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Surgical treatment of sciatica. A prospective study of 99 cases

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The aim of this study was to collect information about early and late results of surgical treatment of sciatica. The effect on symptoms, signs, normal physical activity and work was registered. Certain elements in the history, clinical examination and surgical procedure, of importance for the effect of the treatment, were considered.

The study comprises a consecutive series of 99 patients, who received surgical treatment for sciatica. Surgery was generally not suggested to the patients until 6–8 weeks of conservative treatment, without effect. A preoperative myelography was done in all cases. A partial hemilaminectomy, extirpation of a disc herniation and/or evacuation of the disc, was done in all but one case. 92 per cent positive, 7 per cent uncertain and 1 per cent negative, operative findings, were registered. Analysis and recording of symptoms, vocational situation, sick listing and a physical examination were done before, and regularly, until 3 years after the operation. After 10–13 years, 87/99 (87) of the patients, answered a questionnaire.

There was immediate relief of the sciatica in 95 per cent of the patients and from 6 weeks to 3 years after the operation, almost 90 per cent were free from sciatica and about 80 per cent were free from low back pain (LPB). A significant improvement of the neurological deficit was registered during the same period of the time. After 10–13 years, 93 per cent of the patients were either free from symptoms, or had mild symptoms, which did not prevent physical activity and work.

Surgical treatment of sciatica, on certain indications, is applied to give a satisfying short- as well as long-term result. There is an immediate relief on sciatica and a few weeks after the operation, most of the patients are free from sciatica and LBP. After 10–13 years, more than 90 per cent of the patients are free from, or have mild symptoms not preventing normal physical activity and work. Increasing age, long-standing preoperative sciatica, a negative or uncertain operative finding and further operations, are negative predisposing factors.

Results of operative treatment of lumbar disc herniation

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The results of a retrospective study of 268 operations on 249 patients with a median observation time of 40 months are presented. The correlation between the radiculographic and peroperative findings amounted to 95 per cent. Thirteen per cent of the patients were dissatisfied with the final result of the treatment; women and patients with long-standing sciatica were in the majority. Ninety per cent of the patients over 60 years expressed satisfaction.

Amongst men and those with symptomatology of short duration, disappearance of sciatic pain was registered more frequently. There was a very high correlation between immediate postoperative disappearance of pain and a favourable result of treatment.

Eighty per cent of the patients resumed their former occupation, five were disabled in respect of fitness for work.

Complications were registered in three per cent of the operations.

Further investigations revealed a high degree of psychosocial problems amongst those dissatisfied, and abnormal "X ray lumbosacral spine" was seen more often. The main complaint of the dissatisfied was continuing disabling backache. The majority of them were free from sciatica, and this was confirmed by clinical examination.

During the observation time, 19 patients were reoperated (7 per cent). In 14 cases, ordinary discectomy was again carried out, and in five decompressive laminectomy. In retrospect, three more laminectomies should have been carried out initially. In all aspects, the results of reoperation were fully comparable with those of primary operative treatment, as the final result was favourable in 18 of these 19 patients. Consequently, the widespread assumption that patients with lumbar disc herniation have their "golden chance" at the primary operation, could not be confirmed from the present investigation.

Lumbar spinal stenosis – long-term results after decompressive surgery

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The purpose of this study was to evaluate short-term and long-term results after decompressive surgery for lumbar spinal stenosis in a consecutive series of patients. The results were related to preoperative clinical and radiographic findings.

Material: 117 consecutive patients were treated with decompressive surgery during 1976 through 1982. *Males/females* = 81/36. *Mean age* = 51 years. The indication for surgery was clinical symptoms with radiographic evidence of spinal stenosis. Twenty-seven patients had previous lumbar surgery on at least one occasion.

Method: The patients were followed up postoperatively after a median period of 5.5 months. A long-term follow-up was performed after 42.5 months. Patients were interviewed via a questionnaire and/or telephone interview.

Results: At long-term follow-up, nine patients were dead. Of the remaining 108 patients, 106 (98 per cent) were followed up. Two patients could not be traced. At short-term follow-up (5.5 months), 69 per cent were improved, 29 per cent were not improved, in 2 per cent symptoms were more severe than prior to surgery. At long-term follow-up (42.5 months), the corresponding figures were 68 per cent, 13 per cent and 19 per cent, respectively. In 29 per cent there had been no symptoms postoperatively and in another 27 per cent there had been only minor intermittent symptoms.

At short-term follow-up, 62 patients had returned to work, another nine had returned to another occupation. At long-term follow-up, 51 patients were still active in their previous profession, 17 were active in another profession, 18 had retired because of old age, nine were dead, and 20 were sicklisted and/or undergoing occupational training.

Sixty-seven per cent of the patients who had only one operation were improved, as were 70 per cent of the patients who had previous surgery. Good results were correlated to preoperative radiographic findings and to neurological deficits. Poor results were not correlated to previous surgery.

A study of intervertebral disc during autotraction

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Recent interest in autotraction as the conservative treatment of low back pain with sciatic pain led us to study the effect of autotraction on the configuration of a herniated disc. Three different methods were used:

1. Ten patients with sciatic pain and positive myelogram were treated with autotraction ad modum Gertrud Lind. After treatment, the clinical results were registered and a new myelogram was performed.
2. A group of 30 patients with sciatic pain was studied by CT-scan of the lumbar spine (3-lower levels) before and after autotraction.
3. Five patients were treated on a specially designed traction table which was placed in the CT-scanner. In this way it was possible to study the configuration of the herniated disc even during the time the traction force was being applied.

The results were very uniform. In none of the case could we register any difference in the herniated disc regardless of the outcome of the therapeutic result.

The conclusion is that the effect of autotraction cannot be due to any changes in the configuration of the herniated disc.

Subjective and social results of operative treatment of lumbar disc herniations

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Four hundred and nine patients operated for lumbar disc herniations were asked to answer a questionnaire concerning subjective and social sequels.

Fifty-eight per cent were completely free of pain during work, and 67 per cent had only a few complaints; 28.1 per cent had changed their occupation. Three quarters of those patients had pensions. A total of 22.6 per cent had some sort of public support.

The probability of low back pain as a function of some risk factors

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In a previous cross-sectional study of 940 men (40–47 years old), risk factors for low back pain (LBP) were assessed. In the present study the probability of belonging to the LBP group is estimated as a function of some of the factors using a logistic model. The factors are: degree of lifting at work, monotony at work, worry and tension, smoking and nationality. The predictive power of the factors is elucidated graphically by a curve giving the probability as a function of the percentile point of a LBP score which is a linear combination of the factors.

The probability varies depending on the definition of the LBP group and on the values of the risk factors. For example, if the LBP group is defined as all men who have ever suffered any kind of low back trouble (pain, ache, stiffness or fatigue localized in the lower back and/or sciatica), the probability varies between 0.43 and 0.98.

The estimated function may be used as a method for screening for a high LBP risk in different professional groups and work places.

The intensity of work recovery in low back pain

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The intensity of work recovery in low back pain (LBP) has been studied using the National Health Register. Nine hundred and forty men (40–47 years old), were randomly selected from the census register of the city of Gothenburg, Sweden. Sickness absence data were obtained from the local Health Insurance Offices in which all sickness absence (1955–1976) was recorded. Data were collected for each sickness absence episode with a back diagnosis including the year and month of onset and the duration. The sickness absence episodes were divided into intervals. The intensity of work recovery was then calculated as well as the number of subjects absent at each interval.

The rate of return to work decreased as expected with an increase in absence period. Different rates were found for different diagnoses, however, with low return intensities in patients with sciatica compared to those with back pain, i.e. return to work was slower in patients with sciatica. Men doing manual work had a significantly longer average sickness absence than white collar workers. The intensity of work recovery was lower in blue collar workers during the first 20 days of absence, while the reverse was true after 20 days of sickness absence, i.e. the white collar workers who were absent more than 20 days had a slower rate of recovery than blue collar workers who had been absent for 20 days.

Data as presented here can be used to study the effect of intervention (for example, manual therapy) on the natural course of work recovery. It can also be used, as above, to study differences in sickness absence pattern between different diagnoses, work groups and similar variables.

Evaluation of pre- and postoperative evoked potentials in patients suffering from cervical disc protrusion

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In a prospective study of cervical disc protrusion 14 patients were tested with somatosensory evoked potential and electromyographic techniques pre- and postoperatively.

The disc protrusion was visualized by metrizamide (Amipaque) myelography. All patients were operated using the Cloward procedure, with removal of disc and osteophytes by microscopic technique followed by anterior cervical interbody fusion.

In contrast to most reports, there was very little or no difference between the pre- and postoperative evoked potentials, although the patients studied had medullary and root compressions with postoperative neurological regression.

Total condylar knee arthroplasty. 2-year follow-up of 248 cases

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As part of a prospective study on knee arthroplasties, the results of 248 consecutive total condylar arthroplasties with 2 years follow-up are reported. Of the 185 patients, six patients died during the period of follow-up (eight knees), and one was lost to follow-up.

The remaining 239 total condylar arthroplasties were carried out on 178 patients; thus 61 had both knees operated. The material consisted of 136 females and 42 males, age range from 24 to 81 years (mean 66.3 years). Operation of 79 patients was performed for rheumatoid arthritis, 95 for osteoarthritis, two for psoriatic arthritis, and two for late sequelae of tibial condylar fracture. All patients were evaluated in a rating system, subdivided into six categories: pain, function, range of motion, muscle strength, flexion deformity, and instability. From the total points obtained (maximum 100 points), subtractions were made for walking aids, extension lag, and valgus or varus deformity.

Based on the total score, the overall result was rated excellent or good in 88 per cent of the knees. Pain during walking was present preoperatively in 92 per cent grouped moderate or severe pain; at 2 years follow-up, 91 per cent had none or slight pain. Walking distance >500 m in the osteoarthritis group was preoperatively 15 per cent, and at 2 years follow-up 79 per cent, the rheumatoid arthritis group showed 7 per cent and 57 per cent, respectively. At 2 years follow-up we found 86 per cent with no lack of extension compared to 27 per cent preoperatively. Range of motion was markedly improved in the group of patients who preoperatively had a range of movement less than 80 degrees. Normal alignment (between 3 and 11 degrees of valgus) was present in 23 per cent before operation, improving to 88 per cent postoperatively.

The overall complication rate was 12 per cent, including mechanical loosening in 2 per cent (four tibial comp. and one patellar comp.), deep infection 0.8 per cent, thromboembolic complications 2.8 per cent, superficial skin necrosis 3.2 per cent, and reversible peroneal paralysis 1.2 per cent.

The total condylar knee prosthesis effectively relieved pain and provided a good functional result in most patients. The problem of mechanical loosening seemed to be significantly reduced and was related to prosthetic component positioning. The complication rate was low.

Clinical trials with an uncemented knee prosthesis

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The drawbacks to bone cement are such that there is currently considerable interest in uncemented joint replacement. Several years of animal and laboratory experiments have been carried out with an uncemented knee prosthesis and various clinical trials have been held.

An uncemented tibial component held in place by plastic pegs has been used in over 250 cases over the last 2½ years. No loosenings have occurred. As this prosthesis does not give adequate tensile resistance to allow full femoral-tibial roll back, the prosthesis has recently been reinforced by a multilayer porous coated metal plate.

Patellar resurfacing using ridged plastic peg fixation has been used in 70 cases over the last year and no problems have been encountered. It is not as yet known if there are any significant advantages of reinforcing this with a porous metal plate.

A porous metal femoral component has been designed and implanted. Several potential problems exist. While the results at 6 months are similar, early pain relief is better achieved with a cemented femoral component. To date immediate full weight-bearing has been allowed, but as animal experiments suggest that bone ingrowth takes about 4 weeks to occur, it might be preferable to keep patients non-weight bearing during this time. This prosthesis has been carefully designed to avoid the problems of stress relief osteoporosis.

Radiographic change in position of an endoprosthesis – is that loosening?

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According to current criteria, a change in the position of an endoprosthesis determined by conventional radiography leads to the diagnosis of prosthetic loosening. This diagnosis is made also if the patient is free from symptoms, so-called "asymptomatic mechanical loosening". We have used roentgen stereophotogrammetric analysis (RSA), with a sensitivity 10 times better than that of conventional radiography, to investigate whether this concept is valid.

Material and method: The tibial component of 24 patients operated on for gonarthrosis with Total Condylar tri-compartmental arthroplasty between September 1979 and November 1981 was studied.

Longitudinal movements (= migration) were determined by comparing the position of the prosthesis post-operatively with the position at the yearly follow-ups. Inducible movements (= instability) were determined by having the radiographs taken in the weight-bearing position while forces were applied to the knee in a standardized way. The accuracy (= sensitivity) of RSA is 0.3°.

Results: 19 out of 24 tibial components exhibited a migration ranging from 0.5 to 4.4°. No correlation could be found between the magnitude of the migration and the length of the post-operative follow-up period.

All 24 components showed an instability ranging from 0.4 to 1.8° (mean 0.7°). Linear regression analysis between migration and instability did not yield a significant correlation ($r = 0.16$).

Conclusions: The mutual independence between migration and instability is not in favour of the concept that a large migration – visible by conventional radiography – gives a large instability, i.e. (asymptomatic) loosening. The results in this study indicate that migration is a common phenomenon including patients free from symptoms. It is *not* synonymous with loosening but indicates a migration to a new relatively, stable position. The inducible movements represent a normal state of instability of conventionally cemented prostheses.

Instability of total hip prostheses at rotational stress. A roentgen stereophotogrammetric study

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Roentgen stereophotogrammetric analysis (RSA) allows movements to be detected with high accuracy. The technique has been used to disclose loosening of total hip prostheses. In earlier studies, instability of the components was tested at weightbearing/non-weightbearing and adduction/abduction or compression/distraction. In the present study, rotational provocation has also been used.

Patients and methods: Twenty-four patients with 24 total hip prostheses with clinical and/or radiographic problems without suspicion of infection were investigated by RSA. Under local anaesthesia with the aid of fluoroscopy 3–5 tantalum balls, diameter 0.8 mm, were implanted percutaneously into the os ilium and into the trochanter major. The stereo exposures were made with the hip at compression, distraction, external and internal rotation. The dislocations of the prosthetic components at distraction, external and internal rotation from the reference position at compression were recorded.

Results: One acetabular component showed instability at distraction and one showed instability at external rotation. Five femoral components showed instability at distraction and eight showed instability at external rotation, six of which were stable at distraction. Internal rotation did not add anything to the previous findings.

Discussion: Most clinical, theoretical and experimental biomechanical models on loosening of the femoral component are confined to translatory movements in the frontal plane, whereas rotation has received no attention.

In addition to pistoning and bending in the frontal plane (Gruen et al. 1979), rotation may be an important mode of loosening of the femoral component. In these cases provocation by axial rotation, resulting in a torque at the prosthesis, is important to prove loosening of the femoral component.

Conclusion: Provocation with rotation increases the possibility of evaluating loosening of total hip prostheses.

Tissue reaction after implantation of carbon fibre and polypropylene. An experimental study on rats

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To compare tissue reactions to carbon fibre and polypropylene in rats, both materials were implanted under the skin into the peritoneal cavity and into a bone tunnel. Thirty male rats were divided into two groups of 15 animals each. In the first group carbon fibre paper (Grafil A) 1.5 × 1.5 cm in size was implanted under the skin and intraperitoneally. The left distal femoral bone was exposed laterally and a 1–2-mm hole was drilled at a right angle 3 mm above the supracondylar notch through the femoral bone. Carbon fibre was introduced into the hole and tied around the shaft. In the second group of 15 animals a polypropylene mesh of the same size was similarly placed under the skin and intraperitoneally, and a double 3–0 prolene thread was applied to the femoral bone.

The animals were killed at 1, 3, 6, 9 and 12 weeks for macroscopical investigations and to obtain specimens for microscopy and scanning electron microscopy. For microscopy the specimens were stained with hematoxylin and eosin. The decalcified bone specimens were embedded in methylmethacrylate and stained with Goldner's trichrome. The specimens for EM scanning were fixed in 2.5 per cent glutaraldehyde and fixed in OsO_4.

There were no infections. Carbon fibre induced a more fibrous tissue ingrowth, both into the soft tissue and in the bone tunnel than did polypropylene. There was no bone ingrowth into the tunnel. There was no evidence of disappearance or degradation after a follow-up period of 12 weeks in either type of implant.

Primary repair of knee ligament injuries including medial capsular tears with preservation of the meniscus

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A follow-up study of 115 patients operated within 4 weeks after medial capsular tears during 1976–1980 is presented. Associated injuries to the ACL occurred in 71 patients and 18 patients had a PCL injury. All ruptured ligaments were repaired. Fifty-three peripherally detached medial menisci were sutured back and only six medial meniscectomies were performed. In 55 patients the medial meniscus was not injured. Four additional lateral menisci were sutured and four removed.

At follow-up after 2–8 years (median 4 years) only one patient reported episodes of locking or pain at the jointline indicating meniscus injury. No secondary meniscectomies had been performed during follow-up time. Median knee score value was 97 (Lysholm). In 99 patients a good/excellent result was obtained (score >77) while 16 patients had inferior functional results. No difference in knee score values could be revealed between patients with detached (and repaired) menisci and patients without injury to the meniscus. Inferior results were mainly associated with ALRI, moderate valgus instability or chondromalacia patellae.

Operative treatment of acute ligamentous injuries of the knee

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During the period 1977 to 1982, 101 patients with acute ligamentous injuries of the knee joint were operatively treated in our unit. Of the patients 49 per cent were men, their age averaging 34.5 years (16–66), and 41 per cent were women with an average age of 41.7 years (15–66). Fifty-one per cent of the injuries resulted from sports accidents, skiing accidents leading in this category with 35 per cent, followed by football (24 per cent), indoor ball games (13 per cent and others (28 per cent). The operation was in each case performed during the first 48 h following the injury. Preoperative arthroscopy was done in 20 per cent of the cases. The operation consisted in 70 per cent of the cases of suturation or reinsertion of one or more ruptured ligaments; in 22 per cent there was additionally to this procedure an excision of a semilunar cartilage and in 8 per cent suturation of the semilunar cartilage. The most common operative finding was rupture of the medial collateral ligament and in a further 26 per cent this lesion was combined with a rupture of the anterior cruciate ligament. Isolated tears of the anterior cruciate ligament were found in 11 per cent of the cases. Postoperatively all patients had a plaster immobilisation of the knee joint for 6 weeks. Most of the patients managed without a physiotherapist's aid during the postoperative rehabilitation and 38 per cent of the patients were in need of some type of rehabilitation therapy. According to the Lysholm & Gillquist scoring scale, 34 per cent of the knees were found excellent at the follow-up examination, 37 per cent good, 20 per cent fair and 9 per cent poor. These numbers present a slight improvement when compared to our results from earlier decades.

Anterior cruciate insufficiency treated by lateral stabilization a.m. Losee

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Twenty-nine patients operated on in 1979–1981 for disabling chronic anterolateral rotatory instability (ALRI) were followed up for 15–49 (median 23) months. At follow-up, 20 knees (2/3) were stable with a negative Slocum test, whereas this test was positive in nine patients. Eight patients had symptoms of instability (giving-way). The median knee score value (Lysholm) increased from 56 preoperatively to

90 at follow-up. The excellent and good results were significantly related to absence of ALRI.

