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Hip

Value of routine examination 1 year after cemented total hip arthroplasty: Clinical and economic consequences

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The costs and the consequences of a clinical and a radiographic routine examination 1 year after the insertion of a cemented total hip arthroplasty through a posterior approach was evaluated.

The Charnley score in 150 patients was prospectively, consecutively registered before operation and 3 months and 1 year after the operation. The cost of one outpatient visit was divided into three parts: (1) The examination in the outpatient clinic was assessed to Dkr 200 per patient. (2) The transportation of the patients was calculated according to the distance between hospital and home. (3) The radiographs (one AP and lateral projection of the hip and one AP of the pelvis) were calculated to Dkr 150 per patient.

The Charnley score rose significantly between every examination ($P < 0.001$). The examination 1 year after the operation had no consequences for 145 out of the 150 patients. Five patients (3 percent) had a minor shoe correction due to a leg-length discrepancy. The radiographic examination had no immediate consequences for the further evaluation, and none of the patients were asked to attend a further follow-up. All the patients except 1 were satisfied, and 90 percent of the patients found the examination after 6 weeks and 3 months sufficient.The total cost of the routine examination 1 year after the operation was calculated to be Dkr 630 per patient.

In conclusion, the routine examination 1 year after the operation was not found necessary. A reorganization towards a routine examination 5 years postoperatively for patients younger than 60 years to screen for aseptic loosening would, in the present material, result in examination of only 10 percent of the patients, and thus would reduce the costs for the outpatient clinic considerably.

Hip fractures in Århus County: A prospective study

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This is the first Danish prospective study on the epidemiology of hip fractures.

Patients and methods: Prospectively, all the hip fractures, fracture subtypes, treatment, and personal data were registered.

Results: During 1987, a total of 935 hip fractures in patients aged 15 years and above occurred in Århus County, Denmark. A total of 907 hip fractures occurred in patients aged 50 years and above. The male:female ratio in the latter group was 1:3.3, and rose to 1:4.5 in persons older than 80 years. The cervical hip fracture was four times as common, and the trochanteric fracture was three times as common in women as in men. The overall incidence of hip fractures was 5.5 per 1,000 above the age of 50 years and rose to 26 per 1,000 in persons above aged 80 years. In both sexes the incidence rates increased exponentially with age, and 51 percent of the fractures occurred in patients aged 80 years and above. Based on the age-specific incidence rates in 1987, and not taking the annual increase in the age-specific incidence rates into consideration, a projection was made on the official population forecast for the years 2005 and 2010, giving a 21 percent and 24 percent, respectively, increase in the number of hip fractures.

Monk (Hard-top) hemiarthroplasty for displaced femoral neck fracture

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The purpose of the investigation was to evaluate the incidence of early and late complications, which resulted in outpatient evaluation or hospitalization, and to describe the survival curve of patients treated with hemiarthroplasty for femoral neck fractures. Totally, 168 consecutive patients with a displaced femoral neck fracture and a physiologic age exceeding 75 years were treated from 1979 to 1984 with the Monk Doupleet (Hard-top) hemiarthroplasty. The mean age at operation was 81 years. The operations were performed under general anesthesia through a posterior approach, and the prostheses were all, except one, inserted without cement. Four prostheses dislocated during the hospitalization period, none after the discharge. Two prostheses were extracted: one because of deep infection and one because of hip contracture and dislocation. Five patients sustained an ipsilateral femoral fracture 1–84 months postoperatively. Totally, 7 (4 percent) of all the patients were reoperated on.

One year after the operation, 22 percent were dead. An increased mortality rate was recorded during the first 6 months; later, it was that of the standard population. The younger patients (below aged 80 years) had a higher standard mortality ratio than the older patients (above aged 80 years). At follow-up, median 6 (3–10) years after the operation, 4 of the 62 survivors had femoral pain on weight bearing. Three of of these showed subsidence of the prosthesis, but no one had protrusio acetabuli. None had pain in the groin or at rest.

Ninety-five percent of the patients had no complications that required outpatient evaluation or hospitalization.

In conclusion, it was found favorable to treat the displaced femoral neck fracture in patients with a physiologic age more than 75 years with a cementless hemiarthroplasty, instead of internal fixation.

Complications following osteosynthesis of femoral fractures around and below hip prostheses a.m. Partridge

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In 1976, Partridge introduced his method for fixation of femoral fractures around and below hip prostheses. The aim of this study was to evaluate the results obtained by using this method. Eight successive patients (2 men and 6 women) were operated on a.m. Partridge during a 40 months' period. The patients were followed clinically and radiographically. All the fractures were due to low-energy trauma, and arose around ipsilateral hip prostheses. There were 4 spiral, 3 oblique, and 1 comminuted fracture.

The average age of the patients was 72 years. The observation time averaged 2.3 (1–4) years. Weight bearing started on an average 14.5 weeks postoperatively. The healing time averaged 16 weeks. All the patients developed radiographically verified bone erosion and osteolysis beneath the nylon straps 10–16 weeks postoperatively. In 5 cases the bone erosion was stationary and caused no subjective complaints. In 3 cases the bone erosion became so severe that it necessitated reoperations with replacement of the femoral components by long-stemmed implants. Moreover, excessive homologous bone grafting was necessary in 2 cases.

Using the Partridge system, we obtained stability and fracture healing; but due to the high frequency of complications, the method cannot be recommended as a routine treatment of fractures of the femur around and below hip prostheses.

Early results of operative treatment of acetabular fractures

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This study presents the early postoperative results in 14 patients following internal fixation of displaced acetabular fractures treated during the period January 1, 1985 to August 1, 1988. During the period, 36 patients had an acetabular fracture, which was internally fixated in 15 patients. The 15 dislocated acetabular fractures were classified according to Tile. Five fractures were of the posterior type, and 10 fractures were classified as transverse type. The mean age was 31 (14–52) years. The patients were operated on an average 8 (0–22) days after the accidents. Two patients had postoperative complications: 1 patient had a deep wound infection while 1 patient had subluxation of the operated on hip. All the fractures were radiographically healed at follow-up. One patient, in whom the femoral head was luxated for 3 hours prior to the operation developed necrosis of the femoral head. Coxarthrosis was seen in 2 patients with postoperative complications. Three patients had persistent pain, 3 had tolerable pain, while 8 seldom or never had pain in the operated on hip. Overall, 11 patients had a good or excellent result when evaluated by the Merle d´Aubigne score. The results following internal fixation of dislocated acetabular fractures are satisfactory at short-term follow-up. However, we recommended that the treatment of dislocated acetabular fractures is centralized because the operation is technically difficult and the fracture type is rare.

Lubinus ribbed modular cementless total hip joint prostheses: Short-term results following primary operation

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Cementless total hip joint prostheses have won increasing popularity, although the optimal design has not yet been defined. The short-term results with the Lubinus ribbed modular system were presented. Thirty-three hips were operated on, 23 for coxarthrosis, 8 for rheumatoid arthritis, and 2 for dysplasia. The median age was 54 (23–64) years. The patients were followed clinically and radiographically for 1 year.

The median operating time was 115 (65–205) minutes. Seven patients had deep phlebothrombosis. There were no infections and no dislocations or postoperative fractures. Radiographs showed that 32 cups were properly seated, with 1 cup lacking 2 mm. All were unchanged after 1 year. Twenty-three stems failed to fill the distal part of the medullary cavity, with a median value of 3 mm. After 1 year, two stems were loose. The patients were evaluated a.m. Charnley; and regarding pain, patients, on the average, gained four classes; three classes regarding walking ability and one class regarding range of motion. Twenty-five patients improved under working condition while 8 were unchanged. In all, 31 patients were satisfied with the operation.

The Lubinus ribbed modular cementless hip prosthesis is easy to use, with few operative problems and few immediate complications.

The influence of combined treatment with indomethacin and low-dose heparin after total hip replacement

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The purpose of the study was to elucidate whether the combined use of a nonsteroid anti-inflammatory drug and low-dose heparin in the postoperative period is an acceptable procedure. In a double-blind, placebo-controlled clinical trial, the complications occurring in 235 patients undergoing total hip replacement and postoperatively treated with low-dose heparin in combination with either indomethacin or placebo are described.

