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Experimental studies

Guided tissue regeneration in radius defects in rabbits

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Introduction: The present investigation is our first attempt to use the principle of "guided tissue regeneration" to heal large defects in long bones.

Material and method: 9 adult white rabbits were divided into 2 groups. In group A (3 rabbits) 7-mm diaphyseal defects were produced in both radii. The periosteum was pealed back 3 mm from the bone ends. On one side, the defect was covered by threading a GORE-TEX vascular graft material over the bone ends. The other side served as control. The rabbits were killed 13 weeks after surgery. In group B (6 rabbits) 10-mm diaphyseal defects were produced in a similar fashion as in group A. Care was taken not to disturb the periosteum at the bone ends. One side was covered with a GORE-TEX vascular graft material and the other side served as control. The rabbits were killed 26 weeks after surgery.

Results: Radiographic and histological analysis revealed a striking difference in the healing of the 2 defects. One rabbit in group A was able to heal both the test defect and the control defect. The other 2 rabbits developed non-unions on the control side by forming a cortical cap over the bone ends. The test defects developed sparse callus inside the grafts, but the bone ends remained open. In group B all the rabbits developed non-unions on the control side. In the test defects the bone regeneration ranged from a thin cortical formation covering only parts of the defect to complete cortical coverage.

Conclusion: This study shows that critical sized long bone defects can heal by means of the technique of guided tissue regeneration. It also indicates an important role of the periosteum for healing of long bone fracture.

The effect of dynamization on bone healing under external fixation—an experimental study in dogs

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Introduction: In the treatment of long bone fractures it has been hypothesized that if the bone is subjected to axial loading, the stress that arises will stimulate an osteogenic response during healing. The aim of our study was to compare the healing pathways of axially dynamized versus rigid fixed osteotomies in dogs.

Methods: Bilateral tibial osteotomies in 44 adult dogs were stabilized with a 2-mm gap using an external fixator (Orthofix). After one week one fixator was unlocked to allow axial dynamization while the contralateral side was kept locked throughout the study. Radiographs were done once a week. Animals were killed one day, one, 3, 5, 8 and 11 weeks following dynamization. Torsional testing was used for assessment of mechanical characteristics. The relative distribution of bone, cartilage, and fibrous tissue in the callus was determined. New bone formation was evaluated using ultraviolet light microscopy with a Laser Confocal Microscope and bone porosity was determined on Backscattered-Electron Images.

Results: The gaps of the dynamized osteotomies closed immediately following unlocking of the telescoping mechanism. Periosteal callus reached a maximum at 8 weeks on the dynamized side (612 ±97 mm^2) and at 9 weeks on the control side (651 ±110 mm^2). There was no significant difference in the amount of periosteal callus between sides at all time periods. Dynamized osteotomies were stiffer ($p < 0.03$) and had a trend toward increased maximum torque 6 weeks after surgery. Before and after 6 weeks, no significant differences in mechanical strength was observed. At 4 weeks periosteal ($p < 0.02$) and endosteal ($p < 0.01$) bone density was higher on the dynamized side compared to the control side.

Conclusion: Dynamization induced an earlier maximal callus formation and faster remodeling when compared to the control side. This might be due to the increase in axial loading on the dynamized side as previously proposed. Higher mechanical stiffness on the dynamized side after 6 weeks may also be caused by accelerated callus maturation due to loading increase.

Spontaneous gonartrosis in guinea pigs A stereological study

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Introduction: Studies of structural and biomechanical changes in the early phases in human osteoarthrosis (OA) are for obvious reasons impossible. Therefore, numerous experimental animal models have been designed, but they generally induce a physical or chemial insult to the joint resulting in an arthropathy quite unlike OA. Recent studies of guinea pigs have shown a high incidene of spontaneous OA in the knee joints closely resembling the human OA. This study was undertaken to investigate the pathological changes with quantitative methods on the light microscopic level.

Material and methods: Male Duncan-Hartley guinea pigs 7, 12 and 30 months old were used (n=8). The tibias were prepared for conventional light microscopy. With a random start, 5 µm thin serial step sections, with a standardized interval of 250 µm, were cut and stained with hematoxylin and eosin. Volume density, surface density and height of the articular cartilage and subchondral bone were calculated for the central and peripheral areas of the medial and lateral condyles.

Results and discussion: The animals developed OA, increasing in severity with age. In the middle group the animals showed slight macroscopic fibrillation on the central portion of the medial condyle. The OA changes progressed so that the oldest group displayed severe medial OA, including gross osteophytes and central eburnation, and incipient OA on the lateral side. However, there was a fairly large interindividual variation. Nevertheless, there were significant morphometric differences between the groups. We found a progressive increase of cartilage joint surface density, and a corresponding decrease of cartilage volume density. Bone changes, i e increase of height and volume density of the subchondral bone appeared to precede the cartilage changes, both on the medial and lateral sides. This corroborates previous papers high-lighting the importance of cartilage-bone interactions in the pathogenesis of OA, and provides quantitative morphological data on spontaneous OA, which may serve as a benchmark for future electron microscopic studies.

Bone marrow pressure evaluated with the needle infusion technique and with the titanium pressure chamber

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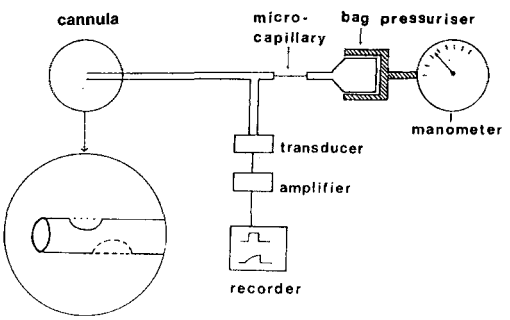
Introduction: This study was performed to compare 2 methods for bone marrow pressure registrations.

Material and methods: A bone integrated titanium pressure chamber with a flexible membrane (Fig 1) and a cannula connected to a microcapillary (Fig 2) were inserted in the proximal tibia (Fig 3) of 10 adult Belgian hares. Normal and elevated pressures obtained by venous stasis or intramedullary infusions were registered using the 2 methods.

Results: Baseline pressures were 6–15 mmHg irrespective of method used. Venous stasis or infusion through the cannula into the medullary cavity quickly resulted in increased intramedullary pressure.

Conclusions: This study demonstrates that the intraosseous pressure may be registered with either of the 2 methods. When using an intramedullary inserted cannula for pressure registrations, small infusion volumes should be used intermittently to detect clotting of the cannula, but no infusion should be used during registration. The pressure chamber is much more complicated to use, but has the advantage that it may permit long-term registrations in the living active animal as no penetration of the cortex is necessary at registration.



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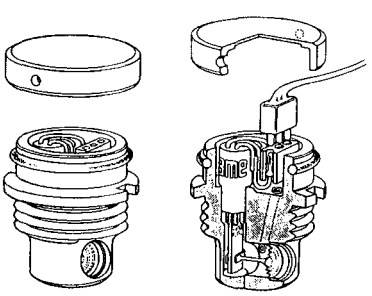

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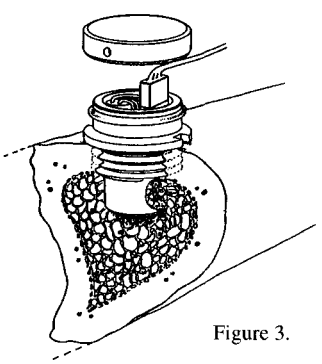

Figure 3.

Spine

Features of the treatment of cervical spine injuries during the 1970's and 1980's in Sweden

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Introduction: The aim of this study was to compare a former standard operative procedure, Cloward fusion, with more recent types of internal stabilization and with conservative Halo-vest treatment of cervical spine injuries (CSI).

Material and methods: 22 operations (11 Cloward anterior fusions, 7 fusions with methyl-methacrylate cement and autogenous bone graft and 4 others, similar to Cloward fusions) were performed during 1970–1980 in Stockholm County. 64 Halo-vest treated patients were sampled between 1974–1983 in the same region. These series were compared with a consecutive series of 40 internally stabilized CSI treated at Uppsala University Hospital during 1987–1989.

Results and discussion: The operative procedure recommended by Cloward and other non-rigid techniques are associated with an unacceptably high frequency of complications and also requires a high consumption of acute hospital bed-days. Halo-vest treatment is a good alternative for a large number of cervical spine fractures. If problems arise with the Halo-vest treatment of the lower cervical spine (C3–C7), stable internal stabilization is recommended, as Halo-vest treatment has a rate of healing difficulties around 5%. The operative treatment should be centralized to university hospitals and possibly other specialized units.

Prospective evaluation with MRI in patients operated with anterior cervical fusion ad modum Cloward

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Introduction: 20 patients operated with anterior cervical fusion ad modum Cloward were examined with MRI (1.5T Magnetom, Siemens) pre- and postoperatively. The aim of the study was a) to follow the time course of the postoperative changes in the operated level with correlation to the clinical findings, b) to study the fusion and c) to monitor the speed of the degenerative changes in the levels cranial and caudal to the operated level.

Material: 20 patients (14 men and 6 women) were enrolled in the study and all had anterior cervical fusion ad modum Cloward due to degenerative disease on one level. All patients had plain radiography and MRI prior to operation.

Methods: The patients were studied 3 days postoperatively using the following protocol. T1 weighted sagittal spin echo sequence (TR 450 ms, TE 15 ms, AC: 2 and 4 mm slices). T2 weighted sagittal gradient echo sequence (TR 300 ms, TE 18 ms, flip angle 15°, AC: 4 and 4 mm slices). The patients were studied 3, 6 and 12 months postoperatively using the same protocol adding T1 weighted images after administration of gadolinium-DTPA (Magnevist, Schering). To fuse the operated level a bovine plug (Surgibone Unilab) was used.

Results: No correlation was found between the clinical findings and the MRI examination 3 days postoperatively. This was due to the fact that a tissue mass was filling out the area behind the plug and this tisue mass showed both high and low signals on the T2 weighted images. This tissue was seen contrast enhanced on the 3-month examination but it shrivelled between the third and the sixth month. No accelerated degenerative disease could be seen in the level proximal and distal to the operated level. All 20 patients showed similar changes regarding the area around the plug, consisting of a rim of contrast enhanced tissue seen on all examinations using contrast. The contrast enhanced rim around the plug consists of fibrous tissue. This has been confirmed by microscopial examination.

Conclusion: We conclude a) that the morphological postoperative result cannot be assessed on an examination done immediately after operation, and b) that the bovine plug heals with a fibrous union.

Does anterior cervical fusion stress the adjacent segments?

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Material: 13 patients (29–67 years) fused with autologous iliac crest bone graft and 11 non-fused patients (23–64 years) were studied median 7 (6–9) years and 5 (3–6) years after operation, respectively. All patients had had an anterior removal of the intervertebral disk and osteophytes a m Cloward because of disk protrusion/stenosis in the lower cervical spine. All operations were performed by the same surgeon.

Methods: The operated level and the 2 adjacent ones were studied with MRI (Siemens Magnetom SP, 1.5T) including IV gadolinium-DTPA contrast enhancement. The compression of medulla and nerve roots caused by osteophytes and disk masses was graded as slight, medium or severe. Plain radiographs including flexion-extension views were taken and a clinical examination was done.

Results: 80% of the intervertebral root canals at the adjacent segments in the fused patients and 73% in the non-fused were normal. No changes were severe. The medulla was free from compression in 79% of the adjacent levels in the fused patients and in 70% in the non-fused ones. The medullary compression observed was of slight or moderate degree in all cases but one. One patient in each group was reoperated because of symp-

toms from the primary level. The non-fused patient also had symptoms from an adjacent level. Another fused patient developed new root symptoms with corresponding morphological changes, not yet warranting reoperation. The bone grafts had all induced a fusion between the 2 vertebral bodies, in 2 instances with a localized kyphosis. None of the non-fused patients showed osseous bridging of the drillhole. 5 patients in this group had a local kyphosis. The fused patients had better clinical results.

Conclusions: Morphological changes at the 2 segments adjacent to the operated one were seen in a minority of the cases and were of slight to moderate degree. There was no difference between fused and non-fused patients, indicating that the fusion did not influence the adjacent segments. Anterior disk removal without fusion was associated with more instaces of localized kyphosis and worse clinical results.

Epidemiology of back pain and prolonged sick leave

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Introduction: The aim of the study was to find out whether groups at risk for negative work consequences could be identified.

Material and methods: The prevalence of back pain was investigated by a questionnaire distributed to 2000 persons residing in Östergötland 1987. They were representatively distributed and randomly selected among people aged 20–60 years. All were re-assessed by a new questionnaire after one year. Sick-listing for low back pain during the year after the first questionnaire was scrutinized.

Results: 23% states that they suffered from back pain at the time. 15% of these subjects reported sick leave and insurance records showed 16% to have had sick leave for more than 7 days during the following year. 6% have had sick leave for more than 90 days and 15/23 had reported sick leave at the inituial questionnaire. During the year in question, 24% of those who initially had no back pain, reported that they suffered from back pain on some occasion. 9% of these were on sick leave for more than 7 days and 1% for more than 90 days.

Conclusion: Back pain is a common cause of disability, but absence from work is concentrated to a small group of people. It could be possible to identify this group from the outset. The group of patients with back pain seems to be rather constant and rehabilitation programmes could easily be aimed at the relevant patients. The incidence of back pain is high, but absence from work less common among previously unaffected people. Prevention of prolonged sick-leave might be addressed to the small but important group of patients with new back problems and more than one week's absence from work.