Lately, deteriorating results have been reported in distal iliotibial band transfers by long-term follow up mainly due to recurrence of instability. The Losee method implies the use of a double thickness iliotibial strip, and has theoretical advantages compared with methods using a single thickness. Our follow-up time is still too short, however, to let our results be safely interpreted as permanent.

Combined medial and lateral extra-articular reconstruction for chronic anterior cruciate ligament insufficiency

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Thirty patients who required surgery for an unstable knee with "giving way" symptoms were operated during 1979–81 with a pes anserinus transfer and an Ellison procedure at the same session. All patients had an insufficient anterior cruciate ligament prior to surgery. Twenty-four patients had a positive pivot shift test and 26 patients had an anteromedial rotatory instability. Postoperatively, all patients were given a plaster-cast with the knee flexed in 45° for 6 weeks. No postoperative complications occurred. After 19–49 months, 28 patients were available for a follow-up examination: 12 women and 16 men, with a mean age of 28 years. Eleven patients (39 per cent) declared that their knee function was distinctly improved and six of the patients (21 per cent) that knee function was moderately improved after surgery. The knee function was unchanged for ten patients (36 per cent) and one patient said that the knee-function had deteriorated after surgery. The functional result was not correlated with the duration of symptoms nor with the follow-up time. Physical examination revealed that the anterior drawer had not disappeared in any of the patients. A positive pivot-shift sign was still present in 18 patients, and 23 patients displayed an increased varus instability.

Although several patients improved after the operation, all but six patients still had some instability experiences, and most of them could not completely return to active sports. However, the method could provide an alternative, especially for patients with frequent but not heavy physical activities.

Experiences of an experimental anterior cruciate ligament reconstruction using carbon fibre in pigs

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To examine the carbon fibre ligament prosthesis in the correction of an anterior cruciate ligament deficiency, the intra-articular part of the ligament was resected in 18 pigs. The reconstruction was done conventionally and the prosthesis was covered by the fascia lata. The 18 animals were divided into three groups of six animals each and killed at 4, 8 and 16 weeks for macroscopical and biomechanical studies as well as for microscopy, scanning electron microscopy and histochemistry.

The macroscopical studies showed an intensive scar tissue formation around the prosthesis already at 4 weeks; the formation continued up to the follow-up period of 16 weeks. Only little fibrous tissue ingrowth into the carbon fibre itself was seen. The prosthesis could easily be pulled out from the surrounding fascia lata and the scar tissue. Two of the ligaments had broken.

The biomechanical studies showed that up to 16 weeks the tensile strength of the reconstructed ligament was not more than 20 per cent of the normal control ligament.

The microscopical studies showed an intensive fibrous tissue reaction around the carbon ligament. During the 16 weeks the collagenous tissue became more dense and organized but only little ingrowth into the prosthesis was seen. No so-called neoligament could be seen.

The incorporation of the collagenous tissue into the carbon fibre prosthesis will be illustrated with the help of immunohistological methods.

Management of old tears of posterior cruciate ligaments of the knee

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The following observations were made in a series of 20 old tears of posterior cruciate ligaments. A number of patients who do not expose the knee to major loads can control the posterior drawer by good quadriceps function. Total stability (negative posterior

drawer, negative anterior drawer in internal rotation, and no posterolateral rotary instability) is impossible to achieve by any reconstruction.

When operative management is warranted, the reconstruction of the posteromedial and anterolateral ligament components separately, e.g. with gastrocnemius and semitendinosus, improves the stability. Primary or secondary laxity of the posterior capsule is always present and posterolateral proximal advancement a.m. Trilat is necessary to support the ligamentous stability. In some old cases with distal avulsion, reattachment with screws (and tightening of the capsule) may succeed.

Postoperative care consists of immobilization in plaster for 6–8 weeks and gradual increase in activities during the first year.

The effect of a strength training program on the functional performance of patients with old cruciate ligament injuries

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Fifty-three consecutive patients with cruciate injury and significant instability problems were treated with a 3 month training program. Forty-one patients had an anterior cruciate ligament (ACL) injury, seven patients a posterior cruciate ligament (PCL) injury and five had a combination of PCL and ACL. Before the training started all patients underwent arthroscopy in order to establish the correct diagnosis and to treat associated meniscus tears.

Before and after training, the patients were evaluated with a Cybex-II dynamometer to determine strength both isokinetically and isometrically, a knee score, an activity grading to establish the actual activity level and performance test to determine the functional disability.

The patients generally responded very well to the training program. A significant rise in strength occurred. The knee score and activity level rose. The results in the performance test were generally improved. Those patients who managed to normalize their quadriceps' strength had the most favourable outcome of the training. Eleven patients were operated on. They either had an improvement in strength and test results but strove for a very high activity level and therefore wanted a ligament reconstruction, or they increased their strength without any symptomatic relief.

Rehabilitation of muscle strength in patients with cruciate ligament injury leads to an improved knee function and the goal should be to restore a normal tight muscle strength. Before selecting patients for operative treatment a strength training program is recommended.

Biomechanical factors in aseptic loosening of the Stanmore total hip prosthesis

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Thirty-three loose Stanmore total hip prostheses were compared to a series matched according to sex, age and preoperative diagnosis without loosening of the THR during an equal follow-up period.

Risk factors for aseptic loosening were previous hip surgery and osteopenia of the proximal femoral region. Further the biomechanical factors, varus positioning of the stem and insufficiency of the cement mantle were significantly related to loosening. Other variables like a wide femoral canal, length of the prosthetic neck, retroversion of the stem and a steep cup inclination were of no significance in this, series.

Recommendations for improval of the operative technique were suggested and discussed.

Cementing technic and loosening of total hip endoprosthesis

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The importance of the amount of cement was studied in a series of 101 Christiansen total hip prostheses with a median observation time of 36 months (range 5–93 months). Ninety-one replacements were performed for osteoarthrosis. The methylmethacrylate cement (Simplex®) was inserted manually into the proximal femur after reaming with broaches and spoons, and rinsing with saline. No distal plug was used.

The result of the cementing was judged in the immediate postoperative X-ray films and compared with the last available films. The results of the cementing were divided into four groups: 1) Cement extending to the cortical bone for the whole length of the prosthesis stem, 2) Cement covering the whole stem but not extending to the cortex, 3) Cement extending to the cortex in the proximal half of the

stem, and 4) Cement with inadequate length and width.

Inadequate cementing (2–4) had a significant association to fracturing of the cement ($P < 0.02$). Cement fracture was associated with migration of the stem ($P < 0.001$) and loosening ($P < 0.01$). The stems with adequate length of cement and with extension of cement to the cortex showed a smaller incidence of cement fracture and stem migration than the other groups.

We conclude that in a cemented hip endoprosthesis the cement mantle has to cover the prosthesis stem as a thick continuous mantle extending to the cortical bone to prevent cement fractures and to secure anchorage.

Loosening – infection in the Swedish material of re-operated total hip replacements

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In a prospective multicenter study including all the orthopaedic departments in Sweden 2716 re-operated total hip replacements were registered in the period January 1, 1979–December 31, 1982. Only patients who had not been revised before in the same hip and if the cause for re-operation was infection or loosening were included in this presentation.

During the period, 230 infections and 1 157 loosenings were re-operated. There has been a continuous and profound increase of aseptic loosenings during these 4 years. The number of infections was stable, however, over the years.

The risk of sustaining an infection or a loosening differed with different primary diagnoses. Elderly people with rheumatoid arthritis that had been operated on before had an increased risk for infection. Surprisingly, we could not identify the same problem with elderly people previously operated on for a cervical hip fracture. Young adults with a high activity level had a greater tendency to loosening, especially those with congenital hip dislocations.

The infected prostheses were replaced 2.6 years after the primary operation, while the loosenings were replaced 4.5 years after the primary operation.

The type of prostheses, type of peroperative antibiotics, surgical approach and operation environment all had the same distribution between infection and loosenings. There were more infections when the hip was previously operated on, or if there had been an infection previously in the same hip, or if there was a wound seroma after the primary arthroplasty.

It is difficult to differentiate before revision between infection and loosening from a clinical point of view and from the radiographs. Of 230 infections 20 per cent were misunderstood and regarded as loosenings before the exchange operation. Puncture before any planned revision and biopsy for culture during the revision is therefore strongly recommended.

Aspirin versus dihydroergotamine-heparin in prophylaxis of deep vein thrombosis in total hip replacement

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In a prospective controlled and comparative study of 82 patients over 50 years undergoing total hip replacement we assessed the prophylactic effect of 1.5 g aspirin given twice daily with that of two daily injections of 0.7 ml dihydroergotamine-heparin (0.5 mg dihydroergotamine + 5000 IU heparin-sodium; DHEH). Administration of drugs was begun on the day before operation and continued until the ninth day after operation. Diagnostic methods included the fibrinogen uptake test, perfusion radionuclide scanning and radiographic phlebography.

Thromboembolism developed in nine of 40 patients receiving aspirin as compared to five of 42 receiving DHEH; there was no statistically significant difference. Analysis of data revealed the unexpected finding that thromboembolism developed in none of 16 men receiving aspirin as compared to nine of 23 women ($P < 0.01$). This absence of a protective effect in women remains unexplained but is in agreement with earlier studies.

Prophylaxis with cefuroxime in total hip replacement (THR) and bone concentration of cefuroxime

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To reduce the infection rate in THR, prophylactic antibiotics are shown to be of great value. Antistaphylococcal drugs such as isoxazolyl penicillins are perhaps mostly used but as the cephalosporin group of antibiotics broadens the protection to include many of the clinically important gram-negative bac-

teria as well, they theoretically could be of more effective.

In a consecutive series of 330 total hip replacements, no case of deep infection was registered during the observation time from 2 to 24 months.

In 20 patients bone specimens were taken at different time intervals during the operation and the concentration of Cefuroxime in bone was determined according to the method of agar diffusion.

This study has shown that there is a good penetration of Cefuroxime into the bone with a peak value of 30 μg/g – 30 min after administration. However, already 60 min after administration, the concentration in bone was diminished to 20 per cent of its peak value.

Conclusions: Cefuroxime fulfills the requirements of prophylaxis extremely well and is shown to be effective in reducing the infection rate in THR. However, to be administered in the most effective way it should be given intravenously just 1 h before surgery and in another dose at the beginning of the operation. If surgery is prolonged, additional doses in the operation room are desirable every 1.5 h.

Radiographic and histologic examination of Moore hip prostheses

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Cemented prostheses are almost invariably surrounded by a soft tissue membrane which is rich in macrophages. The cement is thought to attract these cells and indirectly, thereby, predisposed to loosening. In order to examine whether macrophage accumulation is limited to cemented implants, we have chosen to look at the tissue surrounding uncemented Moore hip arthroplasties.

Material: In this preliminary report five cases (all women) have been examined radiographically and histologically 2–10 years after their hemiarthroplasty: 2 were reoperated because of deep pain in the thigh; 1 had migration of the prosthetic head and only slight pain about the groin; I had a spiral femoral fracture but no complaints prior to the fracture; 1 was an autopsy case without indication of malfunction of the prosthesis. There were no infections. Biopsies were taken from the capsule and from various parts of the femoral medullary cavity.

Finding: In 3 cases the prosthesis was surrounded by a fibrous membrane consisting of dense fibrous tissue with only scattered macrophages. In 2 cases the membrane was infiltrated by an abundance of macrophages. Clinically, both of these patients had pain down the thigh and there was radiographic and scintigraphic evidence of a reaction in the bone.

Conclusion: These preliminary findings indicate that the causes of cellular differentiation around uncemented prostheses merit attention. Our hypothesis is that macrophages are not only related to the implant material but are also part of the tissue remodelling around prostheses in general.

Brunswik total arthroplasty of the hip

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Out of 472 cases operated over 4 years, 390 (82.6 per cent) were available for clinical and radiographic review 5–7 years later (average 6 years). The operations were performed in conventional theatres fitted with an Allander ventilation system. Antibiotic and thrombotic prophylaxis was used throughout. Palacos cement was used in all cases.

Primary wound complications, hematomas or superficial infections, occurred in 20 cases (5.1 per cent). There was no primary deep infection. Other primary complications included thrombosis in the lower extremities in seven cases, embolization in six and dislocation in five.

Late complications included one deep infection and 65 components (16.7 per cent) showed radiographic signs of aseptic loosening; 18 of these had symptoms on walking. Seven patients had pain of various degrees without signs of infection or loosening. New bone formation with decrease in motion was found in 15 joints.

Reoperation was done in two cases of postoperative dislocation and four joints were revised for late complications, one extraction for deep infection, two changes of the stem and one cup for aseptic loosening. Total revision rate was 1.5 per cent or six joints. The relatively favourable outcome of this 5–7-year survey has further convinced us of the good quality and design of the Brunswik prosthesis and assured its continued use in this department in the immediate future.

Surface replacement of the hip

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Fifty Wagner-surface replacement arthroplasties of the hip were followed up 3–5 years postoperatively. The indications for the replacements were: osteoarthritis 43, rheumatoid arthritis six, and late segmental collapse one.

There were nine failures which required operative revision (18 per cent). The failures were as follows: extensive periarticular ossification two, loosening of the acetabular component two, loosening of the femoral component two, and of both components three.

One of the revisions for periarticular ossification became infected and was later followed by a conventional total hip arthroplasty. The other was complicated with damage to the acetabular cup which required a secondary revision. Isolated loosening of the acetabular component was treated with insertion of a new Wagner cup, loosening of the femoral component or combined loosening with conventional or cementless prostheses.

All except three of the patients who had no operative revisions were satisfied and had a good function after surface replacement.

Although the failure rate is relatively high compared to conventional stemmed hip arthroplasties, it still seems that the method should be considered as an alternative in patients below 60 years of age.

Occupational capability in patients with total hip replacement

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A study of 387 patients with total hip replacement was undertaken on average 5.4 years postoperatively.

The working capacity and the dependence on the social welfare system were analysed and found to depend significantly pre-operatively on age, cause and walking ability and at the follow-up on age, walking ability, pain and subjective experience of satisfaction with the operation.

Among patients working pre-operatively, 92 per cent retained their work, whereas 70 per cent of patients on sick-leave went back to work. Only 9 per cent of patients working or sick-listed prior to surgery became invalidity pensioners, but no previous pensioners went back to work.

Effects of a distal venting hole in the femur during total hip replacement

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In 18 patients who underwent total hip replacement, the intramedullary pressure in the femur was measured during the insertion of the femoral prosthesis component. Half of the patients had a pressure release hole (diam. 4.5 mm) drilled into the medullary canal in the distal end of the femur. In the patients without such a hole the intramedullary pressure increased transiently to a median of 390 mmHg during the insertion of the femoral stem, while those with a venting hole only showed an increase to 23 mmHg. A drop in the arterial oxygen tension of 2.2 kPa and in thrombocytes of 51×10^9/l was found in those without venting hole, while the corresponding values in those with venting hole were 0.9 kPa and 20×10^9/l. Furthermore, a significant correlation was demonstrated between the increase in the intramedullary pressure and the drop in the oxygen tension and in the blood platelets.

No significant change in blood presssure was measured during the operation in either of the groups.

Socket wall addition in cases of dislocations after total hip replacement

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Six patients with recurrent dislocations after total hip replacement have been treated with stabilizing additions to the acetabular component. All the patients had a fracture in the hip region before the arthroplasty – in three cases acetabular fracture and in three cases femoral fracture (fracture of the femoral neck, pertrochanteric fracture, and proximal shaft fracture).

Soft tissue imbalance and/or component malposition caused the dislocations in five patients. One schizophrenic patient had positional dislocations – at first anterior and later on posterior dislocations.

At surgery, a sector was cut from a new original socket. This piece was then fixed with screws to the patient's acetabular prosthesis in such a position that further dislocations were prevented.

The simple technique has been successful and is a

simple alternative to revision arthroplasty with exchange of components.

Total hip replacement and reconstruction of the acetabular roof with a femoral head bone graft

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Free bone grafting using the femoral head in order to provide proximal support of the socket was performed in 22 hips in 18 patients (two men and 16 women). All patients had sequelae from congenital dysplasia or dislocation of the hip and their median age at operation was 50 (21–77) years. Re-examination 6–92 months postoperatively (median 54 months) included radiography and emission tomography (Tc-99m diphosphonate) of the pelvis and the proximal femora.

The position of all bone grafts was unchanged but resorption of the most lateral part was observed in 12/22 hips. A marked resorption was found in two hips.

20/22 grafts could be identified by emission tomography. The activity in each of these grafts did not differ from the adjacent iliac bone, indicating viability of the grafts.

Ectopic bone formation in relation to three different approaches to the hip

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Ectopic bone formation (EB) around the hip is a common finding after total hip replacement (THR). Although EB is associated with stiffness, it rarely leads to ankylosis. The aim of this study was to connect retrospectively the incidence, the extent and distribution of EB to three different surgical approaches to the hip joint.

We also studied creatininphosphokinase (CK), alkaline phosphatase (ALP), in serum in the first postoperative period and in some cases muscle biopsies were taken for the evaluation of intracellular enzymes.

Significant differences in the incidence and distribution of EB between the different surgical approaches were found. EB seems to be correlated to the area of maximal tension in the muscle. It was most commonly found after revision operations. The preliminary results show a relative muscle anoxia during operation in areas where EB is later found. No significant increase of CK or ALP was found.

The findings seem to support the view that trauma plays an important role in the development of EB after THR.

Preoperative external and internal determination of ^{99m}Tc-MDP uptake of the femoral head after femoral neck fracture

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Scintimetry with technetium-labelled compounds has become widely used in femoral neck fractures, mainly for prediction of healing complications. Visual uptake estimation has been abandoned and nowadays numerical ratios are obtained with the aid of different reference points, for example the contralateral femoral head, the trochanteric region or the femur, and empirically it has been possible to determine which ratio values are favourable and unfavourable.

Material and methods: Preoperative ^{99m}Tc-MDP scintimetry was carried out on the day of femoral neck fracture osteosynthesis in 30 patients. The femoral head uptake ratio fractured/intact side was determined. During the operation, after fracture reduction, cylindrical biopsies were taken from the trochanteric region and from the femoral head and their uptake was determined in a well counter. After correction for background activity and weight differences, a biopsy ratio femoral head/trochanteric region was determined; the trochanteric uptake may be anticipated to correspond to normal metabolism.

Results: The correlation between the scintimetric ratio and the biopsy ratio was $r = 0.80$. Total absence of femoral head uptake thus corresponded to a femoral head ratio = 0.7 and normal uptake to a ratio = 1.5. The border between favourable and non-favourable healing prognosis was shown previously to be at a femoral head ratio = 1.0, and at this ratio the femoral head metabolism was lowered to about 40 per cent of that of the trochanteric region.

Conclusions: 1. A considerable part of the uptake seen over the femoral head in scintimetry is derived from surrounding structures. 2. It is possible to heal a femoral neck fracture without complications with femoral head vascularization/metabolism reduced to 40 per cent of that of the trochanteric region.

Pre- and postoperative scintimetry to compare the effect on femoral head vascularity of nail versus screw fixation of femoral neck fractures

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Traumatic techniques of internal fixation have been reported to involve a risk of impairing the blood supply to the femoral head. The aim of this study was to determine whether any difference in femoral head vascularity could be detected when comparing nail versus screw fixation of femoral neck fractures.