The incidence and type of complications occurring in the two groups were nearly equal, and indomethacin-treated patients had no increase in complications related to bleeding. The amount of postoperative bleeding into drains was largest in the indomethacin group (NS).

It is concluded that postoperative treatment with indomethacin and low-dose heparin does not significantly increase the bleeding or other complications after total hip replacement. Further, it was shown that patients receiving indomethacin were mobilized on an average 1 day earlier than the placebo group.

Piroxicam, buprenorphine, or both combined in the treatment of postoperative pain following total hip arthroplasty

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The aim of the study was to compare the analgetic effect, side effects, and patients acceptance of a basic treatment with a narcotic (Buprenorphine) combined with a NSAID (Piroxicam) and a basic treatment with each drug given separately.

Material and methods: Eighty patients (aged 20–88 years) operated on with total hip arthroplasty in neuroleptic anesthesia were allocated to the three groups by balanced randomization in blocks of 15. Group I received Buprenorphine + Piroxicam (B + P), group II Buprenorphine + placebo (B + O), and group III placebo + Piroxicam (O + P). In all three groups supplementary treatment with B was allowed on the patient's demand. The pain intensity was estimated by VAS scale at 6 prefixed times during the first 48 hours following surgery. The number of supplementary B and side effects were recorded.

Results: Sixty-three patients completed the study. Twelve patients excluded themselves due to nausea, in 4 patients treatment failed because of respiratory trouble, and 1 patient in group III wanted to be excluded. The use of NSAID (P) reduced the supplementary intake of B. Pain relief was equal in groups II and III (average VAS score 28 and 27), with an average Buprenorphine consumption of 17 and 6 tablets, respectively. The combination of (B + P) decreased pain intensity significantly (average VAS score 18).

Conclusion: The combination of a central and peripheral-acting analgetic leads to significantly better pain relief and reduced use of narcotics. Postoperative pain was well treated orally.

Codeine plus paracetamol versus paracetamol in long-term treatment of chronic pain due to coxarthrosis: A randomized, double-blind, multicenter study

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The aim of the study was to investigate the efficacy and safety of long-term treatment with the combination of codeine and paracetamol in patients with chronic pain due to coxarthrosis.

Materials and methods: The study was planned to include 400 patients with arthrotic hip pain requiring analgesics, which had brought them on the waiting list for total hip arthroplasty. The patients were randomized to treatment with tablets containing either codeine 30 mg and paracetamol 500 mg (CODIPAR) or paracetamol 500 mg (PAR). All the patients had 2 tablets 3 times daily for 4 weeks, and were allowed to take tablets containing ibuprofen 400 mg as supplementary medication.

Results: An unexpectedly high rate of adverse drug reactions was recorded. Therefore, the study was prematurely closed when 161 patients had entered. Totally, 83 patients had treatment with CODIPAR and 78 with PAR. According to the patients' own evaluation, as well as their use of supplementary medication, patients treated with CODIPAR had a significantly better pain relief ($P < 0.01$), but only during the first week of treatment. Patients treated with CODIPAR significantly more frequently had adverse drug reactions in all 4 weeks, most clearly in the first week, with nausea, dizziness, and vomiting as the dominating effects. In all, 43 of 60 patients who dropped out of the study had been treated with CODIPAR. The majority of these patients (39) stopped the medication during the first weeks.

Conclusion: CODIPAR should not be prescribed for long-term treatment in elderly patients containing the tested dose of codeine.

Ankle and foot

Dependence of ankle-joint width on plantar flexion

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Joint space narrowing is the first radiographic sign of arthrosis of the ankle and often assessed by comparison with the contralateral ankle joint. The purpose of this investigation was to study the dependence of ankle-joint width on plantar flexion of the joint.

Patients and methods: Frontal views of the left ankle joint in the neutral position and in 25° plantar flexion were studied in 15 women and 15 men. The volunteers did not have current or previous symptoms from the ankle joint. The vertical distance between the cortices of the talus and tibia was measured at three locations on each AP projection.The mean distance was calculated.

Results: In the neutral position the average width of the joint space in the men was 3.0 ± 0.4 mm and in the women 2.7 ± 0.4 mm. The average relative increment of joint space when measured on radiographs of the ankle joint at 25° plantar flexion was 24 percent in both sexes.

Conclusions: Accurate, standardized positioning of the ankle joint is important particularly concerning the diagnosis and follow-up of arthrosis and arthritis.

Interobserver and intraobserver variation in the Lauge-Hansen classification of malleolar fractures

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Comparison of patient materials with malleolar fractures classified by the Lauge-Hansen system has shown a great variation in frequency of fracture types. Therefore, we have investigated reproducibility of the Lauge-Hansen classification in an observer variation study.

Patients and methods: Radiographs of 118 consecutive patients with malleolar fractures were classified by 4 observers from the Department of Orthopedics: viz., 1 consultant, 2 senior registrars, and 1 registrar. Independently of each other, the observers classified each patient into class and stage according to the Lauge-Hansen system. A comparison of the 4 observers gave a measure of interobserver variation. Six weeks later, a similar classification was carried out. A comparison of the first and the second classification by each observer gave a measure of intraobserver variation.

Results: Interobserver variation: All 4 observers showed agreement on class and stage in 43 percent of the patients and on class in 68 percent of the patients.

Intraobserver variation: The first and the second classification were identical in 64, 67, 75, and 82 percent of the patients by both class and stage, and were identical in 81, 87, 87, and 95 percent of the patients by class alone. Higher seniority in orthopedics did not decrease intraobserver variation.

Conclusions: The Lauge-Hansen classification system has a limited reproducibility, assessed both by interobserver and intraobserver variation. This may partly explain the difference in frequency of fracture types found in different patient materials.

The stabilizing effect of the calcaneofibular ligament and the anterior talofibular ligament on hindfoot movements

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The aim of the study was to investigate the hindfoot movement patterns following a lesion to the anterior talofibular ligament (ATL) either solitary or in combination with a lesion to the calcaneofibular ligament (CFL).

Materials and methods: Totally, 22 amputation specimens were sequentially studied using a kinesiologic testing device. The first step was recording of movements with intact

ligaments; secondarily, movements were recorded after sectioning of the ATL; and finally movement patterns were recorded after also a lesion to the CFL. All the movements were recorded for the entire hindfoot joint complex, i.e., the ankle and talocalcaneal joints.

Results: The largest median *anterior-posterior laxity* with intact ligaments was observed in neutral and plantar flexion (3.1 mm and 3.0 mm, respectively). Cutting of the ATL increased the anterior-posterior laxity, with a median of 3.0 mm, in the entire range of flexion, whereas further cutting of the CFL only increased the laxity, with a median of 1 mm. The CFL was shown to be the primary stabilizer of *adduction.* Cutting of the ATL only increased adduction, with a median of 3.0° , most significant in plantar flexion, whereas further cutting of the CFL increased adduction dramatically in the entire range of flexion, to a median maximum of 14.2° in dorsiflexion. A solitary lesion of the ATL resulted in a median of 3.0° of laxity in *internal rotation* in dorsiflexion, but a median maximum of 11° of laxity in plantar flexion, whereas a further lesion of the CFL mainly increased the laxity in internal rotation in dorsiflexion to a median maximum of 8.0°.

Conclusions: The ATL was shown to be the primary stabilizer of anterior-posterior displacement in the ankle, and CFL the primary stabilizer of adduction in the tibio-talo-calcaneal joint complex. Moreover, the ATL mainly stabilizes internal rotation in plantar flexion, whereas the CFL had that function in dorsiflexion

Knee

Operative treatment of anterior cruciate ligament lesions

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Sixty-eight patients with operatively treated anterior cruciate ligament (ACL) lesions were evaluated with a mean follow-up period of 4.7 years. The mean age of the patients was 24 years. Totally, 50 patients sustained their injuries during sports activities, soccer being the major cause. The method described by Palmer was used for the repair of the ACL lesion. Concomitant lesions were present in 40 cases and repaired when needed. During the follow-up period, 10 patients had received a reconstruction of the ACL due to functional instability. Eight patients were lost to follow-up. Knee instability was evaluated by clinical and computer analyzed measurements; for the latter, we used the Acufex Knee Signature System. The functional results were evaluated by the Tegner activity scale and the Lysholm knee score. Significant instability was found in 22 patients (plus 10 patients reconstructed), with a Lysholm knee score of 84. No significant instability was found in 28 patients with a Lysholm knee score of 91. The activity level was lowered regardless of instability from 6.7 to 5.1. Twenty-three patients resumed their former sports activities, 17 patients at the same preinjury level. Repair of the ACL using a simple technique resulted in chronic instability in half of the cases. Reconstruction of the ACL because of functional instability was required in 11 cases. The subjective knee function was good/excellent regardless of instability at follow-up, at the expense of a lowered activity level.

