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Honorary guest lecture

The source of local neurovascular ischemia in Morton's metatarsalgia

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In 1942, the late Dr. William Holmes of Oxford, a distinguished neurohistologist, declared that the neural lesion in cases of genuine Morton's metatarsalgia is ischemic in nature and secondary to a unique type of local obliterative change in the adherent digital arteries. In agreement with his opinion a mechanism of damage to those vessels can be observed directly through an adequate plantar incision, especially in cases with a short history of attacks of neuralgic pain. The common digital artery is seen to appear on the plantar surface of the deep transverse ligament through a small fibrous foramen, where it is always patent. It soon reaches the deep surface of the common digital nerve, where its position is that of an end artery providing a free supply to the endoneural vasculature. About the distal margin of the ligament, the artery divides and a communicating artery arrives from the dorsum, making a small complex of four named arteries probably vulnerable to mechanical influences. At the same level, the complex is in close contact with the important interphalangeal component of the intermetatarsophalangeal bursa. At operation, excursions and incursions of the bursal wall, along with a short segment of neurovascular bundle, can be induced by alternate gentle compression and free relaxation of the forefoot. No doubt similar combined movements in daily life account for the *minor* changes in both artery and nerve that gradually become a regular finding in control specimens from middle-aged adults; such changes were first noted by Ringertz and Unander-Scharin in 1949. There is evidence to suggest that the crucial factor which determines the *major* arterial changes found in genuine lesions is an exceptionally large interphalangeal component of the whole bursa. With the use of any closed type of footwear, the distal wall of the bursa repeatedly bulges forwards, thus tensing the communicating artery from the dorsum and causing a traction effect on the already vulnerable arterial complex at the point of anastomosis. In the course of time, the communicating artery certainly becomes reduced to a barely visible fibrous strand. The symptoms occasionally develop in an adolescent or even in a child; the mechanism here suggested may therefore begin to operate at quite an early age.

Arthroplasty

Removal of wires in patients with trochanteric pain after total hip replacement a.m. Charnley

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The object of the present study was to evaluate the results after removal of the wires in patients treated with an otherwise uncomplicated THR a.m. Charnley.

The study included 41 patients (mean age 68 years) with pain located in the trochanteric region and radiographic union of the trochanter osteotomy. None of the patients had clinical or radiographic signs of infection or loosening of the prosthesis at the time of operation.

A questionnaire regarding the postoperative status of the hip (mean 37 months postoperatively) was sent to the patients. All files and radiographs were reevaluated at the follow-up.

Twenty-one of the patients were asymptomatic or had less pain after the operation and could be classified as excellent or good. In 20 patients the pain remained unchanged or was worse, and these patients were classified as fair or poor. Three of the patients

had postoperative infections. The walking ability and hip movement remained unchanged.

Factors associated with mechanical loosening in total hip replacement ad modum Lubinus

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The purpose of the study was to evaluate risk factors predisposing to aseptic femoral loosening following THR, especially the effect of femoral plugging.

Totally, 120 patients, with 130 operated hips, were examined 5 (5–7) years after surgery. All operations were performed in a conventional operating theatre using no specific precautions. A medullary plug was used in 60 per cent of the hips. A detailed evaluation of all radiographs were reviewed and classified according to signs of progressive loosening.

The mean grading of pain, mobility, and walking ability increased to 5.7, 5.0, and 5.4, respectively. There were no infections. Seventy-five per cent had no signs of progressive loosening. Definite loosening of the femoral component was found in four hips of which two were reoperated on. Probable and possible loosening was seen in three and 26 hips, respectively.

In conclusion, THR was performed without infections in a conventional operating theater using prophylactic antibiotics and gentamycin cement. The plug technique did not prevent radiographic signs of progressive loosening, nor did it prevent varus position of the stem. Varus position of the stem increased the chances of loosening.

The anterolateral approach in total hip replacement

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The peroperative and postoperative course of 583 consecutive total hip replacements using the anterolateral approach was reviewed. In all, 21 per cent of the hips had previously been operated on. Osteotomy of the great trochanter was performed in 17 cases, of which 12 were rearthroplasties.

Peroperative complications included six fractures of the proximal femur, 17 fractures of the great trochanter, and six cases in which the stem of the prosthesis perforated the shaft of the femur.

The postoperative complications were few, as only two hips needed evacuation of a hematoma, and there were two cases of superficial infections, cured by local treatment. Three hips dislocated in the early postoperative course, all of which could be reduced closed. One patient had a femoral nerve palsy. Postoperative radiographs showed the inclination of the acetabular cup to be between 30° and 60° in 98 per cent, and the femoral stem in the neutral or valgus position in 94 per cent.