Subjective disability in industrial subacute low back pain—validity of two questionnaires

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Introduction: A minority of patients with unspecified low back pain are supposedly disabled out of proportion of underlying pathology. Cognitive-behavioral and psychosocial factors, as opposed to mechanical factors, have increasingly been held resposible. Temporal delineation of symptomatic LBP diagnoses holds patients with subacute LBP to most at risk for long-term disability but preventive interventions that presupposes this group to be homogeneous usually fails. A rational approach to the clinical problem of subsequent disability may gain from an expanded disease model that includes subjective assessment of disability.

Patients and methods: The background population consisted of 13–14,000 blue-collar workers. 103 consecutive patients, sicklisted 6 weeks for unspecific subacute LBP, constituted the sample. Participation rate was 98%, data on absenteeism up to 2 years were available on all patients. Disability was assessed with 2 questionnaires; St Thomas's (Roland) and the Subjective Disability Index (Waddell). Validaiton was done against data from an expanded disease model, including radiological investigation.

Results: Concurrent validity was good. Predictive validity concerning return to work and absenteeism up to 2 years was as good for both questionnaires. Construct validity showed high correlations with pain behaviour. The St Thomas's Disability Questionnaire seemed to tap more aspects of the disability experience, thus showing a higher content validity.

Conclusion: A high content validity is to be preferred when assessing subjective disability. Knowledge of the subjective disability experience may facilitate patient approach, decrease medicalization and thus enhance conservative care.

Low back pain anamnesis, social context and psychosomatic profile in industrial subacute low back pain

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Introduction: A constant predictor of low back pain is a history of low back pain. Activity-related LBP constitutes a large problem, especially in manufacturing industry. Individual predispositions to work-related stressors have been increasingly acknowledged as contributing to subsequent disability. Part of this has been attributed to remuneration by Worker's Compensation but the social inequities, associated with individual general health, have received increased attention. In Sweden, one third of compensated occupational handicap is

due to musculoskeletal disorders, low back pain constituting the main part thereof. The aim of this study was to survey the biological, personal and social context.

Patients and methods: The background population consisted of 13–14,000 blue-collar workers. 103 consecutive patients, sicklisted 6 weeks for unspecific subacute LBP, constituted the sample. Participation rate was 98%, data on absenteeism up to 2 years were available on all patients. Apart from clinical examination, structured interviews on LBP anamnesis and social context were obtained. Assessment of situational cognitive behavior during medical examination was expressed as a "psychosomatic profile".

Results: The sample was socially stable, duration of employment was long, immigrants were overrepresented. Only one of 4 patients had no prior sicklisting due to LBP. Anamnestic LBP severity was skewed. Life events, Health Index and work-related conditions were lower or worse, compared to reference samples. Regression analysis, with the dependent variable return to work, showed the highest explained variance for the individual "psychosomatic profile."

Conclusion: This sample of subacute LBP patients does not behave as a homogenous group. Accuracy of diagnosis may be questioned if definition of pain as a stressor is based, not on subjective report, but on temporal aspects of the sickrole. Our attitude towards this patient group must change.

Detailed pathoanatomical analysis of vertebral fractures

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Introduction: Whereas most bony injuries can be detected on radiographs and CT scans, little is known about the injuries to discs and essential ligaments even in the most commonly treated types of thoracolumbar fractures. Parts of the disc and the posterior longitudinal ligament are thought to be essential to the spinal canal restitution that often occurs when the fractures are reduced. Disc injuries account for most of the late deformity that occurs in most fractures, notably burst fractures, despite surgical treatment.

Material and methods: 12 spine specimens, most from the thoracolumbar junction, were obtained during forensic medical autopsies. Most specimens were from "jumpers" who had fallen from considerable height and subjected the spine to vertical compression forces. After freezing, the specimens were examined by radiography, CT-scanning and cryosectioning in the sagittal plane. The injuries were systematically evaluated and classified accordingly to clinically used classifications (Denis, AO, Fergusson) whenever possible. Bony and especially soft tissue lesions were evaluated and correlated to classification and findings on radiographs and CT-scans.

Results: Apart from minor fractures that were not detected on the plain radiographs, a high incidence of concomitant soft tissue lesions were found. Not only did the disc above the fractured vertebrae show extensive ruptures but also the infradjecent disc was injured in association with end plate fractures in all cases of fractures classified as burst fractures. In the motion segments above as well as below the fractured vertebra a great number of soft tissue injuries were seen, in particular joint capsule and ligament ruptures, ligament avulsions and displacements of the facet joints.

Pathoanatomy of spinal breast cancer metastases and surgical specimens

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Introduction: Breast cancer metastases in the spine are common and up to 12% of patients develop neurological symptoms. In this study we evaluate the growth pattern, causes of instability, progression of deformity, compromise of the neurovascular spinal elements and the efficacy of surgical instrumentation.

Material and methods: Over 30 specimens of radiation and/or surgically treated breast cancer metastases of the spine were obtained from 15 deceased, mean age 51 (38–74) years. For stabilization, posterior segmental pedicle fixation was routinely used, it also was employed as the first procedure with vertebrectomies. After arterial injection and freezing in situ, the specimens were CT-scanned in the axial, sagittal or coronal planes and cryoplaned. The anatomical images were then correlated with the CT scans and with the in vivo symptoms, signs, radiographs and the postsurgical course.

Results: Lytic lesions were observed early in the metastatic process. Most were localized in the vertebral bodies along the basivertebral and subarticular collecting venous systems. Endplate fractures with hemorrhage of the discs and Schmorl's node type disc herniations were common, only few of these were apparent on the radiographs. Non-radiated breast cancer metastases were predominantly osteolytic. Progressive end plate collapse resulted in "fish-vertebra" configuration with disc expansion, probably due to disc swelling pressure. The overall height of the spine was less reduced than was indicated by the degree of vertebral collapse. The posterior, predominantly cortical bony elements were infested later. Kyphotic deformity also occurred late. Contrary to "aggressive" cancer types (hypernephroma, colon, thyroid), no pseudomembrane-type thickening of the periosteum and spinal ligaments was observed and obliteration of the epidural blood vessels was rare. The dura was remarkably thin, corroborating surgical observations of its fragility. While pedicle screws had migrated to varying degrees in most postsurgical specimens, no severe vertebral collapse ensuing neurovascular compromise within the stabilized segments had occurred.

Significance: Pedicle fixation is an effective "first-line-of-defense" operation in an emergency situation. It prevents vertebral collapse and allows to plan ancillary anterior proce-

dures. In many sedentary patients with short survival expectancy, pedicle fixation alone renders sufficient palliative stabilization to prevent neurological disaster.

Cotrel–Dubousset instrumentation in cervical fusions

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Introduction: Our experience with Cotrel–Dubousset Instrumentation (CDI) in the cervical spine in trauma, RA, tumor and degenerative disease is presented.

Patients and methods: The series comprises 30 consecutive patients operated on by CDI in the cervical spine. There were 11 traumatic injuries, 8 RA, 8 tumors and 3 patients with degenerative disease.

There were 9 occipitocervical, 10 cervicothoracic and 11 cervical instrumentations. Rods of 5 mm diameter and hooks were used, and all instrumented segments were fused. In occipitocervical fixations a U rod-plate was used with screw fixation to the occiput, and hook fixation to the spine. Except for occipitocervical fusions (Philadelphia brace), soft collars were routinely used.

Results: In the trauma group 9/11 patients healed without significant subjective complaints. 2 patients improved neurologically one Frankel grade. One patient deteriorated and developed tetraparesis 28 hours after reposition of a bilateral luxation of the facet joints of C6, which was largely resolved at 2-year follow-up. One patient had intermittent paresthesiae in both arms at one-year follow-up.

In the RA-group 2 patients improved one Frankel grade, and none deteriorated neurologically.

In the tumor group one patient improved one Frankel grade. In one patient one hook loosened. 2 patients with occipitocervical fusion had postoperative wound infections, with loss of occipital fixation in one.

Discussion: CDI of the cervical spine is a stable construct that allows immediate mobilisation with minimal external support. There were no obvious problems from metal intrusion into the spinal canal. The inability to decompress the spinal cord is a general drawback of posterior cervical surgery.

Lumbar orthosis with unilateral hip immobilization—effect on intervertebral mobility determined by roentgen stereophotogrammetric analysis

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Introduction: In prior attempts to evaluate the additional effect of hip immobilization using lumbar orthoses/casts after spinal fusion, the results concerning fusion healing rate have been variable and contradictory. With a conventional lumbar orthosis, rigid or not, no stabilization of the intervertebral mobility is achieved. In the present study, roentgen stereophotogrammetric analysis (RSA) was used to determine whether hip immobilization adds any stabilizing effect justifying its use after spinal fusion.

Patients: 10 consecutive patients with no prior spinal surgery, 3 men and 7 women, had a posterolateral fusion in situ without internal fixation for spondylolysis-olisthesis grade 1-2. Peroperatively, tantalum indicators were implanted for the RSA. One patient, a 38-year-old woman with spondylolysis-olisthesis grade 1, had to be excluded due to suboptimal placement of the tantalum indicators. The mean age in the analysed group was 34 (16–53). Fusion was performed between L5 and S1 in 7 cases and L4 and S1 in 2 cases.

Methods: The RSA was performed one month after surgery in all cases. At that time soft tissues were healed and the postoperative pain had subsided but the fusion still did not yield any stabilizing effect. Each patient had 2 separate examinations; without lumbar support and with a molded rigid orthosis of TLSO-type with unilateral extension to one thigh immobilizing one hip. To standardize the examinations, the patients were examined in supine and erect positions avoiding active movements of the spine. The translatory movements of the vertebrae included in the fusion between the 2 positions were measured.

Results: No consistent or significant immobilizing effect could be registered on the vertical or sagittal intervertebral translations using a lumbar orthosis with unilateral hip immobilization. The mean sagittal translation was 2.7 mm with orthosis and 3.5 mm without. The mean vertical translation was 1.5 mm with and without support. The interindividual differences were considerable and any minor stabilizing effect was not predictable for the individual patient. The transverse translations were mostly negligible.

Conclusion: The external lumbar support, with or without hip immobilization, reminds the patient to reduce the gross motions of the trunk but it has no stabilizing effect on the actual intervertebral mobility. Assuming maximum patient compliance to keep gross motions at a minimum, this study gave no support for including hip immobilization when using lumbar orthoses after spinal fusion.

Biochemical influence of nucleus pulposus on cauda equina nerve roots and its prevention by methyl-prednisolone

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Introduction: The neurologic dysfunction associated with disc herniation is generally attributed to a mechanical deformation of the spinal nerve roots by the herniated disc material.

However, it has been suggested that components of the nucleus pulposus may have a direct biochemical effect on the nerve roots. In the present study the effects of locally applied nucleus pulposus on the cauda equina nerve roots were studied. In addition, the prevention of nerve injury development by prednisolone was analysed.

Material and methods: A total of 20 pigs (bw 25–30 kg) were anesthetized by Ketalar (ketamine), Hypnodil (methomidate) and Stresnil (azaperon). Nucleus pulposus was harvested from the L2–3 disc through a retroperitoneal approach. The cauda equina was exposed through a laminectomy of the second coccygeal vertebra. Retroperitoneal fat (n=5), normal nucleus pulposus (n=5), or nucleus pulposus at pH 3.5 (n=10) was applied epidurally to the cauda equina. In 5 of the 10 animals with nucleus pulposus at pH 3.5, 30 mg/kg of methylprednisolone was administered intravenously 5 minutes after nucleus pulposus application. After 7 days the animals were reanaesthetised and the nerve conduction velocity over the exposed cauda equina segent was determined.

Results:

The mean nerve conduction velocities for the 4 series (m/s±SD)

Control	Normal NP	NP at pH 3.5	NP at pH 3.5 and prednisolone
76±11	48±21	23±16	75±15

Conclusion: Nucleus pulposus induced a significant reduction of nerve conduction velocity as compared to control. This reduction was even more pronounced if the pH of the nucleus pulposus was lowered to 3.5. However, if prednisolone was administered within 5 minutes this reduction was absent. The results of this study do not allow any conclusions that might have direct clinical implications. However, the study strongly indicates that nerve dysfunction might be induced by other mechanisms than mechanical deformation and that high-dose corticosteroids may interfere with these mechanisms.

The relation between size of lumbar disc herniations and clinical symptoms

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Introduction: The aim of this study was to evaluate 3 different methods to measure the size of lumbar disc herniations using computed tomography (CT) and to assess the relation to clinical symptoms during conservative treatment.

Methods: 30 consecutive patients (age 35 ±9 years, M/F 23/7) with CT-verified lumbar disc hernias and clinical symptoms in accordance with the hernia location were subjected to CT and clinical examination before, 3 and 24 months after institution of conservative treatment. The size of the herniation in relation to the spinal canal was calculated by 3 different methods using a digitizer table; I) area of hernia/area of spinal canal (A-index), II) combined sagittal and transversal linear size of hernia/linear size of spinal canal (ST-index) and III) sagittal linear size of hernia/sagittal size of spinal canal (S-index).

Results: The different size-indices and the absolute area of the herniations decreased by about 40 per cent during the first 3 months. There was a highly significant correlation between the severity of sciatica and each of the relative hernia size-indices. Straight leg raising (SLR) test was not significantly related to size or position of the hernia. ST-index was highly correlated to the A-index when describing the relative size of the herniation (r^2 = 0.94–0.98) while the correlation between S-index and A-index over time was lower (r^2 = 0.76–0.79).