Anterior-posterior knee laxity: The influence of muscle tone

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The objectives were to evaluate the influence of muscle tone on anterior-posterior knee laxity.

Methods: The anterior and posterior tibial translation at 25° of knee flexion and 10, 20, and 30 pounds of displacement force,using the Stryker Knee Laxity Tester, were measured (1) under maximal muscle tension, (2) under voluntary relaxation of quadriceps and hamstrings, and (3) under anesthesia. The legs were positioned on a splint in 25° of knee flexion and with free axial tibial rotation. Forty-two normal knees (27 patients) were examined. The median age was 29 (11–71) years.

Results: Both anterior and posterior tibial translation increased significantly with voluntary relaxation of the muscles. With anesthesia, there was a significant further increase in anterior translation; posterior translation increased only marginally. No increase in left to right difference (total translations) was found (*n* 16).

Conclusion: Muscle tone significantly influences anterior-posterior knee joint laxity. Complete muscular relaxation can only be achieved with anesthesia.

Arthroscopic meniscectomy: Results and complications

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During 1985, 245 arthroscopic meniscectomies were performed in 235 knees. The median age of the patients was 35 (14–76) years, with two thirds of them males. Totally, 167

were medial and 78 were lateral meniscectomies. In 10 knees, both menisci were resected. More than nine tenths of the meniscectomies were performed electively, and in most cases a tourniquet was used. Complications and results were recorded prospectively during the hospital period and at a check-up 3 months later.

The results were excellent or good in 86 percent of the medial and in 80 percent of the lateral meniscectomies. In 34 patients (14 percent) the results were considered unsatisfactory; 10 of these had arthrosis and were content. At the 3-month control, a new arthroscopy was considered necessary in 3 percent of the patients. No serious complications were registered. Mild complications were hemarthrosis or serous effusion in 18 cases (7.5 percent), superficial wound infection in 1 case, suture granuloma in 1 case, neuroma in 1 case, adhesions in 1 cases, venous thrombosis in 1 case, iatrogenic partial rupture of the medial collateral ligament in 1 case. Single dominant predictors of complications and results were not identified, although there was a tendency towards better results with bucket-handle lesions than with degenerative lesions.

We concluded that the results of the arthroscopic meniscectomy were good and that serious complications were rare.

Tibial plateau fracture: Skeletal traction and early knee mobilization versus surgical treatment

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The long-term results after tibial plateau fractures were evaluated for 61 fractures treated by skeletal traction and early knee activity versus 48 fractures treated by surgery. The average follow-up period was 6 years. Both groups included fractures with a primary articular surface depression of 0–20 mm. The fractures were divided into subgroups according to the degree of primary articular surface depression and to the type of fracture (Roberts' subdivision of types). Gonarthrosis was evaluated according to Ahlbäck and Rydberg. Statistical tests were performed with the Mann-Whitney test with a two-tailed significance level of 5 percent.

We found similar functional results after the two treatments. Meniscectomy was performed in almost half of the patients who had surgery. Arthrosis was seen more frequently after surgery ($P < 0.05$), and there was a tendency towards more arthrosis when meniscectomy had been performed ($P < 0.10$). Confinement to bed and duration of hospitalization were clearly shorter after surgery ($P < 0.0001$).

We conclude that skeletal traction and early knee immobilization are an alternative to surgery. Presumably, they should be reserved for cases where surgery is undesirable.

Hand

Treatment of Bennett's fracture during a 10–year period

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The treatment of Bennett's fracture is still debated. How important is accurate restoration of the joint surface for avoidance of late symptoms and arthrotic changes? A series of Bennett fractures is described with special emphasis on this relationship.

Forty-one fractures were treated between 1975 and 1985. Nine fractures were treated with a plaster of Paris cast after closed reduction, six displaced fractures were treated by closed reduction and percutaneous K-wire pinning, and 26 displaced fractures were treated by open reduction and internal fixation.

After a median of 7 (2.6–12) years, 31 patients were reviewed. Twenty-one patients were asymptomatic; 10 patients had slight pain periodically.

After perfect reduction, 16/19 of the patients were asymptomatic, but only 5/12 of the patients with residual displacement. The frequency of arthrosis in the group with perfect reduction was 3/14; with residual displacement, it was 7/10.

Pain and arthrosis seem to be less frequent after anatomic reduction of the Bennett fracture.

We therefore advocate exact reduction of the fracture—if necessary by open reduction.

Intraarticular fractures at the base of the fifth metacarpal

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The results of treating 64 displaced "Bennett V" or "Reverse Bennett's fractures" between 1978 and 1988 are presented. The median age at injury was 38 (8–88) years. Fracture type 1 (21 patients) had a single radial fragment involving less than 50 percent of the articular surface, and type 2 (43 patients) were comminuted fractures or had a radial fragment involving more than 50 percent.

Primary subluxation was found among three type 1 fractures and 16 type 2 fractures. The position of the fractures was improved by closed reduction and cast immobilization in 2/9 type 1 and 4/28 type 2 fractures, by percutaneous pinning or open reduction and internal fixation in 8/11 and 10/16 frac-

tures. None of the fractures were exactly reduced. Secondary subluxation followed conservative treatment in 5 cases—all type 2 fractures. Ten patients with open reduction had complications: 9 cases with migration of a K-wire and 3 cases with superficial infection. At follow-up after a median of 4 (0.5–11) years, 28 of 50 patients were asymptomatic. Twelve of 29 patients treated conservatively and 10 of 21 treated operatively had slight pain periodically, especially upon firm gripping. Twenty-one of 44 patients had arthrosis, and 25 of 38 patients had decreased gripping power, with a median of 25 (5–60) percent.

The fractures are difficult to reduce exactly, and frequently give sequelae with periodic pain, arthrosis, and decreased gripping power.

Fingertip lesions: A comparative study of silver sulfadiazine and fucidin gauze

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Holm and Zachariae (1974) found conservative treatment to be superior to surgery in most cases, and de Boer and Collison (1981) introduced the silver sulfadiazine treatment in fingertip lesions. The purpose of this study was to compare this treatment with Fucidin gauze according to the time taken for healing, duration of absence from work, and complications.

Patients and methods: From February 1987 through April 1988, 94 consecutive patients with blunt or clear-cut fingertip lesions (with or without osseous involvement) were randomized to silver sulfadiazine or conventional Fucidin gauze treatment. In the first treatment, silver sulfadiazine was applied to the wound and the finger was dressed in a nonsterile PVC glove, and then redressed every 3rd day. Sixteen patients dropped out, 4 because of bleeding demanding more hemostasis; 11 failed to come to controls, and 1 changed the treatment herself.

Results: Characteristics, time taken for healing, and sick leave are shown in Table 1.

Table 1.

	Silver sulfadiazine	Fucidin	Statistics
Number	36	42	
Age	30.0	38.5	NS
Size (cm^2)	1.0	1.1	NS
Osseous involvement	16.7	26.2	NS
Time taken for healing (days	14.0	22.0	($P = 0.012$)
Sick leave (days)	13.7	25.0	($P = 0.025$)

Conclusions: The use of silver sulfadiazine for clear-cut and blunt fingertip lesions was found to be very successful, with few complications, no systemic infection, shorter healing time, and shorter sick leave. The treatment is recommended in all casualty departments, and especially when the responsible doctor is unexperienced.

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Elbow

Elbow arthroscopy

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Only a few papers concerning arthroscopy of the elbow have been published. The indications have been loose bodies. conditions with pain and loss of motion caused by traumas, fractures, and rheumatoid arthritis are widening the indications.

Material and methods: Over the period September 1987 to October 1988, we performed 15 elbow arthroscopies in 13 patients using a 5-mm Storz arthroscope. As routine entrances the anterolateral and the posterolateral approach was used. The median follow-up was 6 months, and the median age was 26 years (11–86 years, 7 men and 6 women).

