# Danish Orthopedic Society

## Copenhagen, October 27–28, 1995

**Editor: Erik Tøndevold**
Department of Orthopedic Surgery
Copenhagen University Hospital
Blegdamsvej 9, 2100 Copenhagen Ø
Denmark

## Hip

### The evaluation of suspected hip fractures—presentation of an algorithm

*Thomas K Poulsen, Peter A Frandsen, Niels Egund*

Odense University Hospital, Department of Orthopaedics and Department of Radiology, Odense, Denmark

In the literature it is recommended, that patients suspected for a hip fracture with normal radiographs are evaluated by scintimetry, CT or MRI to reveal a possible occult hip fracture. We present a prospective study, of a systematic diagnostic approach (algorithm) evaluating patients suspected for a hip fracture.

*Patients and methods:* During 1994, an algorithm was applied to all patients suspected for a hip fracture. Patients with an earlier hip fracture, rheumatoid arthritis involving the hip or arthrosis were excluded.

*Results:* Radiographs revealed 394 hip fractures in 573 patients. The remaining 179 patients were examined for suspected high intracapsular hip pressure (SHIP), painful flexion and internal rotation. This was present in 31 patients, in which CT revealed 10 hip fractures and one patient with haemarthrosis without a fracture. However, subsequential MRI in this case showed a femoral neck fracture. Of 148 patients with normal radiographs and without SHIP, 116 patients were mobilized at home, whereas 32 needed some days in hospital because of other lesions. During 3 months follow-up, 3 patients without SHIP presented 2 femoral neck fractures and one trochanteric fracture, all nondisplaced.

*Conclusion:* Compared to earlier studies, the presented algorithm is a reliable diagnostic tool, minimazing the use of extensive diagnostic modalities.

### Results after femoral neck fracture operated a.m. Ullevaal

*Rikke Landmark, Benny Dahl, Poul Martin Gehrchen, Anne Marie Amtoft, Eidbjørg Davidsen and Jens Retpen*

Deptartments of Orthopaedic Surgery and Radiology, University Hospital, Rigshospitalet, Denmark

The purpose was to evaluate the results after introduction of Ullevaal screws in the department, for treatment of femoral neck fractures.

*Material and methods:* Patient records and radiographs of all patients operated on in the period from January 1992 to July 1994 were used. The first of July 1995 additional information of mortality and reoperations were collected. In all 187 patients were operated on (female/male = 138/49) with a median age on 82 (38–97) years. The median follow-up was 27 (12–42) months.

*Results:* 28% of the patients died within the first postoperative year. 43 (23%) patients were reoperated, 37 of them within the first year after primary osteosynthesis. Nine of the reoperated patients had a hemialloplatsy and 26 had a THA. Four patients had Girdlestone status and one had a refracture treated with dynamic hip screw. Three patients, only had the screws removed.

The radiographs showed preoperatively a dislocation of median 30% on the AP-projection and 20% on the lateral projection. The fracture angle was median 22° on the AP-projection. Nine of the reoperated patients primary suffered a comminuted calcar and 2 had a small fragment of the caput.

*Conclusion:* The frequency of reoperations after osteosynthesis a.m. Ullevaal corresponds with other types of implants.

### Cementless total hip replacement with the Bi-Metric hip prosthesis

*Kell Robertsen, Gerhardt Teichert, Otto Langhoff and Jes Erin-Madsen*

Department of Ortopaedics, Horsens Hospital, Horsens, Denmark

The purpose of this study was to evaluate the outcome of an operation with a cementless total hip prosthesis after six years.

*Patients and methods:* 39 primary hip arthroplasties in 35 patients were evaluated. They were all operated on with a cementless total Bi-Metric prosthesis. The mean age of the patients at the time of surgery was 63 (45–78) years for women and 58 (40–70) years for men. The indications for surgery were primary arthrosis in 30 hips, sequels of fracture in 4, and rheumatoid arthritis in one.

*Copyright* © Scandinavian University Press *1996. ISSN 0001–6470. Printed in Sweden – all rights reserved.*

The evaluation was performed according to Harris Hip Score (HHS) system. The radiographic assessment was made on unilateral antero-posterior and lateral radiographs.

The mean follow-up time was 6 (5.1–6.8) years.

*Results:* At the follow-up time two patients had been re-operated, one because of infection and one because of loosening of stem. Four patients had tenderness in the hip region on activity. The average HHS was 96 (75–100). the results was good or excellent (HHS 80–100) in 37 of 39 hips.

*Conclusion:* Very few patients had pain in the hip region. After six years the average HHS is still high.

## Hydroxyapatite coating of acetabular components does not increase heterotopic bone formation after total hip replacement

*Per Kjærsgaard-Andersen, Peter Revald, Kjeld Søballe, Ulf Lucht*

Department of Orthopaedic Surgery, Aarhus University Hospital, Aarhus, Denmark

*Aim:* To evaluate whether hydroxyapatite coating (HA) of acetabular components does increase the incidence and severity of heterotopic bone formation (HBF), after hip surgery.

*Materials and methods:* 39 patients who, in 1994, had inserted a hybrid total hip replacement (THR) with HA-coated acetabular component were matched on sex with 39 patients who had implanted a cemented THR during the same period. Eleven patients receiving NSAID or steroids were primarily excluded. Three cases were lost to follow-up. Radiographs taken three months after surgery were evaluated, and the HBF graded from 0 to III. Thirty-four patients had a hybrid prosthesis implanted, and 30 patients received a cemented acetabular component. Median age in the hybrid group was 53 (17–67) years, and in the cemented group 65 (35–80) years. P-values < 0.05 were considered significant.

*Results:* The table indicates the issue of HBF in the two groups.

| HBF | Cemented | Hybrid |
|---|---|---|
| Grade 0 | 16 (53%) | 14 (41%) |
| Grade I | 6 (20%) | 10 (29%) |
| Grade II | 4 (13%) | 5 (15%) |
| Grade III | 4 (13%) | 5 (15%) |

No significant differences were observed for the incidence or the severity of HBF between the two groups. In the cemented group males had a significant higher incidence of severe HBF (p=0.03). This difference could not been shown for the hybrid group.

*Conclusion:* Neither the incidence nor the severity of HBF after THR increases by using HAcoated acetabular components when compared with cemented acetabular components.

## A prospective study of 32 Porous-Coated Anatomical total hip replacements—seven years results

*Peter Revald, Per Kjærsgaard-Andersen, Ulf Lucht*

Århus University Hospital, Department of Orthopaedic Surgery, Århus, Denmark

*Aim:* To evaluate the clinical and roentgenographical results 7 years after insertion of 32 porous-coated anatomical (PCA) total hip prostheses.

*Materials and methods:* From August 1985 to May 1987, 32 consecutive PCA total hip prostheses were inserted in 31 patients, 21 women and 10 men. One woman had a bilateral operation. The median age at surgery was 53 years (21–65) years. The preoperative diagnoses were primary osteoarthrosis in 18 hips, sequelae after fracture at the proximal femur in five hips, avascular necrosis of the femoral head in four hips, and various diagnoses in five hips. Two patients died during the follow-up period. The Harris Hip Score (HHS) was used to evaluate the patients before surgery and at each visit. Roentgenograms were obtained first day after surgery, and at each follow-up. Data from 3-, 5- and 7-years follow-up were compared to data from the one-year follow-up. P-values < 0.05 were considered significant.

*Results:* Preoperatively, all patients had a poor Harris Hip Score (median 37: range 9–66). Seven years after surgery 82% had a good or excellent result (HHS>79). Preoperatively, all patients had moderate to severe pain in the hip. At 7-years follow-up 81% had none or only slightly pain in the hip. No dislocations or deep infections were recorded. During the observation period increasing roentgenographical changes were observed. In particular severe osteolysis, extensive wear of the polyethylene liner and radiolucent lines around the implanted components were observed. From five to seven years after surgery, the number of hips with significant osteolysis increased from 34% to 70%. Wear of the polyethylene liner up to 0.4 mm/year was recorded, and a strong correlation between osteolysis and polyethylene wear (p=0.003) was shown. Three patients had been revised, and further four patients has been scheduled for revision at the latest follow-up examination. Therefore 27% have been revised or have been scheduled for revision.

*Conclusion:* The overall results 7 years after surgery are worrying, and therefore we have stopped using the present PCA hip prosthesis. The strong correlation between the polyethylene wear and osteolysis confirms the problem with this type of prosthesis.

## Aseptisk loosening of Boneloc® cemented total hip prosthesis

*Morten Blomgren Andersen, Finn Andersen-Ranberg, Niels Wedderkop, Niels Bang Termansen*

Department of Orthopaedic Surgery, Svendborg Hospital, Denmark

The aim of the investigation was to estimate:

- the frequency of loose total hip prosthesis (THP) cemented with Boneloc 2 years after surgery.
- the need for follow up examinations for more than 2 years
- the survival time for Boneloc cemented THP

*Materials and methods:* From February 1992 to May 1993 147 THP were done at Department of Orthopaedic Surgery at Svendborg Hospital. Boneloc cement was used in 108 patients and PALACOS cement with gentamicin was used in 39 patients with increased risk of infection. The patients were seen 10 weeks, 6 months and 2 years postoperatively.