Ten patients with Garden Type III fractures were randomly allocated to each of the two treatment groups, and examined both preoperatively and 1 week postoperatively with scintimetry usnig Tc-99m MDP as a tracer.

The average percentual increase in the radionuclide uptake ratio between the fractured and intact side was 33.75 after nail fixation and 38.10 following screw fixation. This slight difference was not statistically significant ($p < 0.05$), nor could a statistically significant difference be found with respect to the incidence of postoperatively decreased uptake over the fracture side.

Since scintimetry failed to reveal any significant difference in femoral head vascularity in the immediate postoperative period following nail fixation as compared to screw fixation of Garden Type III femoral neck fractures, it would seem that any differences in the final result should be attributed to variations in the quality of reduction and/or different mechanical properties of the two internal fixation devices.

Scintimetry of femoral head specimens removed at arthroplasty for failed femoral neck fractures

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The aim of this study was to correlate the radionuclide activity over the femoral head evaluated by skeletal scintimetry with histologic assessment of femoral head viability in failed femoral neck fractures. Nineteen patients were examined by skeletal scintimetry prior to hip replacement surgery for nonunion or late segmental collapse. Following intravenous administration of 600 MBq of Tc-99m MDP 1–2 h before hip replacement, a 5–6 mm thick frontal section cut from the center of the removed femoral head was subsequently examined both histologically and by scintimetry. The activity distribution was recorded with a gamma camera and the area of radionuclide uptake calculated.

A correlation was found between the radionuclide uptake recorded preoperatively over the involved femoral head and the uptake in the removed specimens ($r = 0.74$, $p < 0.001$), and confirmed by the results of histologic examination. Both scintimetry and histologic examination showed large variations in femoral head viability between the different specimens.

These results indicate that skeletal scintimetry may be used to determine levels of uptake defining varying degrees of femoral head viability and as such constitutes a valuable complement to radiography in the assessment of disturbed fracture healing.

Transient ischemia of the proximal femoral epiphysis in the child

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With the use of ^{99m}Tc-MDP-scintigraphy in combination with the pin-hole-collimator technique, a high degree of resolution can be obtained. The anatomical regions of the hip joint in the child can be well defined. The purpose of this study was to describe the ^{99m}Tc-MDP-scintimetry pattern in children with the clinical diagnosis of transient synovitis.

Material: 43 consecutive cases with symptoms of transient synovitis and no radiographic evidence of hip disorder were admitted for scintimetry; boys/girls = 31/12: mean age (2–13) years.

Method: ^{99m}Tc-MDP-scintimetry with the pin-hole-collimator technique. Isotope uptake was quantified in a region of interest (ROI) in the proximal femoral epiphysis (PFE) and in a "profile of interest" across the joint. The activity in the ROI was related to a region of reference in the proximal femur. This ratio was related to the corresponding ratio in the contralateral side.

Results: In two cases the study could not be completed. In 27 cases isotope uptake was symmetric in both hips. In eight cases there was a diffuse increase in uptake in the PFE. In six cases there was a deficient uptake in PFE in the initial study indicating a disturbance of blood flow to this region. On follow-up

uptake returned to normal in five cases. In one case the deficient uptake persisted and this patient subsequently developed radiographic evidence of Legg-Perthes disease.

Conclusion: In some cases of acute hip pain in the child there is a transient, spontaneously recovering ischemia of the PFE. The cause of this is so far unknown. Increased intraarticular pressure has been suggested. The concept of repeated vascular insults in Legg-Perthes disease would be in accordance with these findings and raises interesting suggestions about the relationship between the transient synovitis group of patients and Legg-Perthes disease.

Sonography – a valuable new tool for diagnosis of CDH in infants

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CDH in the infant is a clinical diagnosis. It depends to a great deal on the skill and experience of the examiner, and it is difficult to verify the clinical findings.

By use of sonography it has been possible to visualize the ligaments, the acetabular structures and the head of the femur in infants. By videotaping it has been possible to measure the instability in the hip-joints. Sonography has therefore improved the possibility of diagnosing CDH in infants.

Complications associated with extraction of the AO epiphysiodesis screw

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By extraction of the AO epiphysiodesis screw in 23 patients treated for slipped capital femoral epiphysis, complications were encountered in 13 patients. Extraction was difficult because of the relatively greater diameter of the thread in comparison with the shank. In five patients the screw broke and in one patient a fracture of the proximal femur was seen postoperatively. We think that the AO epiphysiodesis screw is unsuitable for use in patients with slipped capital femoral epiphysis.

Protective treatment of ulcers on the dysvascular foot

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The treatment programme for the dysvascular foot developed by F. William Wagner was adopted some years ago at the department of orthopaedic surgery in Norrköping. As an alternative to total contact walking casts, two types of protective shoes have been worked out in the treatment of foot ulcers in neurovascular patients, mostly diabetics.

The first shoe, designed as a "walking bed", consists of a rigid foot-bed produced from a mould of a foot impression. It has a rigid rocker-bottom sole to distribute the pressure during walking and has an open fenestration over the ulcer.

The second shoe is designed to be used after healing of the ulcers and is made from the same last. It is a temporary shoe for the control of healing until the patient is fitted with an orthopaedic shoe or ankle-foot orthosis.

The course of treatment is demonstrated by two cases where amputation was suggested but healing was achieved by protective treatment.

Acute Charcot breakdown of the diabetic foot

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Spontaneous and pathological fractures are common among diabetics with neuropathy, but the diagnosis is not usually made during the acute phase. Later, the destruction becomes visible when an X-ray is taken for some reason.

The innocent trauma and the very small amount of pain from the insensitive neuropathic foot do not make the physician suspect a fracture, and the red, hot, swollen and painful foot is taken for an erysipelas.

The course of the disease and the treatment in some cases with PTB-orthoses are demonstrated.

Fluorescein angiography of the foot-soles for determination of healing possibilities or local amputation level in the diabetic foot

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Dynamic fluorescein angiography (FA) was introduced by Lundin 1973 in studies of nutritional blood supply to the skin in peripheral arterial disease. In this study, FA was used to investigate local disturbances in skin circulation in the foot-soles and in toes in diabetic patients to predict the possibility of wound healing and to improve the diagnostic criteria for determination of the local amputation level in the foot.

Forty patients, eight with juvenile and 32 with adult diabetes were examined. The average age in the juvenile group was 44 years and in the adult group 70 years.

Besides FA, Wagner's wound classification, toe and ankle pressure, ischemic index and biotensiometry were used to assess the viability of the foot, as well as color photographs.

Sodium fluorescein was injected i.v. in a dose of 10 mg/kg bodyweight after body warming. Sequential photographs were taken using an ultraviolet flashlight. The appearance time of fluorescein was registered. Also, the increase in fluorescence during 10 s after the appearance of fluorescence in the skin was registered.

Using the densitometry technique, it was found that there was a significant correlation between the increase in fluorescein density, indicating cutaneous circulation, and toe as well as ankle pressure.

Of the 46 feet treated, the majority with toe pressure below 15 mm Hg underwent below knee amputation or did not heal after local amputation. Still, 7 out of 17 patients with a toe pressure below 15 mm Hg healed, probably due to the correct local amputation level indicated by FA. Above 15 mm Hg, only one patient was amputated below the knee, whereas the other 21 feet healed. All feet except three healed if the ischemic index was above 0.2.

The FA demonstrates regional disturbances in cutaneous blood flow and is of aid together with the ischemic index in determining wound healing in the diabetic foot and in determining the correct local amputation level.

Amputation through the foot in patients with diabetes mellitus or arteriosclerosis

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Preserving a weightbearing part of the foot instead of carrying out below-knee amputation in patients with lower extremity ischemia or gangrene facilitates daily life for the patient as the patient can manage shorter distances with weightbearing without using a prosthesis.

During the years 1977 through 1983, 86 amputations in the foot in 79 patients with diabetes mellitus or arteriosclerosis were done at the University Hospital in Lund. There were 37 females and 42 males. Forty-six of the patients were diabetics and seven of these were operated on bilaterally. Thirty-three patients had arteriosclerosis. A positive bacterial culture and clinical infection was found in 48 of the diabetic feet and in 24 of the arteriosclerotic feet. The indication for operation in 46 of the 53 diabetic feet was gangrene and in seven was infection. In 31 of the 33 arteriosclerotic feet, the indication was gangrene and in two infection. In all the operated patients the gangrene and infection only involved toes or part of the forefoot.

Three types of operations were performed: a) amputation of one or more rays, b) transmetatarsal amputation through the proximal metatarsal bones and c) Boyd amputation.

Healing was defined as healed wound and a useful foot after a postoperative period of 6 months. Of the 52 diabetic feet, 34 healed whereas 18 went to below knee amputation. One patient died.

Of the 33 feet operated with arteriosclerotic disease, 10 healed whereas 18 went to below knee amputation. Three patients died and the fate of two patients is unknown.

Amputation through the foot in patients with localized gangrene or ischemia in the foot seems to have a reasonable outcome in diabetes mellitus but is less favourable in patients with arteriosclerotic disease. To improve the outcome of local amputation, toe and ankle pressure, ischemic index and fluorescein angiography are valuable aids. Some of the patients were investigated using these parameters and these results are discussed.

Subtalar triple arthrodesis of the foot

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Forty-three patients underwent subtalar triple arthrodesis of the foot during a 10-year period with a total of 48 procedures. There were five bilateral procedures. The age of these patients was from 13 to 76 years with a mean age of 34. Twenty-seven patients were men (63 per cent) and 16 were women (37 per

cent). The observation time was 2.5 to 11.6 years with a mean observation time of 7 years.

The reason for this operation was mainly pain and disability while walking, and deformity of the foot. Those 43 patients had the following diagnoses: eight congenital cerebral paresis, one traumatic cerebral paresis, one cerebral hemorrhage seq., eight calcaneal fractures seq., five other injury seq., three rheumatoid arthritis, one seq. osteomyelitis, one seq. septic arthritis, one seq. poliomyelitis and 14 congenital abnormalities. Forty patients healed primarily but three patients did not. These three patients did not heal primarily in the talo-navicular joint and underwent re-operation later and healed without complication. Another complication was one patient with superficial infection and one other patient with bilateral pulmonary embolism.

The follow-up included 41 patients and 45 feet were re-examined. Two patients were dead and three procedures had been performed on them. The overall results were good or fair in 95.12 per cent. All 41 patients were limping before surgery, but after surgery 14 patients (34.14 per cent) were not limping any more. Before surgery, 29 patients had pain at night in the feet while in bed and during movements and while walking, but only three patients had pain after surgery. The walking tolerance was different for the whole group but increased for most of the patients after surgery. 90.25 per cent of the patients returned to the same occupation or to a more difficult occupation after surgery, but only 9.75 per cent returned to a less difficult occupation after surgery. Before surgery, 21 patients (51.21 per cent) had some kind of specially constructed orthopaedic appliance, but only five patients (12.19 per cent) had to use it after surgery.

According to the above results, there is a reason to recommend subtalar triple arthrodesis for these groups of patients.

Ankle-fusion – a long-term investigation

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Twenty-eight of 31 patients with ankle-fusion without fusion of the subtalar joint were examined 2–17 years after the operation (average 8.6 years). Twenty-six were post-traumatic cases with arthrosis.

Bony fusion was achieved in 25 patients. Pain is a problem for seven patients; for three of them it is partially disabling. Twenty-one patients have slight pain or no pain at all.

Mobility between the talus and calcaneum was reduced to less than 50 per cent in 21 patients, while (passive) mobility of the first metatarsal bone increased in one-third of the patients.

The gait is normal in 15 patients, eight have a slight limp and five are disabled. In 17 patients the walking distance is practically normal.

Radiological arthrosis of the subtalar joint is present in 17 patients, but this was present preoperatively in nine patients.

Twenty patients (including housewives) have returned to normal work and three have taken lighter work.

The operation still offers a good solution for patients with arthrosis of the ankle where artifical joints are too uncertain.

Morton's metatarsalgia

Kjell Nøkleby

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The author has examined and operated on 69 patients (57 females and 12 males) for Morton's metarsalgia. The patients underwent 74 operations.

The diagnosis was based almost entirely on the history of the illness. It was not possible by examination to provoke the excruciating pain the patient had when walking.

Histologic examination was done on all removed nerves (76 in all), except for one. In 12 cases the nerve looked normal, but the microscopy showed Morton's neuroma. In 63 cases the macroscopic picture was in accordance with the microscopic picture.

Operations were carried out 55 times in the space between the metatarsal bones III and IV, 17 times between II–III and twice between both II–III and III–IV. Dorsal incisions were done 65 times and plantar incisions 11 times. All operations were done in local anaesthesia on the metatarsus.

Seventy-six interosseous spaces were operated on with good results in 59 cases. Postoperative evaluation was lacking in six cases. One patient got worse and four were no better. One patient with bilateral operations was better for only a short time in spite of macroscopic and microscopic neuromas. Six patients had relapses about 1 year after the operation. All patients with relapses had a dorsal incision. Three were reoperated with a plantar incision, and neuromas were removed with good results.

With a dorsal incision it is not always possible to

cut the nerve as far proximally as is desirable, and a neuroma situated too far distally can develop.

In the light of these results, a plantar incision is recommended.

Freiberg's disease of metatarsal head

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Twelve patients, ten females and two males, have since 1979 been treated by the author for Freiberg's disease. One female had a bilateral manifestation.

The head of the second metatarsal bone was affected 11 times and the head of the third metatarsal bone twice. Eight patients said that the disease started when they were teenagers.

In two patients, girls 3½ and 14 years old, it was possible to follow the outbreak of the disease from before the time when changes in the bone were visible on X-ray.

Only one patient claimed that a trauma was the cause of the disease.

In all the young patients the affected bone showed necrosis in the distal part of the metatarsal head.

In the younger patients a relatively painfree period followed some months after the start of the disease. Operations are usually not necessary in youngsters. In later life, when osteoarthritic changes take place in the affected metatarsophalangeal joint, operation is often necessary because of pain.

Six patients were operated on with partial resection of the metatarsal head and removal of osteophytes on the proximal phalanx. The average age of those operated was 43 years. All those operated on became painfree.

Polydactyly of the feet

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The authors report their experiences with 55 patients with polydactyly of the feet. To begin with, using characteristic examples, they refer to the morphology of these anomalies and present a classification which is based on clinical viewpoints. The basis of this classification is the pathogenetic principle of the division of one or more rays of digits in the direction from distal proximal, discovered by W. Müller (1937). Thus, most of the polydactyly may be classified in different degrees of severity depending on the extent to which the forking-process ranges from a broadening and partial division of a digit in the area of the Tuberositas unguicularis to a complete doubling of one ray of digit. However, not all polydactyly can be accomodated in this scheme.

In the second part of the lecture the authors deal with the therapy of polydactyly: The indications for surgical therapy are based on aesthetic viewpoints as well as on functional viewpoints, e.g. free availability of confection shoes.

The surgical measures correspond in most cases to those which have been successfully tested with polydactyly of the hand and which range from amputation, osteotomy and operation on tendon, joint-capsule and skin plasty. Unfortunately, there is not time either to refer to the detailed techniques or to give an extensive survey of all the operational procedures. The authors, therefore, concentrate only on the most frequent sources of errors and their avoidance.

Compression hip screw versus von Bahr screws in femoral neck fractures

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The treatment of fractures of the femoral neck is still controversial. It is of great importance to find a simple and safe method for this common fracture. In clinical experience the compression hip screw has been shown to give reliable stability. However, the operation is more complicated and represents a greater operative trauma to the patient than e.g. the von Bahr method. Thus, if the von Bahr screws produce sufficient fracture stability, this method might be preferable.

To compare the stability produced by the compression hip screw combined with a proximal lag screw versus two von Bahr screws, subcapital osteotomies were performed on 12 pairs of cadaveric femurs from elderly subjects (age 68–85 years). One side of each pair was fixed with a compression hip screw and a proximal lag screw, the other with two von Bahr screws. The specimens were then subjected to mechanical testing. Continuously increasing axial compression loads were applied on the femoral head until failure. Simultaneously, the displacement of the osteotomies was measured.

With loads up to two kilonewton (about three

times the body weight) no difference in displacement of the osteotomies were found between the two groups. The strength of five intact femurs measured by the same system was 4.5–7.5 kilonewton.

If these results can be confirmed in clinical studies, the von Bahr method seems to be preferable.

Compression screw compared with nail plate fixation in femoral neck fractures

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In a prospective randomized study of femoral neck fracture operations, a newly developed compression screw device was compared with the McLaughlin nail plate: 128 fractures were treated with compression screw and 127 with nail plate. The patients were followed for 3 years.

The duration of the operation was slightly longer in the compression screw group: the rate of postoperative complications, fall in haemoglobin level and need for blood transfusion were equal in the two groups.

All undisplaced fractures healed in both groups. Eleven per cent of displaced Garden 3 and 4 fractures did not heal in the compression screw group compared to 25 per cent in the nail plate group. This difference is statistically significant ($p < 0.05$).

Late segmental collapse occurred in 15 per cent of the healed displaced fractures in the compression screw group, compared to 21 per cent in the nail plate group: This difference is not significant.

Fixation of femoral neck fractures using the new compression screw device gave fewer failures without concominant disadvantages compared to nail plate fixation.

Early mobilization and full weight-bearing in patients with trochanteric fractures.

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In a prospective, randomized study which started in June 1982, patients with trochanteric fractures were operated according either to the Ender technique or to the sliding nail principle. Evans' classification was used. The patients were examined according to a specific protocol at regular intervals.

Gait was studied with an electronic walkway; 8–12 steps were analyzed for each patient. The relation between the maximal vertical force (MVF) exerted by the operated leg and the body weight was determined. The mean ratio for the MVF and the single limb support phase (SLS) between the operated and non-operated leg was also calculated.

The results of the gait analysis 3 months postoperatively, comparing Ender nail-treated patients ($n = 30$) and sliding nail-treated patients ($n = 45$), did not show any significant differences. The patient's general condition and the type of fracture were of greater importance for the walking capacity than the surgical technique. Interestingly, the majority of patients, using walking aids, put as much as 90 per cent of the body weight on the operated leg. However, many of these patients showed a more pronounced difference between the operated and non-operated leg with respect to the SLS ratio, which may indicate that SLS is a more reliable parameter than MVF.

Cervical and trochanteric fractures, clinical, radiographic, and social analysis

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The duration of hospital care and costs were reviewed. Of 450 operations, 250 were available to the study. This preliminary report comprises 180 cases.

Of 62 trochanteric fractures, only one failed to unite. With cervical fractures, if the cervix was compressed into the caput without diastasis, they were designated Type I. We had 27 Type I, with three failures of union occurring in a group of five with pre-operative valgus/varus exceeding 25°. The remainder, 85 fractures, were classified as Gardner III or IV. A radiographic system for early singling out of non-union cases among these was developed.

Preoperatively, we gave 1 point (1 p) if the backward angle was 60° or more, and another (1 p) if the cranial displacement of the shaft ranged 1.5–2 cm. Then, we added (2 p) if there was valgus/varus of 45° or more. Cranial displacement 2.2–2.5 cm meant (4 p), and above 2.5 cm (6 p).