In 7 cases, loose bodies were found, and in 4 of these the loose bodies were extracted arthroscopically. In addition, 2 of the 4 patients underwent transarthroscopic synovectomy and debridement. At follow-up, all 7 patients were free from pain and only 1 patient still had a slightly restricted motion. In 2 cases the arthroscopy was diagnostic (posttraumatic arthrosis of the elbow).

One patient with a chondral disorder was treated with debridement and was asymptomatic at the time of follow-up. The last 3 patients underwent transarthroscopic synovectomy and debridement with good results concerning mobility and pain in 2 of the cases.

Conclusion: Arthroscopy of the elbow is recommended in the treatment of loose bodies, but also to evaluate and treat cases caused by fractures, traumas, and rheumatoid arthritis.

Fractures

Shoulder alloplasty in proximal humeral fractures

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The aim of the study was to evaluate the outcome of shoulder alloplasty in 32 comminuted proximal humeral fractures.

Patients and methods: All the patients were categorized into two groups according to the postfracture operative delay. Eight four-part fractures, mean age 73 (36–84) years, were treated after 13 (7–21) days. Five patients had a hemialloplasty. Twenty-four patients with old fractures included 10 four-part fractures, 8 three-part fractures, and 6 two-part fractures. The mean age was 65 (40–78) years, whereas the median time from fracture to arthroplasty was 14 (4–72) months. Twelve patients had primarily been treated operatively, and 12 patients were treated conservatively. Twenty-one patients had a total shoulder alloplasty, and 3 had a hemialloplasty. At follow-up 2 (1–5) years postoperatively, all the patients were evaluated according to a modified Neer scoring system, and were classified into three groups. (1) Excellent: painfree and good motion. (2) Fair: slight pain and/or restricted motion. (3) Poor: pain and/or poor motion.

Results: In the acute group, 6/8 patients had excellent results compared with 4/24 patients in the chronic group. One patient in the acute group and 9 patients in the chronic group had a poor result. The results in the acute group were superior ($P < 0.05$). No differences were found between hemialloplasties and total joint replacements.

Complications: There were 2 cases of anterior prosthetic instability and 1 distal migration of the prosthesis.

Conclusions: Good results can be expected after prosthetic replacement in acute proximal humeral fractures. Prior surgery or operative delay reduces the end result. A hemialloplasty seems to be sufficient.

Proximal humerus physiolysis—a follow-up

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The main purpose of following up proximal humeral physiolysis was to estimate the frequency of sequelae and relate it to the Neer-Horwitz grades and treatment.

The material consisted of 46 consecutively hospitalized patients from January 1, 1977 through June 1988. Three patients were excluded (1 deceased and 2 foreigners). Seven patients could not be traced. The primary radiographs of 34 patients were evaluated, and the physiolysis was graded according to the Neer-Horwitz classification. The patients were followed up clinically and radiographically at a median time of 6 years.

The median age at the time of accident was 20 years. The types of fracture were divided into Neer-Horwitz grades I (6), II (9), II (8), and IV (11). Reduction was performed for 24 patients. At the follow-up, 20 patients were asymptomatic. The most frequent symptoms were pain (12) and reduced movement (9). In 9 out of 24 cases an improved position had been obtained. Of those patients who at the last radiographic control had a dislocation according to Neer-Horwitz grades I–II, 7 out of 20 had symptoms at the follow-up, whereas for grades III and IV, 8 out of 14 had symptoms.

The tendency was that patients with Neer-Horwitz grades I–II had fewer symptoms than patients with grades III–IV. Probably reduction should be performed in grades III and IV fractures.

Displaced proximal humeral fractures: Results of conservative treatment

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The clinical and radiographic results of 42 patients with displaced proximal humeral fractures treated by conservative means were reviewed. Thirty-four were female, and the median age was 77 years. The follow-up evaluation included physical and radiographic examination a median of 2 years after the trauma. The system advocated by Neer was used to classify the fractures. Sixteen patients had two-part fractures, 17 three-part fractures, and 9 four-part fractures. Twenty-eight fractures were treated with a sling and 14 with a hanging cast. No difference was found between the results in relation to treatment. Five patients developed arthrosis, 2 avascular necrosis of the humeral head, and 5 nonunion. The clinical results were assessed using Neer's protocol. The patients with two- and four-part fractures had failure results (less than 70 units), and patients with three-part fractures had unsatisfactory results (70–79 units). The patients were asked their opinion of the result, and generally found it satisfactory.

The results of conservative treatment of displaced proximal humeral fractures were poor. This supports the idea of treatment with plate fixation or prosthetic replacement, but the patient response to conservative treatment was satisfactory, and therefore the indications for surgery should be carefully considered.

Static or dynamic locked nailing of comminuted femoral shaft fractures

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Patients and methods: Forty comminuted or unstable fractures of the femoral shaft were treated with intramedullary reaming and locked static nailing. Twenty-four fractures were grade 3 or 4 comminuted according to Winquist and Hansen. Sixteen grade 1 or 2 fractures were located in the distal or proximal one third of the diaphysis and were classified as unstable.

Results: At follow-up 12–30 months postoperatively, all the fractures had healed. Three patients had an external rotatory malalignment between 5 and 10 degrees, while 5 had a shortening or lengthening between 1 and 2 cm. No cases of infections or delayed unions were recorded. In the present series, all the fractures were treated with static nailing, and no bolts were removed in an attempt to dynamize the fracture.

Conclusions: Intramedullary closed, locked, and static nailing secures sufficient stability of comminuted fractures of the femur irrespectively of the degree of comminution and the location of the fracture. We did not dynamize any of the fractures, and our study suggests that this procedure can be omitted.

Delayed union in tibial shaft fractures: Is the AO compression osteosynthesis a recommendable treatment?

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Delayed union is not uncommon in tibial shaft fractures, and the condition is associated with high-energy trauma, open fractures, and severity of concomitant injuries. Because there is no ideal treatment, the AO-compression osteosynthesis has been used at the orthopedic department at Hjørring Hospital since 1973 and at the orthopedic department at Aalborg Hospital since 1985 in the treatment of delayed union of tibial shaft fractures.

Patients: There were 21 men and 4 women, aged 24 (15–72) years with unhealed tibial shaft fractures after 6 months, 20 of whom had open fractures and 16 of whom had suffered traffic accidents. Fourteen of the patients were primarily treated at other hospitals.

Methods: All 25 patients were treated with AO-compression osteosynthesis a mean of 10 months after primary treatment. Thirteen of the patients were grafted with autogenous cancellous bone, and in 5 patients the fibula was resected Fifteen of the patients received prophylactic antibiotics.

Results: In 23 patients the tibia healed in 5 (4–8) months, and in 2 patients, the tibia was unhealed after 45 and 10 months. Six patients had superficial skin necrosis and cicatricial defects without exposure of the osteosynthesis material, and all the patients healed spontaneously. There was no case of deep infection.

Conclusion: In delayed union of tibial shaft fractures, the AO-compression osteosynthesis is a good method without significant complications.

Pediatric orthopedics

Ultrasound scanning of newborns for congenital hip dysplasia

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During a 9-month period, we scanned the hips of all the newborns whose parents had given their consent. The aim of the study was to evaluate whether ultrasound could identify hips that should be treated. The indication for splintage was clinical instability throughout the period. Both hips were scanned from the lateral aspect of the hip over the trochanter major, and the results were evaluated according to the criteria established by Graf. There were 547 newborns in the study. In 4 newborns, there was suspicion of dysplasia in five hips and clinical instability in one hip. One was clinically unstable, but had normal findings by ultrasound and was splinted. Two children were scanned at intervals of 3 weeks, and showed normal hips after 6 weeks without treatment. The fourth newborn had ultrasonographically bilateral dysplasia, which was verified radiographically at 6 weeks, and treatment was advised.

During the period, 10 of the children were splinted, only 1 of these had unilateral dysplasia ultrasonographically, and all were radiographically normal after 3 months. Forty-five children had radiographs taken at 5 months because of clicking hips at birth, and all of them were radiographically normal.

We recommend the method, and find it well indicated when clinical instability is suspected in the newborn.