*Results:* 22% (24/108) of THP cemented with BONELOC were definitely loose radiologically after 2 years and 9.5% (11/108) were possibly loose. 1 (1/39) THP cemented with Palacos with gentamicin was definitely radiologically loose and none was possibly loose. At the end of the period (time of observation 24–39 month) clinical failure had occured (indication for reoperation because of pain and radiologically loose prosthesis) in 26 prosthesis cemented with Boneloc. 19 of these have been reoperated, 2 could not undergo surgery because of medical contraindications, 1 had died, 1 waited for reoperation and 3 had not accepted reoperation. There were no clinical failures of prosthesis cemented with Palacos with gentamicin. The median for clinical failure was 22 month and the first clinical failure was seen after 9 month.

*Conclusion:* The risk of radiological loosening of THP cemented with Boneloc was found to be increased about 8 times after 2 years compared with a contemporary risk group of patients operated with Palacos cement with gentamicin. It is recommended that patients with THP cemented with Boneloc are offered follow-up examinations for more than 2 years and are informed about the increased risk of loosening of the prosthesis.

## Boneloc® cemented total hip prostheses

*Lars P Møller, Søren Solgaard*

Department of Orthopaedics, Hillerød Hospital, Denmark

We report our early clinical and radiographic results with Boneloc® cemented femoral components.

*Materials and methods:* Between January 1991 and June 1993 we used Boneloc® cement for 174 total hip replacements in 169 patients, 121 Bimetric® and 53 Taperloc® femoral components. The diagnoses were primary arthrosis in 147 cases, failed femoral neck fracture in 15, rheumatoid arthritis in 9 and others in 3 cases.

*Results:* 17 patients (18 hips) died during the follow-up period without known prosthetic loosening. Twenty-six femoral components have so far been revised for aseptic loosening, in 15 cases accompained by moderate or severe bone loss. Three more components await revision and 1 patient has refused revision. 113 hips at follow-up after 35 (24–53) months were available for clinical and radiographic evaluation. Thirteen patient were without hip pain and refused reexamination. Eighty-nine hips were without or with slight pain, mild or moderate pain occurred in 24 hips. The mean Harris Hip Score was 80 (34–100). Radiographically, 85 femoral components were stable, 17 components were definitely loose, 0 probably loose and 11 possibly loose (Harris 1982).

*Conclusion:* The early failure rate is remarkably high and often accompained with massive loss of bone stock, and patients with Boneloc® cemented components should be followed continually.

*Reference:* Harris WH, McCarthy JC, O'Neill DA. J Bone Joint Surg 1982, 64-A: 1063-67.

## Prolonged thromboprophylaxis with a low molecular weight heparin (FRAGMIN) after elective total hip arthroplasty—a placebo controlled study

*The Danish Prolonged Prophylaxis (DAPP) Study Group.*

*Aim:* To evaluate the efficacy and safety of prolonged thromboprophylaxis with a low molecular weight (LMW) heparin compared with placebo after total hip arthroplasty.

*Patients and methods:* The design was multicenter, randomized, double-blind, prospective, two-parallel group. Following 7±2 days on a standard prophylactic regimen of LMW heparin (Fragmin 5,000 units anti-Xa sc once daily starting 12 h before surgery) patients were randomized to a continuation of prophylaxis with Fragmin or to placebo injections (saline) for further 28±2 days. At the end of the study (day 35±2) all patients had a bilateral phlebography. Bleeding complications and other adverse events were registered.

*Results:* 300 consecutive patients accepted to participate before operation and 281 patients were finally randomized. 216 patients completed the study. Two patients died before randomization. 17 patients developed deep venous thrombosis (DVT), no patient developed pulmonary embolism. 5 of 113 patients in the Fragmin group developed DVT compared with 12 of 103 in the placebo group ($p<0.05$). Proximal DVT was diagnosed in 1 case in the Fragmin group and in 5 in the placebo group. Serious bleeding complications and adverse events were equally distributed in the groups.

*Conclusion:* Prolonged (35 days) thromboprophylaxis with LMW heparin is more effective than a standard regimen (7 days) without an increased risk of bleeding complications or other adverse events. Whether or not prolonged thromboprophylaxis improves the long term survival needs to be investigated in future prospective studies.

# Knee

## Non-operative treatment of isolated total ruptures of ACL

*Michael Scavenius, Klaus Bak, Stig Hansen, Keld Nørring, Kelt Hvitfeldt Jensen and Uffe Jørgensen*

Department of Orthopaedics, Copenhagen University Hospital in Gentofte, DK-2900

The vast majority of previous studies on conservative treatment of ACL-ruptures do not differ between isolated ruptures and those with associated lesions. We present a follow-up study exclusively on patients with isolated total ruptures with the purpose of demonstrating the long term clinical and activity consequences.

*Material and methods:* 70 patients with an arthroscopic/tomic verified isolated total ACL-rupture met the inclusion criteria:

A) No partial ruptures
B) No associated lesions
C) Age between 15 and 45
D) Diagnosis within 4 weeks posttraumatic
E) Min. 3 years of follow-up.

Impossibility of followup: 3 cases. Of the remaining 67, 25 until now underwent secondary ACL surgery equivalent to a failure rate of 37%, which leaves 42 patients for follow-up; 9 answered the questionnaire and 33 went through follow-up examination after a median of 7.1 (3.3–14.6) years including IKDC evaluation form, Lysholm- & Tegner score, ESKA score, furthermore clinical examination and "Stryker-Laxity-Test". Only the results of these 33 patients are listed below. Median age at trauma was 28 (15–45) years. Sex ratio 13 women/20 men. The following sports were most frequently responsible: soccer, handball and alpine skiing.

*Results:* We saw a decline in median Lysholmscore from 100 (90–100) pretraum. to 86 (42–100) at follow-up or differentiated from 33 excellent to 4 poor, 6 fair, 15 good and 8 excellent. Decrease in median Tegner values from from 7 (3–9) pretraum. to 5 (2–7) at follow-up. According to the ESSKA-classification, the number of "cutting-sports" performers declined from 24 to 2! At Lachmann-test 14 knees were assesed + instable, 4 ++ instable, whereas none showed +++ instability. The Stryker-measured AP-translocation were significantly higher in the injured knee -7.27 compared to the healthy -4.80. One-leg-jump: ACL-deficient/healthy knee: 0.81. 63% of the patients suffered from intermittent rest pain.

*Conclusion:* High failure rate of 37% with secondary surgery. Marked decrease in cutting activity. Moderate decline in Lysholm/Tegner score. Significant Stryker-stability values

## Isolated partial rupture of the anterior cruciate ligament

*Klaus Bak, Michael Scavenius, Stig Hansen, Keld Nørring, Keld Hvitfeldt Jensen and Uffe Jørgensen*

Department of Orthopaedics, Gentofte Hospital, University of Copenhagen, DK-2900 Hellerup, Denmark

*Introduction:* The majority of previous studies on partial ruptures of the anterior cruciate ligament (ACL) contain a relatively large proportion of patients that suffer associated intraarticular injury or collateral ligament tear that without doubt contributes to a decrease in knee function. We present a follow-up study of patients with acute, isolated, partial ruptures of the anterior cruciate ligament.

*Patients and methods:* 67 patients met the criteria for a follow-up study. Eleven patients dropped out due to a new knee injury or emigration. A further 6 patients underwent reconstruction of the ACL due to early progression to complete rupture. The remaining 50 patients were evaluated clinically after median 5.3 (2.0–12.7) years using the IKDC evaluation form, the Lysholm score, and the Tegner-score. 36 (72%) presented with hemarthrosis initially.

*Results:* Lysholm score dropped from median 100 (81–100) prior to injury to 86 (52–100) at follow-up. Tegner score dropped from median 7 (3–9) to 5 (2–10) at follow-up ($p=0.03$). The number of patients engaged in cutting sports dropped from 27 prior to injury to 8 at follow-up ($p<0.00005$). The majority of the knees (n=25) were clinically stable with the Lachmann test. AP-translation measured with Stryker was larger in the injured knee, mean 6.1 mm than on the contralateral healthy knee, mean 4.3 mm ($p=0.06$). A relative large number of patients complained of intermittent rest pain (n=27).

*Conclusion:* Most of the patients with an isolated, partial rupture of the ACL have an acceptable knee function and a stable knee after median 5 years. There is, however, a marked reduction in activity and a high frequency of rest pain.

## The effect of braces on knee extension force in patients with anterior cruciate ligament insufficiency

*Torsten Warming and Uffe Jørgensen*

Department of Orthopaedics, Gentofte Hospital, University of Copenhagen, Denmark

The purpose was to compare the effect of two different 4 point braces with a placebo brace on knee extension force in patients with unilateral ACL insufficiency.