One year after the operation, no patient had developed an infection or late dislocation. Six per cent of the hips had heterotopic ossification grade III, and most of them had functional impairment.

The anterolateral approach in total hip replacement is considered a safe procedure, which enables satisfactory positioning of the prostheses with few complications, but with a rather high incidence of heterotopic ossification.

Total condylar knee replacement: A 4–6 year follow-up

Per Kjaersgaard-Andersen, Ivan Hvid, Jon-Oddvar Wethelund & Otto Sneppen

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As part of a prospective study on knee arthroplasties, the results of 241 consecutive total condylar knee replacements a.m. Insall-Burstein in 183 patients are reported. During the period, 17 patients died. Three knees had an arthrodesis, 1 patient had a disarticulation of the hip joint, and 12 patients were lost to follow-up. The remaining 199 arthroplasties were performed in 150 patients, 29 men and 121 women, with an average age of 63 (24–80) years. Mean follow-up was 58 (45–75) months. The replacements were performed in 85 patients with gonarthrosis (GA) and in 61 patients with rheumatoid arthritis (RA). The NYHSS knee-rating scale was used.

According to the total score, excellent or good results were found in 88 per cent. Moderate or severe walking pain was present preoperatively in 91 per cent; at follow-up 93 per cent had no or slight pain. Preoperatively, 13 and 5 per cent had a walking distance greater than 500 meters in the GA and RA group, respectively; at follow-up, 84 and 56 per cent. In 50 per cent the range of motion at follow-up was better than the preoperative range.

Our results show that the total condylar knee prosthesis 4–6 years after insertion still effectively relieves pain and provides a good functional result in most patients.

The evaluation of pain after total knee replacement

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The purpose of this study was to develop and test a knee-pain scale to be used in clinical research concerning the treatment of chronic diseases of the knee. The scale was built up as a questionnaire containing 15 items. It was tested on 98 knees, of which 64 had been operated on at an earlier date.

The data were analyzed using a test-item analysis based on the probability model of Rasch. Five items had to be discarded in order for the scale to show a degree of internal validity that could satisfy the demands of an ordinal scale. Subsequently, the evaluations according to the scale were compared to repeated evaluations of 52 knees, performed by the patients themselves and by three independent clinicians. The result of this comparison was that the agreement between the scale and the patients' evaluations was as high as the reliability of the patients' evaluation (Kappa 48.6 (46–52) per cent and 49.4 (44–49) per cent, respectively).

We concluded that the internal and external validities of the scale satisfied the demands that can be made on a method for evaluation of latent traits.

Modular knee replacement in primary and secondary arthrosis: 1-6 year follow-up

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The purpose of the study was to analyze the 1–6 year results of modular knee arthroplasty.

Forty-five patients (13 females, 32 males) aged 59 (17–75) years were operated on, 4 bilaterally. Fifteen knees had bicondylar arthroplasty performed. Rheumatoid arthritis was the primary disease in 7 patients, tibial condylar fracture in 4 patients, and hemophilia in 1 patient. Two knees were lost to follow-up. Prospective evaluation was by The New York Hospital for Special Surgery knee rating scale.

At follow-up, 23 knees were rated excellent, 12 good, 5 fair, and 7 poor. Pain during walking was present in all the patients preoperatively, at follow-up 69 per cent had no or only slight pain. All the knees showed a range of motion exceeding 90 degrees. Five knees were revised to a total condylar type of knee replacement, and another three awaited revision because of recurrent pain. Life-table analysis showed that the frequency of an excellent result decreased from 75 to 12 per cent during the 6-year period. The revision rate stabilized at 24 per cent from 4 years postoperatively. There were no postoperative infections.

Although the early results were acceptable, the durability of results was questionable, and the revision rate was high.

The total condylar-I knee prosthesis and stability evaluated by gonylaxometry

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It was the primary purpose of this study to see to what extent the laxity (anterior, posterior, varus, and valgus) or lack of laxity (tightness) influenced the functional result in knees with the total condylar-I knee prosthesis. Fifty knees with this prosthesis were examined clinically and radiographically, as well as with gonylaxometry (stress radiography). The average postoperative knee score, mean overall alignment, and prosthetic positioning were fully comparable with other studies of this kind.

The mean values for the laxities measured were lower than the mean values measured in intact knees, i.e., the prosthetic knees were tighter than the intact knees.