Salter's pelvic osteotomy in dislocation/dysplasia of the hip

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A total of 59 patients were subjected to Salter's pelvic osteotomy at the Orthopedic Hospital of Copenhagen and at Rigshospitalet owing to dislocation/dysplasia of the hip. The indication for surgery was established at a median age of 6. The girl:boy ratio was 5:1. The patients were followed clinically and radiographically for 3 and 12 months postoperatively, and the median period of follow-up terminated 3 years after surgery. In case of further surgical intervention, follow-up was discontinued. In the first osteotomies of the series, only one Kirschner wire was used to anchor the wedge; later on, a technique involving two wires was resorted to as a means of securing the osteotomy. Generally, this technique improved the slope of the acetabular roof, measured as the acetabular index, and yielded a superior covering of the femoral head. Only 1 case proved an exception for technical reasons. In 7 cases, mainly patients in whom the osteotomy had been anchored by a single Kirschner wire, a minor displacement occurred at the site of the osteotomy, often entailing a Chiari-like effect of the operation. In 20 percent, further surgical intervention was required, in most cases owing to a position of valgus and anteversion of the femoral neck. In cases of dislocation/dysplasia of the hip, Salter's osteotomy is a useful procedure, because it aims at reestablishing anatomic conditions. If subluxation is pronounced or if dysplasia of the proximal part of the femur is present, the procedure should be combined with or supplemented by surgery involving the femur.

Spine

Posterior spondylodesis with pedicle screw fixation

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Twenty-four patients, 16 females and 8 males, with a median age of 44 years, were operated on with posterior spondylodesis with plates and pedicle screws. Eight patients had spondylolisthesis due to spondylolysis, 7 patients had degenerative spondylolisthesis, and 9 patients had disc degeneration with arthrosis of the facet joints.

Five patients were operated on with Roy-Camille reduction plates, and the rest with Louis plates. The patients were mobilized on the fifth postoperative day, 1 with a plaster cast and 23 patients with a BOB-brace or corset. The minimum follow-up was 6 months.

Results: Eighteen patients were improved (no or only moderate back pain), and 6 patients had unchanged pain. There were 6 cases with broken or loose screws; of these, 4 had unchanged pain.

In 2 cases, there was pain in the L5 dermatome after the operation. Both patients were reoperated on, and the screw position was changed with improvement.

In our series, we found an acceptable fusion rate. The technique is useful with an early mobilization and few complications.

Spinal cord, cauda equina, nerve roots, blood flow, plasma space, and vascular permeability.

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The pathology of motor and sensory dysfunction in the spinal cord, cauda equina, and nerve roots associated with spinal stenosis and nerve root entrapment is not sufficiently explained and is investigated by different experimental models emphasizing changes in regional blood flow.

This work describes the regional blood flow, plasma volume, and vascular permeability throughout the entire spinal cord including the cauda equina, nerve roots, and the dural sac under normal conditions in anesthetized dogs.

Material and methods: Eight mongrel dogs, 6–7 months old and weighing 15–20 kg comprised the material. The dogs were anesthetized in the supine position with Immobilon Vet., relaxed with Pavulon, and ventilated mechanically after orotracheal intubation. The central hemodynamics were monitored by blood pressure, central venous pressure, and arterial blood gases. Regional blood flow was measured with microsphere technique using 15 my spheres labeled with ^{141}Ce. Plasma volume was assessed by the equilibrium distribution of ^{125}I Fibrinogen, which stays inside the vascular system. Albumin slowly permeates the capillary wall, and vascular permeability was assessed by the ratio between ^{131}I Albumin and ^{125}I Fibrinogen 10 min after injection of these tracers.

Localization	RBF (mL/100 g/min)	PS (mL/100 g)	PER (131-I/125)
Cauda L4–L5	13 (0.3)	1.2 (0.1)	0.8 (0.03)
Roots L3–L5 sin.	4 (0.7)	1.5 (0.2)	1.3 (0.07)
Roots L3–L5 dxt.	4 (0.3)	1.4 (0.4)	1.4 (0.06)
Dura	3 (0.3)	2.2 (0.3)	1.5 (0.08)

After killing the dogs, the entire spinal cord, including the lumbar nerve roots, cauda equina, and dural sac, was exposed by laminectomy from C1 to the last sacral vertebrae and cut in segments. Gamma activity in the biopsies from the spinal cord, roots, and dural sac was counted and corrected for background, cross talk, and decay during counting.

Results and discussion: The values of RBF uncovered a decrease in flow from the richly perfused spinal cord segments to the less well perfused nerve roots and dural structures. The plasma space was not correlated with the RBF inside the spinal cord. RBF was highest in segments of the spinal cord where the greatest motor function was located (cervical, thoracic, and lumbosacral segments). Plasma space and permeability showed high values in structures with low RBF, suggesting that an important function of the dural sac is nutritive, allowing diffusion into the cerebrospinal fluid. The relationship between localization, RBF, plasma space, and

vascular permeability indicates that even small changes in regional blood flow might cause dysfunction of the neural structures in cauda equina and nerve roots.

Amputations

Comparison of the skin blood flow and skin perfusion pressure for selection of amputation level

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The aim of the study was to compare the predicted level of amputation by skin blood flow measured by the ^{133}Xenon washout technique and skin perfusion pressure measured by the photoelectric method. We applied both methods in 33 patients who had major amputations performed and compared the results with the clinical outcome. These two methods measure different physiologic properties, i.e., perfusion and pressure, and only the result from the perfusion measurements were known to the surgeon. Thirty-six consecutive patients were investigated, but 3 patients died before wound healing and were excluded. The median age was 72 (38–91) years, and 15 patients suffered from diabetes and 7 had previously undergone vascular surgery.

Twenty-seven had primary healing, 5 had delayed healing at the same level, and 1 case was reamputated.

Results: With reservation for the small size of our material, no significant difference could be found. The photoelectric method is faster than the isotope washout and better tolerated by the patients. We therefore recommend this method for routine preoperative selection of the amputation level in patients with severe arterial disease.

Table 1. The clinical results and predicted level of amputation by skin blood flow (SBF) measured by ^{133}Xenon washout technique and skin perfusion pressure (SPP) measured by photoelectric method

	Predicted same level	SBF predicted lower level SPP predicted higher level	SBF predicted higher level SPP predicted lower level
Primary healing	20	2	5
Secondary healing	3	2	0
Failure	1	0	0
Total	24	4	5

The influence of smoking on complications after primary amputations

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To study the influence of smoking, all the primary amputations in the period 1976 to 1981 were included in a retrospective study. Patients who were amputated because of trauma, tumors, or Buerger's disease were excluded, as were patients whose smoking habits could not be accurately stated or who had ceased smoking prior to surgery. Patients receiving prophylactic antibiotic treatment (not routine) were also excluded. The material included 137 patients subjected to 165 primary amputations (111 below-the-knee [BK], 54 above-the-knee [AK]). Of these, 77 patients smoked (44 cigarettes, 33 cheroots, 3 a pipe). The patients had unlimited license to smoke during hospitalization.

No difference between smokers and nonsmokers with regard to amputation level could be demonstrated ($P = 0.79$). The cigarette smokers were on an average 7.5 years younger than the nonsmokers ($P = 0.02$).

Of the 111, infection occurred in 21 of 50 smokers and in 11 of 50 nonsmokers ($P = 0.03$; 2 dead and 9 dismissed). Reamputation was performed in 20 of 53 smokers and in 11 of 56 nonsmokers ($P = 0.04$).

Of the 54 AK amputees, only 43 could be evaluated. Primary healing occurred in 11 of 19 smokers and in 22 of 24 nonsmokers ($P = 0.009$). Infection occurred in 5 of 19 smokers and in 2 of 24 nonsmokers ($P = 0.11$). Only 1 patient was reamputated (smoker). The poor results obtained in smokers may be ascribed to the fact that smoking leads to a decrease in cutaneous blood flow and the formation of microthrombi.

Consequently, amputees should avoid smoking during the healing phase.

Risk factors in lower limb amputations

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A logistic regression analysis of 17 variables in 83 lower limb amputations was performed in order to predict stump failure.

Results: Five variables were identified as having a significant effect on the logistic model: *Age* had an inverse relation to failure rate ($P < 0.005$). This effect was mediated through a subgroup of 23 patients who had had a *vascular operation,* as this group had a higher failure rate and were younger than those without previous vascular surgery. Furthermore, the *surgeon's experience* was of major importance for stump failure. Experienced surgeons had a failure rate of 3 percent and less experienced surgeons 29 percent ($P < 0.001$). In ad-

dition, it was confirmed that the higher the *skin perfusion pressure* and the *amputation level*, the better the healing.