*Method and material:* Knee extension force and work was tested in both legs in 11 patients (6 women and 5 men, mean age 28 (20-36) years) with unilateral ACL insufficiency was tested. Three braces were tested in a cross-over design.

1: Bledsoe 4-proshifter (supposed to produce an increased posterior force in the final phase of knee extension).

2: DonJoy 4-point brace (supposed to prevent anterior subluxation).

3: A placebo brace (without antero/posterior influence on the). Peak force and total work in extension was measured in

a Biodex isokinetic test machine at 60 and 180 degrees per min.

*Results*: No statistical difference was found between the DonJoy brace and placebo.

With the Bledsoe brace the total work at 60 degrees/min. was mean 743 W, in the unstable knees, which was significantly more than both the DonJoy (733 W) and the placebo brace (720 W). No difference in the stable knees.

At 180 degrees/minute the mean peak force measured in the stable knees was significantly greater with the Bledsoe (118 N) than with the DonJoy (114 N). However, no difference was found in the unstable knees. The individual mean side difference (stable minus unstable) was significantly greater with the Bledsoe (7.2 N) than with both DonJoy (1.9 N and placebo (4.1 N).

*Conclusion:* Isokinetic test of knee extension was influenced by the Bledsoe brace:

1. The ACL unstable leg could produce a higher total work at low speed.

2. The ACL stable leg could produce a greater peak force at fast speed.

The DonJoy brace did not influence this compared to a placbo brace.

## Correlation between the collagen composition in autografts and knee stability in ACL reconstructed patients

*Uffe Jørgensen, Jørgen Peter Haresjuk, Christian Roos Petersen and Thomas Lind*

Department of Orthopaedics, Gentofte Hospital, University of Copenhagen, Denmark

The purpose was to investigate a possible correlation between the collagen composition in autografts used for ACL reconstruction and graft strenght, late knee stability and function.

*Method and material:* ACL reconstruction with the iliotibial band (autograft) was performed in 17 patients (6 women and 11 men, mean age 24 years). An extra long graft was taken so the remaining part could be tested biomechanically and biochemically (prolin, Hydroxyllysin, lysin). Three years after the reconstruction knee stability and function was measured.

*Results:* A high graft prolin content was correlated to an increasing translation in the healthy knee (p=0.035). A low hydroxylysin content in the graft was correlated to an increasing activity level (p=0.03). No statistical significant correlation was found between the measured collagen composition and: 1) graft biomechanics, 2) stability in the reconstructed knee 3 years after.

*Conclusion:* Our findings indicates that the collagen composition in autograft is correlated to knee stabilty and function. Further investigations are needed to elucidate this area.

## Rotation of a patella-bone-tendon-bone graft influences biomechanics

*Therese Pulowska, Uffe Jørgensen, Thomas Lind og Peter Albrecht Olsen*

Department of Orthopaedics, Gentofte Hospital, University of Copenhagen, Denmark

The purpose was to investigate the influence of rotation on the biomechanical properties of a patella bone-tendon-bone (PBTB) grafts.

*Method and material:* 12 PBTB allografts (as used for ligament reconstruction) was tested in a material testing machine. Following preconditioning (5 N) pull-test's were performed at a speed of 50 cm/min. without and with increasing degrees of rotation (increments of 90 degree). Two graft's were tested repetetively without rotation.

*Results:* The stiffness of the grafts changed significantly with rotation.

Maximal stiffness was found at 90 degrees rotation (median incresase 31%), whereas a rotation of more than 360 degrees resulted in a significant decrease in stiffness.

*Conlusion:* In using a patella bone-tendon-bone graft the greatest stiffness is achived by a rotation of 90 degrees.

## Preoperative radiographic examination in patients suspected of menisceal tears

*Jesper Hvolris, Helge Vous Bonde & Michael Reinhold Jensen*

Department of Orthopaedic Surgery, Copenhagen University Hospital, Bispebjerg, Denmark

This study aimed to check, whether it is relevant to perform radiographic examination of a knee suspected of menisceal tears previous to artroscopic operation.

*Materials and methods:* Retrospective evaluation of 291 patients suspected of menisceal tears. All patients had had an radiographic examination previous to the arthroscopic operation. Radiologic and operative findings were compared while operative findings were regarded as definitive. Ordering to this correlation diagnostic sensitivity, specificity and accuracy were calculated.

*Results:* 64 of the 291 patients had pathologic radiographic findings. Arthroscopically 27 of these were confirmed. 227 patients were found without radiologic pathology. 171 of these presented intraarticular disorders at arthroscopy. The diagnostic specificity of the radiographic examination was 62/64 = 0.97 while the diagnostic accuracy was 27/64 = 0.42 and the diagnostic sensitivity was 56/227 = 0.25.

*Conclusion:* In this study we found high disagreement between diagnostic specificity and diagnostic accuracy ordering to the fact that 37 of 62 pathologic radiographic diagnoses were false. Nonpathologic radiographic findings do not exclude intraarticular pathology as the diagnostic sensitivity is only 0.25.

Prearthroscopic radiographic examination is not neces-

sary when menisceal tears are suspected, but has to be kept in mind as a supplemental examination.

## The effect of a total knee artroplasty (TKA) on the working ability for patients that were working preoperativly

*Michael Bo Nielsen, Per W.Kristensen, Martin Lamm, Henrik M Schrøder*

Department of Orthopaedics, Hillerød and Vejle Sygehus, Denmark

We wish to investigate the effect of a TKA in maintaining the working ability among patients that were working preoperatively.

*Materials and methods:* Multicenter-investigation with 14 danish hospitals. Between Feb. 1989 and Dec. 1990, 926 patients (1024 knees) were operated with the same TKA (AGC 2000). Patients were followed prospectivly with information of job situation preoperatively and 1 and 3 years postoperatively. Those patients registered as working preoperatively, were interviewed about type of job, reason for possible change of job or retirement, knee-stress work and about other diseases with a possible effect on working ability.

*Results :* 64 patients (6.9% of the total material) were registred as being working preoperatively. 4 patients died, 8 patients never answered in spite of several calls. 51 patients (62 knees) (6% of the total material) were included (mean age at the time of operation 57 (37–77) years).

1 year postoperatively 49 "knees" (79%) still were working. 3 years postoperatively 36 "knees" (58%) still were working. Every patient that returned to work postoperatively, returned to previous work. Among the 26 "knees" (21 patients) that retired from work, 10 (16%) mentioned the knee operation as the cause.

*Conclusion:* Three out of four patients that previous to TKA are working manage to return to the same job postoperatively. Only 16% find the knee-operation as the cause for their eventual retirement. TKA is, besides a pain relieving and function improving treatment, a socioeconomic good investment for patients who preoperatively are working.

## Screw fixation of titanium porous coated tibial components does not reduce the occurrence of aseptic loosening during the first postoperative years

*Henrik M Schrøder, Poul T. Nielsen, Else Berg Hansen, Søren Toksvig-Larsen, Leif Ryd, Kurt Rechnagel*

Department of Orthopaedics, Hillerød Hospital, Denmark

Biomechanical studies indicate, that screw fixation of a noncemented tibial component gives the best initial mechanical fixation, implying an enhanced osseous ingrowth and a reduction of later aseptic loosening. We have investigated clinical and radiographic differences between using and not using screw fixation.

*Materials and methods:* In Hillerød, the noncemented AGC 2000 total knee arthroplasty has been used since March 1984. The clinical occurrence of tibial aseptic loosening was estimated by going through all medical records for the periods March 1984–1987, where the molded, non-screw fixated model was used, and 1990–1993, where the modular, screw fixated model was used. The femoral component remained the same. The observation period was > 1 year for all knees. The radiographic evaluation was done using radiostereometric analysis (RSA) 1, 3 and 5 years postoperatively.

*Results:* 6 molded tibial components had been removed from 190 consecutive TKA's due to aseptic loosening; four within the first year and two 1-2 years after surgery. 5 of 231 screw fixated components had been removed, four after 2–3 years and one 3–4 years after surgery.

RSA showed no differences in migration up to 5 years postoperatively.

*Conclusion:* Clinical and radiographic examination revealed no differences regarding fixation between the non-screw fixated molded tibial component and the screw fixated modular component. As modularity implies a potentially larger risk of wear debris, the use of the modular component should be evaluated carefully in noncomplicated primary TKA.

## Immunosuppression after cemented total knee arthroplasty

*Claus Munk Jensen, Micael Haugegaard, Birgit Paaske, Carsten Tørholm and Hans Jørgen Nielsen*

Department of Orthopaedics, Gentofte Hospital, Denmark, and Department of Surgical Gastroenterology Hvidovre Hospital, Denmark

Much recent evidence has accumulated to suggest that cell-mediated immunity is suppressed after major abdominal surgical procedures.

The aim of this study was to examine whether the same suppression could be found after cemented total knee arthroplasty and whether a possible effect of H2-receptor antagonist (Ranitidine) was present.