There was no relation between laxity in any direction and postoperative knee score, overall alignment, age, or prosthetic positioning, nor did the values for laxity correlate with the patients' subjective judgement of pain and function.

Skin protection against methylmethacrylate monomer

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Most surgical rubber gloves are penetrated by methylmethacrylate monomer (MMA) in less than 1 minute as demonstrated by gas chromatographic measurements. A three-layer PVP glove, 0.07 mm thick, consisting of of an outer layer of polyethylene, an intermediary layer of ethylene vinyl alcohol polymer, and an inner layer of polyethylene is impervious to MMA for 20 minutes. A viton-butyl rubber

glove, 0.27 mm thick, is impervious to MMA for 15 minutes. The PVP glove is recommended to orthopedic surgeons, nurses, and others handling acrylic bone cements in order to avoid sensitization, and especially to persons with known contact allergy to MMA.

Spine

Combined anterior and posterior fusion for kyphosis

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A two-stage procedure with disc excision and anterior fusion through a thoracic or thoracolumbar approach followed by halo-traction and posterior fusion with the Luque technique has been used in the treatment of progressive kyphosis in 5 young patients aged 14 (11–20) years. The underlying etiology was neurofibromatosis in 2 patients, trauma in 2 patients, and in 1 patient the kyphosis was a result of extensive laminectomy performed in childhood for a growing spinal tumor.

The kyphosis was measured according to Cobb. The preoperative value was 91 (44–140) degrees, and the postoperative 52 (19–10) degrees. One patient had traumatic paraplegia and 1 patient had had spastic paraplegia preoperatively and no further neurologic damage occurred in the patients during the operations. During the average observation period of 10 months, the fusions had healed, although the Luque apparatus in 1 case had to be removed 6 months postoperatively because of a fistula. The results suggest this two-stage technique to be a valid procedure in the treatment of severe kyphosis.

Harrington fusion in idiopathic scoliosis

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The present study is a 1–7-year follow-up of operative fusion in idiopathic scoliosis. The postoperative treatment included a Blount's brace for 12 months.

Forty-nine patients were operated on at the Orthopedic Hospital from 1978 to 1985. Thirty-nine patients were available for follow-up. The mean age at operation was 17 (12–27) years. The main curve (total range 50°-95°) was reduced by an average of 16° to 32°-68°. The primary complications included urinary infection in 12 patients, dislocation of one Harrington hook in 1 patient necessitating reoperation. The late complications included pseudarthrosis in 1 patient. The Harrington rod fractured in 2 patients without attendant symptoms.

At follow-up, 27 patients (69 per cent) complained of fatigue in the back, whereas 6 patients complained of low back pain. The mean functional vitality capacity showed an increase from 71 per cent to 78 per cent ($P < 0.001$). Twenty-eight patients (72 per cent) participated in normal sports activities.

In conclusion, Harrington fusion in idiopathic scoliosis followed by brace treatment provides lasting correction of the spinal deformity with improvement of pulmonary function.

Upper extremity

Late functional result after distal radius fracture

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The radiographic and functional result was evaluated 42±4 months after distal radius fracture in 35 men and 119 women. All the patients had been treated by immobilization in plaster for 6 weeks preceded by reduction if necessary (85 patients). The fractures were classified according to Older, and the functional result evaluated after a scoring system modified after Gartland & Werley. Eighty patients had an excellent result, 56 were good, 18 acceptable, and none were poor.

Multiple contingency tables were used to analyze correlations between the fracture type, the radiographic result and the functional result. As previously demonstrated, the radiographic result was correlated with the fracture type. The functional result, however, was also correlated with the radiographic result, but mostly due to a high score for deformity and complications. Patients with residual deformity often had pain and decreased gripping strength and thus a higher score. Age also influenced the functional result.

Conclusion: The classification system described by Older not only describes the radiographic result, but also the function more than 3 years after a distal radius fracture. Thus, it seems worthwhile to try to improve the radiographic result of treatment in order to improve the long-term functional result.

Radius osteotomy for the treatment of lunatomalacia

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Lunatomalacia (LM) is often associated with a relative discrepancy in the distal extension of the radius and the ulna (minus variant). Surgical technics with the purpose of reducing this discrepancy have been advocated for the treatment of LM.

The purpose of our investigation was to examine the clinical and radiographic effect of radius osteotomy in the treatment of LM in 14 patients operated on since 1978. After the operation, the radiographic progression was arrested in all the patients and a tendency to healing was seen in 6 patients. The symptoms tended to regress. Thus, we recommend radius osteotomy for the treatment of LM.