Conclusion: It is recommended to use a logistic model that includes the variables age, skin perfusion pressure, amputation level, and the surgeon's experience to predict the risk of stump failure.

Infection

Registration of postoperative wound infections and other complication in orthopedic department in Denmark

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"Micro-ort," a microcomputer system designed and elaborated by the infection group in the Danish Orthopedic Society for continuous surveillance of postoperative wound infections and other complications, is now used in several hospital in Denmark. The purpose of elaborating the program was to create a comprehensible and inexpensive tool to obtain a uniform and comparable registration that can be used all over the country.

The provisional results from the registration of 2,300 operative interventions performed in 1,864 patients in four Danish hospital were presented. A total of 189 complications (8.2 percent) were registered, among these were 63 postoperative wound infections (3.4 percent), 43 superficial infections (2.3 percent), and 20 deep infections (1.1 percent). In clean operations, there were 25 superficial (1.7 percent), and 6 deep (0.4 percent) infections principally caused by *Staphylococcus*. Totally, 126 other complications were registered, predominantly infection of the urinary tract, pneumonia, and thromboembolic complications. In case of postoperative complication, a significant increase in hospitalization time was documented.

Bacterial growth on suction drain tips and suction drain fluid following clean orthopedic operations

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During 1985 and 1986, cultures of suction drain tips and/or suction drain fluid were obtained following 489 clean orthopedic operations (hip fractures and hip and knee arthroplasty).

Suction drain fluids were cultured following 195 operations, and in 2 cases bacteria were detected, but wound infections were not seen after these two operations.

Suction drain tips were cultured following 478 operations, and bacteria were detected in 56 cases. After these 56 operations, five wound infections (three deep) were seen. In these five infections the same bacterial species were identified as were found by drain tip culturing. After 422 operations without bacterial growth on the drain tip, six wound infections (two deep) were seen (1.4 percent).

Conclusion: The risk of postoperative wound infections following clean orthopedic operations is increased ($P < 0.01$) if bacteria are detected on the suction drain tip.

Release of gentamicin from collagen sponge and from polymethyl methacrylate beads

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The gentamicin-containing collagen sponge is a new product intended for local application in bone and soft tissue infections. Because the collagen is bioresorptive, removal of this carrier substance is not necessary in contrast to the PMMA beads.

The present study was an in vitro investigation of the release of gentamicin from the collagen sponge and from the PMMA beads. Pieces of collagen sponge or PMMA beads were added to 20 mL of distilled water, and during the following hours the gentamicin concentrations in the water were repeatedly measured (static model). In the kinetic model experiments the released gentamicin was removed from the water exponentially by means of an infusion-withdrawal pump.

For both the carrier substances, the release of gentamicin was found to occur with increasing half-lives. During the first 4 hours, the half-life increased from 0.2 to 1.5 hours for the collagen sponge and from 3 to 61 hours for the PMMM beads. After 90 minutes, 94 percent of the gentamicin was released from the sponges, whereas 8.4 percent was released from the beads.

By comparing the half-lives for the gentamicin release with the elimination rate of gentamicin from surgical wounds, it seems reasonable to conclude that the long-standing high wound concentrations of gentamicin seen after application of PMMA beads cannot be achieved with the use of the collagen sponges.

Epidemiology

Motocross injuries

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The purpose of this investigation was to compare the risk of motocross riding to other sports activities.

Material and methods: In a 1-year period, 40 motocross riders were treated at the casualty wards (0.8 percent of all sports injuries). The mean age was 19 years. The upper and the lower extremity were both injured in 41 percent of the cases. Fractures constituted 36 percent (compared with 14 percent of the fractures in the major study): 47 percent were located in the forearm/hand, and 42 percent were in the lower extremity.

Skin lesions comprised 43 percent and sprains 19 percent. The frequency of serious lesions (The Abbreviated Injury Scale) and fractures increased significantly when accident mechanisms such as jumps, collisions, and strokes against the vehicle were involved. The frequency of hospitalization was 23 percent (compared with 3 percent in the major study).

Conclusion: Compared with other sports injuries, motocross injuries are characterized by younger patients, more serious injuries, and a high frequency of hospitalization. Collision and jumps were the most dangerous accident mechanisms. Protective devices must avert strokes against the driver's own vehicle.

Prehospital advanced life support in trauma victims

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The performance of prehospital advanced life support has been assessed by a retrospective analysis of interventions and outcomes of trauma victims transported by intensive care ambulance service staffed by a physician and nurse. During a 16-year period, 2,048 patients were transported by the intensive care ambulance, of which 123 were trauma victims. The mean age was 32 years. Traffic accidents accounted for 83 percent of the cases. The median Injury Severity Score was 23.

Fifty-five patients were pronounced dead on arrival at the resuscitation areas. Respiratory failure was found in 27 victims, shock in 23, and unconsciousness in 35 of the 63 patients treated by the intensive care unit. Five patients had cardiopulmonary arrest and were successfully resuscitated, but 4 of these died in the hospital.

Treatment was assessed to be of no influence on the outcome in 18 patients and to be of benefit during transport in 21 patients. In 24 patients potentially life-saving interventions, including endotracheal intubation and massive intravenous infusion, were carried out. Six patients in this latter group survived.

Our findings suggest that prehospital advanced life support may reduce mortality and morbidity following severe trauma.

The value of hospital-based traffic accident registration

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The official Danish traffic statistics are based on information from the local police registers, and are used in the planning and evaluation of preventive initiatives. To describe the value of routine hospital-based accident registration, we have compared the content of the hospital accident register, regarding traffic-related accidents, with the content of the local police register for the year 1986.

Material and methods: Of the accident-related 18,417 contacts with the casualty department in 1986, 1,288 were caused by traffic accidents: 249 of these were known to the local police.

Results: See Table 1. (p. 32)

Discussion: The result shows considerable variation in the degree of registration amongst the various groups of road users, and stresses the value of hospital-based traffic-accident registers. The official statistics present a grossly distorted picture of the number and consequence of traffic accidents to the local and central decision-makers.

Table 1. Contacts with the casualty department caused by traffic accidents in 1986 (*N*) and degree of registration by the police in percent (%)

	Pedestrian		Bicycle		Moped	
	N	%	*N*	%	*N*	%
Total	67	46	684	9	188	15
Outpatients	44	25	593	6	160	8
Hospitalized	18	83	89	28	28	54
Deaths	5	100	2	50	0	0
Single accidents	-	-	458	3	144	9
With counterpart	67	46	212	68	41	34
Bed days in hospital	322	89	1018	39	260	50
Fractures	22	73	126	13	36	28
(2) Skull/face	8	88	13	23	3	0
Upper arm	1	100	25	0	8	13
Lower arm	4	50	52	10	8	13
Hip/upper leg	1	100	15	13	6	33
Lower leg/ankle	6	50	12	33	7	71

Table 1. Continued

	MC		Car		Total	(1)
	N	%	*N*	%	*N*	%
Total	72	32	267	40	1288	19
Outpatients	44	18	187	36	1035	13
Hospitalized	25	48	77	47	239	43
Deaths	3	100	3	67	14	86
Single accidents	44	20	71	44	719	9
With counterpart	22	45	138	43	483	53
Bed days in hospital	382	73	906	31	2968	46
Fractures	30	40	36	44	252	29
(2) Skull/face	4	75	10	50	41	46
Upper arm	2	0	4	50	40	10
Lower arm	7	0	2	50	73	12
Hip/upper leg	5	40	6	33	34	32
Lower leg/ankle	8	63	4	50	37	51

(1) Ten contacts with unknown mode of transportation are not included in the table.
(2) Selected types of fractures.

Sports injuries during a year in the casualty ward

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Materials and methods: All the sports injuries/accidents were prospectively registered in the casualty ward of Randers Central Hospital from October 1980 through September 1981. In all, 1,839 sports injuries were registered and classified after the A.I.S. (Abbreviated Injury Scale). Questionnaires were sent to all the participants, three times if necessary. Totally, 1,535 answered the questionnaires. Randers Central Hospital, which serves 124,321 inhabitants, had a total of 17,700 accidents during this period.

