cervical injuries with increasing age, but the incidence of thoraco-lumbar injuries again increased after the age of 30. A central hospital was the place where spinal injuries were first treated in 58 per cent of cases, in 63 per cent if the lesion was associated with spinal cord or nerve root symptoms.

INJURIES OF THE SPINE

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Three hundred and thirteen out of 460 patients with spinal injuries were followed up on average 5 years and 3 months after the accident. The distribution of the lesions was as follows: C1–C7 119, Th1–Th11 98, Th12–L1 149 and L2–L5 94 patients. The series comprised 282 men (61 per cent) and 178 women (39 per cent). The mean age was 41.8 years. The proportion of men was highest in injuries of the cervical spine (76 per cent) and lowest in injuries of the thoracolumbar junction (49 per cent). The most common cause of spinal injury was an accident at home or during leisure hours in the summer months. Next in frequency came road accidents. A complete neurological lesion developed in 30 patients; an incomplete cord lesion or root symptoms in 53. Sixteen patients died of their spinal injury. On average, the radiological deformities deteriorated during follow-up, deformities of the cervical spine excepted. Many radiological deformities, most often narrowing of the vertebral canal, were associated with neurological symptoms. In cervical spine injuries, poor results were associated only with radiological deformities persisting after treatment. In injuries of the other spinal segments the clinical result seemed to depend on the radiological deformities seen on the first radiographs. The present investigation does not, however, permit any confident conclusion as regards the usefulness of correcting these deformities.

TREATMENT OF UNSTABLE VERTEBRAL FRACTURES

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Our policy is that unstable vertebral fractures should be stabilized. Soreff (1977) has shown a clear correlation between residual symptoms and deformity at the fracture site and our indications for surgery have been extended to include progressive kyphosis.

A study was made comparing 20 conservatively treated patients (Group I) with 18 patients treated by surgery (Group II). Patients in Group I were treated by plane bed rest for 4–14 weeks (mean 5.5 weeks) and were able to stand after 10–20 weeks (mean 14.8 weeks). Pseudarthrosis developed in 5 cases. Healing time exceeded 6 months in 12 cases. The average deformity prior to treatment was 19°, after treatment 28°. Pulmonary embolism and decubitus developed in 1 case, deep venous thrombosis in 4, pyelitis in 2, and severe orthostatic reactions in 2 cases.

The patients in Group II were immediately mobilized. Ten patients walked with crutches after 4 weeks or less. Healing time was less than 6 months in 12

cases. Preoperatively the deformity averaged 21°, post-operatively 11°.

PERSONALITY EVALUATION BY THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY (MMPI) BEFORE OPERATIVE FUSION OF THE LUMBOSACRAL SPINE

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Our series comprised 27 patients with chronic low back pain (LBP) and organic lesions of the lumbosacral spine. They were referred to us for the purpose of establishing the need for a fusion operation. In 14 cases the decision was negative, mainly because of the patients' vocational and other social circumstances. Thirteen patients were operated on. The MMPI profiles were not considered when deciding on treatment. The means of neurotic and Lb scales were high, indicating an obvious functional component of the patients' pains. The mean personality profiles were quite similar in the two treatment groups. Thus, the functional component of LBP was present in both groups. We concluded that a personality evaluation (e.g. MMPI) should be part of the preoperative examination to avoid fusion operations in cases of functional LBP.

DISCITIS – A SERIOUS COMPLICATION OF DISC SURGERY

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Thirty-three patients treated for postoperative discitis following disc surgery were followed up. The frequency of discitis during a period of 16 years was estimated as 0.75 per cent. The occurrence of discitis was related mainly to the frequency pattern of postoperative infections.

Two-thirds of the patients were only treated conservatively, while the others were also operated on, for example by performing a disc reoperation, a revision of wound fistulae, and at a later stage, fusions of vertebrae.