Long-term follow-up in nonoperative treatment of Kienböck's disease

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Twenty-four patients with Kienböck's disease treated conservatively were reexamined. When treatment was started, the most frequent complaints were pain and reduced range of motion in the wrist. The average time from treatment to reexamination was 101 (15–135) months.

At the follow-up, 5 patients had been fused, 6 patients had no pain, 5 patients had pain during heavy work, and 9 patients had pain during lighter work.

Before treatment was instituted, 80 per cent of the patients had a fragmented lunate. At follow-up, 73 per cent of the fragmented bones had healed. During follow-up, 28 per cent of the patients developed arthrosis.

The average range of dorsal and volar flexion at the time of follow-up was 43° (10°-70°) and 45° (10°-85°) versus 34° (10°-70°) and 28° (10°-60°) at the first examination.

In 1947, Ståhl concluded that immobilization was the treatment of choice in Kienböck's disease. We found that long-term results of nonoperative treatment in Kienböck's disease were not satisfactory. Only 25 per cent of the patients had a painless wrist.

The ulnar variance in normal wrists and in Kienböck's disease

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By using a standard radiographic projection and a new, reliable method of measuring, the ulnar variance in 100 normal wrists and in 47 wrists with Kienböck's disease was evaluated and compared. We found a significant overrepresentation of "ulna minus variant" in patients with Kienböck's disease. However, in eight of 47 wrists with Kienböck's disease, a subchondral bone formation opposite the lunate had taken place. This bone formation might be an arthrotic response to collapse of the lunate and will tend to enhance the negative value of the ulnar variance. Extracting these eight wrists from the material, leaving 39 wrists to be compared with normal wrists, gave no statistically significant difference in mean ulnar variance values. Further, 18/47 wrists presented an ulnar variance at, or more positive than, the mean ulnar variance in normal wrists.

We concluded that the overrepresentation of the "ulna minus variant" in Kienböck's disease seems to be a consequence of the disease and not vice versa. It seems unlikely that the "ulna minus variant" has any bearing on the cause of Kienböck's disease. Consequently, the indications for ulnar lengthening and radial shortening needs to be reevaluated.

Hyperextension injuries of the PIP joint

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A prospective study of 126 consecutive patients was performed from November 1982 to November 1983. The purpose was to evaluate which treatment is preferable: immobilization (group 1) or nonimmobilization (group 2) of traumatic lesions of the volar fibrocartilage of the PIP joint

Sixty-one patients were randomly selected for group 1 and 65 for group 2. Immobilization was done using a volar aluminum splint.

A follow-up study was carried out 2–3 years after the injury occurred. Forty-six patients from group 1 and 42 from group 2 participated. No statistical difference was found with respect to sequelae between the two groups. Compared with a follow-up per-

formed 6 months after the date of injury, the rate of sequelae had decreased considerably from 57 to 21 per cent of the injured.

We concluded that treatment without immobilization is preferable because of its inexpensiveness and better patient compliance. The rate of sequelae decreases considerably with time.

Lower extremity

Early detection of osteonecrosis of the femoral head. A new method

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In the early stage of osteonecrosis of the femoral head, the hip is clinically and radiographically normal (the silent hip). Methods of demonstrating this stage (intramedullary measurement of the pressure, venography, scintigraphy, and histologic examination) have hitherto been ineffective. By mass spectrometry, we have in 2 cases been able to demonstrate intraosseous ischemia before demonstrable necrosis developed.

Before a left-sided hip replacement in a 61-year-old, otherwise healthy woman with a normal right hip and a normal radiograph, the intramedullary pressure and partial pressures of oxygen and carbon dioxide were examined in both femoral heads. The intramedullary pressure of the right femoral head was found to be very high (67 mmHg) and the oxygen tension was very low (33 mmHg). The carbon dioxide tension was elevated and so was the concentration of lactate in blood aspirated from the femoral head. Three months later, a repeat examination revealed the same findings. After a core decompression, the oxygen and carbon dioxide tensions were normalized and the intramedullary pressure was lowered to near normal.

Similar measurements were made in a 51-year-old woman who had persisting pain in her left hip of 1-year duration and restricted range of motion but a normal radiograph and scintigraphy. Her pain disappeared after core decompression.

We conclude that ischemia is the cause of pain and that core decompression can be performed as a prophylaxis.