Results: Male predominance (60 percent) was observed. The highest number of injuries occurred in the age group 10–19 years. Soccer was the most frequent sport, causing 39 percent of the accidents that needed treatment in the casualty ward. Next to soccer came handball and badminton. Twenty-one percent of the accidents were caused by distortions of the ankle joint and 7 percent were distortions of hands or fingers. About 10 percent of the injuries were caused by contusions of the legs. Fractures comprised 14 percent of the total number of accidents, and out of these, 34 percent were located in the hands or fingers, 18 percent in the legs or ankles. Eighteen percent of the injuries were to the radius or ulna and 14 percent to the feet or toes. The A.I.S. classified 53 percent as minor, 37 percent as moderate, and 8 percent as severe accidents. None of the injuries were fatal. Sixty-four percent finished the treatment right away in the casualty ward, 16 percent were later treated in outpatient clinics, and 12 percent were treated by a general practitioner. Six percent were admitted to the hospital immediately, whereas 3 percent were admitted later. Ten patients were hospitalized for more than a week, and out of these, 2 were hospitalized for more than 6 weeks. Out of all the patients, 69 percent had a recovery period of 1 day or less, and 11 percent for more than 3 weeks. For 0.7 percent (11 patients), it meant unemployment or change of work. Because of the accident, 3 percent (43 patients) lost 1500 Dkr or more of their income.

Conclusion: This work showed a high frequency of sports-related accident treated in the casualty ward and high economic expenses for both the community and the individual.

Minor head injuries: epidemiology and prognostic factors

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The aim of this study was to evaluate the epidemiology of and prognostic factors for patients suffering minor head injuries, and also the possibility of reducing the number of admissions.

Patients and methods: Totally, 1,998 patients were admitted for a minor head injury in 1985 and 1986, while 122 were excluded because of parallel causes of admission. The mean age was 28 years, and the male:female ratio was 1.6:1. The admission rate was 348 per 100,000 inhabitants per year.

Results and conclusions: Sixty-six percent of the patients were admitted between 4 p.m. and 7 a.m., and one third during weekends. Traffic, assaults, and home accidents accounted for 34, 18, and 17 percent, respectively. At least 28 percent of

the patients were under the influence of alcohol.

Nine out of 1,876 patients developed intracranial lesions, of whom 3 had surgery. The admission guidelines used in this study were quite extensive. By using the following more restricted guidelines for admission (viz., depression of the level of consciousness or confusion at the time of arrival, skull fracture, focal neurologic signs, fits, influence of alcohol, or age under 3 years), the admission rate could be reduced by 50 percent without overlooking intracranial lesions. The costs for this group of patients in Denmark could be diminished by approximately 9 million U.S. dollars (67 million Dkr).

Basic science and pathology

The inflammatory phase in fracture healing: The hemodynamic effect of indomethacin on rabbit osteotomy

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It is known that indomethacin inhibits fracture healing, probably via inhibition of the synthesis of prostaglandin. The aim of the study was to investigate the effect of indomethacin on early hemodynamics after osteotomy.

Material and methods: Twenty rabbits were randomized to treatment with placebo (*n* 10) or indomethacin (*n* 10; 10 mg/day per kg body weight) from 3 days prior to surgery until killing 4 days after surgery. In all the rabbits, unilateral mid-transverse tibial osteotomy was performed and stabilized with an intramedullary K-wire and a plaster cast. Four days after osteotomy, the animals were anesthetized and regional blood flow (RBF) was measured with 15 μm ^{141}Ce-labeled micospheres. The plasma volume (PV) and extracellular fluid volume (ECV) were assessed by the distribution space of ^{125}I fibrinogen and ^{51}Cr EDTA, respectively, 30 minutes after injection of the tracers. Subsequently, the rabbits were killed and the legs dissected into standardized specimens.

Results: The RBF was reduced in the bone marrow in the osteotomized tibia, but unchanged in the diaphyseal bone. The RBF in the muscle was increased suggesting an inflammatory reaction. The PV was significantly reduced in osteotomized diaphyses and bone marrow, but unchanged in the muscle.

Conclusion: Indomethacin did not cause any significant change in early hemodynamics after osteotomy.

Experimental osteosynthesis in human bone fractures with ethyl 2 cyanoacrylate tissue adhesive

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The tensile strength between human cadaver bone and ethyl 2 cyanoacrylate (E2C) has been determined. Twenty-eight short oblique fractures were produced. A thin film of the adhesive was applied covering 15–20 percent of the fracture surface. In 23 cases the adhesion was between cortical bone fractures, and in 5 cases between spongious bone. The fractures were reduced and held in position for 3 minutes. The material was stored in a saline solution for 24 hours, and then the tensile strength was measured.

The results varied from 0–45 kg/cm^2. In 3 cases the tensile strength was 0 kg/cm^2; in a further 5 cases the adhesion was rather strong, 21–45 kg/cm^2. The results did not depend on the thickness of the cortical bone or whether the adhesion was cortical or spongious bone.

During the experiment, we discovered that it was extremely important to achieve exact reduction, even minor dislocation (less than 1 mm) or interposition of minor bone pieces or soft tissue disturbed the adhesion.

These ideal conditions were difficult to obtain in vitro and may be even more difficult to obtain during an operation. E2C can therefore only be recommended in selected cases, for instance, for temporary fixation of intermediary fragments, provided that the monomer is biocompatible.

Capillary blood flow and permeability to albumin in a musculocutaneous flap reattached at different tissue tensions

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Excessive, as well as reduced, tension in connective tissue is considered to influence the microcirculation adversely. This investigation explored the effect of different tissue tension on capillary blood flow and permeability after resuturing of a musculocutaneous (MC) flap.

The *material* comprised 16 dogs, 6–7 months old, weighing 15–20 kg. Four arterialized 4 by 8 cm MC flaps based on the superior and inferior epigastric vessels were outlined on the abdomen of each dog. Four flaps were raised in 8 dogs. Two flaps were raised, and the last two flap areas served as untouched controls in 8 dogs. The elevated flaps were randomized to reattachment at resting tension (1.0), half length (0.5), and one and a half times the original length (1.5). Regional capillary blood flow (RBF) was measured by the microsphere technique. Vascular permeability (VP) to albumin

was investigated as the ratio between the distribution space of ^{131}I-albumin and the high molecular ^{125}I-fibrinogen.

Results: Clinically, the 1.5 flaps were maximally stretched, while the 0.5 flaps were without tension. RBF in skin and subcutis was unchanged. Muscle blood flow was decreased after elevation of the flap when the flaps were reattached at reduced and normal tension ($P < 0.05$), whereas blood flow was insignificantly reduced when reattached at increased tension. VP was not increased in any of the four groups.

Conclusions: The capillary blood flow in muscle seems to be more sensitive to surgical trauma than that of skin and subcutis. The muscle component of MC flaps tolerates stretching better than reduced tissue tension with respect to blood flow.

Regional distribution of blood flow and arteriovenous shunting in a musculocutaneous flap

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Flap elevation may elicit vascular reactions including vasospasm, circulatory redistribution, and arteriovenous (AV) shunting. Substantial AV shunting and major derangements in nutritional perfusion are known to occur in skin island flaps. Musculocutaneous (MC) flaps are more resistant to infection. This may be due to a superior vascularization, but the postoperative circulatory events in MC flaps are poorly understood. The present studies were undertaken to clarify the microvascular consequences of creating a MC island flap.

Material and methods: The superior epigastric vein was cannulated on one side in 7 pigs. The corresponding rectus flap (8 x 15 cm) was raised. Total blood flow in the flap was measured as venous outflow (VO) before elevation of the flap, and 1 and 4 hours after. Simultaneously the nutritional blood flow (NBF) was assessed by the radioactive microsphere technique. AV shunting was calculated from the amount of nonentrapped microspheres in the venous outlet and also as the difference between VO and NBF.

Results: VO was nearly doubled and AV shunting increased from 5 percent of VO to nearly 50 percent after elevation of the flap ($P < 0.05$). Total NBF was unchanged 1 and 4 hours flap elevation, but subcutaneous NBF tended to decrease ($P < 0.07$).