At follow-up, 7.5 years after treatment, several patients showed advanced symptoms in the back as well as increased radiographically certified degenerative changes. More than half of the patients were pensioners.

A COMPARISON BETWEEN FLUCLOXACILLIN AND DICLOXACILLIN IN THE ANTIBIOTIC PROPHYLAXIS OF TOTAL HIP REPLACEMENT

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The effect of two semi-synthetic penicillins, flucloxacillin* and dicloxacillin** was compared in systemic antibiotic prophylaxis in total hip replacement. Flucloxacillin was given to 88 patients parenterally on the day of surgery and on the next day, totally 7 g. Dicloxacillin was given to 87 patients parenterally on the day of surgery and orally during the next six days, totally 12 g. Aerobic bacteria were cultured from the suction tubes twice in the flucloxacillin group; no anaerobic bacteria were found. Superficial infections were diagnosed three times in the flucloxacillin group and once in the dicloxacillin group. All superficial infections healed. There were two deep infections in the dicloxacillin group and a strong suspicion of one deep infection in the flucloxacillin group. Gastrointestinal symptoms were fewer in the flucloxacillin group.

These preliminary results indicate that treatment for 2 days with flucloxacillin is as effective a protection against infections as treatment for 1 week with dicloxacillin in the antibiotic prophylaxis of total hip replacement.

* Floxapen, Beecham/Astra Oy.

** Diclocil, Bristol/Lääke Oy.

FLUCLOXACILLIN IN BONE AND AROUND THE ENDOPROSTHESIS IN KNEE ARTHROPLASTY

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Adult patients undergoing knee reconstruction for rheumatoid arthritis or gonarthrosis were given 2 g flucloxacillin intravenously approx. 2 hours before operation. Tourniquet was not used. Serum samples were analyzed before and 30, 60, 120 and 360 minutes after antibiotic administration. The mean concentration of flucloxacillin obtained at operation was 13.4 µg/ml (range 4.3–21.0) in synovial fluid; 3.0 µg/g (0.4–13.3) in synovium; 2.0 µg/g (0.3–5.7) in spongy bone; and 1.3 µg/g (0.2–4.2) in cortical bone. One patient had a loosened Walldius prosthesis exchanged and another a St. Georg prosthesis. The concentrations of flucloxacillin obtained in the thin layer of granulation tissue surrounding the Walldius prosthesis and the bone cement were 0.9 and 0.5 µg/g.

The MIC value for flucloxacillin was 0.25 µg/g against *Staph. aureus*. Consequently, antibiotic prophylaxis ought to be used if postoperative infections cannot be kept below 1 per cent by other means.

WEIGHT BEARING AND THE BONE-CEMENT INTERFACE

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The purpose of this work was to study the interface between bone and cement in dogs with total hip replacements with and without postoperative weight-bearing. Twelve dogs were included in the study. Six were permitted immediate weight-bearing while the other six were amputated through the knee joint. Histological examination was performed after 3 and 6 months; on each occasion six animals were studied (three from each group). Independent of weight bearing a fibrous tissue layer formed between the bone and cement. This membrane was on average 50 µm thick in both groups and at both sacrifice times. Immediate weight-bearing does not seem to be the critical factor with respect to early membrane formation between bone and methylmethacrylate.

REOPERATIONS FOR LOOSENING OF TOTAL HIP REPLACEMENTS

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The results of 313 Weber total hip replacements (polyester head and metal acetabulum) and 160 Ring prostheses are presented. The frequency of loosening of these prostheses has up to 1978 been 25.7 and 9.3 per cent, and the number is increasing. The old Weber prosthesis loosens because of tissue reaction to the polyester head after significant osteolysis. The Ring prosthesis loosens because of mechanical reasons.

For reoperations we have mostly used the new Weber prosthesis (metal head and high density polyethylene acetabulum), the Christiansen and Brunswik prostheses. We find the new Weber prostheses very good for reoperations in cases where the bone destruction is great. The design of the prosthesis makes it possible to attach it along the border of the acetabulum so that the pressure against a degenerate acetabulum floor is lessened. The Christiansen prosthesis is not as successful for reoperations.