Quantification of a-p laxity in 15 versus 90 degrees of knee flexion

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In recent years, the Lachman test for assessing anterior cruciate ligament laxity, executed with the knee flexed to 15 degrees, has been introduced. The aim of the present study was to quantify the differences between drawer signs measured in 15 and 90 degrees of knee flexion.

Material and methods: Two groups were investigated. Group one (11 patients, 22 knees) had no history of knee injury. Group two (16 patients, 16 knees) had rupture of the anterior cruciate ligament. Data were obtained by stress radiography. The force exerted on the proximal tibia was 220 N.

Results: In the uninjured group, both anterior and posterior laxity were significantly greater in 15 than in 90 degrees of flexion ($P < 0.001$ and $P < 0.0001$, resp.). In the injured group, the anterior drawer sign was still greater in 15 degrees of flexion ($P < 0.01$), but we found no difference in posterior drawer sign. The increase in laxity achieved by examining knees in 15 rather than in 90 degrees of flexion was not significantly greater in the injured knees than in the uninjured knees. The variation within the patients' knees in the uninjured group was ≤ 3.9 mm in 15 degrees and ≤ 3 mm in 90 degrees of flexion.

Chondromalacia patellae

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Chondromalacia patellae is a clinical entity characterized by retropatellar pain associated with changes in the articular cartilage of the posterior surface of the patella. Chondromalacia patellae is important because in man it is the earliest clinically recognizable manifestation of cartilage breakdown before the stage where subchondral bone is exposed.

Patellar cartilage samples were obtained at the time of surgery from 20 patients – 11 with normal cartilage and 9 with chondromalacia patellae. All the patients had a meniscal lesion and/or patellar plica syndrome and/or chondromalacia of the patella diagnosed at arthroscopy. The cartilage samples were

analyzed for glycosaminoglycans (GAG) content by a modification of the method described by Cappelletti et al. (*Anal. Biochem.* 99, 311–315, 1979). By this method the main GAG constituents of cartilage were electrophoretically separated to allow quantification by optic scanning.

Cartilage from chondromalacia patients showed a significant ($P < 0.05$) increase in dermatan sulfate and hyaluronic acid, and a significant ($P < 0.05$) decrease in chondroitin 6-sulfate, with only slight changes in chondroitin 4-sulfate and karatan sulfate. The total uronic acid concentration was significantly ($P < 0.01$) decreased.

Metastatic size in pathologic femur fractures

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The sizes of the metastases in 69 patients with pathologic femoral fractures were evaluated radiographically. The following parameters were measured: the width of the metastasis (M), the ratio between the width of the metastasis and that of bone (M/B), the axial length of cortical destruction in the bone (H), and the percentage of cortical bone destruction of the circumference. A positive correlation was found between the four methods of measuring, except between H and M and between H and M/B. When grouping the metastases according to the origin of the primary tumor, there were no differences between the sizes of the metastases and no predilection to localization in the different regions of the bone. However, the cortical destruction in axial length of the bone was significantly smaller in the neck than in other parts of the femur. For 90 per cent of the fractures, the metastatic sizes exceeded the following measurements: the ratio M/B $\geq$ 0.06, the cortical destruction H $\geq$ 13 mm in the collum and $\geq$ 30 mm in other parts of the femur, and the destruction in the circumference $\geq$ 50 per cent. The width M in itself was of no value. We propose that pathological lesions in the femoral bone be considered for prophylactic internal fixation when the sizes exceed these measurements.

Closed unstable tibial shaft fractures treated with open reduction and external fixation a.m. Hoffmann

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Evaluation of 79 patients with an unstable tibial shaft fracture treated in our department with external fixation revealed the same complications as in other series.

Strict rules for the use of the Hoffmann apparatus were set up. Paramount of the issue is anatomic reduction before insertion of any pin. In 34 patients, closed reduction was impossible. The fractures were exposed, reduced, and temporarily fixed with a bone forceps until the fixator was applied. Combined use of lag screws were successfully used in 8 patients, especially with large intermediate fragments. No complications arose in patients treated according to the rules. The average time of healing decreased from 32 to 17 (12–28) weeks. In 3 patients the rules were violated by inserting pins before reduction and 2 cases of pin infection and 1 case of fracture infection occurred. All signs of infection, however, had vanished in all 3 patients at the time of bone healing. The 34 patients were treated by 14 different surgeons with varying experience, which indicates the logic of the mandatory, but simple, rules and the simplicity of the appliance of the apparatus.