Postoperatively (2 p) were added if there was diastasis involving at least half the fracture area, and another (2 p) if nail/nails were placed anteriorly

(area 1 or 2). However, with perfect angular alignment and compression in the total fracture area 0.3–0.8 cm, 2 points will be subtracted (−2 p). In type III we observed no failures if the sum of both angular displacements before and after operation plus the angular movements of realignment kept below 125°. This was also credited (−2 p).

The following distribution was obtained:

0–1 points, non-union rate 15 of 51.
2–3 points, non-union rate 9 of 15
4 points, non-union rate 3 of 4
>4 points, non-union rate 8 of 8

Above 3 points there was no significant difference in prognosis pre- and post-operatively. Thus elimination of the non-union cases by 1/3 seems possible.

Rehabilitation of patients with a nailed hip fracture in a long-stay hospital

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For several years an active rehabilitation programme with direct postoperative weightbearing and early return home has been practised in Lund for hip fracture patients (Ceder & Thorngren, *Lancet* ii, 1097–1098, 1982). In spite of this, 15 per cent of the patients in the Lund area had to be transferred to a long-stay hospital. Most of those came originally from some institution. Of patients coming from their own home, only 10 per cent went to a long-stay hospital.

Thus, 78 consecutive patients with a nailed hip fracture were admitted to a long-stay hospital from the orthopaedic department during 1977 through 1980. They were followed for 2 years concerning rehabilitation outcome. Thirty-four of the patients came originally from their own homes, 22 from old people's homes and the others from nursing homes or similar institutions. Especially the patients originally coming from their own homes or old people's homes had been selected for this long-stay hospital by the orthopaedic surgeon and his staff because of the poor chance for rehabilitation to the patients' original residence. Due to a very active rehabilitation attitude at the long-stay hospital, one third (11/34) of the patients had returned home 1 year after the fracture and 2 years after the fracture one third of the surviving patients were still at home. However, all but one of the 22 patients originally coming from old people's homes remained in the long-stay hospital or had died. In total, 2 years after the hip fracture, 20 per cent had been discharged to and remained in their own, home or old people's home, 40 per cent were still in the long-stay hospital and 40 per cent had died.

The knee joint in rheumatoid arthritis. A long-term follow-up of a population study

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The aim of the study was to investigate the long-term development of knee deformities and symptoms in rheumatoid arthritis. A follow-up was made in 1983–1984 of a material from a population survey on rheumatoid arthritis, which was carried out 1968. This material initially included 239 individuals. At follow-up, 128 were still alive, of whom 105 were examined.

A detailed joint examination was performed, including questions on the start of joint symptoms, operations performed and various measures of disease severity. The median duration of rheumatoid disease was 34 years and at follow-up 72 per cent of the patients reported symptoms from their knees; 62 per cent had evidence of inflammatory joint disease; 32 per cent regarded their overall symptoms to be severe or very severe; 32 per cent considered the knee joint as their most troublesome joint; no other single joint caused the same degree of inconvenience. Extension lag was observed in 25 per cent and instability in 10 per cent.

In view of these and other results from this study, special attention should be paid to the knee joint affections and their surgical treatment in rheumatoid arthritis.

Long-term results of early synovectomy in the knee of early cases of rheumatoid arthritis

Bohmann, Preschitz & Schwägerl (Vienna); H. Brattström, M. Brattström, Larusdottir & Mogensen (Lund); Czurda, Lach & Schwägerl (Vienna); Gschwend & Kentsch (Zürich); Hagena & Jäger (Munich); Kinell & Wigren (Uppsala);

Köhler, Mohing & Richter (Augsburg); Mori & Hamada (Osaka); Pavlov & Zagorodny (Moscow); Thabe, Geriche & Tillman (Bad Bramstedt).

Long-term = at least 10 years follow-up time of each knee.
Early cases = Grade 0–III, according to Larsen (an X-ray grading).
Ten clinics with in all 508 knees are reported.
Results: 65 per cent of the results are graded *good;* the rest *fair* or *poor.* Mean grade (Larsen) preop.: 1.7; postop.: 2.7.
Conclusion: "Early" synovectomy of the knee is a good, time-gaining operation.

Total knee replacement in juvenile chronic arthritis

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Twelve patients with juvenile chronic arthritis underwent 18 primary knee replacements during 1975–1981. The patients were followed for an average of 6 years (range 3–9 years).

Indications for surgery were deformity, decreased range of motion and pain. Four knee joints were revised, one of them three times, because of malposition and/or mechanical loosening of the prosthetic components.

At follow-up, all patients except one were pain-free in the operated knee. All patients except one were ambulatory. The functional capacity was improved in two-thirds of the patients. The arc of motion was increased by 17 degrees. The radiographs at follow-up showed a hip-knee-ankle angle of 182 (173–193) degrees.

In eight knee joints, the tibial and/or femoral component showed a radiolucent zone at the bone-cement interface exceeding 2 mm, and in four of these joints there were signs of prosthetic migration.

To aid in the decision of choosing an appropriate knee prosthesis for the juvenile arthritic knee joint, standardized measurements of the radiographic dimensions of the knee joint were made.

Taking into consideration the high rate of revisions during the short observation period and the potentially high failure rate shown from the radiographs at follow-up, we recommend a cautious attitude to knee replacement in patients with juvenile chronic arthritis.

Surface replacement of the elbow in rheumatoid arthritis. Early results with the Wadsworth prosthesis

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Nineteen elbows in 15 patients with rheumatoid arthritis were operated with a surface replacement prosthesis of the Wadsworth type. The patients were followed for an average of 30 months.

At follow-up, the humeral component was radiologically loose in ten and the ulnar component in five elbows.

Eleven patients representing 15 elbows were entirely satisfied regarding freedom from pain and range of motion. There were two reoperations. One prosthesis was removed because of early deep infection and one exchange of the humeral component was performed because of loosening.

Anatomic positioning of the humeral component reduced the risk of mechanical loosening. The high potential failure rate calls for changes in the prosthetic design and improved instrumentation for alignment of the components. Elbow prosthetic surgery is still to be regarded as experimental.

The unstable cervical spine in rheumatoid arthritis

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Thirty-four patients suffering from rheumatoid arthritis were referred to the Surgical Hospital during the period 1979 to 1982 because of progressive instability of the cervical spine. All patients had pain in the occipitocervical area, and 22 patients presented signs of cervical myelopathy. The neurological deficit ranged from loss of muscle mass, numbness in the limbs and a positive Babinski's sign to tetraparesis with subtotal loss of motor function.

The instability of the cervical spine was assessed in all patients by conventional radiographs and cervical myelography combined with computed axial tomography. Conventional radiographs revealed the

extent of displacement in the craniocervical junction and any coexistent subaxial instability. The predominant radiographic finding was anterior atlantoaxial instability (20 patients), intrusion of the odontoid process (18 patients), lateral subluxation (14 patients) and subaxial instability. The computed tomograms revealed the extent of compression on the cervical cord.

Eighteen patients were treated surgically, 11 by atlantoaxial fusion, seven patients by occipitocervical fusion. Sixteen patients were treated with a neck support.

At follow-up 24 months later, radiographs from patients not operated on revealed increased vertical subluxation and unchanged or decreased anterior subluxation. In the 18 patients operated on, the deformity had not progressed; in two patients a pseudoarthrosis was found. Pain was unchanged or worse in the conservatively treated patients and has subsided in 12 of the patients operated on. Signs of neurological complication increased in eight of the conservatively treated patients, or remained unchanged. In the patients with a fusion of the cervical spine the neurological changes improved in six patients and showed no improvement in 12. There were no deaths in the series.

Posterior fusion according to Louis in rheumatoid atlanto-axial dislocation

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Twelve patients with rheumatoid arthritis and atlanto-axial dislocation of 8 mm or more were treated with a modified Gallie procedure according to Louis – after reduction of the dislocation, a sculptured piece of bone from the ilium was enclosed and fixed in a wire loop between the posterior arch of the first and second cervical vertebrae. The procedure is fast and safely done under control of an image intensifier. A semi-rigid orthopaedic collar is used for 3 months postoperatively. Ambulation is early and hospital stay less than a week.

The results are good, with pain relief and stability. Bony consolidation of the graft has occurred in all but one case. Here a redislocation of 4 mm was noted because of resorption of the graft. However, the wire loop was intact.

The method is simple and safe and does not require the use of bone cement.

Complications in multiple alloplastic joint reconstructions in rheumatoid arthritis

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A follow-up study was made on patients with rheumatoid arthritis with three or more alloplastic joint reconstructions, special attention being paid to the analysis of any complications or other reasons for unsatisfactory results. Fifty patients, the last alloplasty in all the cases being done within the period 1.I.1980–31.XII.1983, had had 1981 joints reconstructed (3 shoulders, 7 elbows, 71 hips, 88 knees, and 12 ankles). There were 33 female and 17 male patients, and the median age at the time of the follow-up was 56 years (31–78). The observation period varied from 3 months to 12 years, average 3.3 years.

Early deep infection making arthrodesis necessary was seen after three knee-alloplasties in two patients. One total hip replacement (THR) resulted in primary deep infection spreading to the alloplastic knee-joint and ended up with a life-saving hip exarticulation. There were three cases of proximal dislocation of the trochanter after Charnley THR, but only one required refixation. Two cases of postoperative hip-luxation were treated with closed reduction and adductor tenotomy. There were four cases of skin-necrosis after knee-alloplasties, but only two needed excision and closure. Transient peroneal nerve palsy was seen in eight cases and deep thrombophlebitis in four. Small hematomas, wound drainage or superficial infection were seen in nine patients.

Late deep infection occurred in one hip and the ipsilateral knee, necessitating revision THR and knee-arthrodesis. Eight joints developed aseptic loosening and in four the implants have been exchanged. There were no fatal complications.

All in all, 73 per cent of the alloplasties were without complications and an additional 11 per cent had only small transient complications. But 58 per cent of the patients experienced some kind of complications in connection with one or more operations.

It is concluded that the accumulative nature of the risk of complications must be taken into consideration in the planning of multiple alloplastic joint reconstructions.

Results of tibial osteotomy in young patients with early gonarthrosis

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The purpose of this study was to analyse knee function and the general level of daily, recreational and eventual sporting activities in young patients with early gonarthrosis operated with high tibial osteotomy.

Material and methods: Among all patients operated with tibial osteotomy at the orthopaedic clinics in Lund, Eksjö and Gävle, Sweden during the years 1970 to 1981, 30 patients fulfilled the criteria of age below 50 years and medial gonarthrosis stage I according to Ahlbäck. The indication for the operation was pain on weight-bearing for at least half a year. There were 26 men and four women. The average observation time was 7 years. All knees were radiographically examined in standing, weight-bearing position, pre- and postoperatively, to classify the degree of arthrosis. The mechanical axis of the leg was also determined at the follow-up examination. The mobility, stability of the knee and the pain situation were registered. Also, the knee score of Lysholm was used and the patients were thoroughly questioned about their physical activities and as regards work and sport.

Results: Twenty-four patients had a pain-free walking distance of more than 1 km. Twenty-two of the 30 patients considered themselves as good or very good, and 19 performed some basic recreational sport activities. Of the 30 knees, 19 were corrected in the interval of ± 4 degrees around 4 degrees of overcorrection of the mechanical axis. Of the 30 knees, five had increased in the stage of arthrosis and of these four were clearly undercorrected. The majority of the patients, 24/30, had an anterior sagittal instability indicating an insufficient anterior cruciate ligament.

Conclusion: Medial gonarthrosis in young patients is a rare condition and affects almost exclusively men. Tibial osteotomy gives subjective and objective good results in almost 4/5. These patients had a pain-free walking distance of more than 1 km and could perform daily activities without any problem. Two-thirds could also perform basic recreation and sport activities and the sporting activity in some was on a still higher level.

Porous coated uncemented total knee prosthesis – short-term follow-up of 51 cases

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Between September 1982 and January 1984, uncemented total knee replacement using the PCA prosthesis was performed in 51 cases of knee joint disability. The material consisted of 11 men and 40 women, with an age range of 39 to 82 years; 60 per cent of the patients had degenerative osteoarthritis and 35 per cent rheumatoid arthritis. Two weeks postoperatively, 94 per cent of the patients had achieved at least 70° of flexion and 69 per cent 90° or more. One superficial but no deep postoperative infection was noted. The clinical course has been comparable with conventional cemented prostheses of modern design. There has been no case of evident prosthetic loosening or increasing radiolucent zones but there have been three cases where the tibial plateaus have slightly migrated during the follow-up period. The follow-up time is short but is relevant in uncemented joint replacements, as the early fixation of the prosthetic devices to the bone is essential for a possible future stable bond. In the longer perspective, however, the bone remodelling changes have to be observed.

Survival of knee arthroplasties

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A nation-wide, computer-assisted survey of knee arthroplasty complications was started at 43 orthopaedic units in October 1975. Primary knee arthroplasties and their 1-, 3- and 6-year results are reported for computer filing. The survey is designed to identify complications and revisions. The indication for knee arthroplasty was osteoarthrosis in 4337 and rheumatoid arthritis in 3353 at the end of 1983. The survival rate has been calculated using a life table technique. Each arthroplasty has been followed until revised with either removal, replacement or addition of endoprosthetic components or until the death of the patient or the end of the follow-up

83.12.31. An arthroplasty was classified as surviving until revised. The ratio of revised knees over the yearly mean number of knees at risk was calculated. The overall survival rates were correlated to the type of endoprosthesis and to the indication for operation. *Conclusion:* In medial gonarthrosis the medial unicompartment arthroplasty was the safest technique with least dangerous failures and a 6–year survival rate of 0.9. In rheumatoid arthritis the bi- and tricompartment arthroplasty had the best balance between size, stability and anchorage with the same 6–year survival rate. The lowest 6–year survival rates (0.7) were recorded for hinge arthroplasty for arthrosis and demi-arthroplasty for rheumatoid arthritis.

Arthrodesis in twenty failed knee arthroplasties

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Twenty consecutive patients were treated with attempted arthrodesis for failed knee arthroplasty. One patient refused to undergo arthrodesis because of a cardiac infarction after removal of the prosthesis. Eight hinged, five stabilized and seven compartment prostheses were removed because of infection in 15, loosening in four and severe instability in one. Infected knees were treated with a two-stage procedure with temporary gentamicin bead treatment. All infections were cured. Six arthrodeses after hinged arthroplasties were carried out with a Hoffmann-Vidal fixator, resulting in two temporary failures. One Ace-Fischer fixation was successful. Ten primary attempts with intramedullary Küntscher nail fixation resulted in fusion in all but one that fused after two more attempts with the same method. The Hoffman-Vidal failures and two patients referred after failure with Charnley single frame fixation were successfully fused using intramedullary nail fixation. Three arthrodeses with delayed union fused after repeated bone transplantation and prolonged fixation.

The failures with the Hoffmann-Vidal fixator occurred in patients with poor metaphyseal bonestock. In such cases fixation is solely dependent on fixator stability. We have biomechanically tested the fixator stability and the Ace-Fischer device was found to be superior due to its sagittal pins and ventral frames, and is therefore recommended.

Intramedullary nail fixation was a patient-compliant and successful method. The method and some technical problems (nail positioning, migration and fatigue fracture of the nail) will be demonstrated and discussed.

Genu varum and genu valgum

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Most authors agree that the legs of the newborn are normally bent in a varus curve which disappears within the first few years of life. This varus stage may then be followed by genu valgum which disappears after 6 years of age. It is, however, important to differentiate between these physiologic deformities and those of pathologic origin which require further evaluation and treatment.

2640 Swedish children aged 0–16 years were clinically examined for varus and valgus deformities of the knees. The examinations were carried out in maternity wards, child welfare clinics, nurseries and comprehensive schools by the two authors. No orthopaedic patients were included. The authors present their own method of examination.

In our study of healthy children, we found that radiographic examination is unjustified, impractical and expensive. Thus, only clinical measurements have been made in studying physiologic varus-valgus deformities in Swedish children. We found that:
– the *varus* deformity (2–15°) was present between *0–1* years of age. The legs were *straightened* between *1–2* years of age. The maximum *valgus* deformity (up to 12°) was present at *3–4* years of age, then gradually *decreased* at 8–9 years of age, after which about 2° valgus remained. The girls were up to 3° more knock-kneed than the boys.

Osteochondritis dissecans in hip, ankle and knee joints nailed with autogenous bone nails

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A material of 25 joints with osteochondritis dissecans in knee, hip and ankle joints is presented. Since 1972, the method of treatment of osteochondritis dissecans at the Orthopaedic Clinic, University Hospi-

tal, Reykjavík, has been nailing with autogenous, square, wedge-formed bone nails.

At the review, all cases showed radiographic healing, even those where the osteochondritis lesion had been totally loose and displaced. Symptoms and signs synchronized with radiographic healing.

The results appear to warrant the conclusion that nailing with autogenous square, wedge-formed bone nails is a satisfactory operation for osteochondritis dissecans, even displaced, in knee, hip and ankle joints in grown-ups where spontaneous healing is less likely. The method obviates the need for a second procedure for removal of osteosynthetic material.

The Lund osteotomy jig. A new instrument for tibial wedge osteotomy

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Since knee joint replacement is now a well-established method for the treatment of gonarthrosis, and tibial osteotomy has found its indication range, the osteotomy operation has become less frequent. In "free-hand" operations controlled by a fluoroscope, we at the Department of Orthopaedics in Lund have managed to achieve sufficient precision, but the need for a guide instrument in performing tibial osteotomy has increased. Since available guides have shown limitations and disadvantages, a new instrument was constructed with the requirements: to be used in an ordinary operative exposure; easy to handle; not lengthening the operation time; the same instrument for right and left knee; and high precision.

The instrument is now used together with a reciprocating saw. So far, 13 osteotomies have been carried out with the help of the instrument.

The operative precision was measured on frontal radiograms as the change in angle between the tibial plateau jointline and the anatomic axis pre- and postoperatively, respectively.

Six knees achieved the exact correction. The greatest deviation from the predicted angle was three degrees, found in one knee. The mean error deviation was less than one degree, which is on the same level as the measuring accuracy on frontal knee radiograms.

It thus seems that this instrument is a valuable tool, is easy to use and increases security and precision in tibial osteotomy.

Treatment of chondromalacia patellae. A prospective study

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Fifty-four patients treated for arthroscopically proven patellar chondromalacia by exercises (24 knees), lateral retinacular release (16 knees) or anterior displacement of the tibial tuberosity (46 knees) were followed for 2 years after the start of the respective treatment.

Only four knees had lasting improvement in the exercise group, and during the 2-year period, 14 knees in this group had some kind of surgery.

Of the 16 knees treated by lateral retinacular release, only five knees were improved after 2 years.

After anterior displacement of the tibial tuberosity, 40% of the patients had increased their level of activity at the 2-year follow up. Of these knees 59% were subjectively improved. However, 22% were worse than before the operation, and 78% were bothered by tenderness of the tibial tuberosity.

There were no differences between the groups in clinical, radiologic or arthroscopic findings, and we could not find any reliable prognostic factors in any of the groups.

In this study, the results of treatment by exercises or lateral retinacular release were disappointing. Anterior displacement of the tibial tuberosity had a higher rate of success. We feel, however, that the result of this operation is also somewhat unpredictable, and the percentage of "bad results" and complications is too high to recommend this operation as a routine treatment for patellar chondromalacia.