ASEPTIC LOOSENING OF CHARNLEY-MÜLLER TOTAL HIP REPLACEMENTS

A clinical and radiological follow-up study after 5 to 10 years

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Out of a total of 151 operated hips, 115 remained for the follow-up after a minimum of 5 years. Fourteen hips had been reoperated on with exchange of the femoral components because of aseptic loosening. Thirty-one of the re-examined hips showed radiological evidence of femoral component loosening and in 15 hips loosening was suspected. One acetabular component was loose. No deep infections were detected. In 10 of the 31 hips with femoral stem loosening, no complications were suspected after clinical examination only. Among the conditions associated with increased loosening rates were varus position of the prosthesis and lack of cement support of the distal stem. In patients with a body-weight over 80 kg and in patients younger than 60 years at operation, loosening had occurred in over 50 per cent of the hips.

RE-OPERATIONS FOR LOOSE "SOFT-TOP MONK"-HIP ARTHROPLASTIES

N. MOSSING & J. ERIN-MADSEN

A total of 104 Monk arthroplasties were reviewed after 5 years. Forty prostheses had been removed due to aseptic loosening and 3 due to loosening and late infection. It is suggested that wear of the polyethylene cap plays an important role in the loosening.

In 36 cases a new cemented hip prosthesis was reinserted and in 7 cases the patients were left with a resection arthroplasty.

RADIOGRAPHY OF TOTAL HIP REPLACEMENT

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Diagnostic radiography is facilitated by standardization of the roentgen examination of the hip and pelvis, and by always comparing the radiograms with the first and the last examination. Abnormalities related to the socket always include an increasing bone-cement lucency and/or a change in position, irrespective of the cause. In the upper end of the femur, an isolated separation in the metal-cement interface is the result of mechanical failure. However, secondary bone reaction may mimic infection. A wide-spread or localized bone resorption in the bone-cement interface, pronounced calcar resorption and an irregular periosteal reaction are changes

predominantly observed in conjunction with deep infection.

MECHANICAL LOOSENING OF PROSTHETIC COMPONENTS

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The long-term results after arthroplasties show that mechanical loosening occurs with increasing frequency. The reasons for mechanical loosening are certainly many and complex. Inadequate fixation at the time of surgery and the design of the prosthesis appear to be the two most important factors. The reaction of bone to methylmethacrylate, the technique of cementing and the positioning of the prosthesis have been discussed in other round table discussions. Other causes of mechanical loosening include breakdown of the mechanical fixation between bone and cement because of cyclic loading or sudden impact loading, for example a fall. The distribution of mechanical stress to the interface is of critical importance because too little stress or too much stress both cause bone resorption. Poor mechanical properties of the host bone and tissue reactions to implant materials are other factors that have been mentioned as reasons for mechanical loosening.

Preventive measures are primarily a good choice of prosthesis, careful preoperative planning, good cementing technique, and careful surgery.

REVISION ARTHROPLASTY OF THE INFECTED HIP REPLACEMENT

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Seventy-seven septic THR were treated by revision with gentamicin-containing bone cement. At the follow-up there were 68 THR as 7 had been excluded and 2 patients had died. Fifty-six septic hips were rated as healed after the first revision; 4 of these had non-infectious loosening radiologically. Ten infections remained after the first revision; 6 of these were revised a second time and healed provisionally. Two patients had elevated ESR but no other signs of infection. Including all healed infections, the rate of healing with the prostheses *in situ* was 91 per cent (62/68 THR). An evaluation of the function in 57 septic THR revised with gentamicin-containing bone cement was made 2–5 years postoperatively. Forty-one patients had normal or nearly normal walking ability; 40 had no pain and 17 slight or intermittent pain. It was concluded that revision in most cases gives a better functional result than a simple removal of the prosthesis.