Conclusion: The degree of sciatica and the improvement from pain over time was highly correlated with the size of the herniation while no similar correlation could be seen between the SLR test and the hernia size. It must be presumed that additional factors such as inflammatory reactions, and not only mechanical pressure, are of importance for clinical symptoms associated with lumbar disc herniations. The ST-index offers a reliable and simple way to describe hernia size while further simplification to measure in only one direction (S-index) caused a substantial reduction in accuracy.

Are level of pain and function predictable factors for the outcome of the microscopic-assisted operation of lumbar disc herniation?

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Introduction: Functionally incapacitating pain ought to be one of the strongest criteria for surgical intervention of disc herniation. Our investigation intended to analyse if the preoperative level of pain and function were predictors for the outcome.

Material and methods: 43 patients with lumbar disc herniation graded their pain in leg and lower back on a visual analogue scale (VAS) pre- and postoperatively at 2 months and 28 (10–44) months later. Simultaneously the level of function was scored by grading of 15 different occupational activities, transformed to a scale 0–100. All patients were operated on with the aid of a Zeiss SM 2 microscope.

Results: 3 patients were reoperated within 2 years due to recurrent disc herniation. For the remaining 40 patients the level of pain in leg as well as lower back was significantly reduced already at 2 months postoperatively from 85 to 28 and 58 to 27 respectively. Functional level was at the same time increased from 26 to 58. At follow-up a certain increase of the pain in both leg and back was registered, whereas the functional level remained essentially unchanged. Age and gender of the patient, level of herniation, volume of the extirpated disc hernia, presence of sequester, result of preoperative traction, time of surgery or peroperative bleeding did not affect the out-

come with reference to pain and function.

Conclusion: Microscopic-assisted surgery for lumbar disc herniation significantly reduces the pain in both leg and lower back in the long term and simultaneously increases the self-graded level of function in 15 different occupational activities. However, the preoperative level of pain and function did not predict the outcome, nor did the distribution of pain between leg and back.

Thoracic disc herniations

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Introduction: The incidence of thoracic disc herniations is estimated to be one per million per year. With access to MRI, the diagnosis will probably become more frequent.

Material and methods: 6 cases of thoracic disc herniation are reported. There were 5 women and one man. The man was 27 years old and the age of the women varied between 51 and 66 years. The localization of the hernia varied from T5/6 to T11/12. 2 patients suffered from thoracic pain without neurologic symptoms. The remaining 4 patients had a more complex picture with neurologic symptoms varying from decreased sensibility to paraparesis. All patients were treated with exstirpation of the disc and anterior fusion via a thoracotomy.

Conclusion: Patients with a thoracic disc hernia with neurologic dysfunction or persistent pain in spite of non-surgical therapy could be treated safely and successfully with surgical discectomy.

Decompression for lateral spinal stenosis Results and impact on sick-leave and working conditions

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Introduction: This study concerns the results after nerve root decompression in patients with sciatica due to lateral spinal stenosis with special reference to postoperative sick-leave and working conditions.

Patients and methods: 100 consecutive patients operated on for lateral spinal stenosis were included in a prospective study. Mean patient age was 48 (23–75) years and male/female ratio was 35/65. Preoperative duration of leg pain was mean 2.5 years. Preoperatively 81 were employed (21 sedentary, 36 moderately heavy, and 24 heavy work). Mean duration of preoperative sick leave was 13 months. On admission subjective and objective variables were registered for all patients in a protocol suited for data processing. All patients had follow-up 4 months and one and 2 years after surgery. The subjective effect of the surgical procedure was graded by the patient into one of 4 categories: excellent (almost or totally painfree); fair (improved, but residual pain); unchanged and worse. Postoperative sick-leave and working conditions were registered.

Results: Subjective result at 2-year follow-up: The result was graded as excellent in 65 cases, fair in 23, unchanged in 11 and worse in one case. During the follow-up period, 8 patients underwent further surgical procedures (5 posterolateral fusions and 3 nerve root decompressions).

Postoperative working conditions at 2-year follow-up: Of the 81 patients employed preoperatively 17 had gained disability pension and 5 were on sick-leave due to unrelated diseases or were retired. 44 returned to their previous work and 15 to less heavy work after a mean postoperative sick-leave of 5.5 months. Change of work was more common in patients with heavy work load.

Conclusion: In a patient group operated on for lateral spinal stenosis with a mean preoperative duration of pain of 2.5 years, 88% experienced improvement at 2 years postoperatively. 75% returned to work after a mean postoperative sick-leave of 5.5 months. Patients with a heavy work load preoperatively more often had to change their working conditions.

Repeat decompressive lumbar spine surgery—a prospectiveconsecutive 2-year evaluation

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Introduction: The aim of this study was to evaluate the results after lumbar nerve root decompression in patients with a previous lumbar spine operation and to correlate the surgical results to operative findings.

Patients and methods: In a prospective and consecutive study 93 patients with previous lumbar spine surgery and planned for decompression were included. Mean patient age was 52 (20–75) years and male/female ratio was 43/50. The previous lumbar spine operation consisted of disc surgery in 65 cases and decompression for spinal stenosis in 26 cases. In 2 patients decompression as well as posterolateral fusion had been performed. 2 years postoperatively, the surgical effect was graded by the patient into one of 4 categories: excellent (almost or totally painfree); fair (improved, but residual pain); unchanged and worse.

Results: During the follow-up period 2 patients died from unrelated diseases. Results related to diagnosis in the remaining 91 patients were as follows:

	Disc herniation (n=19)	Lateral stenosis (n=18)	Central stenosis (n=19)	Fibrosis (n=35)
Excellent	16	12	7	6
Fair	2	4	7	10
Unchanged	1	2	4	15
Worse	–	–	1	4

The high number of operations for fibrosis reflects the fact that most operations were performed before the era of MRI.

Conclusion: In patients with previous lumbar spine operations the results after decompression were related to the surgical findings. The outcome in patients with release of peridural/periradicular fibrosis was inferior to those after decompression due to a degenerative lumbar spine disorder. Furthermore, better results were obtained in patients with a single root affection compared to patients with central stenosis.

Lumbar myelography with a simplified routine and a comparison between a sharp and an "atraumatic" needle

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During a one-year period we prospectively evaluated the safety of lumbar myelography performed in principle as an outpatient procedure. A new "atraumatic" needle was also compared with a sharp needle.

Patients and methods: 84 patients underwent 86 myelographies. All patients had degenerative disorders of the lumbar spine. The patients received a questionnaire, where they were asked about side effects and how they experienced the procedure. All but 2 questionnaires were answered. In 36 myelographies the lumbar puncture was performed with an "atraumatic" needle (Sprotte) and in 50 myelographies with a sharp needle (Everett). The diameter was the same (0.7 mm, 22 G). 15 ml Iohexol (Omnipaque, 180 mg/mL) was used. In 70 patients CT was performed in connection with the myelography. Th patients were observed 2-4 hours in an orthopedic ward where they were recommended to rest in a chair. Older patients without attention at home could stay over the night in the hospital and 17 patients used this possibility.

Results: The procedure was experienced as easy by 57 (68%) patients. 35 (42%) patients had no complaints at all. 24 (29%) patients complained about headache, of whom 6 graded it as severe, 12 as moderated and 6 as slight. Dizziness, nausea or vomiting occurred in 20 (24%) patients. An increase in preexisting pain in the back and/or in the legs was reported by 36 (43%) patients. 4 patients required hospitalization because of side effects and/or a complicated technical procedure. There was no significant difference in the frequency or severity of the various side effects between the patients punctured with the sharp needle and the patients punctured with the "atraumatic" needle.

Heat generation and heat protection in methy methacrylate cementation of vertebral bodies

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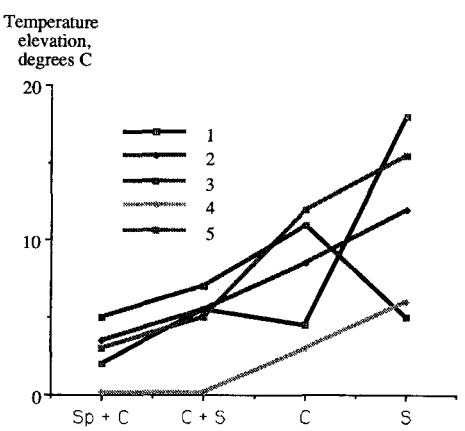
Introduction: Methyl methacrylate cementation is being used increasingly in conjunction with anterior operations on the spine in metastatic disease, but also sometimes in primary tumors and benign tumors. Neurological injuries have been reported after vertebral cementation. This investigation concerns the heat created by the cement curing process in vertebrae.

Material and methods: Methyl methacrylate cementation was performed in the LII or LIII vertebra of 5 cadavers without neoplastic spine disease. Heat generation at the level of the dural sac was measured with 2 thermocouples, and the temperature in the cement was also determined. Measurements were performed in 4 situations:

1) Resection of all the spongious bone in the vertebral body except for the posterior 0.5 cm
2) Resection of all spongious bone within the vertebral body, leaving the dorsal vertebral cortex intact and reinforced with a silicone membrane
3) As 2) but without silicone membrane
4) Silicone membrane only

Results: The maximum temperature was obtained 10-13 minutes after cement mixing. The highest temperature measured in the cement was 82 °C, mean temperature increase in the cement was 65 °C.

The temperature increase as measured on the dural sac ranged between 0 °C and 23 °C. The temperature increase in each of the 5 vertebrae was as follows:



Mean increase in temperature as measured on the dural sac was:

Cortical bone plus .5 cm of spongious bone	4 °C
Cortical bone plus silicone membrane	5 °C
Cortical bone	10 °C
Silicone membrane	15 °C

Conclusion: In the test situation described, methylmethacrylate cement replacement of the vertebral body in cadavers yielded only moderate temperature elevation as measured on the surface of the dural sac, provided that the posterior cortex of the vertebrae was retained together with 0.5 cm of the spongious bone or a silicone membrane. The ability of the spinal nerves to withstand thermal injury should be investigated further.

Surgical treatment of metastatic spine disease

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Spinal metastases in patients with malignant diseases often cause severe pain and imminent paralysis. Historically, surgical solutions (laminectomy) have not been successful and a defeatistic attitude has prevailed. Recent development with better understanding of the pathoanatomy and improved imaging (MRI) and stabilisation techniques, has, however, resulted in treatment results where the great majority of patients threatened by paralysis remain ambulatory and pain is effectively relieved.

Pathoanatomically, metastatic deposits in the vertebral body are most common, resulting in lack of supportive function and kyphosis. The posterior part of the tumorinfiltrated vertebral body protrudes into the spinal canal. Especially in the thoracic spine this is often accompanied by paraparesis. Posterior metastatic involvement is more variable; besides epidural growth, tumorinfiltrated hypertrophic laminae and pedicles often play a substantial role in the compression on the spinal cord.

The surgical treatment must take into account the special situation of these patients. Their general condition may be poor and their life expectancy limited, often less than one year. Surgery with minimal trauma should be preferred and surgical solutions of a temporary nature are sometimes sufficient.

Access to the cervical spine is easily gained by an anterior approach. Anterior resection and reconstruction of the anterior support with acrylic cement and plates are the obvious solutions in most cases. The morbidity after anterior surgery is very low. Stabilisation of the upper cervical segments often needs special solutions.

In the thoracolumbar spine, although the pathological changes often are anterior, the posterior approach usually is preferable. Anterior surgery in this region is a major surgical procedure and by definition should be avoided for most of these patients. Short segment pedicle fixation gives excellent stability, anterior pressure on the spinal cord due to a pathological fracture can usually be decompressed by a reduction. The posterior decompression should be extended beyond the classical laminectomy whenever needed, pediculectomy is often indicated especially in prostatic cancer. Through the base of the pedicle some anterior decompression is often possible in fixed kyphosis. Preoperative embolisation is important in renal carcinoma. In patients with short expected survival, bone-grafting should be omitted in order to minimise the surgical trauma. Anterior surgery with excision of a metastatic vertebra and reconstruction of the anterior support is performed as a planned secondary procedure in selected patients with long expected survival.

Surgical pathology of the lumbar spine An interactive videodisc exhibit

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Introduction: New spinal surgical procedures and instrumentation call for increasingly detailed knowledge of the complex relationships of the vertebral column to the neurovascular spinal elements for surgical approach planning, landmark identification and analysis of surgical complications.

Material and methods: Over a 10-year period, more than 80 cadaveric spines have been studied with the Uppsala Cryoplaning Technique, also correlating specimen anatomy with in vivo and in vitro diagnostic studies. In the postsurgical specimens, most using segmental pedicle fixators for decompression and stabilization of deformities, fractures and spinal metastases (some in conjunction with laminectomies, fat grafting, vertebrectomy and replacement of the vertebrae with bone grafts or cement), the screw tracts were filled with colored contrast after extraction of the devices from the frozen specimens. All specimens were CT scanned before cryosectioning with high resolution algorithms.

Results: Of the 80 specimens, 53 displayed pathological findings such as fractures, cancer metastases, spondylosis and spondylarthrosis along with a wide range of disc pathology such as internal disc disruption, sequestrated, contained and subligamentous herniations. 5 discs showed traces of repeated herniations with vascularized granulation tissue and arterioles sprouting into the clefts of the previous ruptures. Several of these degenerated discs communicated with veins in the spinal canal. Specimens with severe central and lateral spinal stenosis displayed severe vascular compromise, arterial as well as venous, in addition to the compression of the cauda equina and nerve roots. Percutaneous approach studies in cadavers in the axial and the sagittal plane revealed that the instruments invariably pass close to (or even through) the segmental nerves and blood vessels, emphasizing the necessity for a strictly blunt instrumentation.