*Material and methods:* A skin test system device capable of simultaneous application of seven delayed-type hypersensitivity antigens was used. The skin tests were applied preoperatively and postoperatively on day 3 and 7. All test were read 24 hours after application.

28 patients who underwent cemented total knee arthroplasty surgery were included and randomized to ± Ranitidine for a total of 7 days postoperatively. 9 patients were excluded (2 anergy reactions, 9 medical interactions with Ranitidine).

*Results:* 8 patients were treated with Ranitidine, and 11 patients were controls. In both groups the skin test responses fell postoperatively and increased again on day 7( vaccinisation effect). None of these changes were significant. There

was no significant difference between the 2 groups +/- Ranitidine Mann-Whitney).

*Conclusion:* The shown suppression of immunoresponse after TKA is less manifest than earlier shown after major abdominal surgery with same design of study. In contradiction to what was found in abdominal surgery we found no immunomodulating effect of H2-antagonists. This can be explained by the difference in surgical trauma. The immunosystem is suppressed by the release of endotoxines in the abdominal surgery and this suppression can be influenced by H2-antagonists.

In TKA with the use of tourniquet there is no release of endotoxines and the immunosuppression must be explained partly by the ischemia/reperfusion trauma. On this trauma the H2-antagonist seems to have no effect.

# Shoulder/arm

## Primary repair after traumatic anterior dislocation of the shoulder joint

*BW Jakobsen, JO Sojbjerg*

Danish Society for Shoulder and Elbow Surgery, Denmark

Traumatic anterior shoulder dislocation is associated with a lesion of the anterior capsule with or without detachment of the labrum from the anterior rim of the glenoid. Baker (1990) diagnosed by arthroscopy a complete detachment of the labrum and the capsule in 62% after acute traumatic dislocation and 24% had a partial lesion. Most authors have reported unacceptably high redislocation rates, between 37 and 66% in young persons. Arciero (1995) had 85% recurrence with nonoperative treatment and 3 of 33 patients treated with primary repair using bioabsorbable tacks had recurrent dislocation.

To address this problem a randomized prospective study was done in The Danish Society for Shoulder and Elbow Surgery comparing nonoperative treatment and open primary repair. 76 consecutive patients, aged 15–39 years had an arthroscopy and if an anterior capsular lesion was found, the patient was included. Median age was 22 years. 80% had a complete anterior labral and capsular detachment, 13% had a partial labral tear. 39 were treated nonoperatively, and 37 had an open primary repair. All had a sling for 1 week, and the patient was encouraged to do exercises without external rotation, lifting or pushing. After 3 weeks, physiotherapy was started with internal rotation and elevation. No complications were recorded.

At 2-year follow-up, 16 patients have suffered recurrent dislocation, 15 had nonoperative treatment. The recurrence rate was 3% in patients treated with primary repair (Table).

**Table.**

| | Conservative | Repair | P-value[a] |
|---|---|---|---|
| Recurrence | 15 (41%) | 1 (3%) | 0.005 |
| Constant's score positive[b] | 95 (75–100) | 98 (69–100) | NS |
| Apprehension test | 37% | 7% | 0.01 |
| Load & shift test < grade 1 | 67% | 96% | 0.02 |

[a]Pearsons test; NS: not significant. [b]Median (range). Constant score, apprehension test and load & shift test were not recorded in the cause of recurrence.

*References*

Baker CL, Uribe JW, Whitman C. Arthroscopic evaluation of cute initial anterior shoulder dislocations. Am J Sportmed 1990;18:25-28.

Arciero RA. Arthroscopic Stabilization of First Time Anterior Dislocations with Absorbable Tack. AANA, Speciality Day Meeting, Orland 1995.

## Open anterior capsulolabral reconstruction with the rotator interval procedure

*Suder P A, Hougaard K and Nielsen K*

Orthopaedic Department, Randers General Hospital, Denmark

Open anterior approach of the shoulder joint is normally done with a deltopectoral splitting-procedure with transsection of the subscapularis tendon. The transsection of the subscapularis tendon might increase the risk of axillary nerve injury and prolong the rehabilitation periode.

*Aim:* The aim of the study was to introduce a new surgical procedure in open anterior capsulolabral repair of the shoulder joint.

*Method:* The standard deltopectoral approach through the skin was used primarily. After osteotomy of the coracoid process opening of the shoulder joint was performed through the rotator interval between the subscapularis and supraspinatus tendon, allowing a sufficient view of the anterior part of the shoulder joint and avoiding a transsection of the subscapularis tendon.

*Results:* Thirteen patients were operated with the rotator interval procedure by the same shoulder surgeon. Twelve patients had a complete anterior capsulolabral detachment between one to three o'clock or one to five o'clock. The last patient had had an earlier unsuccessful arthroscopic repair of a SLAP IV lesion. The capsulolabral detachments were reattached successfully with the Mitek Anchor System using between two to five anchors. Average time of operation was 60 (55–90) min and no peroperative complications, especially neurovascular lesions were observed.

*Conclusion:* The rotator interval procedure was an alternative approach in connection with open anterior capsulolabral repair. The procedure allowed a good view of the anterior part of the shoulder joint and admitted the use of the Mitek Anchor System. The approach reduced the risk of peroperative lesion of the axillary nerve.

## Self-training versus physiotherapist guided rehabilitation after arthroscopic subacromial decompression—a prospective randomized study

*Niels Holmark Andersen, Hans Viggo Johannsen and Otto Sneppen*

Shoulder and Elbow Clinic. Department of Orthopaedics, University Hospital of Aarhus, Denmark

The aim of the study was to compare the results of a patient administered self-training program with physioterapist guided rehabilitation after arthroscopic subacromial decompression for Neer stage II impingement.

*Material and methods:* Design; prospective randomized study. The patients were randomized peroperatively to self-training (Group 1) or physiotherapy (Group 2). A written, detailed patient instruction on rehabilitation guidelines was given to all patients. Functional outcome was assessed by means of the Constant Score. For statistical analyses the Wilcoxon Rank-sum test was used (significance level $p<0.05$). Results were evaluated 3 and 6 months postoperatively. During a 12 months period 44 patients were included; average age 47 (29–64) years.

*Results:* Five patients were excluded from the study leaving 39 patients available for follow-up; 19 patients in group 1 and 20 patients in group 2. For Group 1 the Constant Score improved from a preoperative mean of 52 (26–75) to 74 (32–94) 6 months postoperatively. For Group 2 the Constant Score improved from 53 (20–90) preoperatively to a mean of 74 (32–96) 6 months postoperatively. The patients in Group 1 returned to work on average 8.5 (1–14) weeks after surgery, and patients in Group 2 after an average of 8 (3–13) weeks.

*Conclusion:* We found no differences in the short term results between the two rehabilitation methods after arthroscopic subacromial decompression. The routine use of physiotherapist guided rehabilitation after arthroscopic subacromial decompression is not necessary.

## Posterolateral elbow joint instability—a sequelae to traumatic dislocation of the elbow

*Bo Sanderhoff Olsen and Jens Ole Søjbjerg*

Biomech. Lab. and Shoulder-Elbow Clinic, Orthopaedic dept. E, Aarhus University Hospital, Denmark

The object of the present study was to describe posterolateral elbow joint instability (PI) experimentally, clinically and surgically.

*Materials and methods:* 28 osteoligamentous elbow joints were included in a kinematic evaluation of PI before and after selective transactions of the lateral elbow ligaments. Then an isometric lateral collateral ligament (LCL) reconstruction was performed and tested kinematically. The specimens were tested with the clinical test for detection of PI, that includes forced external rotation (supination) and valgus applied to the forearm during passive elbow flexion/extension. Finally a typical case story was presented, followed by the presentation of a surgical method, based on the isometric LCL reconstruction, for re-stabilization of the elbow joint.

*Results:* Total transection of the lateral ligaments induces a valgus laxity of up to 80 at 800 of flexion. Selective lesions of the annular ligament (AL) and the lateral, ulnar collateral ligament (LUCL) causes no valgus laxity, but LCL transaction causes a valgus laxity of max. 40° at 90° flexion. Results are equal during rotation, though the laxity is larger.

Reconstruction of the LCL reconstructs the elbow joint stability.

Preop. the case presented recurrent subluxations of the radiohumeral joint and lateral elbow pain. Postop. the symptoms were cured and the patient now participate in elbow demanding sports without reporting any sequela.

*Conclusion:* PI was described experimentally, clinically and surgically. We have shown the LCL to be an important constraint for PI, and demonstrated valgus laxity after lesions only in the lateral ligaments. Further an isometric LCL reconstruction was described experimentally and clinically.

## Two years follow-up on elbow prosthesis a. m. Kudo

*Tom Ringstrøm Nielsen, Jens Ole Søjbjerg, Otto Sneppen*

Department of elbow and shoulder surgery, University Hospital of Aarhus, Denmark

A 2-year prospective follow-up on elbow prostheses a.m. Kudo.