Reconstruction of the tibial shaft: results of dual grafting after large resections for tumor

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In four patients (2 × adamantinoma, osteosarcoma, giant cell tumor) a part of the tibia was resected. The length of the gap ranged from 0 to 24 cm. Immediately following the resection, the gap was bridged by a cortical graft from the contralateral tibia. The graft was pushed into the metaphyseal cancellous bone or the marrow cavity of the remaining tibia. No

internal fixation was used. The leg was immobilised in plaster. Three months after the first operation the remains of the tibia, the graft and the fibula were exposed through a lateral approach. The interosseous membrane was dissected and partly resected. After superficial gouging, a liberal quantity of iliac strips were put between the tibia, graft and fibula. There was superficial skin necrosis in one patient; there were no other complications. All patients proceeded to sound union with unguarded weightbearing. In one patient the grafted area had to be extended. The mean time to union was 9 months.

Results after treatment with the trapezoidal external fixation frame for unstable pelvic fractures

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The management of unstable pelvic fractures has consisted of closed reduction by traction and immobilization with pelvic slings. In recent years pelvic stabilization with different external fixation frames has been advocated by many and good results have been reported. At the Department of Orthopaedic Surgery in Göteborg, we have treated all unstable pelvic fractures with the trapezoidal external fixation frame since 1978. Our series comprises 21 patients treated in 1978–1982. Five patients died from associated injuries after application of the frame. The remaining 16 patients were re-examined clinically and radiologically 1–4 (mean 2) years after the accident. Three types of pelvic disruption are described: antero-posterior compression, lateral compression and vertical shear fractures.

Antero-posterior compression injuries were the most stable lesions. No early or late dislocation was observed and no residual symptoms were recorded.

Lateral compression injuries posed more problems, and although the reduction was acceptable in all cases it was anatomical in only 50 per cent of the patients.

Vertical shear fractures. The reduction and maintenance of these injuries was more difficult, and anatomical reduction was achieved in only one patient.

After application of the compression frame, all patients noted instant and dramatic relief of pain. The compression frame was well tolerated, no complications were noted, the nursing care of associated injuries was facilitated, and early weight bearing made possible.

Residual sequelae, such as persistent back pain, pelvic pain, and difficulties with walking, were rare.

Square-plate fixation of the sacroiliac joint in pelvic fractures

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Pelvic fractures often involve one of the sacroiliac joints. In cases of totally ruptured posterior elements of the pelvic ring a complete reduction is difficult to obtain. It is also difficult to get a satisfactory fixation with any of the external fixation systems.

In these more advanced pelvic injuries we have treated the patients with an open reduction with the aim of obtaining an exact position of the dislocated ilium to sacrum.

The sacro-iliac joint is reached from an incision over the iliac crest and a subperiosteal dissection on the ilium. After the reduction of the joint, it is fixed with a newly designed, square, dynamic compression plate with two 50 mm cancellous bone screws in the sacrum as well as in the ilium.

The method has been used in four fresh pelvic fractures and in one late, all with an uneventful, complete recovery.

Comparison between porous fiber and solid titanium rods applied as intramedullary devices in cat femurs

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Assessed by deflection in a three-point bending test, the porous rods were 12 × more flexible than the solid rods. Fourteen adult cats (seven of each kind) were operated with insertion of the rods as intramedullary devices in the right femurs. A 7 mm ring was resected from the mid-diaphysis to assure that the rods would be load carrying. The bones were reamed with a 6 mm dental burr. Compared to the proximal fragment, the distal fragment required only a gentle reaming near the osteotomy, a procedure that most likely left much of the endosteal tissue intact. The porous rods were fixed by press fit, while the solid rods were cemented in, using low vis-

cosity cement. The animals were killed 8 months postoperatively. All bones with a porous rod were stable, and all except one of them had abundant callus that traversed the gap in the diaphysis. One of the cement rods was completely loose, one had slight instability, while the rest were stable. None of the bones with stiff rods had any callus. The bones with porous rods had had a periosteal bone formation, apparently as compensation for the bone loss in the reaming procedure. This was not observed for the bones with the solid rods. This indicates that the stiff implants had shielded the bone from stress and thereby removed the stimulus for bone formation. Bone ingrowth was highest in the section of the porous rod that had faced the bone fragment that underwent only gentle reaming. Thus it seems that a gentle reaming procedure that saves endosteal tissue is preferable.

Bone growth into porous glassy carbon implanted into rabbit femur

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In an experimental study, bone growth into porous glassy carbon was evaluated histologically, by the oxytetracycline-fluorescence technique and microradiographically. Histomorphometry was used as a quantitative method to determine the amount of bone ingrowth.

Cylinders of porous glassy carbon (Rautavuori & Törmälä, *J. Mater. Sci.* **14**, 2020–2, 1979) were implanted intra-articularly in the metaphysis of both femora opposite the patella of 30 rabbits. The rabbits were sacrificed 1, 3, 6, 12 and 24 weeks postoperatively, six in each group.

All the implants were firmly attached. Histomorphometry revealed increasing ossification in the pores with a maximum of 45 per cent at 12 weeks postoperatively. Microradiographs showed first faint shadows in the pores at 3 weeks and at that time also fluorescence uptake was seen in the pores. At 12 and 24 weeks, the density of the bone was the same in the pores as in the surroundings of the implant and the uptake was minimal.

The ingrowth of bone occurred at the rate of normal osseous repair, and the ossification did not progress after 12 weeks.

Silicone implant arthroplasty in the treatment of malacia of the lunate

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In 1971–82, 60 patients with malacia of the lunate were treated by Swanson's silicone implant arthroplasty. The indications and the operative technique were the same as generally presented in the literature. Fifty-three patients attended the follow-up examination. Thirty-nine were men, 14 women, the mean age 32 years and the follow-up period on average 30 months.

The arthroplasty had a favourable effect on the wrist pain, 96 per cent of the patients being improved in respect of the resting pain and 90 per cent in respect of the pain on exertion. The range of movement remained smaller throughout in the operated than in the contralateral wrist, the mean difference being in extension 15 and in flexion 16 degrees. The mean grip strength was 25 per cent less in the operated hand.

Twenty-six patients continued in their former work and 22 took up lighter work. Two patients had retired because of their wrist problem. Slight radiocarpal or intercarpal arthrosis was noted in 34 patients and moderate arthrosis in seven patients. Severe arthrotic changes were not observed.

As complications, we noted five dislocations of the implant, one postoperative infection and one case of severe cystic change of the wrist bones, probably caused by the migration of silicone particles.

Femoral fracture treated by interlocking intramedullary nailing

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During the period 1979–82, we have treated 48 femoral fractures with the Grosse-Kempf interlocking intramedullary nail. The median age of the patients was 28 (range 15–87) years. Twenty-five patients

were females and 23 were males. About 65 per cent of the fractures were caused by high-energy trauma. Twenty-three fractures (48 per cent) were comminuted, six (13 per cent) were compound, and 14 fractures (29 per cent) occurred in patients with multiple injuries. Three patients underwent interlocking intramedullary nailing in two locations, e.g. both femora, or femur and tibia.

The nailings were performed with closed technique in 43 and with open technique in five cases. The latter was due to simultaneous removal of failed plates. Transverse screws were inserted into both ends of the nail in 13 cases (static nailings), and into the proximal or distal end of the nail in 35 cases (dynamic nailings). The median time for full weight-bearing was 30 days post-operatively (range 7–150 days). All the fractures healed. In five patients, a shortening beyond 2 cm was observed. Malposition of the fracture was corrected in four cases of dynamic nailings without removal of the nails. One interlocking screw had to be exchanged because of fatigue. No infection was observed in the series. The median time of unemployment due to the illness was 13 (range 1–26) weeks.

The result of the clinical and radiological evaluations (12–49 months post-operatively) was excellent in 27, good in 10, fair in 9 and poor in one cases. The result was excellent or good in all compound fractures, and as good in fractures caused by high-energy as in those caused by low-energy trauma.

It is concluded that interlocking intramedullary nailing is expedient in high-energy fractures, in osteoporotic fractures, and in patients where a femoral fracture is accompanied by multiple injuries. The interlocking principle induces rotational stability which favours healing, and extends the use of intramedullary nailing to the second sixth and fifth sixth segments of the bone.

Interlocking intramedullary nailing of femur and tibia

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In 30 patients interlocking i.m. nailing was used for treatment of 15 fractures (14 femurs, 1 tibia) and for internal fixation after reconstructive surgery (12 femurs, 3 tibias). 27 Grosse nails and 3 Küntscher nails with predrilled holes were used.

The fractures were comminuted and unstable and/or with a localization unsuitable for conventional i.m. nailing. Eleven of the fractures were closed and four open. Closed nailing was performed in seven cases and open in eight. The locking of the nail was dynamic in five cases and static in ten. After static locking dynamization was performed after 8–17 weeks.

The indications for reconstructive surgery on femur or tibia were posttraumatic deformity nine, nonunions four, recurrent nail migration after previous conventional i.m. nailing one, and multiple metastases one. The locking was dynamic in two cases and static in 13. Dynamization was performed after 7–28 weeks.

The patients (including five cases with multiple injuries) were discharged from the hospital after 6–74 (mean 14) days.

There was one complication in the fracture group (one infection) and four in the reconstructive group (one compartment syndrome, one haematoma, two infections, and one loosening of locking screw).

Full weight-bearing could on the average be allowed after 7 (range 1–24) weeks. There was no significant loss of function.

Interlocking nailing seems to be a suitable method for treatment of certain types of femoral and tibial fractures as well as for internal fixation after osteotomy, especially for posttraumatic shortening.

Treatment of tibial fractures by interlocking intramedullary nailing

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We treated 45 tibial fractures with the Grosse-Kempf interlocking intramedullary nail during the period 1979–82. The median age of the patients was 35 (range 17–80) years, and 15 patients were females and 30 males. Half of the fractures were caused by high-energy trauma, and only one third of all fractures were located in the middle third of the bone. Nine fractures (20 per cent) occurred in patients with multiple injuries. In four patients, both tibiae or tibia and femur were intramedullary nailed simultaneously.

As a rule, the operations were performed as closed nailings on a traction table. Transverse screws were inserted into both ends of the nail in six cases (static nailings), and into the proximal or distal end of the nail in 39 cases (dynamic nailings). The patients

were encouraged to put partial weight on the fractured limb from the first postoperative day. Full weightbearing was possible in 40 fractures (89 per cent) within 3 months postoperatively, and in all cases, 3 months later. Forty-one fractures united without shortening. The shortening in the four others was less than 2 cm. Malposition of the fracture had to be corrected in two cases, and one nail was removed because of fatigue. One superficial and one deep wound infection occurred in the series. Both were treated successfully. One patient developed pseudoarthrosis, and was reoperated. The median time of unemployment due to the illness was 12 weeks (range 1–52 weeks).

The result of the clinical and radiological evaluations (12–49 months post-operatively) was excellent in 29, good in 13, fair in two and poor in one case. The location of the fracture did not affect the result, and the result was also similar in fractures caused by high- and low-energy trauma.

We treat about 35 per cent of our tibial fractures with interlocking intramedullary nailing. This treatment is especially indicated in unstable and comminuted fractures with a shortening tendency, and in multi-trauma patients with tibial fractures.

Stress-protection after metal plate osteosynthesis in the human tibia

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After application of a rigid plate on diaphyseal bone, a considerable stress-protecting effect has been found in animal studies. However, in human bone the extent of stress-protection caused by rigid metal plates has not been determined, and the object of the present study was to throw light on this problem.

Nine patients (17–42 years old) with previous tibial shaft fracture treated by plate osteosynthesis were examined. Tibial plates of stainless steel (Zimmer or Synthes) fixed with 6–8 screws had been used. The period from plate application to plate removal varied from 13 months to 15 years.

Both tibiae were examined by computed tomography (CT) scanning 1 or 2 days after plate removal. Scanning was performed at cross-sections of the bone previously covered by the plate, as well as outside the site of the plate. The cortical density and thickness were obtained from the CT-scans.

In the previously plated segment, a significant reduction in cortical density related to that of control tibiae was found ($P = 0.008$). The reduction was more pronounced in the quadrant of the cross-section directly beneath the plate (median reduction 14 per cent) than in the other quadrants (median reduction 7 per cent). No increase in osteopenia with increasing duration of the plate beyond 1–2 years seemed to occur. There was no reduction in cortical thickness of the previously plated bone segment. Proximal and distal to the site of the plate no significant differences in cortical thickness and density occurred.

The results indicate that the extent of stress-protection after rigid metal plating in the human tibia is less pronounced than that previously reported from experimental studies in animals.

Lateral malleolar fractures – operative versus conservative treatment

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The treatment of choice of stable, slightly dislocated lateral malleolar fractures (LMF) is still controversial. The aim of this prospective study was to compare results of operative and conservative treatment. All the patients who visited our emergency department because of a pure LMF of Weber type A or B with a dislocation of 1–4 mm during 1981 were randomized into two groups, with 38 patients in each.

In one group, the LMF was reduced and screwed according to the AO-principles (eight patients refused the operation and were omitted from the series). In the other group, the LMF was treated by, closed reduction. In both groups a below-knee plaster cast was used for 6 weeks. Slight weight bearing was allowed at 2 weeks and full weight bearing at 4 weeks after the injury.

26/30 patients of the operative group and 33/38 of the conservative group attended a clinical and radiological 1-year follow-up. Results of the study (Table) demonstrate the superiority of the operative treatment:

Treatment group (number of patients)	Exact reduction at 2 weeks x-ray	Duration of sick-leaves (days)	Excellent subjective recovery	Posttraumatic osteoarthritis at 1-year x-ray
Operative (n=26)	24	75	10	4
Conservative (n=33)	7	79	4	15
Statistical significance of the difference ($P <$)	0.001	n.s.	0.005	0.005

As a conclusion the authors suggest that stable lateral malleolar fractures with even minor dislocation should also be operated. Exact reduction is an essential prerequisite for excellent recovery.

Traumatic cervical spine injuries treated in 1971–1980 in the Stockholm area

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A review covering 10 years of 345 treated traumatic cervical spine injuries from the whole Stockholm area has been conducted at the Department of Orthopaedics, Danderyd Hospital. There was a tendency to an increased incidence during the last 5 years of the seventies.

The most common level of traumatic injury of the cervical spine in this material was the C_2-level (47 per cent), whereas 30 per cent of these constituted a fracture of the dens axis.

Three per cent of patients had an associated neurologic impairment; 4 per cent of patients died.

The prognosis concerning survival will be decided at the moment of trauma and also whether the traumatic cervical spine injury is a part of other complicated concomitant injuries. In the situation with a traumatic cervical spine injury, with survival primarily, we found that the prognosis of survival is based on other injuries and not the cervical spine injury itself.

Treatment with operation and/or skull traction was associated with a high frequency of complications compared with halo-vest treatment and treatment with different types of collars. The complications of surgical treatment were of a more severe kind.

There was no significant difference concerning nonunion or remaining instability between the groups. The incidence of nonunion of dens axis fractures in the whole material was 4 per cent.

X-ray and/or tomography and/or computed tomography in the diagnosis of traumatic unstable cervical spine lesions

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Nine cases treated for traumatic, unstable cervical spine lesions were all investigated with CT-scan. Our interest in this study was focused on which type of radiologic examination gives the most adequate information when diagnosing traumatic, unstable cervical spine lesions. In no case was CT-scan necessary for the diagnosis or for the decision about treatment.

Even if the number of cases presented is small, our opinion is that conventional X-ray and tomography in combination give enough information for the choice of treatment. In the emergency room it is easier to investigate the patient with conventional X-ray and tomography than with a CT-scan examination. CT-scan can be useful when further investigation is necessary, and it always gives more detailed information about fracture systems. However, it is not the method of choice instead of conventional X-ray investigations, primarily.

Forces and motion across the neck in patients treated with halo-vest for unstable cervical spine fractures

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Halo-vest treatment for unstable cervical spine injuries is regarded as a stable fixation which may permit immediate mobilisation of the patient. However, little is known about the forces across the neck and the motions of the spine during halo-vest treatment. Fourteen patients with halo-vest fixation were studied regarding flexion-extension motion during treatment, and four patients were studied regarding distraction-compression forces across the neck. Fifty per cent of the patients in the two groups had tetraparesis. During different exercises, motion of the cervical spine was registered with lateral x-ray. The force across the spine was registered by strain-gauges mounted in the two vertical halo-vest rods.

Maximal motion of the cervical spine during halo-vest fixation was approximately 25 per cent of normal; however, there were great variations between patients. The stability could be increased by fitting the vest tight to the upper part of the thorax.

After 2–3 months of treatment, three of four patients had distraction forces of approximately 32 N across the spine during rest and in the supine position. In other positions, however, there was a compression force, and the force across the spine varied considerably, depending on the activity and position of the patient. The variability of the forces may be disadvantageous for the stability and healing of the injury.

Surgery of the brachial plexus

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In clinical investigation of brachial plexus lesions, a detailed and precise history of the accident is necessary. A complete neurological examination, ENMG, histamine response test, Ninhydrin test, and often myelography are carried out. The muscles are tested and a grading using the M0–5 formula is made. The development of the paralyses is carefully observed during the first weeks.

There were 42 male and 10 female patients. The mean age was 22.7 years. Two patients were over 50 years of age and three were babies. The average follow-up time was 4.2 years. Thirty-three of the injuries were caused by traffic accidents. Many patients had severe associated regional lesions. In 46 cases the level of injury was supraclavicular. The operative delay varied from 1 week to 48 months (mean 7.8 months). The operative procedure was planned prior to surgery, the different diagnostic findings were summarized and a schema of the lesion was outlined.

Preforaminal avulsions were diagnosed in 22 patients. Avulsion of all roots was seen in five cases and avulsion of four roots in four cases. Reconstruction by means of autologous grafts was performed in 24 cases, neurolysis in 14 cases. In many cases a combination of these procedures was used.

Fifty-one patients were evaluated on average 4.3 years after the operation. Good results included cases where a useful function, i.e. power M4, was achieved at least at one of the functional levels (shoulder, elbow, wrist, hand). The result was classified as fair if active motion against gravity was achieved to reach positions of functional value, i.e. with power M3.

The result was good in 19, fair in 13 and poor or nil in 19 cases. Regained function was best at the level of the elbow. Functional recovery (M3–5) of the biceps after fascicular grafting was achieved in 16 cases (62 per cent). In neurotization cases functional recovery was achieved in four cases.

Unstable thoracolumbar fractures. A comparative clinical study of conservative treatment and Harrington instrumentation

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Fifty patients (14–55 years of age) with unstable thoracolumbar fractures were studied: 24 patients were treated conservatively in 1971–1977 and 26 patients were treated surgically with Harrington instrumentation in 1977–1981. The treatment groups were comparable in all respects. Radiologic evaluation showed that Harrington distraction rods restored the fractured vertebra almost to its original shape, and the gibbus and scoliosis were significantly reduced. However, at the follow-up at least 2 years after the injury, the gibbus angle had recurred almost to the value at admission in patients with the rods removed. The conservatively treated patients showed a continuous increase of the gibbus angle and of the anterior and central vertebral compression. At the follow-up, all fractures in both treatment groups were healed.