Exhibit format: Almost 16,000 accurately registered overview- and high-magnification closeup images, patient- and

specimen CT scans and radiographs were stored on laser videodisc for instantaneous random access to all cases and individual images. Customized tutorial programs detail surgical procedures, open or percutaneous approaches, simulations of screw insertion into the pedicles and the sacrum and 40 detailed studies of surgical pathology. This interactive exhibit allows self-paced viewing and cross-referencing between normal anatomy, pathology and diagnostic imaging.

Definition of vertebral deformity/fracture

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There are several definitions of vertebral deformity/fracture. It is therefore difficult to compare the results of studies, e g studies on the prevalence of osteoporotic vertebral fractures. We present a new definition based on the vertebral shape registered with a digitalizing table and an analysis of 3 ratios of each vertebra. For each vertebra we are able to calculate the difference from the mean of the normal of that vertebra expressed in standard deviations. This method permits international comparisons.

In one study we had for each individual (n=47) 2 spinal radiographs with 15 years interval, the incidence of vertebral fractures in this group is 3-4 times higher than the number of patients seeking medical care for symptoms of vertebral fracture. The bone mass of the distal end of the forearm measured with single photon absorptiometry technique shows a good correlation with vertebral fracture.

Hip arthroplasty

The Scandinavian PCA multi-center study Clinical and radiographic results with 5–7 years follow-up

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Introduction: Cementless hip replacement is now used widely and thought to be a significant advantage in orthopedics. The proper indication is not clear and cementless implants should not replace cemented prostheses. However, they offer a viable alternative to certain patient populations.

Material: 1984–1987 522 hips were operated using the PCA prosthesis. 11 major centers in Scandinavia are participating in the study. Minimum follow-up is 5 years. 12 patients have died and 8 patients are lost to follow-up.

Methods: The study is a prospective, longitudinal follow-up. The clinical evaluation is performed according to the Harris Hip Score system. In the radiographic analysis, a digitized image analysis system is used for evaluating the implant stability, bone-implant lucencies and a semiquantitative method for evaluating bone mineral content.

Results: 55% of the patients had primary osteoarthrosis, 16% childhood diseases, 11% inflammatory hip disease and 8% osteoarthrosis secondary to trauma, mean age was 50 years. The preoperative Harris score was 42 and at follow-up we found a constant result over time with an improvement to a mean of 90. The radiographic evaluation shows up to 5 year stable implant fixation. At 7-year follow-up we found an increasing amount of migrating implants and in 15% of the patients we found granulomas in varying size. In 5 patients with 7 year follow-up we have noticed severe polyethylene wear with massive granulomas making revision necessary. 12 patients have been revised due to aseptic loosening of the stem and in 18 patients the cup has been changed for the same reason.

Conclusion: We find the initial clinical results satisfactory with a good pain relief. The radiographic analysis shows an alarmingly high incidence of migrating implants and granulomas probably due to polyethylene debris.

Life expectancy after total hip arthroplasty A prospective survival rate and cost-utility analysis

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Introduction: From 1985 to 1989 we operated 410 cemented THA in a prospective, randomized study. The aims of this study were to analyze long term, clinical and radiographic results and to compare 2 different implant concepts (Charnley/Spectron) of cemented THA. After a mean follow-up of 5.3 (3.4-7.1) years 20% of the patients were dead which initiated us to investigate the mortality rate and cost-utility after cemented THA.

Patients and methods: In 373 patients 410 hips were operated and followed 1, 3, 5 and 10 years postoperatively. Mean age at operation was 71 (40–86) years. All dead patients and their death causes were reported to us. The mortality rate among the patients in the study was compared to the death rate in an age matched control group. A cost-utility analysis was performed. In this analysis we included all costs from the preoperative examination to the postoperative controls.

Results: After a mean follow-up of 5 years, 71 patients (82 hips) were dead. The patients had a mean time of disabling hip symptoms for 4.5 years prior to surgery. The mean waiting time was 9.5 months. On average the patients died 3 (0–6) years after the operation. The total costs for the out-patient care and the hospital treatment were approximately SEK 75,000 (USD 10,400) per patient.

Conclusions: On average the patients in this group had symptoms from their hip much longer than they lived with their prosthesis (mean 1.5 time). In this old population, operated on with contemporary cementing technique, we are sure that the majority of the prostheses will "survive" the patients. Therefore we ask: Do we operate the diseased hip too late?

Combined 20-year survivorship and multivariate analyses of revisions for mechanical loosening of hip prostheses

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Purpose: To increase the validity of long-term survivorship evaluation of potential risk factors for revision due to mechanical loosening of total hip replacement (THR) for primary arthrosis.

Patients: 1970–1980 cemented metal-on-plastic THR was performed with the same surgical technique in 799 hips with primary arthrosis. There were 3 prosthetic types: 377 Charnley with 22-mm femoral head, 151 Brunswik with 35-mm snap-fit head and 271 Lubinus with 32-mm snap-fit head.

Methods: The surgical revision rates for mechanical loosening and potential risk factors were evaluated by survivorship analyses. The survivorship findings were validated by a multivariate statistical analysis. No patient, death or revision, was lost at the follow-up on January 1, 1991.

Results: There were altogether 97 surgical revisions for mechanical loosening. Survivorship analyses showed an increased risk of revision for men, younger age at primary THR, the Brunswik and the Lubinus prostheses, and long experience of the surgeon. The survivorship findings were validated by a multivariate statistical analysis showing a threefold increased risk of revision for men (p <0.001) compared to women, an increased relative risk of 0.9 per year younger at surgery (p <0.001), and a fivefold increased risk for the Brunswik prosthesis (p <0.001) and a threefold for the Lubinus prosthesis (p <0.01) compared to the Charnley prosthesis. Experience of the surgeon, however, could not be validated as a risk factor.

Conclusion: The study exemplifies how true risk factors, including inferior prosthetic designs, for revision due to mechanical loosening can be identified with a high accuracy by combining survivorship and multivariate statistical analyses.

Cemented mega total hip replacement 25 cases with a median follow-up of 6 years

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Purpose: To study the long term results with a cemented mega prosthesis used after resection of a tumor and as a salvage procedure in revisions for prosthetic loosening with major bone loss.

Patients: There were 16 tumor patients and 9 revisions. 12 patients were dead and one prosthesis had been extracted because of infection. The remaining patients were followed for 8 (5–15) years.

Methods: Radiographs and medical records were examined. The hip function was evaluated by a questionnaire.

Results: Tumor group: 2 patients were reoperated because of local recurrence of the sarcoma. One hip was revised in 2 stages because of infection and one acetabular component was exchanged because of loosening. 2 patients had recurrent dislocations; one of them was reoperated. Radiographic analysis revealed one loose stem. In 8/10 cases there was a rapid and severe cortical atrophy starting proximally and visible already one year postoperatively. It progressed until there was only a thin shell of cortical bone left. 4/8 examined patients had only occasional pain on walking.

Revision group: 3 patients had recurrent dislocations. Radiographic analysis revealed loosening of both components in one, the acetabular component in one and the stem in 3 cases. It was not possible to measure the change of the cortical bone thickness as most of the patients had pronounced bone loss already when operated upon. 2/3 examined patients had severely reduced walking ability because of pain.

Conclusion: Cemented mega prosthesis as a primary prosthesis after resecion of a tumor has a good long term result, and the severe cortical atrophy does not lead to loosening. When used in revisions there is a high incidence of loosening and dislocations.

Early radiographic loosening of a total hip replacement impairs function

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Introduction: Correlation between early radiographic loosening and clinical symptoms has been difficult to establish. The reason for this could either be that the selected radiographic signs of loosening do not necessarily signify that the prosthesis is loose or that insufficient prosthetic fixation does not significantly impair function.

Patients and methods: During the period February 1984 to February 1985, 74 patients had a total hip replacement per-

formed in the Orthopedic department of the University Hospital in Lund due to arthrosis or complications following a nailed femoral neck fracture.

Follow-up with radiographic and clinical examination, including evaluation with the Charnley hip score, was performed postoperatively before discharge from hospital and after 3-6, 12, 24 and 60 months. After 5 years the patients also received the Nottingham Health Profile (NHP) questionnaire with a reply envelope. 49 patients remained for the study, 26 men and 23 women, 68 (44-86) years old. The 3 modes of investigation (radiographic, clinical and the NHP) were performed by separate investigators.

Results: 8 patients had radiographically loose stems and/or cups. None of the patients had clinical symptoms warranting revision. There were no significant differences between the groups in the Charnley scores. In part one of the NHP the intact prosthesis had lower (better) scores than the loose prosthesis. Significant differences were noted in the pain score (p =0.03). In part 2 of the NHP the patients with a loose prosthesis to a larger extent confirmed health induced problems in 7 aspects of daily life. Significant differences were found in social life (p =0.004) and holidays (p =0.013). There was a correlation between the Charnley scores and the NHP scores.

Conclusion: Early radiographic signs of loosening probably correlate with impaired function. The correlation between the Charnley scores and the Nottingham Health Profile scores indicates that the two are measuring similar factors, however, the sensitivity of the Nottingham Health Profile may be higher than that of the Charnley scores.

Dislocations after total hip arthroplasty performed by transtrochanteric and posterior approach

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Introduction: The importance of the surgical approach as a cause of hip instability and dislocation has been debated over the years. All previous reports have such a wide difference in registration methods, patient inclusion, prosthetic design, technical procedures and surgical experience that safe conclusions are impossible. The present study reports one type of prosthesis inserted by either the traditional transtrochanteric approach or the posterior approach according to Moore, with the same follow-up time and using the same methods of tracing dislocations.

Material and methods: During 1979-1991, primary Charnley hip arthroplasty was performed by transtrochanteric approach (n=1831) in Malmö and by posterior approach (n=1359) in Kalmar. The approach has been the standard procedure in each centre during the entire study. Dislocations have been traced until December 31, 1992 by a co-ordination of reports to the National Register, local data registers and a manual check of the original operating files and related patient files.

Results: The number of dislocated hips during the entire period was 62 (3.4%) in the transtrochanteric group and 45 (3.3%) in the posterior group. The incidence of dislocation within one year postoperatively was 2.4% in Malmö and 2.8% in Kalmar. However, with a 2 year follow-up the incidence was 3.0% and 2.7% respectively. Preliminary data indicate no difference between patients with arthrosis, rheumatoid diseases and non-healed hip fractures.

Conclusion: The incidence of dislocation after Charnley total hip arthroplasty does not seem to be influenced by type of surgical approach.

Results from the national register of revised THR failures 1979–1990 in Sweden

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Introduction: There is a need for continuous improvement and quality control of joint replacement procedures. One method to assure the public quality control is the registration of complications. We report results from the prospective National Register of Revised THR performed 1979–1990 in Sweden. Important parameters and determinants of the long-term success or failure of the procedure are analyzed.

Material: All revisions after a primary THR performed in Sweden 1978–1990 are included, in contrast to previous publications primary THR from 1974 were included. The analysis is based on 92,675 primary THR and comprise 4,828 first-time revisions.

Methods: From every hospital in Sweden information about types and numbers of primary implants per year are known. Furthermore, complete copies of hospital records of all revised THR are collected and data computerized since 1979. All orthopaedic departments in Sweden are included. The definition and end-point for failure is exchange or permanent extraction of the prosthesis. Patient-related factors such as age, sex and primary diagnosis and also implant-related factors are analyzed by means of survival technique.

Results: The number of primary arthroplasties in Sweden has increased continuously. The number of revisions has levelled off and the main reason for revision is still aseptic loosening. Cumulative frequency of revision for deep infection has significantly improved during the 80's and also the cumulative frequency of revision for aseptic loosening has significantly been reduced due to improved technique. There are significant differences between different types of implants with respect to long-term success.

Conclusion: This unique National Register gives us important information in order to continuously improve the whole joint replacement procedure. The information is yearly fed back to the profession.

Clinical and radiographic results of uncemented total hip revision arthroplasty

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Introduction: Long-term results after revision hip arthroplasty using cement have been disappointing in young and middle-aged patients. The purpose of this study was to evaluate the results after revision using cementless fixation and bone transplantation.

Patients and methods: From 1983 to 1989 we performed 78 (73 patients) uncemented first-time revision arthroplasties. All hips were followed prospectively with clinical and radiographic evaluation. Average age at the revision was 56 (26-82) years. The reason for revision was aseptic loosening in all cases with the exception of 2 infections. In the beginning of our study we used the Lord prosthesis (9 sockets, 9 stems), with an average of 7.8 years' follow-up. Later on the PCA prosthesis (10 sockets, 25 stems) and the Harris Galante prosthesis (53 sockets, 10 stems) were used with an average follow-up of 5.6 and 3.8 years respectively. Bone transplantation was performed in 31% on the femoral side and in 75% on the acetabular side.

Results: The results are based on evaluation made in 1991. The mean Harris hip score was 80 points after 5 years. 74% of the patients were satisfied, 22% indifferent and 4% dissatisfied. 5 hips had been revised. 3 were threaded Lord cups and 2 early loosening of PCA stems. The radiographic evaluation of the acetabular component showed 84% stable implants, 9% impending failure and 7% unstable implants. The femoral component showed 94% stable implants and 6% impending failure.