*Material and methods:* 18 patients with rheumatoid arthritis, 14 women and 4 men, age ranging from 40 to 76 years (mean 60), were followed prospectively with a mean follow-up of 26.5 (13–37) months; after having a elbow prostheses a.m. Kudo. The patients have been scored before surgery, and after surgery seen with 1/2 to 1 years interval for scoring and clinical and radiographic control.

*Results:* Per- and postoperative complications were seen as one fracture of the medial epicondyle and one larger hematoma. Afterwards there were three cases of ulnar neuropathy and in one case articular adherence, which made reoperation necessary. One prostheses were revised because of infection and loosening of the ulnar component. Mean score preoperatively was 39 (16–51) points. At the latest control all patients had good clinical function with no signs of instability, mean score was 87 (61–100) points with the most improvements on parameters of pain and function.

Radiographically, none of the prostheses, except the revised, has showed any signs of loosening.

*Conclusion:* On the basis of a two years follow-up , elbow prostheses a.m. Kudo seems to be an alternative to other elbow prostheses. It is, however, necessary with a longer follow-up period before any conclusions can be made.

# Hand surgery

## Three or five weeks immobilisation of Colle's fracture, Older type 1 and 2

*Frederik Vang Hansen, Henrik Staunstrup, Søren Mikkelsen*

Department of Orthopaedics, Silkeborg Centralsygehus, Denmark

*Purpose:* The purpose was to evaluate the results of Colle's fracture, Older type I and 2, immobilised for either three or five weeks.

*Material and methods:* 100 patients with Colle's fracture, Older type I or 2, were randomised in two groups. One group was treated for three weeks and the other for five weeks. Both groups were immobilised in a short dorsal plaster cast. Radiographic evaluation was carried out after 10 days and after the end of immobilisation. At the follow-up examination one year later, another radiographic evaluation was carried out.

*Results:* Six type 2 fractures had dislocated within ten days and were excluded from the study. After one year, it was possible to examine 73 patients with 74 fractures. 23 type 1 and 14 type 2 fractures had been immobilised for three weeks. 21 type 1 and 16 type 2 fractures had been immobilised for five weeks. None of the fractures in the two groups had dislocated. When the two groups were compared, there was no significant difference in age, pain, range of motion, gripscore and radiographic appearance.

*Conclusion:* Three weeks of immobilisation should be sufficient treatment of Colle's fracture, Older type 1 and 2.

## External fixation versus conservative treatment of distal radius fracture Older type 3 and 4

*Thorbjørn G. Christiansen, Ole M Christensen, Michael Krasheninnikoff, Bjørn Lind, Lisbet R Hölmich, Frank F Hansen and Gulla S Jensen*

Herlev Hospital, Orthopaedic department T and Glostrup Hospital, Orthopaedic department A, Denmark

In the period May 1990 until February 1993, a prospective study was performed showing the results of treatment with external fixation versus conservative treatment of distal radius fracture Older type 3 and 4.

At Glostrup Hospital the patients were treated conservatively and at Herlev Hospital they were treated with external fixation a.m. Hoffmann.

All patients were evaluated by Gartland and Werley's scorings system after 3 and 9 months. Radiographic control was performed after reducing, on day 10, after 5 weeks and after 3 months. Radiographic examination of the undamaged wrist was performed for comparison. 27 patients were treated conservatively and 16 with external fixation. The 2 groups were comparable concerning sex, age and type of Older. There was significantly better function and less pain in the group of the external fixation after 3 and 9 months. At the 3-month control, the score for conservative/external group was 16 (4–26) and 10.4 (4–19), respectively and at the 9-month control 11.3 (1–26) and 5.7 (0–13), respectively. This corresponds to a fair result in the conservatively treated group and a good result in the group treated with external fixation. Radiographically the portion of the fracture was better in the external fixated group. The dorsal angular deviation after reduction was 15.3° (-30° to -5°) and -6.6° (-22° to + 3°), respectively. There was no significant difference concerning the radial angular or shortness after the reduction. The radial angular deviation was significantly increased in the period of strapping in the conservatively treated group.

Our conclusion is that distal dislocated radius fracture Older type 3 and 4 show better functional results when treated with external fixation than treated conservatively.

# Spine

## Is retrograde ejaculation a complication after anterior lumbo-sacral spine fusion?

*Finn Bjarke Christensen and Cody Erik Bünger*

Spine Section, Department of Orthopaedics E., University Hospital of Aarhus, Dennark

Some authors reported in the sixties and seventies concern about the complication of impotence and sterility in patients, who have had anterior low lumbar spine fusion. These complications have for years deterred many surgeons from using the anterior approach. Anterior fusion tecniques are gaining increased popularity secondary to new methods and in particular the cage techniques. The frequency of male genital dysfunction with retroperitoneal dissection has not been settled.

*Materials*: From 1979–1988 the department carried out 132 anterior lumbar spondylodesis operations. 56 were male patients. Two male patients died postoperatively from pulmonary tromboembolic complications and two died within the next years of nonrelated reasons. Two patients had immigrated to another country. The study-base is 50 male patients.

*Methods:* The study contains a 6–13 year postoperative questionnaire specially designed to analyse the complication with male genital dysfunction. The investigation also contains a retrospective part based on patient records as well as a postoperative follow-up by use of a questionnaire (Dallas Pain Questionnaire (DPQ)).

*Results:* From a total of 50 patients, 41 patients (82%) returned the Questionnaire. 2 patients claimed that they have had permanent retrograde ejaculation since the anterior fusion. 1 patient had a stop of ejaculation for 6 months and thereafter a volume reduction of 50%. The DPQ showed no negative effect of retrograde ejaculation in relation to functional outcome.

*Conclusion:* This study demonstrates, that male genital dysfunction was seen as a complication to anterior spine fusion in at least 6% of the cases. We found no tendency for poorer total functional outcome (DPQ) for patients with retrograde ejaculation.

## Posterolateral lumbar or lumbosacral spondylodesis with or without a rigid pedicle-screw fixation system

*Karsten Thomsen, Cody Bünger, Finn B Christensen, Søren Eiskjær, Søren Fruensgaard and Ebbe S Hansen.*

Spine section, Department of Orthopaedics, University Hospital of Aarhus, Aarhus, Denmark

A short lumbar and lumbosacral fusion is an established treatment in severe chronic low back pain patients. The surgical approach in posterolateral, intertransverse spondylodesis allows neural decompression, and this operation can be performed both with and without a rigid pedicle-screw fixation system. If the possible higher fusion rates using an instrumentation system is counterbalanced by higher complications rates and thereby altering the general outcome is not known from the litterature.

*Materials:* In a prospective design and after informed consent randomisation to operation either with (Cotrel-Dubousset) (n=63) or without (n=66) instrumentation was performed from November 1992 through December 1994 in this type of patients.

*Results:* (Status August 1995) Complication rates: No differences in minor general and no major general complications in the two groups. 4.8% (3 patients) suffered from misplaced pedicle screws. The functional outcome (Dallas Pain Qestionnaire) significantly improved in both groups at one year with no differences between the groups.

*Conclusion:* Pedicle screw fixation in posterolateral lumbar fusion does not influence the general complication rates, but a significant risk of nerve root entrapment from misplaced screws was noted. A short lumbar fusion significantly improves the functional status at one year.

## Stress analyses of a lumbar disc-body unit—the basic FEM principle and time saving modelling

*Christian Wong, Finn Bojsen-Møller*

Anatomical Institute, University of Copenhagen, Blegdamsvej 3, 2200 Copenhagen N, Denmark

The purpose was to simplify the process of Finite Element Method of the lumbar Disc-body unit. To examine this hypothesis a model of the disc-body with linear material properties and simple cross-sectional geometry has been built, whereas earlier works (1) have used non-linear material properties and exact geometry. The model was correlated to the results of Shirazi-Adl et al. (1).

*Materials and methods:* This model was built and analysed in COSMOSM. It consisted of 113 8-node axisymmetric elements with 380 nodes. Young's moduli and Poissons ratios for cortical bone were 12000 MPa and 0.3, and for trabecular bone 100 MPa and 0.2, and for annulus x, y, and z, were 46.1, 5, and 5 MPa and 0.75, and nucleus was incompressible. The model was considered axisymmetric and was loaded with a uniform deformation with a maximal force of 3000 N.

*Data:*

| Stress ($\delta_z$-MPa) | Outer layer | Middle layer | Inner layer | %-dev. for stress Outer | Middle | Inner |
|---|---|---|---|---|---|---|
| Annulus (Ref.[a]) | | | | | | |
| 1.38 mm | –0.93 | –2.26 | –2.9 | | | |
| 4.13 mm | –2.43 | –2.53 | –2.46 | | | |
| Annulus (own values) | | | | | | |
| 1.38 mm | –0.88 | –2.00 | –2.91 | 5.6 | 11.7 | 0.4 |
| 4.13 mm | –1.88 | –1.61 | –2.41 | 26.0 | 36.4 | 2.0 |
| Cortical (Ref.[a]–own) | 11.25 | 12.01 | | | 6.8 | |

[a]Shirazi-Adl et al. 1984.