Conclusion: NBF seems relatively undisturbed in a recently elevated musculocutaneous island flap in the pig, whereas the opening of AV shunts implicates a substantial increase in total blood flow. The localization of AV shunts and the mechanism in shunt opening has not yet been clarified.

The influence of growth hormone on different phases of fracture repair in the rat

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The effect of growth hormone administration during different phases of fracture repair was investigated in a rat model. The biomechanical properties of healing tibial fractures was investigated after 40 days of healing. Biosynthetic human growth hormone (b-hGH), 2.7 mg/kg body weight/day was given in two daily injections to three groups of rats: (1) for the entire healing period, (2) for the first 20 days, and (3) for the last 20 days of healing. Three corresponding groups of control rats were injected with saline. In group 1, the maximum load and stiffness of the healing fractures increased to 165 percent and 175 percent, respectively, compared with the control group. In group 2, the maximum load, stiffness, maximum stress, and energy absorption at ultimate load increased to 222 percent, 175 percent, 171 percent, and 247 percent, respectively, compared with the control group. In group 3, no statistically detectable effects were found. The results indicate (1) that the stimulating effect of b-hGH on fracture healing is most pronounced during the first part of the healing period, (2) that no further effect will be obtained if the b-hGH administration is extended to the entire healing period, and (3) that pretreatment is not a prerequisite for obtaining a stimulating effect of b-hGH on fracture healing.

The significance of micromovements between bone and implant

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Lack of initial mechanical stability of cementless prostheses may be responsible for the evidence that prosthetic components often are fixed to the skeleton by fibrous tissue ingrowth. We studied the significance of micromovements on bony ingrowth into porous-coated Ti implants and investigated whether HA coating can overcome the possible negative influence of micromovements between bone and implant.

Materials and methods: A dynamically loaded unstable device producing 500 microns axial translation of the implants during each gait cycle was developed. Mechanically stable devices served as controls. Stable and unstable devices with *porous titanium* (Ti) and *hydroxyapatite* (HA) coating were inserted into the weight-bearing regions of the femoral condyles in 7 mature dogs.

Results: Histologic analysis after 4 weeks showed a thick fibrous membrane surrounding both Ti- and HA-coated implants subjected to micromovements, whereas bone ingrowth was obtained in mechanically stable implants. Histologic analysis of the membranes showed fibrocartilaginous tissue surrounding unstable HA-coated implants, whereas loose fibrous connective tissue surrounded unstable Ti implants. Collagen determination of the fibrous membranes showed a 64 percent increase in collagen content around unstable HA-coated implants compared with those of Ti implants ($P < 0.05$). Ultimate shear strength of unstable Ti- and HA-coated implants was significantly reduced compared with the corresponding mechanically stable implants ($P < 0.01$). However, shear strength values of unstable HA-coated implants was greater than those of unstable Ti implants. The greatest shear strength was obtained by stable HA-coated implants, which was increased threefold as compared with the stable Ti implants ($P < 0.001$). Bony ingrowth into stable Ti- and HA-coated implants averaged 8 percent and 47 percent, respectively ($P < 0.001$).

Discussion and conclusion: This study demonstrates that micromovements of 500 microns between bone and implant inhibit bony ingrowth and lead to development of a fibrous membrane irrespective of the type of coating. However, fibrocartilage developed around HA-coated implants, whereas loose fibrous connective tissue was present around Ti implants. The higher collagen content in the membrane may be responsible for the stronger anchorage of dynamically loaded HA implants compared with Ti implants. The best anchorage and the greatest amount of bony ingrowth was obtained by mechanically stable implants coated with a thin layer of hydroxyapatite.

Hydroxyapatite coating stimulates porous ingrowth across a gap between bone and implant

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Intimate contact at the bone-implant interface is not always achievable during noncemented prosthetic implantation. We investigated the effect of hydroxyapatite (HA) coating on skeletal attachment in noninterference fit 4 weeks after implantation in 6 mature dogs. The push-out test of HA-coated implants surrounded by a 1-mm gap showed a 120 percent increased shear strength and a 425 percent increased shear stiffness as compared with titanium- (Ti) coated implants ($P < 0.05$). The fixation of Ti implants was reduced by 63 percent when inserted in a gap as compared with press-fit ($P < 0.005$), whereas HA-coated implants in a gap showed anchorage close to implants in press-fit (NS). Only minor differences were found between HA and Ti implants in press-fit. Histomorphometric analysis using fluorescence microscopy showed a significant increase in mineralizing surfaces in direct contact with HA-coated implants as compared with Ti implants inserted in both a gap ($P < 0.001$) and press-fit ($P < 0.01$).

The tightness of surgical fit appears to be an important factor for sufficient fixation of the implant. However, our results demonstrate that a thin layer of hydroxyapatite coating almost eliminates the negative influence of noninterference fit between bone and unloaded implant.

Manual and vacuum mixing of bone cement

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Nine commercially available acrylic bone cements were tested according to ISO and ASTM standards: ISO 5833-79, ASTM-F451-76, ISO 178-75, and ISO 527-78.

The cement was manually mixed or mixed at 0.2 bars absolute pressure in the MitAB vacuum cartridge. It was found that prechilling of the cement to 5 °C was necessary to preserve the viscosity and prolong the handling time. If the cement was not prechilled, adverse effect on the viscosity was experienced. For most of the cements, however, prechilling and vacuum mixing resulted in a 10–12 °C increase in the exotherms, often exceeding 88 °C. Only in Palacos standard cement, with and without gentamicin, the exotherm was not increased.

Strength in compression and three-point bending was increased for all the cements, and the modulus of elasticity for most of the cements.

Prechilling and vacuum mixing of bone cement seemed most suitable for Palacos standard cement, with and without gentamicin, as the strength increased 15–30 percent, the modulus of elasticity increased 20–25 percent and no adverse exotherms was experienced.

^{99m}Technetium-MDP scintigraphy compared with histopathology in early arthrosis and nontraumatic osteonecrosis of the hip

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Bone scintigraphy may demonstrate changes in perfusion and metabolism in early (preradiographic) stages of arthrosis and nontraumatic osteonecrosis.

We studied the diagnostic value of bone scintigraphy in patients complaining of hip pain who had no radiographic changes, slight arthrosis, or nontraumatic osteonecrosis.

The study comprised 17 patients with 25 painful hips. The scintigraphic appearance was classified into normal, increased, or decreased (abnormal) uptake. All the patients had a core biopsy of the femoral head performed. Medullary and trabecular necrosis was graded histologically.

The results of the radiographic examination, bone scintigraphy, and histologic findings are shown in the table.

Radiology	Normal		Arthrosis/Osteonecrosis	
Histology	Normal	Necrosis	Normal	Necrosis
Scintigraphy				
normal	4	3	1	4
abnormal	0	2	1	10

Conclusions: Bone scintigraphy does not seem to be sufficiently sensitive to detect preradiographic stages of arthrosis and nontraumatic necrosis. In more advanced necrosis, increased uptake is found in all the cases, while slight radiographic arthrosis inconstantly is followed by scintigraphic changes.

Growth hormone influences mechanical properties of rat cortical femur and tibia

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Growth hormone (GH) increases the length of bones. Does GH also influence the mechanical properties of cortical bone?

Materials and methods: Female Wistar rats 42–49 days old (10 per group) were injected s.c. with GH 0.16, 1.10, and 8.33 mg/kg/day for 90 days. One group received placebo.

The right femur and tibia were tested mechanically by a standardized, three-point bending procedure. The internal and external diameters were determined and mechanical data normalized. Ash weight, density, and collagen content were determined.

Results: In the femur and tibia, respectively, 8.33 mg GH/kg/day resulted in an increase in internal diameters (13 and 0 percent), external diameters (10 and 13 percent), ultimate load (56 and 46 percent), energy absorption at ultimate load (113 and 90 percent), and maximum stiffness (45 and 54 percent).

In femur the normalized energy at ultimate stress was increased by 27 percent, and the elastic modulus (Young's modulus) decreased by 14 percent. The real density of femur was decreased (11 percent); the mineral and collagen content did not differ between the bones.

Conclusion: GH can induce increased mechanical strength in rat cortical femur and tibia, which can partly be explained by changed dimensions of the bones. In femur, qualitative changes have also taken place, as the normalized energy absorption at fracture is increased and the Young's modulus and density of the bone are decreased.