The modified Wilson's oblique displacement osteotomy for hallux valgus

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Seventy-seven modified Wilson osteotomies with follow-up from 26 to 44 months were reviewed to introduce a simple and stable alternative to the procedures generally used.

The patient age was 46 (15–70) years. Twenty-two feet showed radiographic signs of arthrosis preoperatively. The patients were examined clinically and radiographically. Eighty-one per cent were satisfied with the operation and 59 per cent were totally free of pain. Metatarsalgia was the main cause of poor results and was related to dorsally angulated osteotomies. Shortening of the great toe, radiographic signs of arthrosis, and advanced age were not related to poor results. One patient had stiffness of the first metatarsophalangeal joint. The valgus and intermetatarsal angles were reduced to normal values.

The modified Wilson's oblique displacement osteotomy was found to give satisfactory correction of the hallux valgus deformity, but careful attention is necessary to retain the displacement as intended.

Prevention of deep venous thrombosis in elective hip surgery

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Totally, 205 patients completed a prospective, double-blind, radomized trial in which the combination of graded compression stockings, 5,000 IU heparin, and 0.5 mg dihydroergotamine given twice daily was tested against compression stockings alone in preventing deep venous thrombosis (DVT) following elective hip surgery.

All the patients were screened with the $^{99}Tc^{m}$-plasminscintimetry test on the 2nd and 7th postoperative days and a DVT was verified by phlebography. Thirty-six patients developed DVT, 25 in the placebo group and 11 in the combination treatment group ($P < 0.05$). Of the 36 patients with DVT, 8 patients (7 in the placebo group and 1 in the combination treatment group) developed pulmonary embolism ($P < 0.05$). There were no fatal embolisms.

We conclude that the combination of graded compression stockings, low dose heparin, and dihydroergotamine are superior to compression stockings alone in preventing DVT following elective hip surgery.

DHEH and Dextran 70 in thromboprophylaxis after hip fracture

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This study compares the prophylactic effect of Dihydroergotamine/Heparine (DHEH) and Dextran 70 in combination with TED-stockings with a group of patients treated only with TED- stockings.

In all, 96 patients with cervical or trochanteric fractures of the femur were randomized into three groups. 1) DHEH (0.5 mg DHE, 5,000 I.E. Heparine) given subcutaneously twice daily until mobilized (at least 7 days). 2) Dextran 70 (Macrodex 6% in NaCl) 500 ml peroperatively, 4–6 hours postoperatively, and every other day until mobilized. 3) Control group. All patients were given TED-stockings to use until mobilized.

Venography was performed in all patients at days 9–11 and evaluated blindly by a radiologist (EF).

There was a lower incidence of DVT in the DHEH group (7/36) and Dextran group (5/29) compared with the control group (14/31) ($P < 0.025$). The incidence of DVT in the DHEH and Dextran groups did not differ ($P > 0.8$).

There was no difference in the peroperative and postoperative hemorrhage between the three groups (DHEH: 495 ml ± 80 ml; Dextran 70: 565 ml ± 112 ml; control: 517 ml ± 110 ml.

Conclusion: DHEH and Dextran 70 together with TED-stockings proved equally effective in preventing DVT. The control group showed a lower incidence of DVT than other studies where no stockings were used.

Pediatric orthopedics

Calvé-Perthes disease of the hip

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The purpose of the study was to investigate and determine the following: 1) In how many joints is early classification a.m. Salter (extent of subchondral fracture) feasible? 2) Is it possible to reduce the treatment time by weight bearing in the early reossification phase? 3) What are the primary results after wheelchair treatment?

From 1965 through 1969, 39 hips in 32 children were treated. Twenty-five sat in a wheelchair, 6 had supplementary treatment, and 1 used a Thomas splint only. None were operated on. In 11 joints, Salter classification was feasible, whereas in 28 joints femoral head necrosis had to be awaited before classification (a.m. Catterall) was possible.

In view of recent knowledge, 11 children should not have been treated at all. Early mobilization might have reduced the mean treatment time from 29 to 13 months.

The sphericity of the femoral heads was evaluated with the Mose circle. In Catterall groups I-II, a uniform distribution of good, fair, and poor results was found. In groups III-IV, none were good, a few were fair, but the majority (70 per cent) were poor.

Conclusion: Early prognostication with Salter's classification was feasible in one fourth of the cases. Mobilization in the early reossification phase may reduce the period of weight relief by 50 per cent. The wheelchair does not appear to be optimal treatment.