*Conclusion:* Analysis of a simple geomtric model with linear material properties gives adequate results in stress values for the nucleus and cortical bone compared with the non-linear and geometrical exact model.

*References:* 1. Shirazi-Adl et al. Stress analysis of the lumbar disc-body unit in compression. Spine 1984; 9 (2).

# Tumor

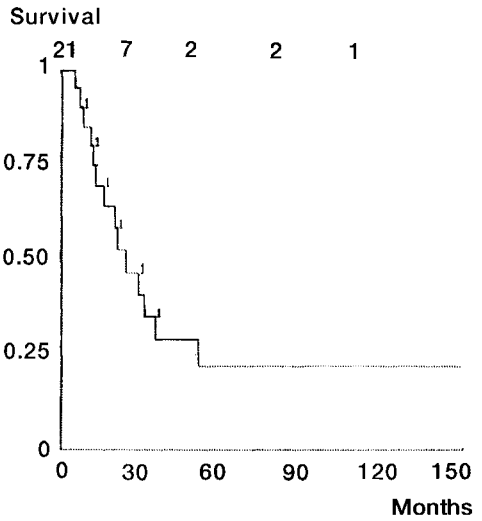
## Extraskeletal osteosarcoma

*Bente Schumacher, Johnny Keller, Ole Steen Nielsen, Olaf Myhre Jensen*

Centre for Bone and Soft Tissue Sarcomas, University Hospital of Aarhus, Denmark

Extraskeletal osteosarcoma is a rare malignant tumor. The turnor is characterized by the production of malignant osteoid localized in the soft tissue without relation to bone or periosteum. In the present study our experience with extraskeletal osteosarcoma was anaiyzed.

*Material:* In the period 1969–1994, 22 patients (12 women and 10 men) with extraskeletal osteosarcoma were treated at the Centre for Bone and Soft Tissue tumors in Aarhus, Denmark. Median age was 63 (35–82) years. First operation was performed median 4 (1–36) months after the patients first experience of symptoms. The major part of the tumors were localized in one of the extremities (thigh 12, shoulder/arm 7) and 3 tumors in the head, the neck or the trunk. In all cases a normal radiograph of the lungs were found before operation. All but one tumor were histologic highly malignant.




*Results:* One patient was treated only with radiotherapy because of poor general condition. 21 patients were treated with excision. Six operations were supplied by radiotherapy (4 patients) and/or chemoterapy (3 patients). Of the 21 operated patients 17 patients demonstrated local recurrence or metastasis within median 8 month (2-24) after removal of the tumor; of this 14 of the patients had metastasis to the lungs and 8 patients local recurrence.

*Discussion:* Extraskeletal osteosarcoma is a highly malignant soft tissue tumor which seems to behave quite differently from other soft tissue sarcoma. Our results show a five year survival rate at about 23 per cent whereas other soft tissue sarcoma has a five year survival rate up to 60 per cent.

## Subscapular elastofibroma—reactive pseudotumor

*Tom Nielsen[1], Otto Sneppen[1], Olaf Myhre-Jensen[1], Søren Daugaard[2], Jens Norbæk[2]*

[1]The Shoulder and Elbow Clinic, University Hospital of Aarhus and [2]the Centres for Bone and Soft Tissue Tumors, University Hospital of Aarhus and State University Hospital of Copenhagen

Six cases of elastofibroma located in the subscapular region are reported. The age of the patients ranges from 45 to 71 years (mean 59.5). In three cases the symptoms were posterior shoulder pain with arm motion, and one of these also had a snapping scapula. Two cases had tumor prominence as the only symptom and in one case the tumor was found accidentially during thoracotomy. At MRI a non encapsulated soft tissue mass closely related to the thoracic wall and elevating the scapula was identified. At surgery the tumor was densely adherent to the periosteum of the ribs and the external fascia of the rib cage and periferially it processes into the loose connective tissue of the subscapular space. Local excision was performed. At follow-up 1-8 years after surgery no recurrence was observed and all patients with painful lesions had complete relief of pain.

## Resection endoprostheses in metastatic tumors in bone

*Barbara Kulinsky, John Gregor Petersen, Bjarne Lund*

Department of Orthopaedics, Rigshospital, Copenhagen, Denmark

Resection endoprosthesis in metastatic tumours in bone with relationship to joints is mainly a palliative treatment with the intention to improve the quality of life. This study evaluates the response to the treatment by painreduction, mobility and survival.

*Patients and methods:* This retrospective study includes 20 patients with metastatic tumours in the lower extremity. 85% were localised in the proximal femur, 5% in the distal femur and 10% in the proximal tibia. All patients got a resection endoprosthesis. The diagnose was based on radiography, scintigraphy and biopsy. The primary malignancy was c. mammae (45%), hypernephroma (20%), c. pulm. (10%), myelomatosis (10%), melanoma (5%), c. prost. (5%) and adenocarcinoma, untyped (5%). Female preponderance was 3:1. The average age was 59 (40–79) years. The response to treatment was evaluated by pain reduction, mobility and survival. Pain was evaluated by the patient, the surgeon evaluated the mobility 3 months after surgery as the walking ability with or without a cane.

*Results:* In 85% of the patients the pain was reduced. 11 patients were painfree, 6 had occasional pain and one had pain all the time. 14 patients regained mobility, 5 patients without a cane. One woman got a resection prosthesis in the distal femur and could walk normally for one year. After one year the entire femur was replaced because of a pathological fracture in the proximal femur. After surgery she walked with two crutches. 4 patients walked with one crutch, 4 patients walked with 2 crutches. About two patients we lack information, because they were dismissed after surgery to local hospitals.

*Survival:* 6 patients are alive. 3 patients died in the first month after surgery because of disseminated illness. The average survival for the other 17 patients is 24 (2–133) months.

*Conclusion:* Metastatic tumours in the bone of the lower extremity treated with a resection prosthesis is mainly palliative, but the treatment ensures pain reduction, mobility and an improved quality of life.

# Traumatology

## Interlocked nailing of humeral shaft fractures

*Niels OB Thomsen[1], Jan B Mikkelsen[3], Ralf N Svendsen[4], Niels Skovgaard[2], Claus H Jensen[4] and Uffe Jørgensen[1]*

Department of Orthopaedics[1] and Diagnostic Radiology[2], Gentofte Hospital, University of Copenhagen, Hellerup, Orthopaedic Department[3], Odense University Hospital, Odense and Department of Orthopaedics[4], Hvidovre Hospital, University of Copenhagen, Denmark.

The purpose of this study was to evaluate the long-term results for humeral shaft fractures operated on using the Seidel interlocking nail.

*Materials and methods:* Between 1989 and 1993 we treated 48 patients with humeral shaft fractures. There were 30 female and 18 male patients, with a median age of 67 (22–91) years. Indications for operative treatment were: 28 patients because of unsatisfactory position of the fracture, multiple injuries or jeopardized mobilisation, 12 patients with pseudarthrosis, and 8 patients with pathological fractures.

The length of follow-up ranged from 3 to 60 months (median 26 months).

Failure was defined as reoperation because of non-union.

*Results:* Fracture: There was an 11% (3/28) failure-rate. The mean Neer score was 83. Ten patients had impingement, which was related to protrusion of the nail. After healing of the fracture 3 patients had the nail removed because of impingement and 1 patient because of pain in the elbow.

Pseudarthrosis: There was a 42% (5/12) failure-rate, one patient had functional but not radiological healing.

Pathological fracture: All were free of pain and achieved a satisfactory functional result.

*Conclusion:* Humeral shaft fractures have been satisfactory treated with the Seidel nail and we emphasize the importance of countersinking the tip of the nail into the humeral head to avoid impingement. For treatment of pseudarthrosis the stability of the system seems to be inadequate. It does, however, seem to be an efficient treatment in patients with pathological fractures.

## Follow-up investigation of patients with fractures of the pelvis in a Danish county

*I L Kjær[1], J O Jansen[1], L Rotwitt[2], B H Hansen[3], L U Hansen[4] and K G Freund[1]*

Departments of Orthopaedic Surgery, Hospital in [1]Vejle, [2]Kolding, [3]Horsens and [4]Fredericia, Denmark

*Aim:* To study permanent injuries, social changes and disablement after pelvic fractures according to degree of trauma and type of fracture.

*Materials and methods:* A follow-up study of 628 patients admitted to hospital due to pelvic fracture in Vejle county in a ten year period (1983–1992). 410 patients were alive at the time of follow-up. 330 patients (179 women and 151 men) answered the questionnaire (82.3%). Average age was 54 (11–97) years. Follow-up time was on an average 6.5 (1.5–11.5) years. The mechanism of trauma was classified due to Alffram in moderate and severe trauma, while fractures were classified according to Peltier in stable and unstable fractures.