There was no difference between the treatment groups regarding neurological improvement. Thirteen of 14 patients with severe or moderate paraparesis considerably improved their neurological status.

A rehabilitation index with special reference to

paraparetic patients showed no difference between the treatment groups months after the injury. Thoracolumbar fatigue, thoracolumbar pain and stiffness, skin problems and pain at direct pressure at the fracture site occurred equally in the conservative and Harrington groups.

The overall complications were few. The aseptic intermittent catheterization method introduced in 1977 considerably diminished the frequency of upper urinary tract infections.

The treatment with open reduction, fusion and stabilization with Harrington rods considerably reduced the immobilization and hospitalization times. The average immobilization time was reduced from 67 to 18 days. The hospitalization time in neurologically intact patients was reduced from 80 to 30 days.

Anterior fusion in the thoracolumbar region

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Instabilities and deformities are frequent in the thoracolumbar junction both in posttraumatic cases and in patients with ankylosing spondylitis. By using a lateral extraperitoneal and retrodiaphragmatic approach, as described by Nissen Moerscher, the vertebral bodies and intervertebral discs in this region can be reached.

This approach was used in eight patients with posttraumatic thoracolumbar instability and pain. In three of these cases the patients also had ankylosing spondylitis. After excision of the pseudarthrosis or affected disc, an anterior fusion was performed with a wedge graft from the iliac crest as well as in most cases with an anterior supporting plate. In three cases there was a significant kyphosis (up to 60°), which could be corrected.

Early mobilization and ambulation in a polythene brace was applied. There was one major complication – sepsis due to an infected central venous line. All the lesions healed and there was no significant loss of correction.

The same approach was used in three other cases of severe kyphotic deformity due to ankylosing spondylitis. After wedge resection of the posterior elements and vertebral osteotomy, correction was achieved and secured with an anterior graft and anterior as well as posterior plating. In this group one patient was reoperated because of delayed union and in another case there was some loss of correction.

The technique has proved to be a suitable method for treating lesions in the thoracolumbar region, with high rates of union and lasting correction.

The thoracolumbar crush fracture. An experimental study on instant axial dynamic loading

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Seven vertebral preparations of L 1, with surrounding discs, facet joints and ligaments, were exposed to an instant axial dynamic force in order to produce a burst of crush fracture.

The resulting fractures were similar to fractures observed clinically, and showed a comminuted vertebral body with fractured vertebral endplates, dislocated disc nucleus, bone fragments severely encroaching upon the spinal canal and facet joint laxity. The flexion-extension range was considerably increased. This implies that this fracture type should be regarded as unstable with a risk of progressive flexion deformity, neurological deterioration and pain.

The fracture could be reduced by an axial distraction force of 400 N simulating the effect of Harrington distraction rods. However, the distraction resulted in an "empty" vertebral body with small areas of spongious bone mixed with fragments of the disc nucleus and fragments of the vertebral endplate.

Secular changes in fracture of the distal end of the radius

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The age- and sex-specific incidences for fracture involving the distal end of the radius in the city of Malmö, Sweden, were compared between the 1950's and the years 1980–1982 (2000 fractures).

In children, the incidence was the same today as 30 years ago, whereas in adults the risk of fracture has increased, more than doubled, not only in the elderly but also in middle-aged individuals of both sexes. Seasonal variation – a high number during December to February – was observed. Moderate trauma was the most common cause.

Reduction of Colles' fractures without anesthesia using mechanically applied continuous traction

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116 patients with Colles' fracture were allocated to receive one of two types of reduction: A) manipulative reduction of the fracture using local anesthesia infiltration, B) mechanically applied dynamic traction without anesthesia.

During reduction, only 8 per cent of the patients in the dynamic traction group had pain, whereas 35 per cent of the patients with anesthesia had significant pain during fracture reduction ($p < 0.001$).

Nonunion of the carpal scaphoid – long-term results of surgical treatment with the Matti-Russe technique

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A consecutive series of 43 patients (mean age 29 years) with nonunion of the scaphoid was operated between 1968 and 1978 by one surgeon with the Matti-Russe method – bonegrafting and immobilisation in a plaster for 3 months. Clinical and radiological reexamination were performed after a mean observation time of 10 years according to a specific protocol.

Fracture healing was observed in 68 per cent. The passive and active range of motion in the wrist and the strength of the grip was measured. Impaired range of motion, especially with respect to dorsal extension and radial deviation, was noted (30 per cent decrease) as well as a decrease in strength (20 per cent). Subjectively, 3 per cent of the patients were very satisfied, 63 per cent satisfied and 9 per cent felt worse. 78 per cent of the patients had returned to and continued in their previous occupation.

The Matti-Russe method proved to be beneficial to two-thirds of the patients with respect to pain relief and fracture healing and comparable to other surgical methods for treatment of scaphoid nonunions.

Results of operative treatment of rupture of the rotator cuff

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An analysis of the material, which comprises 128 cases of operatively treated rupture of the rotator cuff, is presented. The mean age of the patients at the time of the operation was 54.4 years; 83 were male and 43 female. The average duration of preoperative symptoms was 15.8 months and, for 78 patients, that of preoperative disability was 14.5 weeks. Of the remaining patients, 30 continued working and 18 retired. Eleven (8.6 per cent) patients had a history of previous shoulder surgery; of these, nine cases involved the rotator cuff.

A new reconstruction technique developed by K. A. Solonen was applied in 64 cases. A modification of this, together with the "shoe-lace" technique reported by McLaughlin, was applied in 48 cases, whereas direct suture was used in 16 cases. A free tendon graft taken from the m. plantaris longus or from one to three long toe extensors was used in reconstruction cases. The average follow-up period for all patients was 3.5 years. Fifty-seven of the patients were examined twice at 2-year intervals.

According to a new scoring technique, the operative result was excellent in 28.9 per cent, good in 23.4 per cent, fair in 25.8 per cent and poor in 21.9 per cent of the cases. The patients in the fair group had benefited from surgery, and the result can be considered satisfactory. Sixty-eight patients returned to modified, less strenuous work.

Forty-one per cent of the patients had no significant pain when they were working and 59 per cent felt no pain when resting. The range of flexion improved by an average of 37 per cent or 41°, while abduction improved 53 per cent or 52°. The range of external rotation did not improve. Only one-third of the patients achieved strength comparable to that of the contralateral shoulder. The average strength obtained, expressed as a percentage of the strength of the contralateral shoulder, was 56 per cent for flexion, 53 per cent for abduction, and 62 per cent for external rotation.

Factors influencing the operative results of rotator cuff rupture of the shoulder

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This paper reports the conclusions from a clinical, radiological and mathematical analysis of the material of 128 operatively treated rotator cuff ruptures, especially prognostic factors. The material comprised 85 male and 43 female patients. The mean age of the patients was 53.4 years and the average follow-up period was 3.5 years. According to a new scoring system, an acceptable result was achieved in 78 per cent of the cases (excellent in 29 per cent, good in 23 per cent and fair in 26 per cent).

The chi-square and the two tailed *t*-tests indicated that the following preoperative or peroperative variables influenced the operative results significantly: preoperative sick-leave ($P < 0.0001$), operative delay ($P < 0.0001$), the number of operations on the rotator cuff ($P < 0.0001$), atrophy of the spinati muscles ($P < 0.0001$), degenerative changes of the greater tubercle ($P < 0.0001$), the heaviness of the patient's work ($P < 0.005$), magnitude of the resection of the acromion ($P < 0.005$), and indication for the surgery (pain, lack of motion or both) ($P < 0.025$). According to regression and covariance analyses, these factors independently influenced the final outcome of the rotator cuff surgery.

A long preoperative sick-leave and a long operative delay predicted a poor prognosis, as did also severe degenerative changes of the greater tubercle. Those patients who did heavy work did not recover as well as those who did light or intellectual work. In those cases where a half or more of the acromion had been resected, the final outcome was significantly poorer. A small acromiohumeral space also foretold a poor final outcome to some extent.

On the other hand, the following variables did not significantly predict or influence the operative result: age of the patient, sex, conjoined lesions, size of the rupture, location of the rupture or detachment of the deltoid.

Arthrodesis of the shoulder

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A series of 27 shoulder fusions during the years 1970–1982 is reported. Seventeen shoulders were paralytic and ten arthrotic. There were 14 male and 13 female patients. The mean age of the patients was 33 years. The right shoulder was fused in 16 and the left one in 11 cases. The fusion was stabilized by two or three screws. Free bone grafts were not used. The extremity was immobilized in a shoulder spica for an average of 14 weeks. On five patients the arthrodesis was performed twice because of a non-union or delayed union. Twenty-three patients were evaluated on average 6.6 years after the arthrodesis.

The range of active forward flexion preoperatively in the paralytic cases was on average 17° and in the arthrotic cases 76°, and abduction 14° and 54°, respectively. At follow-up, flexion was 62° and 64°, and abduction 58° and 51°, respectively. Mean internal rotation in all cases was 52°, extension 6°, adduction 6°, and external rotation minus 4°.

Abduction of the humerus on the lateral border of the scapula was on average 65°, and on the vertebral border 21°. When abduction on the lateral border of the scapula was greater than 75°, the range of active flexion and abduction was significantly greater. One-third of the patients had considerable shoulder pain at the follow-up.

Motions of the extremity improved in 60 per cent of the cases, especially the ability to bring the hand to the mid-line of the body, the face and the side pocket. On the other hand, the ability to bring the hand to the back and the anal region deteriorated. Preoperatively 60 per cent of the patients were able to bring the hand to the back; postoperatively only 15 per cent.

Inhibition of bone metabolism by acetylsalicylic acid: biochemical studies on intact and transplanted bones in rats

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The influence of acetylsalicylic acid (ASA) on bone metabolism in young male rats was studied during 18 days medication. The serum concentrations obtained were comparable with the recommended therapeutic anti-inflammatory levels in humans. Three studies were performed using radioisotopes (14-C-hydroxyproline, 3-H-hydroxyproline, 85-strontium and 47-calcium) for evaluation of the degrees of bone formation and resorption.

In the first, the effects on the synthesis and mineralization of growing bones (femora) were studied. The rate of collagen synthesis and rate of mineral incorporation decreased during the study and were significantly impaired after 18 days of ASA medication. The contents of collagen and calcium in the femora were also reduced after 18 days.

In the second experiment, the bone resorption in these femora during the medication period was studied. After 9 days treatment with ASA, the bone resorption was significantly reduced and the resorption of both collagen and minerals was inhibited.

Isogeneic bones were transplanted to muscle pouches in the third study. The resorption of the transplanted bone was inhibited in the ASA-treated rats after 18 days medication. The resorption of collagen and minerals was reduced to the same extent. Also, the new formation of bone in the transplants was inhibited. The rates of both collagen synthesis and mineral incorporation were reduced by ASA.

The results indicate an inhibitory effect of ASA on the bone formation and on the bone resorption.

The effect of immobilization on the spine in rats

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The aim of this study was to investigate the effect of distractive, compressive and neutral immobilization on the vertebrae and intervertebral disc; 150 adult white rats were used. A special external fixation device was used for immobilization. Fixation periods varied from 2 to 36 weeks. Undecalcified bone sections were used to investigate histological changes.

There were some changes in hyaline cartilage and fibrocartilage after 2 weeks immobilization. When the period of fixation was short, there were different changes between the types of immobilization. When the fixation periods were longer, the changes were more equal; fibrocartilage and hyaline cartilage became thicker and hyaline cartilage became irregular.

Biodegradable material used for fixation of experimental osteotomies on rabbits

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The aim of this study was to investigate a biodegradable material for fixation of experimental osteotomies. Forty adult rabbits were used. Medial parapatellar incision was made. Two small, parallel tunnels were drilled to the distal femur for suture fixation. The bone was osteotomized between the tunnels. The first group consisted of 22 rabbits. A channel (12 × 3 × 2 mm) from the medial condyle of the femur was drilled into the cancellous bone in the axial direction. A resorbable polyglycolic acid plate was introduced into the channel to fix the osteotomy. The fixation was secured by polyglycolic acid sutures pulled in drill-holes through the fragments. Three rabbits of this group had to be excluded because of infection. The second group included 18 rabbits. The fixation of the osteotomy was made only by polyglocolic acid sutures pulled in drill-holes through the fragments. The rabbits were sacrificed at 3, 6, 12 and 24 weeks after the operation. Radiographic examinations were done. The specimens were embedded in methylmethacrylate, cut to 5 μm and sawn to 80 μm thickness.

In the first group, radiographic examinations showed good healing of the osteotomy in 18 cases out of 19 and in the second group in 14 out of 18. At 3 weeks postoperatively drill-holes, the osteotomy line and the channel of the resorbable plate could be seen clearly. Ater 6 weeks they were not seen so clearly as before and the osteotomy line had in some places disappeared. The osteotomy line disappeared in 12 weeks. Consolidation was confirmed by histological, OCT – fluorescence and microradiographic studies.

Antitumour effects of Interferon on human osteosarcoma. A clinical and experimental study

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Since 1971, a consecutive series of 54 osteosarcoma patients at Karolinska Hospital have received human leucocyte interferon (IFN) as adjuvant treatment to ablative surgery. Half of the patients devel-

oped metastasis within 5 years. The mechanism for the anti-tumoral effects of IFN is still mainly unknown. In order to investigate this mechanism, we have developed an experimental model system with nude athymic mice.

Small pieces (2 mm^3) of human osteosarcoma were implanted subcutaneously in the mice. In serial passages in the mice the tumours were analyzed. The tumours were found identical to the original ones with respect to histology and DNA content.

The growth rate was calculated from regular measurements of tumour size with a caliper (three largest diameters).

The treatment study was started when the tumours had reached a size of 5 × 5 × 5 mm. IFN of both leucocyte (α) and fibroblastic (β) type was used in doses comparable to those given to the patients. Control animals were treated with albumin. α – IFN completely inhibited the growth of the tumours. α–IFN had a stronger effect than β – IFN. After withdrawal of IFN, the tumours resumed their previous growth pattern, indicating a cytostatic effect of IFN.

T-lymphocyte subsets in the osteo-arthritic synovialis

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In a prospective study biopsies from all synovial membranes were taken during total hip and knee replacement operations, including six RA-patients and 20 OA-patients.

The synovial specimens were immediately frozen in liquid isopentane. Sections were stained with a double immunocyto-chemical staining procedure. The monoclonal antibodies used were Leu 1, Leu 2A, Leu 3A, IgG, IgM, OKM 1, OKT 6, OKT 9 and HLA-DR.

There were T-lymphocytes present (Leu 1) in all specimens but more abundantly in RA than in OA. The suppressor cells (Leu 2A) occurred much more sparsely in OA than in RA. All the other monoclonal antibodies showed the same pattern, more abundant in RA than in OA.

The results demonstrate that the synovial membrane of the osteo-arthritic joints contains T-cells, macrophages and cells presenting HLA-Dr, but in OA the T-cells were often collected in rounded follicle-like clusters. These findings indicate an immunological reaction in the synovial membrane.

Dynamic reconstruction of the cruciate ligaments of the knee

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This paper reports on the long-term results of dynamic gracilis or semitendinosus transfer in chronic cruciate ligament insufficiency of the knee. During the period 1968–1981, 65 dynamic reconstructions were performed. In 1983, 54 patients or 56 knees were evaluated. The evaluated material comprises 44 male and 20 female patients (mean age 29.1 years, average diagnostic and operative delay 2.8 years and 3.7 years, respectively).

The patients had a total of 95 ligament injuries in the actual knee. Altogether 25 ligaments (12 cruciates) had been sutured or reconstructed, and 26 menisci removed before the dynamic reconstruction. The gracilis muscle was used in 45 cases, the semitendinosus in seven, and both these in two cases. In 51 cases the anterior, in three the posterior and in two cases both cruciates were reconstructed. In addition, the medial collateral ligament was reconstructed in 22 cases and the lateral one in 13 cases.

At the follow-up, on average 7.8 years postoperatively, 68 per cent of the patients reported the knee to be better than preoperatively. Thirteen per cent of cases were worse. According to a scoring system (up to 50 points, 16 parameters), an excellent result was achieved in 16 cases, good in 14, fair in 15, and poor in 11 cases. The average scoring result was 32.2 points. Subjectively, only four patients evaluated the end result to be poor.

In 17 patients, only the anterior cruciate was reconstructed. Their average scoring result (sc.) was 37.6. In 10 cases the time between the injury and the operation was less than 1 year (sc. 38.0). Twenty-two knees had been operated on more than twice (sc. 28.3). A cruciate ligament repair had been performed previously on 11 patients (sc. 30.4). In six cases three ligaments were reconstructed (sc. 24.0). In nine cases the anterior cruciate and the lateral collateral were reconstructed (sc. 32.7). In 35 cases, one or both menisci were removed (sc. 32.4). In 12 knees the drawer sign was 10 mm or more (sc. 27.7).

A performance test in rehabilitation and evaluation of knee ligament injuries

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To evaluate the functional disability so that rehabilitation could be controlled better after cruciate injury, a performance test, simulating sports activity, was constructed. It consisted of the following items: 1. A one-leg-jump. 2. Running in a figure-of eight, two laps – each 20 m long. 3. Running up and down a spiral stair-case. 4. Running up and down a slope.

Twenty-six men with unoperated, old anterior cruciate (ACL) injury and 67 healthy soccer players without knee or ankle problems were examined. The ACL injured patients also had their strength determined on a Cybex-II dynamometer.

The ACL-injured patients ran the figure of eight, the stair-case and the slope significantly more slowly than the healthy soccer players. Their jump quotients (injured/non-injured) were also lower. 40 per cent of the patients had normal strength but could still not perform normally in all the test items. Only two patients had normal performance in all strength measurements and all items of the performance test.

It is concluded that normal muscle strength, normal performance in a test simulating sports activities should be achieved before sports training can be resumed after an ACL injury.

Is the rehabilitation after knee ligament surgery effective enough?

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Rehabilitation after knee ligament surgery is long and demanding. Many studies suggest that some patients never resume normal muscle function in the operated leg.

Twenty-five patients all men (group I) were examined 12–29 months after treatment of an anterior cruciate ligament injury. All had completed a standardized rehabilitation programme for 1 year and showed a stable knee at the follow-up. Isokinetic muscle strength in quadriceps and hamstring muscles was determined. A functional test including one-leg jump and running in a figure-of-eight was done. The times for running on the turn and straight ahead were registered separately. A functional knee scoring scale evaluation was done (Lysholm & Gillquist 1982). For comparison the same examination was done in 67 healthy male soccer players (group II) and in 26 men with symptomatic old anterior cruciate tears (group III).

Results: Patients in group I and III needed a significantly longer time for running on the turn than the healthy soccer payers. There were no differences between the groups in running straight ahead. Group I patients showed the same results as the healthy soccer players (group II) in the jump test but group III patients showed significantly worse jumping ability. No significant differences in muscle strength between group I and group II were found, but group III showed less than normal quadriceps' strength. The mean score was lower in group III than in group I.

Conclusion: The results suggest that muscle rehabilitation was adequate. The result in the figure-of-eight may be an early sign of insufficient ligament repair, indicating a risk for increasing stability in the future although the joint 1–2 years after the injury was stable.