Conclusion: Compared with previous reports on revision using conventional cementing techniques our short-term results using cementless fixation are promising. However, there are just a few reports on revisions using modern cementing technique. Only by evaluating long-term clinical performance can the potential success or failure of an operative procedure or device be determined.

Early migration of cemented femoral hip components revised because of pain or osteolysis—5-year follow-up using roentgen stereophotogrammetric analysis

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Some studies have found a correlation between pain and migration of the femoral component in total hip arthroplasties, but the clinical significance of early micromovements has not been completely evaluated. The purpose of this study was to investigate the early migration of cemented femoral components subsequently revised because of pain or osteolysis.

Patients and methods: The fixation of 67 cemented femoral components were investigated with repeated roentgen stereophotogrammetric examinations from the immediate postoperative period to minimum 5 and at most 7.5 years after surgery. There were 47 primary and 20 revision arthroplasties. 7 patients deceased before the last follow-up.

Results: At the latest follow-up one primary arthroplasty had been revised because of pain and one because of femoral osteolysis. In both cases the revisions were done about 7 years after the index operation. 4 revised stem arthroplasties had been rerevised because of pain 2–6 years after the index operation. Further, one had pronounced pain and femoral fatigue fracture, but was not revised because of advanced cardiopulmonary disease. During the first year after the index operation prostheses subsequently reoperated because of pain displayed higher subsidence and maximum migration (any direction) than those which were not (p <0 01). The early migration in the hip which subsequently was revised because of osteolysis was small and did not become significant until 2 years after the index operation.

Table. Subsidence and maximum migration (any direction) of the femoral head centre (median and range, millimetres).

	Subsidence	Max migration
In situ, primary hips	0.21 (0.01–1.77)	0.44 (0.07–1.77)
In situ, revised hips	0.20 (0.01–1.38)	0.82 (0.25–2.37)
(Re-)revised (pain)	0.63 (0.49–1.77)	1.24 (0.60–2.96)
Revised (osteolysis)	0.21	0.42

Conclusions: Migration of the femoral head centre during the postoperative year above 0.6 mm increased the risk of revision because of pain. Contrary to earlier reports migration was detected before the development of femoral osteolysis.

Total hip arthroplasty for inveterate congenital dislocation of the hip

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Over a period of 14 years (1978–1991) 14 patients (16 hips) had total arthroplasty performed for painful, congenital, high-riding hip dislocation with secondary changes.

Material and methods: All but 2 of the patients were females. One of the male patients had died 3 years after operation leaving 13 patients (15 hips) for this survey. Average age at operation was 54 (39–71) years and average follow-up time was 10.5 (1.5–14) years. 11 of the patients (13 hips) had been operated over 10 years ago. The hips included in this material were completely dislocated since childhood, not subluxated or

dysplastic. 2 of 3 patients who had bilateral CDH had THA of both hips. All components were fixed with bone cement. A lateral approach was used in 13 hips ad a posterior in 2. Epidural anaesthesia was used and thrombotic and antibiotic prophylaxis was given routinely.

Results: Primary complications included 3 dislocations requiring 2 closed and one open reduction, 2 deep vein thromboses and 3 urinary tract infections. Adductor tenotomy was needed in one case during the first postoperative week. Rotatory control of the hip was temporarily lost postoperatively in 3 cases. All wounds healed primarily and no nerve involvement occurred. Average time in hospital was 18 (9–31) days. All of the patients gained a very satisfactory pain relief, although 3 patients developed some pain from non-union of the greater trochanter requiring a later removal in 2 cases. Gait and walking distance was much improved and leg length discrepancy was reduced or neutralised by lengthening from 2 to 7 cm. The Trendelenburg sign as a rule became level or remained slightly positive. Average Harris Hip Score was 78 (53–97).

Late complications consisted of pain due to aseptic loosening of 7 components in 5 hips (4 patients). These hips were successfully revised from 6 to 13 years after the primary operation. 2 further hips have probable cup loosenings with mild symptoms, not yet requiring operative intervention.

Complications at the revisions consisted of dislocations and one fracture of the femoral shaft, which was immediately stabilized allowing early ambulation.

Conclusions: Very satisfactory results can be achieved with specially designed implants although durability is compromised due to weakened bone stock. Arthroplasty using the neoacetabulum had a less painful postoperative course, improved more rapidly and had fewer complications than those at the original level. This indicates that the former may be the method of choice when possible.

Preliminary results with the uncemented long stem Wagner prosthesis in revision hip arthroplasty

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Bone deficiency in femur often involves a technical problem in revision of total hip arthroplasty. The problem could be solved with extensive bone transplantation or with a distal anchoring of the prosthesis. The Wagner uncemented long stem femur prosthesis in Titanium alloy (Protasul-100) relies on the latter concept.

Since 1990 we have used the Wagner prosthesis in 11 cases of revision hip arthroplasties. In 5 patients the prosthesis was implanted through a transfemoral approach and in the other 6 patients an ordinarily transgluteal incision was used.

The mean follow-up is 18 months. The results show a great improvement of the Merle d'Aubigné score. Radiography has shown a significant increase of the bone stock in the proximal femur.

Conclusions: In revision arthroplasty with great bone deficiency in the proximal femur, the concept of a distal primary fixation of the prosthesis to the femur shaft seems promising. Furthermore, the need for bone transplantation is reduced.

Pressure cementation of the human arthrotic acetabulum

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Introduction: Cementing technique is considered to be of great importance for fixation of arthroplasties. However, by modern techniques the survival of the actabular component has not improved as much as the femoral component, where it is easier to achieve "containment". The mechanical strength has proved to correlate to the penetration depth of the cement, where 3-5 mm is needed. From in vitro studies we have reported a pressure level >0.2 MPa necessary for adequate penetration into human arthrotic cancellous bone. This study was performed to measure the pressure level achieved by clinical routine cementation in the acetabulum.

Materials and methods: In 12 patients with primary coxarthrosis receiving a routine cemented THR (Scan Hip); after reaming the acetabulum, before drilling the anchore holes, a narrow channel was drilled by a 2.8-mm drill, through the ilium from the outside cranial to the acetabulum in a direction aiming as centrally as possible inside the acetabulum. One of the anchor holes was drilled around the previous hole, 10 mm in diameter and 10 mm deep. A balloon catheter was pulled through the channel, from the outside to the bottom of the hole, and was linked to a pressure measuring system. The balloon was filled to nominal size and pulled back to tighten the drill hole. Vacuum mixed, precooled cement (Palacos cum gentamicin) was introduced and the acetabulum was cemented by 3 different techniques; fingerpacking, Exeterballon and silicon membrane in a random fashion. The pressure gradient was measured by using 2 catheters; one at the very tip of the cement gun and the other at the bottom of the hole. The gradient was registered at pressure levels and mixing times mentioned above and was found to be <10%.

Results: At pressurization of the cement and also at acetabular component insertion, 2 small pressure peaks were registered. The duration of the maximum pressure elevation was short, almost instantaneous, and the total duration of the elevation lasted less than 10 seconds. Only in exceptional cases did the maximum pressure exceed 0.1 MPa.

Discussion: All registrations principally showed the same pattern, the pressure levels were short and of low magnitude, not sufficient for adequate cement penetration. As known, it is almost impossible to achieve a containment in the acetabulum. Conclusively, this study indicates that only in exceptional cases adequate pressure levels are achieved during fixation of the acetabular component by using present routine techniques.

The significance of circulation on pressure cementation in arthrotic bone of the human hip

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Introduction: Good prosthesis-to-bone fixation needs a cement penetration of 3–5 mm into the bone trabeculae. By modern techniques, prosthetic survival has improved considerably, especially the femur component. Present problems concern late aseptic loosenings of the acetabular component. In an earlier study we found that a pressure >0.2 MPa is needed for optimum penetration. The object of this work was to study the influence of the circulation on cement penetration.

Material and methods: In 21 hips, during THR, after dislocation of the femoral head, before osteotomy of the femoral neck, a hole was drilled 10 mm in diameter and 10 mm deep in the upper most worn part of the head. The hole was lavaged and rinsed in a routine way. Cementation was subsequently performed according to random schedule at 0.1, 0.2 and 0.3 MPa and at 1.2 and 4 minutes after cement mixing, using vacuum mixed precooled cement (Palacos R), and an ordinary cement gun, provided with a silicon nipple. Pressure was measured at the very tip of the delivery pipe by a balloon catheter linked to a transducer (Druck PDCR 75/1) with the measuring range of 0–5000 mmHg and was read both digitally and by a pen writer (BBM). The system was calibrated to a gold standard in the range 0–3500 mmHg (error <2.5%). After cementation the femoral head was removed and the procedure was repeated in exactly the same way, at the same pressure level and mixing times in order to avoid influence from differences in bone quality. After curing the bone was sliced and penetration was measured on 2 slices according to the formula: ((Max diameter1 + Diameter 90°1 + Max diameter2 + Diameter 90°2)/4 – 10/2).

Results: The overall results showed less penetration of cement in these holes cemented in circulated bone within every pair, at all pressure levels and mixing times. The mean difference was 50%.

Discussion: The intraosseous pressure is 15–30 mmHg, which is less than 5% of the cementation pressure. Nonetheless there was a considerable decrease of penetration depth in circulated bone at corresponding pressure levels. This influence was independent of pressure levels and mixing times. In conclusion, we interprete these data to indicate that the influence of circulation must be explained by means of incompressibility of fluid and lack of escape venues rather than blood pressure.

Osteoporosis and hip fractures

Energy Dispersive X-ray micro analysis of bone mineral composition in human bone

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Introduction: In studying bone quality we have complemented the semiquantitative routine histology with Energy Dispersive X-ray micro analysis (EDX). This technique allows for a microstructural quantitative analysis of the major constituents of bone, calcium and phosphorous as well as some minor constituents, simultaneously. It is a non-destructive method with the advantage of permitting the use of specimens prepared by the same method as for regular bone histomorphometry. We have evaluated the accuracy of bone mineral composition determination by EDX by comparing it to instrumental neutron activation analysis (INAA) and chemical analysis. In cases with osteomalacia due to chronic renal failure and subsequent hemodialysis, alterations affecting the intratrabecular mineral composition have been analysed and compared to normal cases.

Material and method: Bone specimens were obtained from 5 femoral heads during total hip replacement because of osteoarthrosis. Transiliac bone biopsies from 9 men, age 46 (26–62) years, on hemodialysis for 16±19 months were compared to 11 previously normal suddenly diseased men, age 45 (25-75). All samples were embedded according to the routine method. For the analytical procedure Philips SEM 515, equipped with a LINK QX2000 EDX-ray spectometry unit was used, and analysed by the ZAD-Peak to Background rationing program on each specimen. 12–15 measuring points were randomly selected centrally in the different trabeculae. The osteomalacia was histomorphometrically verified.

Results		Ca wt%	P wt%	Mg wt%	Al wt%
I	EDX	25.9±0.79	10.5±0.14	0.31±0.02	
	INAA	22.2±0.53	9.8±0.21	0.26±0.02	
	CHEM	23.0±1.0	10.0±0.44		
II	Normal	23.9±1.48	9.3±0.5	0.24±0.04	0.02±0.02
	Dialysed	24.6±1.55	10.0±0.5	0.36±0.05	0.02±0.01

Conclusion: We find the EDX analytical method for quantifying the major mineral components of bone a method of good precision and it correlates well with other quantitative methods. It has the unique advantage of allowing for a microstructural quantification on individual trabeculae. In osteomalacia we still find a normal mineralization centrally in the individual trabeculae. Apparently the defective mineralization mainly affects the trabecular borders and not the mature trabecular bone.

Lifelong persistance of posttraumatic osteopenia

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Introduction: There is always a local loss of bone after an injury to a limb. It has earlier been shown that one year after a tibial fracture the net loss is 25% in the fractured limb and one year after a knee ligament injury the net loss is 10% in the injured leg, measured with single photon absorptiometry in the tibial condyle. The aim of the study was to see if posttraumatic bone mineral loss is reversible and also to study if patients sustaining these 2 types of injuries have lower regional or total bone mineral content (BMC) than age matched non-injured controls.

With the introduction of the DEXA-technique we have a precise way of examining the bone mineral content in different regions in the injured extremity and to compare with the uninjured side.

Material and methods: 38 patients with tibial shaft fractures and 24 with knee ligament injuries were examined. All were after their original injury in 1950–1975 examined by single photon absorptiometry. A re-evaluation has now been done using the DEXA-technique. Total body, hips, femur condyle, tibia condyle and tibia diaphysis were measured. All patients with new fractures after their original injury were excluded.

Results: We found a persisting difference in the bone mineral content between the injured and uninjured legs, most obvious in the femoral condyle ($p < 0.001$). The same result was found when patients with ligament injuries ($p<0.01$) and with tibial fractures ($p < 0.05$) were examined separately. Patients with fractures 28–38 years ago, still retained their posttraumatic osteopenia in the femur condyle in the involved tibia ($p < 0.05$).

Separated into sexes, the result remained in men ($p<0.001$) but no difference was found for women. There was no significant correlation between the inital loss of bone one year after the injury compared to the loss of bone at the time of the follow-up. There was no BMC difference in any of the non-fractured regions comparing the injured group with age- and sex-matched controls.

Conclusion: A tibia fracture or a knee ligament injury leaves a decreased bone mass in the injured leg that is never completely replaced.