*Results:* Severe trauma occurred in 253 patients, of whom 146 had a stable fracture. Moderate trauma occurred in 77 patients, of whom 72 had a stable fracture. 20% of the patients stated change of work due to the trauma. 12% had totally left the labour market. Only 9% had been through work rehabilitation. Average absence from work was 0.9 years. Of those stating changes of work due to the trauma, 27% had been through work rehabilitation, 47% had totally left the labour market and average absence from work was 2.7 years. At the time of follow-up 39% still complained of pain from the pelvic region, 12% had constant pain and 13% used painkillers daily. 20% stated shortening of the leg, absent before the trauma. Average shortening was 1.44 (0.5-5.0) cm measured as the cm heelsupport inside or underneath the heel used daily. 26% complained of limping, 36% had reduced mobility of the hip and 10% had reduced walking distance due to the pelvic fracture. 25% complained of persistent parestesia, most common on the thigh (12%) and on the buttocks (10%). 25% complained of disturbances of urination, most common involuntary urination (15%) and cystitis (10%).

*Conclusion:* Patients with pelvic fractures are getting numerous permanent injuries. The more severe trauma and the more unstable fracture the higher degree of permanent injuries. There is a need for better information on these risks and bigger effort with rehabilitating and resocialising these patients.

## Early preoperative thromboprophylaxis with Klexane® in hip fracture surgery—a placebo controlled study

*Per Seest Jørgensen[1], Carsten Tørholm[1], Birgit Pedersen Paaske[1], Søren Wistisen Rasmussen[1], Steen Winther Christensen[1], Charlotte Strandberg[2], Kirsten Neergaard[2], Margit Mantoni[2], Hanne Thamsen[2] & Peer Wille-Jørgensen[3]*

Department of Orthopaedic Surgery[1] and Department of Radiology[2] at Gentofte Hospital and Center for Clinical Thrombosis Research[3] at department K., Bispebjerg Hospital, University of Copenhagen, Denmark

The aim of this study was to evaluate any possible benefit of early thromboprophylactic treatment in the prevention of deep vein thrombosis (DVT) in high risk hip fracture patients.

*Material:* Within 30 months 239 patients were included in a double-blind placebo controlled study. With the diagnosis hip fracture confirmed the patients received either 40 mg Enoxaparin s.c. or placebo continuing once daily until oper-

ation. Postoperatively, all patients recieved 40 mg Enoxaparin s.c. once daily until phlebography. Phlebography was first performed on the operated leg, and with no thrombosis detected, the other leg was investigated as well.

*Results:* The two groups did not differ in demographic aspects. Eighty-five patients were excluded. Eight died during the study period. The remaining 146 had ascending phlebography performed. 9/74 (12%) in the Klexane® and 15/72 (21%) in the placebo group developed DVT. Risk ratio 0.58 (95% confidence limits 0.271.25) p= 0.15 ($Chi^2$-test). There was no difference in perioperative bleeding or in transfusion requirements.

We conclude, that there is a trend towards better thromboprophylaxis with early treatment in hip fracture patients without any increase of bleeding complications.

# Epidemiology

## The lesions in two mass-accidents within three days

*Carsten Fladmose Madsen*

Department of Ortopaedics, Vejle Hospital, Vejle, Denmark

In summer 1995 two accidents with many people injured happened near to the county hospital in Vejle. The first accident happened when a banister on a stand at the footballstadium broke and many people fall down up to three meters. Two days later a crash between two trains resulted in even more injured people.

*Materials and methods:* Case records for all persons which was taken to the county hospital in Vejle was studied in order to describe the lesions.

*Results:* From the footballstadium 26 injured were taken to the hospital and from the traincrash 49 persons were admitted. The distribution of the lesions was as follows:

| | FOOTBALL STADIUM | TRAIN CRASH |
|---|---|---|
| THE HEAD | | |
| Commotio cerebri obs pro | 3 | 2 |
| Superficial lesions | 7 | 5 |
| Injuries to bone and teeth | | 3 |
| THE NECK | | |
| Edema of the larynx | 1 | |
| Fractures/luxations in the spine | | 2 |
| Contusions to the neck | 2 | |
| Distorsions to the spine | | 7 |
| THE TRUNCUS | | |
| Fractures in the lumbal spine | 2 | |
| Fractures in the thorax | | 3 |
| Superficial contusions | 4 | 2 |
| Lesions to intraabdominal organs | | 2 |
| UPPER EXTR. | | |
| Fractures | 3 | 2 |
| Superficial contusions | 3 | 4 |
| LOWER EXTR. | | |
| Fractures | 2 | 2 |
| Superficial lesions | 6 | 13 |
| OTHER | | |
| Unknown or not specified | | 2 |
| Observations without known lesions | | 7 |

*Conclusion:* The number of lesions were approximately the same in the two accidents when corrected for the total number of patients. The lesions from the traincrash were by far the worst, whereas the lesions from the footballstadium in general were more superficial. This might be explained by the fact that people were standing very close at the stadium and thus in the accident the first ones hid the ground and decreased the lesions to the other ones.

## The injury risk in down-hill skiing can be reduced by information about injury prevention on video

*Uffe Jørgensen, Tommy Fredensborg, Jørgen Peter Harazuk, Ditte Fredensborg*

Department of Orthopaedics, Gentofte Hospital, University of Copenhagen, Denmark

The purpose was to investigate the effect of a video on ski injury prevention.

*Method and material:* 926 randomly chosen skiers were randomised to see the video or not on the way to a one week skiing holiday in the alps. Injyry registration was performed on the way home by questionnarie. 763 skiers agreed to participate in the study (85%), 58% were men, 42% women, mean age 24.3 years.

*Results:* A total of 205 injuries were registered in 158 skiers. Knee injuries were most frequent (n=67). In the group that had been exposed to the video 16% were injured, whereas 23% were injured in the group without video ($p<0.05$). A 30% reduction of the injury frequency by the video. In the video group 86% had tested their release bindings, whereas only 60% did in the non-video group ($p<0.05$). The frequency of knee injuries were highest amongst those that did not test their bindings ($p<0.05$). Injuries to the 1. finger were more frequent in those who had their hand in the pole strap ($P<0.05$).

*Conclusion:* In danish downhill skiers it is possible to reduce the injury risk. Injury preventive information on video reduced the injury risk by 30%. Adequate setting of the release binding and skiing without the hand in the strap of the pole resulted in a significantly lower injury risk.

# Experimental orthopaedics

## Microbiology in bone banking and transplantation—is the number of developed cultures relevant?

*Henrik Husted and Morten Kramhøft*

Department of Orthopaedics, Hvidovre Hospital, Denmark

The aim of the study was to describe the bacteriology of the bone allografts, which were harvested for and transplanted from the bone bank at Hvidovre Hospital.

*Materials and methods:* The bone bank records were studied retrospectively from the start of the bone bank in april 1992 until the end of 1994 ensuring at least 6 months for possible manifestation of bacterial infection by the bone allograft.

Data of the donor were registered along with the date of bone-donation, the developed cultures from the procured bone and from the sterilized glass specimen jars used for storage, the data of the recipient—including whether or not bacterial infection had developed postoperatively, the micro-organism cultured and the subsequent treatment—and the cultures taken perioperatively under bone-transplantation.

*Results:* Of the 110 donated bone allografts, 10 were not used for transplantation, but only one allograft was discarded because of the development of a positive culture (staph. epidermidis). All cultures from the sterilized glass specimen jars were without microbiological growth. Three incidences of deep infection (once acinetobacter calcoaceficus and twice staph. aureus) followed the transplantation of 100 bone allografts in 58 patients at 62 operations.

*Conclusion:* The precautions and strict aseptic technique used, when bone allografts are harvested, ensure the procurement of non-contaminated bone in more than 99% of the donations. Culturing the already sterilized glass specimen jars seems unnecessary. The bone allograft per se was not contaminated and probably did not cause any infections. The rate of infection after transplantation of bone allograft is not higher than in other complicated surgery.

## Fixation of hydroxyapatite coated implants—porous versus blasted surface

*Søren Overgaard, Martin Lind, Ole Rahbek, Cody Bünger, Kjeld Søballe*

Biomechanics Lab., Department of Orthopaedics, University Hospital of Aarhus, Denmark

The purpose of this study was to compare porous and blasted surface texture for fixation of hydroxyapatite (HA)-coated implants in a gap model in trabecular bone.

*Materials and methods:* Non-loaded titanium alloy (Ti-6Al-4V) implants initially surrounded by a 1 mm gap, were inserted bilaterally into trabecular bone of the proximal humerus of 8 skeletally mature mongrel dogs. The surface texture of the implants were either porous coated or sand-blasted, and were further plasma-sprayed with HA. Mechanical fixation was evaluated by push-out test. Histomorphometry was determined on 3–5 serial cut vertical sections. Data are presented as mean values with standard error of mean (SEM) in brackets. Paired t-test was applied. $P<0.05$ was considered significant.