The healing of experimental fractures after rigid plate fixation, intra-medullary nailing and external fixation. A biomechanical study in rabbits

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A standard transverse osteotomy of the midshaft of the tibia in rabbits was stabilized by rigid plate fixation in 19 animals, intramedullary nailing in 32 animals and external fixation in 30 animals. Two fractures treated by intramedullary nailing remained ununited at 12 weeks. All others healed by formation of subperiosteal and subendosteal callus.

The biomechanical strength showed a rapid increase up to 6 weeks in all groups. After 12 weeks it decreased again also in all groups, reflecting cancellous transformation and weakening of the cortical bone. The radiologically visible cancellous transformation was most profound in the plated bones, but was also noticeable in the other two groups.

The conclusion was that although all these osteosynthesis methods led to an undisturbed bony union, a secondary atrophy and a weakening of the biomechanical properties of the cortical bone could be observed. In this respect all these fixation methods seemed to have adverse effects on bone tissue.

Does the porosity induced in rabbit tubular bone by rigid plate fixation disappear after plate removal? A planimetric study

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Porosity of rabbit tibial bone was induced with an oversized rigid AO-DCP plate fixed to the bone for 12 or 24 weeks. The bones were examined 0, 6, 12, 18, 24 and 36 weeks after the plate had been removed. The biomechanical strength of the whole bone was assessed in a torsiometer, and the data obtained compared with histomorphometric assessment of the bone reactions from UV-photographs of fresh specimens, UV-micrographs and microradiographs.

In the bones plated for 12 weeks and 24 weeks, the biomechamical strength recovered almost linearly, approaching normal values within 12 weeks and 18 weeks, respectively.

In the 12-week group, the porotic changes increased up to 12 weeks after plate removal while in the 24-week group the degree of porosity remained unchanged during the 36-week observation period. The porosity was most marked in the cortex on the plated side, and the recovery seemed to be slower than on the opposite side.

The present study suggests that, although the biomechanical strength soon increases after plate removal, the structural changes in the previously plated bone remain largely unchanged during the period of observation.

Incidence of hip fractures based on hospital admission rates

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The incidence of hip fractures in a population of 1.08 million has been estimated by using hospital admission data for the period 1977–1981. The overall incidence was 1.91 per 1000 inhabitants, with a 2:1 ratio of females to males. Hip fractures increased dramatically with age, i.e. the incidence for females ≥70 years was 75 times higher than that for those under 45 years. No increase in the incidence of hip fractures during this period could be detected.

Discharges for hip fractures constituted about 1.4 per cent of all hospital discharges. The average length of hospital stay for these fractures (24.0 days) was 2.5 times that of the total somatic care (9.6 days). Thus patients with proximal femoral fractures occupied 3.5 per cent of the somatic bed-days. For women ≥80 years hip fractures caused more than 10 per cent of all hospital discharges in this age-group.

Age- and sex-specific incidence of femoral neck and trochanteric fractures. An analysis based on 19 906 fractures in Stockholm county, 1972–1981

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The incidence of femoral neck and trochanteric fractures, in 5-year age groups from 20 years of age and above, is presented. The increase of the age-specific incidence of both femoral neck and trochanteric fracture with age was almost constant in both sexes. For males 20 years of age or older and for females 30 years or older, the age-specific incidence rate displayed an almost linear increase on semilogarithmic plots, i.e. it was exponential. The incidence of femoral neck and trochanteric fractures in males over 20 years of age doubled every 7 and 7.8 years, respectively. In females over 30 years of age the doubling rate was the same for both type of fractures, 5.6 years. A slightly more pronounced increase rate of cervical fracture was recorded between 40 and 54 years of age. The observed almost constant increase rate through life suggests a factor associated with the aging process, causing bone fragility, as the main risk factor for proximal femoral fracture. Only a limited, if any, effect of the menopause on the risk for hip fracture is indicated by the observed age-specific incidence rates.

Secular changes in the hip fracture risk

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In the city of Malmö the number of hip fractures (cervical and trochanteric fractures of the upper end of the femur) has increased by a factor of 5 during the last 30 years.

A comparison was undertaken between fractures that had occurred in the 1950's and fractures in 1980–1982, about 1600 and 1300 fractures respec-

tively. During that time the risk of fracture in women was approximately doubled; the increase was mainly in octogenarians. During that same period the risk in men had increased even more and is today about the same as that of women in the 1950's. Depending on sex and fracture type, the mean age at the time of fracture has increased 5–8 years during the last three decades. Both types of fractures (trochanteric and cervical) have increased; trochanteric fractures have increased more than cervical, but cervical fractures are still somewhat more common.

Fractures of the proximal femur in Finland in 1970 and in 1980

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The number of fractures of the proximal femur or femoral neck and trochanteric fractures is increasing in all civilized countries. There are differences only in the rate of the increase.

The patients were selected from the National Board of Health statistics. The material was analyzed according to sex and type of facture. The age-specific incidence was counted as the number of fracture cases of the proximal femur per 100 000 population per year.

In 1970, 1590 patients with femoral neck and 782 with trochanteric fractures were treated in Finland. During the period 1970 to 1980 there was a 55 per cent increase in femoral neck and 46 per cent in trochanteric fractures. In 1970 and 1980 the female-male ratio was 3:1 for femoral neck fractures. For trochanteric fractures the ratio changed from 1:1 in 1970 to 2:1 in 1980. During the same period the age-specific incidence increased in both fracture types for patients over 50 years old. The increase remained constant, however, in older age groups. The incidence was highest for patients over 80 years old. In 1980, 75 per cent of the patients with a femoral neck fracture and 70 per cent of those with a trochanteric fracture were over 70 years old.

The conclusion is that the number of fractures of the proximal femur will double in Finland during the period 1970 to 1990.

Increasing incidence of hip fractures – what to do?

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Evidence is accumulating showing a non-age-related increase in hip fracture incidence in Scandinavia and Great Britain. Both cervical and trochanteric fractures increased in both sexes. Hip fracture epidemiology in Gothenburg, 1940–1983, is presented.

We are facing an increasing demand on orthopaedic hospital resources. Research must now be directed to background factors to hip fractures and also to postoperative rehabilitation. Operative treatment today gives a fairly constant proportion of late segmental collapse, necessitating operation with endo-prosthesis in 18 per cent of cases (1965–1981). No definite way of changing this proportion of late segmental collapse in cervical fractures has been found yet.

The results of treatment of trochanteric fractures are fully satisfactory with the sliding-screw-plate or in some hands Ender hails, giving a very low rate of re-operation (3–6 per cent).

Etiologic factors of importance to hip fractures are discussed and the rehabilitation projects in Gothenburg are presented.

Consumption of hospitalization time for fractures in Stockholm 1973–1982

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The study is an analysis of all fracture patients from the age of 20 years residing in the North West Health Administration Area (NWHA) of Stockholm County who were hospitalized in acute-care units during the period, 1973–1982. Data were obtained from computer-based diagnosis registration. During this 10-year period the population within NWHA increased from 233 415 to 239 432 and the proportion of inhabitants ≥65 years from 8.2 per cent to 10.2 per cent. Fracture patients consumed on average 17 885 hospital care days annually; inhabitants ≥65 years accounting for 9543 days (53 per cent).

During these 10 years hip fracture cases required 39 per cent of the total consumption of hospital care days.

The total consumption of hospital care days decreased by 12 per cent in spite of an increasing proportion of elderly people during the relevant period. This can probably be explained by a simultaneous decrease by 27 per cent of the mean hospitalization time.

Epidemiology of distal radius fractures

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In 1981, the county of Frederiksborg, Denmark had 224 705 inhabitants over 20 years of age. From January 1 to December 31, 1981, all patients with distal radius fractures were registered, comprising 394 women and 99 men. Two hundred and four patients fractured the right wrist, 285 fractured the left, and four patients fractured both wrists. Reduction of the fracture was required in 46 per cent of the men and 58 per cent of the women ($P = 0.02$). Most of the patients were treated as out-patients, but 32 were admitted to the hospital because of other lesions, mostly fractures of the hip or cerebral concussion. In 82 per cent of the cases the mechanism of injury was a fall on level ground.

The age-specific incidence was calculated for men and women and compared to similar investigations from Malmö and Oslo. The incidence was higher than in Malmö but lower than in Oslo. The peak incidence in Frederiksborg County occurred in patients aged 80–89, which was 10 to 20 years later than in both Malmö and Oslo. Possible explanations for this are discussed.

The incidence in the winter months was related to the temperature and snow-cover, and the results confirmed earlier investigations. Furthermore, the county was divided into areas with rural and urban population. No difference between the incidences could be demonstrated.

All radiographs were reviewed, and the fractures classified according to the system described by Older et al. (1968). The age-specific incidences of the four fracture types are given and commented on.

The epidemiology of fractures of the diaphyseal femur and the cervical spine

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Age- and sex-specific incidence rates in 5-year age groups of fracture of the diaphyseal femur and the cervical spine are reported. The incidence rates are based on 2570 fractures of the diaphyseal femur and 878 cases of fracture of the cervical spine, occurring in Stockholm County, Sweden 1972 to 1981. The incidence of both fracture of the diaphyseal femur and the cervical spine increased with age in a similar way to the well-known highly age-related incidence of the proximal femoral fracture. The increase of femoral diaphyseal fracture incidence with age did not differ much from the situation in hip fractures, with a doubled incidence every 9.1 years in females.

The increase of cervical spine fracture incidence with age was also surprisingly found to be exponential in both sexes over 50 years of age. Thus, the previously reported correlation between fracture incidence rate and aging has been confirmed by the results of the present study. The observations demonstrate that this is true not only in fractures, traditionally related to osteoporosis, but also in femoral diaphyseal fractures and cervical spine fractures. The results are considered to indicate that the quality of the bone is the main determinant of the risk for fracture in general.

The influence of post-fracture osteoporosis on the occurrence of later fractures

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It has been shown that some fractures lead to persistent osteoporosis of the fractured bone and also of adjacent bones. This study was undertaken to show whether such post-fracture osteoporosis increased the probability of later fracture of these weakened bones.

All patients with fractures treated in the Orthopaedic or Casualty departments were questioned with regard to earlier fractures. A total of 2627 patients were registered during a 14-month period. Of these, 567 fractures were caused by high-, and 2160 by low-energy trauma. A history of earlier fracture was given by 950.

It was found that sustaining a fracture of the following bones did not lead to increased incidence of later fracture of the same extremity when compared to the incidence in the opposite extremity: humerus (23/24, confidence interval 0.34–0.64), radius (101/116, 0.40–0.53), ulna (18/17, 0.36–0.68), and ankle (22/23, 0.34–0.64). Patients with a history of fracture of the femoral shaft or condyle (23) had a statistically significantly increased incidence of later fracture of the same extremity. Those with earlier tibial shaft (62) and proximal femoral (66) fractures showed the same pattern, but this was not statistically significant ($p > 0.01$).

Patients treated for fracture of the tibial condyle

(24) and thoracic vertebrae (35) had a significantly higher incidence of earlier fracture than age-matched controls.

It was concluded that fractures of the humerus, radius, ulna and ankle probably do not increase the risk of later fractures, whereas fractures of the femoral shaft and condyle do. Fractures of the tibial condyle and thoracic vertebrae predominantly occur in patients with a weakened skeleton.

The one-year incidence of accidents among children and teenagers in a Swedish municipality

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This study reports on a prospective epidemiological investigation of accidents among children and teenagers (0–19 years) in Falköping, a Swedish municipality, during a period of 1 year (July 1981 to July 1982). The accidents were classified with regard to the environment of the accident, in the home at work, traffic and 'other' accidents.

The number of inhabitants in the area studied was 31 870, of whom 8179 were aged 0–19 years. The number of accidents registered, including both ambulatory and hospitalized patients, in all age groups was 3117, of which 917 occurred among children and teenagers. Of these, 276 (30.1 per cent) were home accidents, 49 (5.3 per cent) working accidents, 77 (8.4 per cent) traffic accidents and 515 (56.2 per cent) 'other' accidents. Among the 515 'other' accidents, there were 186 school accidents and 194 sports accidents.

The material was stratified for age and sex. The International Statistical Classification of Diseases, Injuries and Causes of Death (ICD) was used for coding the diagnosis, and the Abbreviated Injury Scale (AIS) for rating the severity of the injuries. All the patients were interviewed and their records were examined.

The importance of mapping the risks of accidents in the local environment is stressed as a basis for accident prevention.

Accident prevention based on hospital monitoring of casualties

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Since 1972, a computer-based registry of injuries and of accident circumstances has been built up at Odense University Hospital. For road traffic accidents, the information obtained since 1975 has been combined with accident data collected by the police. This registry contains basic information on the external causes of the accidents as well as basic information on the injuries classified by pathology, severity, treatment and the use of hospital resources. For some groups social consequences are elucidated through follow-up studies.

The use of the system will be illustrated by two recent examples:

a) Revision of the national system for calculating the costs of road traffic accidents as used by the national road authorities.

b) Notification of dangerous products leading to casualties in the home and its surroundings.

Epidemiology of slipped capital femoral epiphysis in southern Sweden

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Five hundred and thirty-two cases of slipped capital femoral epiphysis (= physiolysis colli femoris – PCF) treated at three orthopaedic departments in southern Sweden during the years 1910–1982 were used for epidemiological studies. Three hundred and twenty-five cases came from a well-defined area and were used for incidence analyses.

During the whole period of investigation, the disease was more common in males than in females. The difference was more pronounced in the earlier years of the investigation, and among patients living in the country compared with patients living in cities. The mean age at onset of slipping has in males decreased from 16.0 to 12.7 years, and in females from 12.6 to 11.8 years since the beginning of the century. The left hip is more often affected than the right, especially in males, but during the last decades there has been a tendency to equalization. Of the males 25.4 per cent and of the females 17.7 per cent had evidence of bilateral slipping. Males living outside the cities were at higher risk for bilateral involvement compared with males living in the cities. In females the situation was the opposite.

The incidence has followed a periodic pattern with peaks approximately every 20th year. The mean incidence (no. of cases/10 000 live-born) during the period of growth was 6.1 in males and 3.0 in females. The maximal risk is supposed to be 25.7 in males and

20.5 in females. Males living in the country have always been at higher risk compared with males in the cities. Since the 50s the incidence in females is also higher in those living in the country. In females, the incidence was significantly higher during the summer period May–August. In males, no seasonal variations were seen.

Prevalence of coxarthrosis

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Recently, and on average 20 years ago, roentgen images of double-contrast colon examinations were examined with regard to the presence or absence of primary coxarthrosis – about 4000 films on each occasion. During that time period the prevalence of coxarthrosis had not changed, nor was there any change in sex ratio, the distribution between bilateral and unilateral cases or between types of coxarthrosis. The severity of the disease was also approximately the same.

In the recent study, about 1/3 of the patients had been operated on, usually with a total hip replacement. Among these patients lateral coxarthrosis was more common. Although the occurrence and severity of coxarthrosis were the same in both sexes, women had more often been operated on.

The relationship between labour and coxarthrosis

Håkan Lindberg & Lars G. Danielsson

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Three hundred and thirty-two labourers in a shipyard who had all been engaged for decades in heavy labour were compared, with regard to the occurrence of coxarthrosis, with a similar sized group of white-collar workers, and with a random population sample. All three sets of men were of the same age. About one fourth, the same in all three groups, had been referred to a hip roentgen examination at some time during recent decades. In the labourers and their white-collar controls, coxarthrosis occurred in about 3 per cent without any difference between the two samples. The occurrence was less, but not significantly less, in those men who had been randomly selected from the population.

The overall mortality in patients with total hip replacement – with special reference to coxarthrosis

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The mortality was calculated in 1385 patients who had been operated on with total hip replacement in 1968–1981, and compared with the population at risk. In elderly women with coxarthrosis – after the age of 70 – the mortality was decreased after the first postoperative year; there was no such difference in men.

In women, there was no change in mortality in those who had had revision operations, whereas in men operated on for coxarthrosis who were over the age of 70 there was an increased mortality after the first postoperative year following revision.

Patients operated on because of complications after hip fracture and because of rheumatoid arthritis had an increased mortality after the first postoperative year – both women and men below 70.

The incidence of spinal deformities in tall girls

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The relationship between growth and structural scoliosis has been known for more than 150 years. It has also been shown that children with idiopathic scoliosis (IS) are taller than healthy controls and that children with IS have higher blood levels of growth-promoting hormones than age-matched controls. The objective of this study was to find out if the incidence of scoliosis and juvenile kyphosis was higher in a selected group of tall girls than in an average population.

In a prospective study, 62 girls, aged from 9 to 18 years, with excessively tall stature (>2.5 standard deviations above the mean) were screened clinically and radiologically for spinal deformities. They had all been evaluated in the paediatric department as possible cases for oestrogen treatment.

Thirteen cases (21 per cent) with a scoliosis measuring 10 degrees (Cobb) or more were found. In addition, 18 girls (29 per cent) had a thoracic kyphosis of more than 40 degrees; most of these had additional vertebral changes indicating Scheuermann's disease.

The incidence of scoliosis and roundback deformity was much higher in this selected group of tall girls than previously found in average populations. This finding is yet another indicator that there is a close relationship between increased growth and scoliosis; possibly a similar relationship exists between increased growth and roundback/juvenile kyphosis.

Characteristics of femoral neck fractures. A population study based on 3053 cases

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Femoral neck fractures from the years 1975–1977 in Stockholm County Council were analysed regarding social and demographic classification. The material comprised 2277 females and 776 males. The majority of the patients (2418/3053) were admitted from their own homes. This was more common in the central city areas (82 per cent) than in rural areas (74 per cent). Direct return to their homes was possible in 36 per cent and 47 per cent further could return home after some weeks of institutionalized rehabilitation.

No increase in fracture incidence was found during the 3-year period. More fractures occurred on Mondays and fewer on Sundays than during the rest of the week. The period December–March showed the highest fracture rate. Additional diseases were seen in about every second patient (1492/3053). Osteosynthesis was performed in 2837 fractures, mainly with von Bahr screws (1465 cases), Hessel multiple pins (674 cases), the Thornton nail (380 cases) and Rydell nail (224 cases). Only 80 primary hemiarthroplasties were performed.

The detailed analysis of this population-based series (covering one-fifth of the Swedish population) is intended as a base for more uniform treatment and rehabilitation of this group of resource-consuming patients.

Preoperative prediction of vitality of the femoral head by ^{99m}Tc-MDP scintimetry in femoral neck fractures

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The outcome of 117 femoral neck fractures was evaluated in a 2-year follow-up study and correlated to preoperative ^{99m}Tc-MDP-scintimetry of the hips on each patient. A ratio between the uptake in the femoral head of the fractured side and that in the intact side was made, with compensation for the posttraumatic hyperemic effect in the fractured femur. Such a ratio above 0.90 correlated well with uneventful outcome such as non-union and segmental collapse.

Preoperative scintimetry is a simple and accurate method of assessing the prognosis of the femoral neck fracture before the choice of primary treatment.

Internal fixation or prosthetic replacement in fresh femoral neck fractures

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This prospective, randomized comparative study comprised 102 patients aged 70 years or more with intracapsular femoral neck fracture displaced to Garden stage III or IV. Fifty were treated by internal fixation using four AO screws and 52 primarily by an uncemented Moore prosthesis. When at all possible, the patients were mobilized with weight-bearing within a week, were followed up regularly, and seen for evaluation at 2 years.