Background factors to fractures of the hip and the forearm

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Introduction: The rapid increase of incidence of fragility fractures in the elderly will put great demands on hospital resources and rehabilitation. Therefore, we must try to identify those persons at risk to sustain a fracture in order to, perhaps, prevent the fracture.

In this study we analysed the cause of the fracture and the background factors in the individuals to see if there were differences between patients and controls.

Patients and method: A questionnaire was given to consecutive patients with hip and forearm fractures. The same questionnaire was sent to age- and sex-matched controls. The responses from 102 hip fracture patients were compared with the responses from 102 control subjects.

Results: Most hip fracture patients had fallen during walking or rising and they often fell sideways. Hip fracture patients showed more symptoms of diseases, were more often afraid of falling and had a lower capacity in daily living than control subjects.

Conclusion: Hip fracture patients, even before the fracture, are more frail and sedentary than average. Some, perhaps, can be trained in order to prevent or postpone the fracture.

Nandrolone decanoate in women with hip fracture or fracture of the proximal end of the humerus

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Introduction: A placebo controlled study with Nandrolone decanoate (Deca Durabol®) over 2 years was performed in old women with a recent fracture of the hip or a fracture of the proximal end of the humerus. The objective was to evaluate the effect of anabolic steroids on bone mass and functional variables in elderly women with a recent fracture.

Material and method: The study included 73 women aged 75 (65–85) years. All had within the last 6–12 months sustained a fracture of the hip or the proximal end of the humerus. Cases of secondary osteoporosis or concomitant use of medications of importance for bone turnover were not included. The study was double-blind and the patients were randomly allocated to either placebo or Nandrolone decanoate (Deca Durabol®) 50 mg i m every fourth week for a period of 2 years. BMC of both forearms was measured with SPA (241 Am radiation source) at a distance of one cm (mostly trabecular bone) and 6 cm (mainly cortical bone) from the tip of the styloid process of the ulna. Serum and urinary electrolyte concentrations, urinary hydroxyprolin and osteocalcin were measured. Functional status was evaluated (gait, muscle strength, balance). The patients were observed every 6 months with measurements of all variables.

Results: The groups did not differ at baseline. A significant difference in bone mass was seen already after 6 months at both sites and this difference was persistent during the study at the cortical site with no bone loss in the group treated with Nandrolone decanoate whereas the placebo group lost 7%. Significant differences were seen after 6 and 18 months also at the trabecular site, with a net gain for the treated group vs the

placebo group. No differences were seen in functional variables. Including only those who at entry of the study were walking without a stick, altogether 38 women, there was significant difference in bone mass as well as in muscle strength.

The Medoff sliding plate— new class of fixation device for trochanteric and subtrochanteric fractures—the first Swedish experience

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Introduction: Medoff from Hawaii has developed a new type of compression screw system for use in high subtrochanteric and unstable trochanteric hip fractures (J Bone Joint Surg (Am) 1991;73(8):1192-9). This device allows collapse and compression to occur in a direction parallel to the longitudinal axis of the femoral shaft. The standard compression screws only allow compression in the longitudinal axis of the femoral neck. Theoretically, this makes the new system superior to the standard hip compression screws regarding transverse and reversed oblique fractures of the trochanteric region.

Material and methods: From January to November 1992, 110 consecutive patients were operated with the Medoff device (including dislocated two-fragment or multi-fragment trochanteric fractures as well as subtrochanteric fractures) and were followed prospectively for at least 4 months.

Results: Until January 1993, 5 technical complications had been recorded—all screw penetrations of the femoral head. 2 of the 5 complications were in two-fragment trochanteric fractures but none in subtrochanteric fractures. By unlocking the set screw and dynamizing the lag screw without removing the plate, the lag screw could be withdrawn and stay within the femoral head.

Conclusions: The Medoff sliding plate is a new and promising device for use in unstable trochanteric and subtrochanteric fractures. The implant complements existing standard compression screw systems as an add-on plate and uses the same technique of insertion and instrumentation.

The Medoff sliding plate (the axial compression screw)—a new method of treatment of trochanteric non-unions of the hip

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Introduction: Current methods of treatment for non-unions following trochanteric fractures of the hip are not always reliable. Fixation with a standard compression screw may compromise results by limiting impaction of the proximal and distal fragments along the non-union site.

Patients and methods: 4 patients with symptomatic trochanteric non-unions following fracture were treated with a new technique, which combined fixation with an axial compression screw and a sliding plate along the femoral shaft with peripheral autogenous iliac bone graft. This implant allows vertical impaction of the non-union site both at the time of surgery, as well as dynamically postoperatively. In 3 patients, the non-union site was not opened, and existing medial offset of the fragments at the fracture site was left unchanged. Dynamic axial loading of the fracture site was observed postoperatively, and early weight-bearing was encouraged.

Results and conclusion: All patients have united. Based on the results in this limited series, this new technique appears to be a reliable method of treatment for these difficult injuries.

Bone and muscle mass after femoral neck fracture—comparison between osteosynthesis and primary total hip arthroplasty

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Introduction: The most frequent treatment for femoral neck fractures is osteosynthesis with screws or pins. The rate of late complications, e g non-unions or segmental collapse is still rather high, leading to a secondary operation with a hip arthroplasty. In a selected group of patients with displaced fractures it could possibly be better with a primary hip arthroplasty.

Patients and methods: 20 healthy patients (15 women, 5 men) with displaced femoral neck fractures (Garden III-IV) with an age over 65 years and admitted from their own homes were included in the study. The patients were randomly selected to either osteosynthesis (OS) with Olmed screws or to a total hip arthroplasty (THA). The bone mineral density (BMD), the cortical bone volume and the transverse area of the thigh muscle were analysed with quantitative computed tomography 18 months after the operation.

Results: 3 patients died during the study period (2 OS, one THA). One patient with Olmed screws was reoperated because of infection, leaving 16 patients to final analysis. In the cortical bone of the middle femur there was a loss in BMD of 3% in the OS group and 4% in the THA group, compared to the uninjured leg. In the cancellous bone of distal femur, the bone loss was 12% in both groups, and in proximal tibia 17% in the OS group and 18% in the THA group. The loss in muscle volume was 15% in the OS group and 11% in the THA group.

Conclusion: 18 months after a femoral neck fracture there is a loss in bone volume in middle femur and of BMD in distal femur and in proximal tibia. However, we could not detect any significant differences between the 2 treatments. The loss of muscle volume was higher in the OS group than in the THA group.

Tetracycline prophylaxis in femoral neck fracture fixation

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Introduction: In osteosynthesis for femoral neck fracture the infection rate is 1–2%. We report our results over a 13-year period.

Patients: At the Lund Department of Orthopedics femoral neck fractures have consistently been treated by primary osteosynthesis. The infection rate was studied retrospectively in the years 1977 through 1980 and 1986 through 1989. The years 1981 through 1985 the patients were studied prospectively. 1894 femoral neck fractures were admitted during the studied period

Method: Early in the period the patients had primary osteosynthesis with a 4-flanged nail and from 1982 and onward with hook-pins. No antibiotic prophylaxis was given. However, as part of a femoral head vitality study 658 patients were given tetracycline orally or intravenously.

Results: Deep infection was diagnosed in 15 of the 1894 femoral neck fractures (0.8%). 2 of these patients belonged to the group of 658 being marked with tetralcycline (0.3%) and 13 deep infections were seen in 1236 patients without tetracycline administration yielding an infection rate of 1.0%. In 8 patients prosthetic replacement was performed with no recurrence of infection. All but one of these patients had the replacement performed in a 2-stage procedure. Successful treatment restored functional capacity to its former condition or nearly so.

Discussion and conclusion: The deep infection rate in this retrospective study may well be underestimated and could thus be considered as minimum figures, while it is, however, very unlikely that a deep infection was not noted in the prospective series. One dose tetracycline may thus serve as an efficient prophylaxis in a femoral neck fracture osteosynthesis, however, from a theoretical point of view an antistaphylococc-antibiotic should be chosen.

Early redisplacement of cervical hip fractures—combined results of three prospective randomized trials

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The complications after cervical hip fractures are of 3 types: 1) Early redisplacement, 2) AVN; Avascular Necrosis, and 3) Non-union. The latter 2 are the more biological complications.

In order to evaluate different fixation devices, several experimental studies have been performed. However, the end points of these studies vary. We think that early redisplacement, which leads to reoperation within 6 months, is a representative measure of the quality of fixation.

Methods: The early results of 3 prospective randomized studies of fixation of cervical hip fractures are compared regarding reoperations within 6 months.

Results: The different types of osteosynthesis and reoperations at 3 and 6 months are shown in Table 1.

Type of fixation	Year of study	N	Reoperations 3 mo	6 mo	total	Primary THA
Rydell	1983–4	122	14	3	17 (14%)	16
Gouffon		101	9	2	11 (11%)	
LIH	1984–5	128	7	6	13 (10%)	6
Sliding screw		114	5	6	11 (10%)	
CHP	1987	53	0	3	3 (6%)	11
LIH		183	4	7	11 (6%)	

The differences in the individual studies were not significant. However, during the period of the studies 1983-87, the result was increasingly better ($p < 0.002$), even when the same fixation device was used (LIH in 2 studies).

Discussion: The time trend in the results are not only explained by the type of fixation device used. The most likely explanation is that when quality control is performed, there is an increasing interest and higher skill is developed in the performance of the surgical procedure.

Hook-pins versus sliding-screw-plate for fixation of femoral neck fractures

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2 methods of internal fixation were compared in a prospective randomized study of 222 patients. Radiographic evidence of early redisplacement, non-union, or late segmental collapse occurred in 43 of 122 patients operated on with 2 hook pins and in 40 of 100 patients operated on with the sliding-screw-plate. According to the actuarial method of follow-up, the failure rate after 2 years was respectively 38% and 46%, which is a nonsignificant difference.

Early fixation promotes healing of displaced femoral neck fractures

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Factors important for healing of femoral neck fractures were studied in 2 concecutive prospective randomized clinical trials of different methods of osteosynthesis. In the first year the patients were allocated for fixation with a 4-flanged nail or 3

to 4 Gouffon pins and in the second year 2 hook pins or a sliding-screw-plate. Of 528 patients, 384 women and 144 men, with femoral neck fractures admitted to Sahlgren Hospital, Göteborg, during 2 years, 234 patients with displaced fractures (Garden stage 3 and 4) were followed for 24 months, or until radiographic healing complication occurred.

Results: By multivariate analysis we found 4 factors associated with uneventful healing. These were then included in a logistic model where yes=1 and no=0. The probability of healing was 1/1+exp (-S). S=0.83x(internal fixation within 24 hours)+1.5x(satisfactory reduction)+1.36x(satisfactory position of the fixation device)-0.76x(female sex)-2.35.

For a man with a displaced fracture with good reduction and position of the fixation device, the probability of healing was 79% if he was operated on early and 62% if the internal fixation was delayed. For a woman the corresponding figures were 64% and 44%.

Age-related results in the Swedish multicenter hip fracture study

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A multicenter study of hip fractures in the elderly has been introduced in Sweden to compare different methods of surgery, mobilization and rehabilitation. Data concerning the hospital stay are, prospectively, registered on printed forms by the operating department. There is also a patient enquiry, which gives follow-up functional parameters at 4 months after the operation. Data are reported on disks through a special program for personal computers. The project started in 1988 and now covers two thirds of the Swedish hospitals. The database now includes more than 20,000 cases.

Three fourths of the patients were women. Mean age at fracture was 78 years and half of the patients were living alone. Patients aged 60-69 years were in 86% living in their own home and 4% in old people's home, whereas among patients aged 90-99 years 41% were living in their own home and 43% in old people's home. Thus, even at high age the majority of the patients were living in some type of independent living before the fracture.

The mean (median) hospitalization time for these 2 age groups was 14 (10) days and 21 (14) days, respectively, with a successive increase. However, patients aged 50-59 years had a mean (median) hospital time of 18 (9) days, indicating influence of other concomitant diseases. Of patients coming from their own home aged 60–69 years 69% returned directly to home from the operating department. For the age group 90-99 years the direct return home was 29%. For those coming from old people's home the direct return there was 57% and 53%, for these age groups, respectively.

The graph showing daily changes in habitat for all patients showed a stabilized pattern around 30 days after the fracture for the age group 60–69 years. Then most patients had returned to their original habitat. For the age group 90-99 years this was found after around 60 days. The mortality after 4 months was considerably higher for those older patients, just over 20% versus 5%, and they consumed considerably more bed-days in the operating department.

Mental and physical status in geriatric surgery

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Introduction: The implementation of the prospective payment system necessitates a reappraisal of the actual costs of health care, including nursing care. It has previously been shown that hip fracture patients have a poorer mental and physical state than agematched controls (1). But how do acutely admitted elderly orthopedic patients in general compare with patients admitted to the other surgical departments?

Patients and methods: 196 consecutive patients from independent living, 65 years or older, admitted from the emergency room, were examined when arriving to the general surgery, urology and orthopaedic departments. Mental state was assessed with Short Portable Mental State Questionnaire (SPMSQ) (2) and physical state was assessed with ADL-index (3).

Results: The elderly patients constituted 51% of the orthopaedic emergencies but only 25% of all other surgical emergencies. The mean age of the orthopaedic patients was higher, 80.3 years, compared with the mean age of the other surgical patients, 77.4 years, and on admission they also had a poorer mental and physical state than the other group, a fact that was further accentuated at discharge.