*Results:* Push-out tests of porous coated implants showed, that energy absorption was 616 (92) J/m$^2$ compared to 340 (33) for blasted implants ($p<0.05$). Shear stiffness of porous implants was reduced significantly by 32% : 18(2.6) MPa/mm vs 25 (2.5) MPa/mm. No difference in ultimate shear strength was found. Failures of porous implants occurred predominantly in the HA-tissue interface. In contrast, all blasted implants had areas with failure in the implant-ceramic coating interface. Bone ingrowth was 49 (3.2) % for porous coated implants, and 66 (4.0) % for blasted implants ($p<0.05$). Ingrowth of bone marrow and fibrous tissue did not differ significantly . Bone volume in the initial gap was 12 (0.9) and 14 (1.3) %, for porous and blasted implants, respectively (NS).

*Conclusion:* HA coated implants with plasma-sprayed porous surface texture were stronger fixated than blasted implants. A porous coated metal surface seems to be more suitable for application of plasma-sprayed ceramic coatings. Moreover, when the HA coating has resorbed, a porous surface will be superior to that of a blasted surface for maintaining of implant fixation.

## Transforming growth factor beta stimulates bone ongrowth to hydroxyapatite coated implants in dogs

*Martin Lind, Søren Overgaard, Kjeld Søballe, Cody Bünger*

Biomechanics Laboratory, Orthopaedic Hospital, University Hospital of Aarhus.

Hydroxyapatite (HA) coating is known to be a potent stimulator of bone ongrowth and to enhance mechanical fixation of implants. Growth factors and especially transforming growth factor ß3 (TGF-ß) has in numerous in vivo studies demonstrated stimulative effects on bone healing. The purpose of the present study was to investigate if rhTGF-ß1 adsorbed onto HA coated implants could stimulate bone ongrowth and mechanical fixation of unloaded implants inserted in trabecular bone in dogs.

*Materials and methods:* Cylindrical gritblasted titanium implants (6x10 mm) coated with HA ceramic were inserted unloaded into the proximal humerus of 20 skeletally mature labrador dogs. RhTGF-ß1 was adsorbed onto the ceramic coating prior to insertion by a time-controlled incubation in a rhTGF-ß1 containing solution. As a intraindividual control, each animal recieved two implants, one without growth factor and the other with rhTGF-ß1 adsorbed onto the HA ceramic. Two doses of rhTGF-ß1 were tested, 0,3 and 3.0 µg. There were 10 dogs in each concentration group. The dogs were sacrificed after 6 weeks. By histomorphometry, bone ongrowth and gap healing was measured. Push-out test

was performed to assess ultimate shear strength, shear stiffness and energy absorption on an Instron universal testing machine. All data are expressed as percentage of control. Mean values and SEM in brackets is shown.

*Results:* All dogs completed the study. Bone ongrowth was significantly increased in animals administered 0.3 µg rhTGF-ß1. (Table 1). Gap healing was increased insignificantly by 22% in the 0.3 µg rhTGF-ß1 group compared to the control group. Mechanical testing showed insignificantly increases in ultimate shear strength by 23%, shear stiffness by 9% and energy absorption by 41% in the same lower dose group. For the higher dose of 3.0 µg rhTGF-ß1, less effect of the evaluated parameters was observed (Table 1).

*Discussion and conclusion:* The present study demonstrated that rhTGF-ß1 is capable of increasing bone ongrowth to unloaded HA coated implants in skeletally mature dogs. Mechanical fixation of the implants was increased after 6 weeks observation but not to a significant level. The correct dose of growth factor is essential since higher doses of rhTGF-ß1 decreased the stimulatory response. These data are promising for future use of rhTGF-ß1 for stimulation of bony ingrowth in endoprosthetic surgery.

**Table 1.**

| Parameters | Control | rhTGF-ß1 (%) | |
|---|---|---|---|
| | Abs. values | 0.3 µg | 3.0 µg |
| Bone ongrowth | 36 (5.7) % | 136 (12) * | 98 (7) |
| Gap healing | 13 (2.1) % | 122 (11) | 95 (9) |
| Shear strength | 2.6 (0.4) MPa | 123 (15) | 112 (15) |
| Shear stiffness | 13.5 (1.9) MPa/mm | 109 (10) | 111 (20) |
| Energy absorp. | 366 (68) J/mm$^2$ | 141 (18) | 139 (28) |

* = $p < 0.05$

## Proteoglycanes in the cartilage of osteoarthrotic and osteonecrotic hips

*Elith Bjarne Olsen and Gunnar Schwarz Lausten*

Department of Orthopaedic U, Rigshospitalet. Copenhagen, Denmark

Uronic acid and hexosamin are the components of the repeating unit of all glycosaninoglycans with the exception of keratansulphate, in which galactose replaces the uronic acid moiety. Uronic acid is widely determined as representative of glycosaninoglycans in biological substances and can be used as markers for the content of proteoglycanes in the cartilage (Howell et al. 1986; Olsen et al. 1989).

As synovial fluid is considered to be the main source of nourishment of the joint cartilage, disturbances of the synovial membrane and the synovium might cause destruction of the cartilage, as in osteoarthrosis of the femoral head (OA). However, in nontraumatic osteonecrosis of the femoral head (ON), the synovial membrane and the synovial fluid are unaffected, and consequently, a normal content of proteoglycanes in the joint cartilage are expected in this disease.

*Material and methods:* We examined biopsies from weightbearing and non-weightbearing areas of the cartilage of acetabulum and femoral heads from each of 6 patients with OA and 6 patients with ON due for total hip replacement. The biopsies were immediately fixed in acetone for later analysis of uronic acid. The analysis was performed by the procedure described by Blumenkrantz & AsboeHansen (1973) using glucoronic acid as standard.

The results were compared to values of uronic acid in normal joint cartilage obtained from the literature and from previous examinations (Olsen et al. 1989).

*Results:* A lower content of uronic acid was found in acetabular non-weightbearing cartilage of OA compared to acetabular nonweightbearing cartilage of ON.

All the remaining biopsies from acetabular weightbearing areas of patients with OA and ON, and all biopsies from the femoral heads in both groups showed a diminished content of uronic acid, but there were no statistical differences amongst these groups.

*Conclusion:* As expected, the content of uronic acid was low in all areas of cartilage in OA. It was remarkable that the content of uronic acid was decreased in the cartilage of femoral heads of patients with ON. This finding might indicate, that factors other than disturbances in the synovial fluid influences the proteoglycanes of the cartilage of the femoral head in ON.

*References:* Blumenkrantz et al., 1973, Annal Biochem 54:484-489, Howell et al., 1986, Clin Orthop 213: 69-76 Olsen et al., 1989, Acta Orthop Scand 60: 23-65

## Bone remodeling around loaded hydroxyapatite and fluorapatite coated implants

*Søren Overgaard[1], Martin Lind[1], Henning Glerup[2], Cody Bünger[1], Kjeld Søballe[1]*

[1]Biomechanics Lab, [2]Institute of Pathology, University Hospital of Aarhus, Denmark

The purpose of this study was to compare bone remodeling parameters of bone around hydroxyapatite (HA) and fluorapatite (FA) coated implants.

*Materials and methods:* A stable implant device system, which allowed loading of the implant, was inserted bilaterally into the medial femoral condyles of 8 skeletally mature mongrel dogs. Porous coated, titanium alloy (Ti-6Al-4V) implants were plasma-sprayed with FA or HA. The implants were initially surrounded by a 0.75 mm gap. The dogs were killed after 25 weeks. Histomorphometry was determined on 8 µm thick undecalcified sections of a blinded observer. The gap zone and a zone from outside the gap = OZ were analyzed.

*Statistics:* Data are presented as mean values with standard error of mean in brackets. Paired T-test was applied. $p<0.05$ was considered as significant.

*Results:* Total bone volume (TBV) in the gap and in the OZ was equal for HA- and FAcoated implants (Table 1). In contrast, the amount of osteoid surfaces was significantly higher for the gap zone compared to the OZ for both types of

implants. The amount of tetracycline labelled surfaces was higher in the gap zone compared to the OZ for FA-coated implants only ($p<0.05$). No difference between resorptive surfaces was found. No woven bone (WB) was found in the OZ, but was present in the gap zone for both types of implants ($p<0.05$). No differences between HA and FA coated implants were found, apart from TS in the OZ.

**Table 1. Remodeling parameters (values in percentage)**

| | TBV | | OS | | RS | | TS | | WB/TBV | |
|---|---|---|---|---|---|---|---|---|---|---|
| | gap | OZ | gap | OZ | gap | OZ | gap | OZ | gap | OZ |
| HA | 40(4) | 39(3) | 23(5) | 14(3) | 7(1) | 8(1) | 33(5) | 31(4) | 11(4) | 1(1) |
| FA | 38(4) | 37(2) | 20(3) | 14(2) | 7(1) | 7(1) | 35(4) | 25(3) | 5(2) | 0(0) |

*Conclusion:* 6 months after implantation bone repair was still active, but the gap was filled with mainly bone of lamellar type.