Better results were found after internal fixation in spite of 32 per cent failures. The mortality in the Moore group was higher. Serious, deep infections occurred in three cases (5.8 per cent) after implantation of the Moore prosthesis. Besides, 30 per cent of the Moore group had local complications in the course of the study period.

Half of each group attended follow-up examination after 2 years. Functionally, socially, and with respect to accommodation, the group treated by internal fixation did better than the one treated by prosthetic replacement.

Two-year follow-up of femoral neck fractures with special reference to type of osteosynthesis

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The current report is a prospective randomized study of the long-term results of nailing versus pinning in femoral neck fractures.

Material and methods: For 14 consecutive months, all 152 femoral neck fracture patients – 50 years of age admitted to Lund University Hospital, were operated on with two hook-pins if born on an uneven date and a four-flanged nail if born on an even date.
Results: A clinical 2-year follow-up revealed 35 per cent mortality. Among survivors, radiographic healing complications were seen in 13/49 pinned and 28/46 nailed fractures ($p < 0.01$. In undisplaced fractures, complication figures were 1/13 pinned and 5/14 nailed ($p > 0.05$) and in displaced fractures 12/36 pinned and 23/32 nailed ($p < 0.01$). This outcome correlated well ($p \ll 0.001$) with the early postoperative scintimetry. Reoperation within 2 years from fracture had been performed for seven pinned and 19 nailed fractures. In hook-pinning, thus, less than one patient out of 12 needed a reoperation with THR within 2 years.
Conclusions: 1. Hook-pinning yielded significantly better long-term results than nailing in femoral neck fracture.

2. The accuracy of postoperative scintimetric healing course prediction was proven in a large material.

3. In a 2-year perspective, arthroplasty instead of hook-pinning would be an unrewarding procedure in 11 patients out of 12.

Social and clinical results during the five years following femoral neck fracture nailing

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During 1977 and 1978, 235 patients were treated with primary osteosynthesis for femoral neck fractures at the Department of Orthopaedic Surgery, Lund University Hospital. Patients from the mental hospital were not included in this figure. This retrospective presentation comprises social and clinical data during the 5 years from fracture for these patients.

The mean patient age was 76 years and the female:male ratio was 3:1. One patient out of three had an undisplaced fracture. The method of osteosynthesis was the four-flanged nail (Rydell 1964) in 96 per cent of the fractures.
Results: 67 per cent were admitted from their own home. At 1 year from fracture 50 per cent were in their own home and at 5 years 33 per cent. Before fracture 21 per cent were in an old people's home; at 1 year postoperatively 17 per cent and at 5 years 10 per cent. The proportion of institutionalized patients was about 10 per cent throughout the period of observation. At 1 year from fracture 22 per cent were dead and at 5 years 50 per cent were dead.

Complications were diagnosed in 1/3 of the patients, mainly redisplacement, non-union and segmental collapse, and a few cases of infections and subtrochanteric fracture through the entrance of the nail were seen. In 2/3 of these patients no reoperation was performed. Nail extraction because of lateral symptoms in healed fractures was carried out in 8 per cent. Early redisplacement was treated with re-nailing in 1 per cent. Major complications required reoperations in 24 per cent (hip arthroplasty in 17 per cent and only nail extraction in 7 per cent).

Injury rates and binding release torques in Alpine ski racers

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The injuries in alpine competitions in Norway were registered during the season 1981/82. Data from 251 out of 381 races, i.e. 66 per cent, were obtained. Forty injuries were recorded in 36 skiers. Forty-five per cent of the injuries were located in the lower extremity, and 20 per cent of all injuries were fractures. One third of the injured skiers had bindings that did not release during the accident. Most of these injuries were located in the lower extremities.

The average injury rate was 1.4 injured per 1000 participating ski racers. About 75 per cent of the racers were younger than 16 years, and the injury rate among them (0.7) was only about one-fifth of the injury rate among junior and senior racers (3.8). The injury rate was related to the type of race, and about 10 times higher in downhill (10.3) than in slalom (0.8) and giant slalom (0.7) races.

In seven of the competitions, the release bindings of 376 randomly selected racers were examined. The mean lateral toe release torque of the bindings was about 50 per cent higher than release torques recommended for speedy and well-trained skiers. Thirteen per cent of the racers had bindings which were adjusted twice as tightly as recommended. This is above the injury threshold of the leg, and most of these skiers were downhill racers. Junior and senior racers had tighter bindings than the population mean. This was also observed in skiers participating in downhill competitions, in skiers with prior skiing injuries, in skiers who had adjusted their bindings themselves, and in skiers with untested bindings.

It has been shown previously that skiers with lower extremity skiing injuries have tighter bindings than uninjured skiers. The injury rate in the present study was highest among skiers participating in downhill competitions and among junior and senior racers. These groups of skiers also had the tightest bindings. Racers should therefore test the release function of their bindings frequently.

Spondylolysis and -olisthesis. Relationships between clinical and radiographic variables, and prognostic signs

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There is a wide variation in symptomatology of spondylolytic patients and uncertainty about risk factors for the slipping of the spondylolytic vertebra.

The aims were to study, in a group of 255 patients with lumbar spondylolysis with or without -olisthesis, the following questions:

- What are the features of the course of the disorder with respect to frequency and intensity of symptoms and occurrence of functional impairment?
- Is the radiographic pathology at diagnosis and follow-up correlated to the clinical picture during an observation time of more than 20 years?
- Are there, already at the time of diagnosis, anamnestic data, clinical symptoms, or radiographic signs with prognostic value for -olisthesis?

Low-back pain radiating to legs was frequent. In most patients, the symptoms were stable and of moderate severity. Short periods of sick-leave as well as restriction of non-occupational activities occurred in about 50 per cent of the patients, Disability pension and change of occupation were, however, infrequent.

There was strong positive correlation of symptomatology and functional impairment to disc degeneration at lysis level, and vertebral slipping, and to a low lumbar index at diagnosis.

Low age at symptom onset, pain radiating to legs, and a low lumbar index has prognostic value for -olisthesis.

Vibration-specific effects on bones and joints in work with hand-held tools?

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Work with hand-held pneumatic and rotating tools has been claimed to result in vibration-specific changes: arthrosis of the hand and elbow joints, osteopenia in the lunate bone with cyst formation, fatigue fracture of the scaphoid, etc. A critical review of the available literature has been made on request from the International Standardization Organization (ISO). There are data indicating that work involving, among other factors, vibration exposure may cause premature pathological changes in bones and joints, but the contribution from, for instance, heavy load on the musculo-skeletal system in hard manual work has not been taken into account in a satisfactory way. Insufficiencies in the epidemiological design and uncertainties in the interpretation of orthopedic signs and symptoms cast doubt upon the results of many published reports.

The proper design of studies with the purpose of obtaining valid information on this health risk is outlined. Among the essential requirements are the following.

The persons in vibration-exposed and control groups should be selected to avoid bias from, for instance, "healthy worker effect", the mixing of persons who have and have not sought medical care for their orthopedic disorder, and concomitant factors in the working and non-occupational environments that may have the same effect on health as vibration. The most likely among these is physical workload.

Information bias (introduced by, for instance, ambiguous or faulty diagnosis, lack of consideration of differential etiology, and incorrect identification of profession) should be avoided, since it may influence the results in an unpredictable way.

Another type of bias stems from confounders, i.e. factors related both to vibration exposure and to disorders in the musculo-skeletal system, age being the most important example. The investigations should preferably be longitudinal to enable a more accurate assessment of exposure and a better control over confounders and effect modifiers.

The possibilities of a more cost-effective case-control study should also be considered, with radiographically and clinically diagnosed arthrosis patients as "cases" and well-selected control groups. The comparison groups should be age-matched and athletes excluded. An analysis should be made of the relative frequencies in the case and control groups of heavy manual work using tools with and without vibration.

A controlled study of cefuroxime (Zinacef®) as prophylaxis in trochanteric femoral fractures operated with a nail and plate

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As prophylaxis in trochanteric femoral fractures operated with a nail and plate, 0.75 g cefuroxime (Zinacef®) was started intravenously 1–2 h before surgery and repeated 8 and 16 h later. The prophylaxis was instituted in 110 patients and in a double-blind study half of the patients were allotted to peroral cefalexin 1 g t.i.d. or placebo t.i.d. per 6 days. The aim was to investigate if cefuroxime i.v. for 24 h per- and postoperatively is as good as the same prophylaxis ensured by peroral cefalexine for 6 days. Only a few post-operative wound infections and urinary tract infections were noted. Side effects were rarely seen. It is our intention to present the material blindly in two groups, with and without peroral prophylaxis. At the end of the presentation we will break the code in the presence of the audience, before drawing conclusions.

Nephrotoxicologic and pharmacokinetic study in Septopal treatment

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Treatment of orthopedic infections with Septopal causes low gentamicin serum concentrations with a low but constant load of the kidneys with gentamicin. We investigated the safety of gentamicin-PMMA beads with the help of beta-2-microglobulin (B-2-M). This body-own protein proved in other experiments to be a very sensitive parameter of the influence of gentamicin on the renal (prox.) tubulus function: a dose-dependent increase of the renal excre tion rate of B-2-M.

Five orthopedic patients were treated for 10–14 days with septopal: four patients (age 21–33 years) because of an osteomyelitis with 48–90 beads, and one patient (67 years old) because of total hip revision with 360 beads. During the whole period of treatment, frequent samples of blood and urine were taken, in total, about 700 samples. In each sample the concentration of beta-2-microglobulin, creatinine (creat), gentamicin (genta) and alanine amino pepti dase (AAP) was estimated. For each urine portion the renal excretion rates of B-2-M, creat and genta were calculated. For each patient, the total amount of genta excreted during the whole treatment and the *in vivo* half-life, the time needed for 50 per cent of the present genta to be excreted, were also calculated

Septopal treatment resulted in renal excretion which was on a very low level and constant during the whole period of treatment. The genta renal excretion rates were 3–10 μg/min in the patients treated with 48–90 beads, and 40 μg/min in the patient treated with 360 beads. The corresponding serum genta concentrations were resp.: 0.03–0.1 μg/ml (calculated) and 0.4 μg/ml (measurable).

There appeared to be no influence at all of this kind of gentamicin therapy on the glomerular filtration ratio of creatinine. Also, the proximal tubulus function, expressed as the resorption capacity for B-2-M, was not influenced. So there were no toxic side effects on the glomerulus or tubulus of the nephrons despite the continuous (low-dose) load with gentamicin during the whole treatment period. The enzyme AAP was not detectable in the urine.

The total amount of excreted gentamicin was 20–70 per cent of the amount of gentamicin implanted. The *in vivo* half-life appeared to be 5–10 days. Gentamicin seems to be better resorbed when implanted in soft tissue than in bone.

Conclusion: The gentamicin as administered by Septopal is safe for renal functions. The beads are real "slow release" carriers, causing constant but mostly unmeasurable serum concentrations and a low renal excretion rate.

Local bone growth stimulation with growth hormone in the normal rat

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A direct local growth-promoting effect of growth hormone was recently shown with tetracycline technique by Isaksson (*Science* **216**: 1237–1239, 1982). We have adopted and varied this experiment in non-hypophysectomized rats in order to describe more thoroughly the effect on bone growth.

Different groups of rats aged about 60 days were given local voluminous growth hormone injections towards the region of the growth plate of the proximal tibia, into a preformed channel in the same re-

gion, under the perichondrium-periosteum or into the knee joint. The injections given towards the growth plate were repeated 2 days later. Growth was measured by tetracycline marking and was found to be slightly but significantly increased on the hormone-treated side in all groups. The effect of one single dose of growth hormone given locally to the growth plate was also studied with repeated tetracycline injections. The single dose had a much smaller effect than expected. Growth acceleration mainly occurred during the fourth to sixth day. The same time pattern but a better growth promoting effect was found after intra-articular injections. The effects of single injections towards the growth plate were small and somewhat inconsistent. This may be due to the obvious difficulties in reaching the right place with the needle. Another possible explanation could be the necessity for a first injection to stimulate development of hormone receptors (as described in *in vitro* tests) and a second injection to act on these receptors.

Increase of bone formation rate by growth hormone in the normal rat

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The profound influence of growth hormone (GH) on the bone growth process is well known. GH when given to hypophysectomized rats stimulates the retarded longitudinal bone growth, and GH-producing pituitary tumors result in gigantism or acromegaly depending on the presence of the growth plates. The effects of administered GH to normal growing individuals is less well known. The present investigation was made to study if a high dose of systemically given GH could accelerate the rate of longitudinal bone growth in normal rats. Cortisone acetate was given to compare its bone growth retarding effect with the effect of GH.

Female rats were given daily subcutaneous injections of 5 IU/kg Crescormon (about 500 μg/rat for 20 days, beginning at 75 days of age. Tetracycline was used as intravital marker to determine the longitudinal bone growth of the proximal tibia and the bone remodelling of the femur. Also the body-weight was registered.

The subcutaneously given dose of GH resulted in an increased accumulated longitudinal bone growth during the administration period, amounting to an acceleration of about 25 per cent. Cortsone acetate at the highest dose given (10 mg/kg), on the contrary, retarded the longitudinal bone growth rate by 50 per cent. The effects on the bone remodelling process were less pronounced, but GH administration increased the periosteal apposition significantly. Also, low doses of cortisone (0.1–1.0 mg/kg) stimulated periosteal apposition, whereas the high dose retarded it.

Effects of plate removal on fracture healing in the rabbit tibia

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In the present study the effects on experimental fracture healing of plate removal after various periods of time were examined. The purpose was to gain information as to the optimum time for removal of a rigid plate in diaphyseal bone.

Thirty-six rabbits weighing 2390–3510 g were used. A transverse, midshaft, unilateral tibial osteotomy was made, and fixed with a six-hole steel plate (45 × 5 × 1 mm). The animals were divided into six groups according to different periods of time for plate removal (4, 6, 9 and 12 weeks) and sacrifice (6 and 12 weeks).

The healing bones had regained almost normal biomechanical properties after plating for 6 weeks. Significantly greater strength and stiffness of the healing tibiae were obtained at 12 weeks when the plate had been removed at 4, 6 or 9 weeks and no further fixation subsequently applied, compared to those with the continuous presence of the plate for 12 weeks. The results indicate that a metal plate should be removed as soon as the bone has regained normal biomechanical properties; before the stress-protecting effect has secondarily weakened the bone. The optimum time for plate removal in the rabbit tibia seems to be at about 6 weeks of healing.

The clinical implication of this study is questionable. Provided that the fracture is not comminuted and the blood supply to the bone fragments is adequate, the findings of the present study indicate, however, that it might be rational to remove a metal plate at an earlier stage of the healing period than is usually done in clinical practice.

An experimental study on changes in the mechanical properties of diaphyseal bone during growth

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In order to elucidate age-dependent changes in the mechanical properties of juvenile diaphyseal bones, paired tibiae and femora from 22 dogs, age range 8–44 weeks, were tested. After stripping of the periosteum, the bones were measured with a caliper. The entire and fresh bones were torsionally tested with a computerized equipment. One of the bones of a pair was repeatedly loaded and unloaded with a graduated twist increase until final fracture, and its paired bone was uninterruptedly twisted to fracture.

All the bones sustained a spiral fracture at the mid-diaphysis. In some of the bones, without correlation with age, the fracture had a thin cortical continuity somewhere along its path.

The torque-twist curves were registered and several parameters calculated. The relative deformation at ultimate fracture, was larger for the younger bones than for the mature bones, but the juvenile bones, like adult bones, have no macroscopic plastic properties, and are essentially elastic-brittle.

Growth of the canine bones ceases at the age of around 30 weeks. Stress at fracture and shear-modulus strongly decline in impetus at the same age, which indicates that there is no important maturation of the bone material as regards strength properties after cessation of growth.

Cancellous bone strength patterns at the ankle joint

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Resurfacing types of total joint replacement depend on the quality of subchondral cancellous bone for support and fixation. At the ankle joint, mechanical loosening of the tibial component is a significant problem. Knowledge of the variation of bone strength at this joint is not available, yet it is a mandatory input in analytical models used to study design developments and may provide clues to improve surgical technique.

Ten ankle joints, nine grossly normal and one severely arthritic, were obtained from amputations indicated by vascular disease or proximal malignant tumor. Joint surfaces were removed just to the depth of the subchondral bone plate. Penetration tests were done at right angles to the resection surface (Hvid et al. *Eng. Med.* 1984, in press) to a depth of 12 mm. At the tibia, measurements were centered at the junctions of a 5 × 5 individually adjusted surface matrix. At the talus, vertical measurements were obtained on a 2 × 5 matrix after removal of the dome, an additional row being obtained anteriorly and posteriorly after further bone resection. The mechanical tests allow comparison of strength data from different levels of penetration. Five 2 mm levels were compared.

Computerized three-dimensional visualization of strength patterns revealed large differences between individuals. The arthritic ankle was the weakest of all. The general pattern of surface and depth variation of bone strength showed only minor interindividual differences. At the tibia there was a significant reduction of strength between the two superficial levels. At the talus there was a slight increase in strength at the surface, followed by a significant reduction of strength. On average, talar bone was twice as strong as tibial bone.

Comparison of absolute strength values with available data on ankle joint load during gait suggests that critical levels of stress may be reached at the tibial resection surface in a substantial proportion of joints. The amount of resected bone should be kept to a minimum, especially on the tibial side, when surface-replacing arthroplasty is performed.

Changes in intraosseous PO_2, PCO_2 and hydrostatic pressure in the distal femur epiphysis during abrupt unilateral joint tamponade in juvenile dogs

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The aim of this study was to show the impact of abrupt unilateral joint tamponade on intraosseous PO_2, PCO_2 and hydrostatic pressure in the distal femur epiphysis (DFE) in eight mongrel puppies.

After an equilibration period of 4 h the joint pressure was raised 1.5 times mean arterial pressure. PO_2, PCO_2 and hydrostatic pressure were measured continuously and simultanously in both DFE's during 30 min of joint tamponade and 30 min post-tam-

ponade. Blood pressure, central venous pressure, core temperature and cardiac output were monitored throughout.

Abrupt joint tamponade resulted in a three-fold rise in intraosseous hydrostatic pressure within 1 min. Gas tensions showed signs of initial hyperaemia followed by a significant fall in oxygen tension and a significant rise in carbondioxide tension. After joint tamponade, PO_2 and PCO_2 returned to values not significantly different to pretamponade values. No change was observed, in the control DFE's.

The results indicate an early rise in blood flow in DFE on joint tamponade, followed by a fall. Termination of joint tamponade resulted in normalisation of blood-flow.

In conclusion, blood supply of the juvenile DFE is vulnerable to a rise in intra-articular pressure. This vulnerability has a marked influence on intraosseous gas tensions and can be explained by the all-intracapsular blood supply of the juvenile DFE.

"Steindler stripping" – 10 years survey

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The result of stripping of the os calcis a.m. Steindler for pes varo-excavatus is presented. The long-term effect of this operative procedure is described with special reference to improved gait and endurance, along with measurable changes in the structure of the operated feet.

The paper emphasizes the necessity for early diagnosis and operative treatment to be undertaken some years before growth ceases.