Department	Manage ADL independently before admittance	Normal mental state on admittance	Manage ADL independently at discharge
Orthopedic	71%	59%	16%
Other surgical	87%	71%	71%

Conclusion: Among admitted patients over 65, orthopedic patients have a poorer mental health and a lower ADL-capacity than those admitted to general surgery and urology. This certainly affects the total treatment costs. Yet, the reimbursements are based on diagnoses, which not always reflect the actual utilization of resources. Therefore we think that continuous measurements of ADL and cognitive function are efficient aids in resourse allocation.

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Femoral fractures in patients with hip arthroplasty

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During 3 years, 20 proximal femoral fractures in 18 patients (7 men and 11 women) who had previously undergone total hip arthroplasty were treated surgically. Prior to fracture, 14 of the stems were considered loose, 2 stems had recently been revised due to loosening and only 4 stems did not exhibit any sign of loosening. At operation, 16 of the stems were found to be loose. 6 different types of revision stems were used.

All fractures healed but, despite fracture consolidation, 6 of the revision implants rapidly loosened again, and 2 of these have been revised.

The average hospitalization time was 22 (9–39) days, including all complications. This has to be compared with the several months needed in conservative treatment when traction and casting are implemented.

In a unit well-trained in fracture and prosthetic surgery, operative treatment is recommended as an alternative to conservative. Patients as well as society benefit from such a solution.

Knee

A Swedish total knee arthroplasty—the Scan Knee—a clinical and radiographic 1–3-year follow-up

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The Scan knee, a total knee arthroplasty was introduced in 1988. We report the early experience of 215 knees followed 1–3 years.

Material: During 1988–1991, 223 knees were operated in Skövde and Norrköping. 215 knees were followed up. There were 66 male and 149 female knees. 154 had OA and 61 RA.

Methods: Pre- and postoperative clinical examination included mobility, stability, walking distance and walking aids. Postoperatively also the patients' opinion was graded in 4 groups: excellent, good, fair and poor.

One year postoperatively radiography included whole leg examination. The deviation of mechanical axis and femurotibial angle were recorded and also the position of the components in frontal and sagittal plane.

Complications: There were 2 myocardial infarctions, 2 cerebrovascular insults, 2 pulmonary embolies, 3 lower legs thromboses, 2 infections, 10 urinary tract infections and 2 peroneal palsies.

Radiographic results: Tibial component: Frontal plane 2° varus ± 3° in 87%. In sagittal plane: 7° dorsal inclination ± 3°: 67%.

Femoral component: Frontal plane 6° valgus ± 3° in 73%. Sagittal plane 0° inclination 5° in 61%.

Mechanical axis: 0° ± 5° in 88% and femuro-tibial angle 4°–10° valgus in 75%.

Clinical result: Flexion 90° or more in 90%. Extension lag less than 10° in 97%. All knees were stable. Patients' opinion: Excellent or good in 94%.

Conclusion: We found no complications correlated to the prosthesis. Positioning of the prosthesis was good and clinical results in accordance with other knee prostheses.

PCA uni-compartmental knee prosthesis in gonarthrosis—a 3–9-year follow-up

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In the Department of Orthopedics, Malmö General Hospital, 108 PCA uni-compartmental arthroplasties were performed in 98 patients with medial or lateral gonarthrosis during 7 years (1984–1990). In 1993 a 3–9-year follow-up examination was undertaken. Of the 108 knees operated on, 90 knees (83%, 17 men, 64 women) remained for follow-up.

Results: Of those remaining, 26 were rated as excellent, 29 as good, 8 as fair and 27 as poor. The number of revisions were 25 and in another 2 there was an indication for a revision. In 2 patients the revision was bilateral. Average time to revision was 39 (11–80) months. In 14 revisions the femoral components were loose, severe wear of the polyehtylene of the tibial component was observed in 14 revisions.

The average HSS score preoperatively was 66, after 1 year 85 (80 in the revised group) and after 5 years 78 (only 9 of the revisions were included in the estimation of the HSS score after 5 years as the other 16 patients had already been operated on). Light to moderate wear of the polyethylene was observed radiographically in another 18 of the patients, but only one of these had severe wear indicating an immediate reoperation. First step pain as a sign of prosthetic loosening was observed in 12 of the patients after 5 years. These patients also had radiographical as well as clinical signs of prosthetic loosening.

Discussion: There was a remarkable deterioration of the results and HSS score after 5 years compared with the first postoperative year. This is obviously due to the common complication of femoral component loosening and the excessive wear of the polyethylene of the tibial component causing a high rate of knee revisions.

Cemented vs uncemented fixation of the tibial component in total knee arthroplasty A randomized study with 5 year follow-up using roentgen stereophotogrammetric analysis

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Introduction: Cemented (C) and uncemented (UC) tibial components have shown equal clinical results in the short term. Using Roentgen Stereophotogrammetry (RSA), we could not detect any differences in terms of the quality of the fixation between cemented and uncemented tibial components of the Tricon-M knee during the initial 2 postoperative years (1). To evaluate whether these results still are valid after a longer time period, these patients have now been followed for 5 years.

Material and methods: Between 1986 and 1988, 38 consecutive patients (39 knees) were operated on with the Tricon-M knee. At operation the mode of fixation was randomized, and the knees were prepared for RSA by the insertion of tantalum markers. The groups were comparable with respect to age, gender, diagnosis and weight. RSA was performed postoperatively and at 6 weeks, 3, 6, 12, 24 months and 5 years.

Results: During the initial 2 years, one cemented knee was revised due to loosening, and 2 patients died of unrelated causes. Between 2 and 5 years another 3 patients died of unrelated causes, one patient refused to attend (but had no pain from her knee on inquiry by telephone) and one uncemented knee was revised at 59 months due to wear of the polyethylene and fracture of the tibial tray.

Maximum migration (MTPM), subsidence and tibial tray rotations did not differ significantly between the 2 groups. Maximum lift-off was higher in the cemented knees (median values 5 years; C 0.8 mm, UC 0.15 mm, p <0.01). In both groups the MTPM increased significantly between 2 and 5 years (median values 2 years; C 1.0, UC 1.4, 5 years; C 1.7, UC 1.6, p <0.01.) Anterior/posterior tilt and internal/external rotation of the tibial component also increased but only in the cemented knees, whereas these movements were unchanged in the uncemented knees.

The clinical results did not differ between the groups at 5 years. 4 cemented knees and 2 uncemented knees experienced some pain while walking. There was no correlation between migration and clinical results.

Conclusion: The initial migration recorded during the first 2 years did not cease, but tended to increase somewhat between 2 and 5 years in both cemented and uncemented tibial components. After 5 years there was somewhat larger lift-off in the cemented knees.

Reference: 1) Nilsson, K G, Kärrholm J et al. J Arthroplasty 6:265-278, 1991

Hydroxyapatite coating versus cement in fixation of the tibial component in total knee arthroplasty

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Introduction: Hydroxyapatite coating has been introduced to enhance the primary fixation of uncemented total joint replacements. The purpose of this study was to measure micromotions of the tibial component in total knee arthroplasty with a uniform design, randomized to cemented (C) or hydroxyapatite (HA) fixation using roentgen stereophotogrammetric analysis (RSA).

Patients and methods: 53 consecutive patients, mean age 69 years (34 women, 19 men; 41 OA, 12 RA) with 57 knees were operated. The mode of fixation was randomized after the proximal tibia was cut, stratification for diagnosis was performed. The groups were comparable with respect to gender, diagnosis, weight and Knee Society knee score.

A Tricon II (Smith&Nephew) titanium metal backed tibial component with central intramedullary stem and equipped with 2 sliding cancellous screws was used in both groups. The uncemented tibial components were coated with 98% pure HA with an average thickness of 200 µm. In the cemented knees, vacuum mixed bone cement (PalacosR with gentamicin) applied by a syringe was used.

At operation the knees were prepared for RSA by insertion of 7–9 tantalum markers into the proximal tibia, and 6 markers into the polyethylene of the tibial component.

Results: The HA-coated tibial components displayed significantly larger migration (MTPM) at 6 weeks and 3 months (p <0.05). At 6 months the HA knees displayed a median MTPM of 0.39 mm and the cemented ones 0.36 (NS). In both groups the magnitude of rotation about the 3 cardinal axes was rather small and did not differ significantly. (Median values at 6 months anterior/posterior tilt: HA 0.24°, C 0.19°; internal/external rotation: HA 0.22°, C 0.12°; varus/valgus tilt: HA 0.17°, C 0.13°.) Subsidence was the predominant type of micromotion recorded in the HA coated knees, both when measured at the center and at the periphery (maximum subsidence). In the HA knees, maximum subsidence occurred during the initial 6 weeks, whereas in the cemented knees it was continuously increasing during the investigation period. (Median values at 6 months; maximum subsidence: HA 0.26 mm, C 0.18 mm (p <0.05); subsidence of the center: HA 0.16 mm, C 0.03 mm (p <0.05)). Lift-off was small and insignificant in both groups. In 76% to 62% (6 weeks – 6 months) of the HA coated implants, some part of the tibial plateau displayed translations less than 150 µm, usually anteriorly or centrally.

The median Knee Society knee score at 6 months was: HA 89, C 88 (ns); median Knee Society function score at 6 months: HA 80, C 80 (ns).

Conclusion: The HA coated implants displayed significantly larger subsidence of the tibial component during the first 6 postoperative months. The difference was most pronounced during the 6 initial weeks. Compared to previously (by RSA) investigated uncemented tibial designs (Tricon-M, Tricon M Central Stem, Miller-Galante I), the addition of HA coating seemed to improve the initial fixation.

Does tranexamic acid reduce blood loss in total knee arthroplasty?

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At our department, tranexamic acid (Cyklokapron®), has been given since 1987 during total knee arthroplasties in order to diminish blood loss. The drug was administered towards the end of the operation before the tourniquet was released. The aim of the study was to evaluate the effect of this treatment on blood loss and blood transfusions.

Material: The records of all patients who had been operated on with primary total knee arthroplasties during 1985-1988 were reviewed retrospectively. 70 patients had received tranexamic acid before the tourniquet was released. 109 patients who had been operated with the same prosthesis during these years but without receiving tranexamic acid served as controls. The groups differed regarding the number of cemented/uncemented components.

Results: The mean peroperative blood loss did not differ between the 2 groups. Multiple regression and logistic regression analysis of the factors that differed between patients and controls showed that tranexamic acid administration reduced postoperative blood loss with 340 mL and also greatly reduced the risk for receiving any blood transfusions. The mean postoperative blood loss in the controls was 1260±590 mL.

Conclusion: A retrospective study of 179 total knee arthroplasties gave strong evidence that tranexamic acid, given during operation, significantly reduced postoperative blood loss and blood transfusion.

Retrograde intramedullary nailing of supracondylar fractures after bicondylar knee prosthesis

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Introduction: Supracondylar fractures after knee prosthesis consitute a challenging problem for the orthopedic surgeon. Closed methods of treatment employing traction with or without cast-bracing are relatively safe methods but also carry risks such as difficulties in maintaining proper alignment of the fracture, mal-union and non-union. In addition, enforced bed rest in an elderly patient increases the risk of thromboembolism, pressure sore and confusion. Early mobilisation in a stabilized fracture after internal fixation is to prefer.

Patients, methods and results: 2 patients (85 and 65 years) with osteoarthrosis and bicondylar prostheses (PCA and AGC) sustained dislocated supracondylar fractures after a fall. Open reduction and retrograde nailing (Ender nails distally locked by coupling pieces and screws) was followed by mobilisation and partial weight-bearing. The patients returned to their prefracture functional knee level within 8 months. A third patient (81 years) in a very poor general condition (rheumatoid arthritis with sacral pressure sores and cardiac incompensation) with PCA-prostheses in both knees sustained an open dislocated supracondylar fracture at the level of the proximal part of the knee prosthesis after a fall from a wheel-chair. In this special case we used the Grosse-Kempf nail, which was inserted into the intercondylar notch just behind the prosthesis, and the prosthetic fragment was stabilized by the interlocking screw. Postoperatively, the wound healed without infection and the patient returned to her prefracture ambulatory status but 2 months later she died from her poor condition.

Conclusions: Treatment of supracondylar fractures after knee prosthesis needs an individual approach depending on the degree of fracture comminution, the type of prosthesis and on the status of the patient. Our third patient was treated in an unconventional way, but nailing through the intercondylar notch is an overlooked method.

On the clinical significance of micromotion of joint implants

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Introduction: Consistent migration of prosthetic components has been reported using roentgen stereophotogrammetric analysis (RSA). This study reports the migratory behavior of tibial components in knee arthroplasty in the long time range and relates the migration to the clinical outcome.

Material and methods: 155 knee arthroplasties, consecutively marked for RSA, with a follow-up time between 5 and 13 years were studied. There were a variety of prosthetic designs, both unicompartmental and total, both cemented and non-cemented. 10 cases were revised for mechanical loosening of the tibial component after 1–11 years. All patients were marked for RSA during the arthroplasty by the insertion of tantalum markers in the tibial component polyethylene and the tibial methaphysis. Stereo roentgenograms were obtained in the immediate postoperative period and at 6 weeks, 6 months and at 1, 2, 4, 6 and 10 years. By precise measurements and computer treatment of data, the 3-D motion of the tibial com-

ponents relative to the tibia was arrived at. The accuracy of RSA has previously been established to 0.2 mm.