Collagen type III predominance in newborns with congenital dislocation of the hip

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Because systemic alterations in collagen metabolism might be of pathogenic importance in congenital dislocation of the hip (CDH), the collagen content and the relative distribution of collagen types I and III were measured in umbilical cords from newborns with CDH and healthy controls.

Umbilical cords from 5 patients with CDH and 6 normal patients were used. The total collagen was estimated as μg hydroxyline per mg dry tissue weight and the acid soluble collagen as well as the pepsin soluble collagen (PSC) was determined. The total protein content was estimated as μg α-amino-nitrogen per mg dry tissue weight and the collagen type III/I ratio was measured in PSC by polyacrylamide gel electrophoresis and densitometry.

The total tissue protein was within the normal range, the total collagen amount was diminished but not significantly; the ratio type III/I was increased ($P = 0.04$). We concluded that, if systemic, these alterations in collagen metabolism may explain the joint hypermobility seen in CDH, and we suggest that the redistribution of collagen type III/I during normal development may be delayed in CDH. Further, it may explain why CDH is readily reduced by splinting without subsequent recurrence.

Congenital idiopathic clubfoot: Results of treatment of 40 feet

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This study is a clinical follow-up of 35 children (50 feet) treated during the 6-year period 1977 to 1983.

Ninety-four per cent of the feet were operated on when the infants were aged 3–6 months. Fourteen children (20 feet) had a posterior release (group A), whereas 19 children (27 feet) had a posteromedial release (group B). Two children (3 feet) were treated conservatively. Nine feet (45%) in group A and 3 feet (11%) in group B were reoperated on. Twenty-nine children (40 feet) were available for the study.

Regarding correction of the four elements of the clubfoot, the movements of the ankle and subtalar joints and the gait pattern, the results could be grouped into 22 good, 14 fair, and 4 poor feet, the "poor" signifying the indication for reoperation.

The results indicate that a majority of clubfeet should be treated with posteromedial release.

Fractures of the proximal humerus in children

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This paper reports the results of 77 fractures of the proximal humerus in children in 1976-1978. The follow-up included a radiographic and clinical investigation.

The fractures were classified according to degree of angulation and/or dislocation in four groups of patients. The cases of physeal fractures also were subdivided according to Salter-Harris.

Twenty-two children had a physeal fracture and 54 had a fracture of the proximal humerus. Eleven had the most severe type of fracture/lysis (angulation extending 60° and/or an ad latus dislocation exceeding two thirds of the shaft). Eighty-two per cent of the patients had a follow-up investigation 8–9 years after their injury.

Only patients with the most severe fractures/lysis or pathologic fractures had persisting discomfort, disability, or clinical signs of anatomic abnormality.

Remodelling of forearm fractures in children

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Seventy children treated for distal forearm fractures were clinically and radiographically reexamined with a follow-up time of 3.5 (1.5–6) years. The angulation of the fractures and the epiphyseal plates at the time of healing and at follow-up was measured. The patients were divided into three age groups: 0–5 years, 6–10 years, and 11–15 years at the time of fracture.

Concerning the epiphyseal plate and the remodelling of the fractures, we could draw the following conclusions:

1. In children below the age of 11 years with residual angulation after distal forearm fractures, the change of orientation of the epiphyseal plate towards

normal seems to account for nearly all the actual correction at the fracture site up to 28 degrees.

2. In children over the age of 11 years, the capacity of correction of the orientation of the epiphyseal plate is preserved, but the influence upon the correction of distal forearm fractures is decreased. This does not prevent correction of possible residual angulation at the fracture site – in this study up to 18 degrees. This is because appositional bone formation and resorption is an additional remodelling factor.

3. The orientation of the epiphyseal plate is influenced by the distance between the fracture site and the epiphyseal plate and by the age at the time of healing.

The prognosis of displaced intraarticular fractures of the calcaneus in children

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Fractures of the calcaneus in children have generally been considered as rare injuries leaving no sequelae.

The purpose of our investigation was to examine the long-term prognosis following displaced intraarticular calcaneal fractures in childhood.

During a period of 30 years, 20 patients were treated for intraarticular fractures of the calcaneus and 15 were reexamined 12 (1–21) years after the injury. All the patients had been treated conservatively.

None of the patients was functionally inhibited as a result of the fracture. Slight inconveniences and deformity of the feet were encountered in 9 patients. The radiographic examination revealed persistent broadening and reduction of the Böhler angle in nearly all the patients.

We conclude that minor inconveniences can be encountered following fracture of the calcaneus in childhood, although the prognosis when compared with adults is good.