Results: All tibial components migrated during the first year. Overall, about one in every 3 prostheses continued to migrate after the one-year time point, although at a slower speed than during the first year. The remaining two thirds of the prostheses stabilized after one year. After one year, cemented prostheses had migrated not quite one mm, while non-cemented prostheses had migrated about twice as much, the difference representing subsidence. There were no differences between the different designs nor was there any difference in migration between patients with RA and OA. All tibial components which were revised for loosening had migrated continuously. This difference in the proportion of initially migrating vs continuously migrating prostheses between the 2 groups was statistically significant ($p < 0.002$). At one year, the prostheses which were later revised had migrated significantly more than the successful cases.

Discussion: This long-term study has shown that tibial components migrate consistently during the first postoperative year. After one year most prostheses stabilize and remain stable also beyond 10 years. Cases which eventually went on to loosening could be identified after 1-2 years, despite the fact that most of them were clinically successful at this time. These findings may have considerable implications from both clinical and scientific points of view.

The effect of femoral ligament insertion site on the sagittal stability following anterior cruciate ligament reconstruction

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Introduction: Many patients show increased sagittal displacement of the tibia also after reconstruction of the anterior cruciate ligament (ACL). We have previously reported on a correlation between length changes during isometry measurement (change in fixation distance) and tension in a test ligament in vitro and in vivo. The pattern of length change was then attributed to different femoral ligament insertion sites.

Methods: The course of tibial anterior-posterior (A/P) displacement folowing ACL reconstruction with a patellar tendon strip, was followed prospectively for 2 years in 24 patients, measured with the OSI knee-laxity tester. The femoral ligament insertion site was documented, and the change in intraarticular fixation distance was measured intraoperatively.

Results: After 2 years the overall mean A/P displacement difference between the operated and the uninjured knee was 2.0±2.3 mm. All ligaments were fixed at 20° of knee flexion. Patients in whom this angle coincided with the angle of minimum intraarticular fixation distance (Group W), and patients who had a femoral ligament insertion site >2 mm anterior to the center of the normal ACL (Group A) had a larger tibial A/P displacement than the rest of the patients. Even though these 2 groups were defined by different criteria, the concordance was 6 out of 8 patients possible, implying that an anterior femoral ligament insertion site is likely to give a minimum intraarticular fixation distance in semiflexion. A tibial A/P displacement of ≥3 mm compared with the uninjured knee was regarded as a failure of sagittal stability. The failure rates for Group W (86%) and Group A (88%) were higher than those for the rest of the patients (25-29%). No correlation was found between A/P displacement and the magnitude of the change in intraarticular fixation distance.

Conclusion: Intraoperative isometry measurement is helpful, gives a good estimation of the achieved femoral ligament insertion site, and should be examined prior to fixation of the ACL substitute, in order to optimize sagittal stability.

Lower extremity

Entrapment of the superficial peroneal nerve (SPN)—results of treatment by local fasciectomy

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It has been shown that patients with entrapment of the superficial peroneal nerve (SPN) and with pathological neurography can be treated successfully with fasciotomy of the lateral compartment. The purpose of this study was to evaluate the outcome of local fasciectomy in patients with clinical signs of entrapment of the SPN, but with normal neurography.

Methods: 17 patients with a mean age of 37 (19–71) years were followed-up for 3.8 (1–11.5) years after treatment by local fasciectomy. 10 of the patients, who also had a peroneal tunnel syndrome, had an additional decompression of the nerve. No patient was treated by fasciotomy. Intramuscular pressures were recorded in most patients.

Results: 13 patients were satisfied at follow-up. 4 were symptom-free and 9 were improved with minor residual symptoms. Of the 4 unsatisfied patients one was improved, 3 were unchanged and none was worse.

Conclusion: Local fasciectomy, as compared to complete fasciotomy of the lateral compartment, is a good alternative to treat patients with entrapment of the SPN. However, patients with peroneal tunnel syndrome require additional decompression of the nerve. Patients with normal nerve conduction velocity in this study seem to benefit from the surgical procedures as compared to patients with pathological nerve conduction reported in previous studies.

Intermediate term follow-up of patients operated for chronic lateral instability of the ankle

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Introduction: Numerous operation techniques (utilising reconstruction with tendons, periostal flaps, carbon fibre or ligaments) with varying intermediate term results have been presented for chronic lateral instability of the ankle. This paper reports on a 5 year follow-up with a not widely used operation method using a ligamentous-capsular repair.

Material and methods: Included in the study are 30 ankles in 27 patients (6 female/21 male, mean age 30 years) with a duration of symptoms of 9 years and operated 1984–1988 using a ligamentous-capsular technique.

The patients were investigated preoperatively, at 20 months and at 60 months using roentgen stereophotogrammetric analysis. The ankles were examined in neutral position, during manual adduction test and anterior drawer tests (loads 40 and 160N) as well as during maximal passive plantar and dorsal flexion. The opinion on the results were obtained according to a questionnaire.

Results: 17 ankles were by the patients considered excellent, 11 improved and 2 unchanged at the 60 month follow-up. The instability was better in all the excellent/improved ankles. pain had disappeared or decreased in 18 patients and was unchanged in one patient. 7 of 11 patients who did not return to athletic activities claimed the ankle was the reason.

The talar range of movement was not altered whereas the talar adduction and anterior drawer tests were significantly decreased at both the 20 months and 60 months follow-up.

Conclusion: The persisting result after 60 months indicates that this operation method could be recommended in patients with chronic lateral instability of the ankle without disturbing the range of movement.

Acute compartment syndrome—results of treatments by fasciotomy

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This study describes the results of wound closure on the third day following treatment of acute compartment syndrome (ACS) by fasciotomy.

Methods: The clinical diagnosis of ACS was confirmed by measuring intramuscular pressure (IMP) in 10 patients (5 arms and 5 legs) with a mean age of 31 (17–71) years. On the third day following fasciotomy, intramuscular pressure was recorded with the "meniscus method" (modified injection technique) in appropriate compartments before, during and after secondary wound closure by wire sutures. IMP was not allowed to exceed 35 mmHg in the underlying compartment during wound closure. All patients were followed-up for 3.5 (1.5–10) years.

Results: At follow-up none of the patients had neuro-muscular dysfunction indicating residual symptoms from ischemic injury. It was possible to close the wound on the third or fourth day in all but one patient, who required a 2-step closure on the third and fifth days. IMP increased from values between 7 and 12 mmHg before closure to values between 6 and 35 mmHg after secondary suture.

Conclusion: Secondary wound closure by wire sutures on the third or fourth day following acute fasciotomy is a safe method of treatment, if IMP is not allowed to exceed 35 mmHg. By this method skin transplantation was not necessary in any of the patients treated for ACS.

Consequences of major amputation A study of amputations in Malmö 1989–1990 followed one year postoperatively

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Introduction: All first time major amputations in Malmö during 1989–1990 were reexamined one year postoperatively. The mean age of the men was 74±9 (51–94) years and of the women 79±10 (46–99) years. The mortality within one year was 46% in men and 44% in women.

Material and method: 36 men and 43 women were alive one year postoperatively. They were examined and compared with the deceased patients.

Results: The patients alive had significantly more minor amputations previously and were younger compared with those not alive. Men alive were more often living in their own homes at the time of the major amputation and the women alive had more often unchanged mental status and more often BKA as a major amputation compared with those not alive one year after the amputation. At the follow-up 67% of the men and 58% of the women initially were amputated below the knee. 67% of the men and 44% of the women were living in their own homes but only 1/3 of the men were living alone at the follow-up compared with 3/4 of the women. About half of the patients needed home aid at least every day and 2/3 could not walk by themselves at the follow-up. 75% of the men and 53% of the women had received a prosthesis but only half of them used it at the follow-up and only 1/2 of the men and 1/4 of the women could put on/off a prosthesis by themselves. 1/4 of the men and 1/3 of the women were bilaterally amputated.

Conclusion: Nearly half of all first time major amputation patients are deceased one year postoperatively and those alive often have great disabilities.

Varia

Degenerative changes after fractures of the scaphoid

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Method: 75 patients suffering from a fracture of the scaphoid in 1950–1959, were invited to a follow-up study on an average of 36 years later. 60 patients were interviewed and 56 were re-examined and had radiograms taken of both hands. Their average age at time of fracture was 28 (15–48) years. All patients were treated with a scaphoid plaster not extending over the elbow joint.

Result: The non-union rate at follow-up was 10%. Dorsal intercalated segment instability (DISI) was found in 3 cases. All of these 3 patients had a pseudarthrosis and marked radiocarpal arthrosis. In healed fractures there was usually no development of radiocarpal arthrosis (2%), in the group with pseudarthrosis, however, this was far more common (55%). Cysts were found in 15% if there was a healed fracture and in 33% if there was a pseudarthrosis. It seems as if the degree of arthrosis is correlated to the amount of complaints, since there was a manifest radiocarpal arthrosis only in 6% of those who did not have any complaints at re-examination, compared with 43% in those who had complaints.

Conclusion: In this long-term follow-up study of fractures of the scaphoid we found that a pseudarthrosis in many cases will lead to a radiocarpal arthrosis. This in turn will increase the risk of future complaints.

Primary arthrosis of the hip and inheritance of strong trabecular bone

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Alterations in the quality of subchondral bone could have profound effect on the ability of articular cartilage to withstand compressive dynamic forces (Radin et al 1974). Roh et al (1974) found the distal end of the radius to have an increased bone mineral content in cases with arthrosis of the hip as compared with healthy controls. In this disease Lindberg (1986) demonstrated a certain degree of hereditary etiology, and a reduced risk of hip fracture has been demonstrated in mothers of patients with coxarthrosis (Åström and Beertema 1992), indicating an increased trabecular bone density in these mothers.

Hypothesis: Children of patients with primary coxarthrosis have an increased bone mineral density (BMD) in the distal forearm.

Material: 51 children of patients operated with total hip replacement because of primary coxarthrosis. Mean age was 39 (35-61) years, and 26 were female. A control group consisted of 41 husbands and wives to these children. A normal material was based on the population of Linköping with age and sex specific means of BMDF.

Methods: Single photon densitometry was performed using a single photon densitometer ND 1100 on the non-dominant distal forearm of both observation and control groups. BMDF was expressed in per cent of the age and sex specific mean of BMDF in the Linköping normal material.

Results: The children of patients with arthrosis of the hip have a mean relative BMDF of 108.4% as compared to 103.3% for the control group ($p < 0.02$).

Conclusion: Through inheritance of strong trabecular bone, close kinship to patients with coxarthrosis may entail an increased risk of developing arthosis and a reduced risk of sustaining osteoporotic fractures.

Shoulder injuries and alcohol abuse

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The aim of this study was to analyse the prevalence of alcohol addicts in patients with shoulder injuries.

Material and method: In a prospective study 437 adult patients with various shoulder injuries sustained in Malmö in 1987 were reviewed. Patients registered at the Department of Alcoholic Diseases were considered alcoholic abusers.

Results: There were 279 patients with fractures of the proximal end of the humerus. 22 (8%) were alcoholic addicts and alcoholic abuse was more prevalent in patients with displaced fractures (11%). There were 71 patients with fractures of the clavicle and 21 (30%) were alcoholic addicts. Alcoholism was significantly more frequent in patients with fractures of the lateral end of the clavicle (48%). 17 patients had sustained fractures of the scapula and one was registered as an alcoholic addict. There were 51 primary glenohumeral dislocations and 7 (14%) of these patients were registered. One out of 19 patients with acromioclavicular dislocations was also registered as abuser.

Conclusion: Our results seem to indicate that alcoholic abuse is an important casual factor in some types of shoulder injuries.

Local failure and survival after surgical treatment of skeletal metastases to the extremities

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Introduction: The value of surgical treatment of skeletal metastases to the extremities has become more and more recognized. Presently, patients are being treated not only for pathologic fracture but also to alleviate pain and to prevent fracture. The aim of the present study was to assess the rate of local failure and survival, and the time spent at home outside of institutionalized care centers after surgical treatment of bone metastases.

Patients: During the period 1986–1988 patients were surgically treated for 103 bone metastases. The median age was 62 (20–85) years, 38% were males and 62% females. The median time between diagnosis of the primary tumor and treatment of the metastasis was 2 (0–31) years. The most common primary malignancies were cancers of the breast, 32% and kidney 19%. In 20% the skeletal metastasis preceded the diagnosis of the primary tumor. The femur was involved in 62% of the cases and the humerus in 25%. Pathologic fractures had occurred in 52% and were especially common in breast cancer patients. Treatment modalities included internal fixation, with 36% or without 21% acrylic cementation, prosthetic replacement 24%, or resection without reconstruction 11%.

Results: The local failure rate was 13%. Local failures were more frequent in kidney cancer 28% and after osteosynthesis without cementation 25%. Regarding survival, 76% survived 3 months, 39% one year and only 20% 2 years. Cox regression analysis showed that pathologic fracture and non-skeletal metastases were negative prognostic factors for survival. Patients with kidney cancer had the longest survival time, 68% being alive after one year. Regarding rehabilitation, 24% of the patients never left the hospital and only 38% spent more than 6 months at home.

Conclusion: The present study shows that the local failure rate was relatively low with either prosthetic replacement or osteosynthesis and cementation. However, patients with kidney cancer, running a higher risk of local failure and with a longer life expectancy, warrant radical local surgery. The short life expectancy and the brief time actually spent at home may call in question prophylactic surgical treatment of patients with bone metastases without fracture.