Hematogenous osteomyelitis in children

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The purpose of this study was to evaluate the primary treatment and long-term results in children with hematogenous osteomyelitis.

From 1973 through 1982, 31 children were treated, 9 of whom were infants. In 14 patients, bacteria were isolated, of which 13 were *Staphyloccocus aureus*. Fifteen patients were treated conservatively, and 16 were operated on. Three had a recurrence that could possibly have been prevented.

A follow-up after a mean of 5 years showed that 3 neonates developed severe long-term sequelae despite treatment.

Experimental orthopedics

Experimental evaluation of stabilizing operations for posterolateral knee instability

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Chronic posterolateral knee instability is relatively uncommon compared with other types of rotatory instability. It is difficult to diagnose, and the results from ligamentary reconstructions are disappointing. The instability is due to lesions of the structures of the lateral compartment.

The stabilizing effect of three commonly used reconstructive methods was investigated on 20 osteoligamentous knee preparations. The methods investigated were 1) the modified reverse Ellison procedure, 2) biceps tendon transfer to the lateral femoral epicondyle, and 3) popliteal tendon bypass.

The experiments were performed with an apparatus registering anterior-posterior tibial displacement, valgus-varus and axial tibial rotation instability on knee preparations continuously in the extension-flexion movement with the tibia submitted to a well-defined constant torque or force.

Initially, the stability of the intact knee was recorded continuously from 0 to 130 degrees of flexion. Subsequently, the posterolateral instability was induced by cutting the lateral structures (PT + PLC + LCL), and curves of instability were recorded. Finally, the reconstructive procedures were performed under defined conditions at different degrees of knee flexion and axial rotation, and the stability of the joint was recorded.

Concerning posterolateral instability, the best results were obtained by performing the popliteal bypass operation with the tibia in neutral rotation and 90 degrees of flexion. The stabilizing effect included the whole range of flexion movement.

Concerning varus instability, our measurement revealed the modified reverse Ellison procedure to be the best stabilizing procedure when the operation was performed at 90 degrees of flexion and with the tibia rotated 10 degrees internally.

Experimental lateral instability of the elbow

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In a study of 10 osteoligamentous elbow preparations, the contribution of the annular ligament and the head of the radius to stability of the elbow was investigated.

The study was divided into two series. In the first, cutting the annular ligament created a varus instability of a mean of 13.0 degrees (SEM 1.8) at an elbow flexion of 70 degrees. Excision of the radial head further increased the varus instability, which peaked at 6.0 degrees (SEM 1.8) at a flexion of 70 degrees. The external rotatory instability was increased to a mean maximum of 32.8 degrees (SEM 3.3) after cutting the annular ligament. Excision of the radial head gave an insignificant increase in external rotatory instability.

In the second series, isolated excision of the radial head produced a varus instability with a mean of 4.8 degrees (SEM 0.8) and an external rotatory instability with a mean of 10.4 degrees (SEM 2.8) at elbow flexions about 40 degrees. Cutting the annular ligament further increased the varus instability to a maximum of 21.8 degrees (SEM 1.6), and the external rotatory instability peaked at 37.2 degrees (SEM 4.1).

Conclusions: The annular ligament is the prime varus stabilizer of the lateral aspect of the elbow. Excision of the radial head produces only slight instability provided that the annular ligament is preserved. The elbow has an inherent articular stability independent of the annular ligament and capitulum in the extreme positions.

Lateral instability in subtalar joint following sectioning of the calcaneofibular ligament: A kinesiologic study

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The aim of this study was to assess the contribution of the calcaneofibular ligament to the lateral stability in the subtalar joint.

A standard experimental set-up was used to measure the mobility patterns of the ankle and subtalar joints in 10 osteoligamentous preparations. A continuous registration during plantar-dorsal flexion (PF-DF) was made with a constant moment applied to the calcaneus. First, the total ankle and subtalar joint complex (TJC) motion was measured. Secondly, the subtalar joint (SL) was measured after tibiotalar fixation. Thirdly, the calcaneofibular ligament was cut, and finally the tibiotalar fixation was abolished.

Adduction in both TJC and SL was found to increase significantly after cutting the calcaneofibular ligament (2 SED). In the interval 7° of PF to 5° of DF, the adduction in SL increased gradually from 3.1° to 4.6° with DF. In TJC the increment was from 3.0° to 7.0°.

The study has shown that the calcaneofibular ligament constitutes an important structure in prevention of lateral subtalar joint instability. After cutting of the ligament, the adduction in SL was found to increase gradually with dorsal flexion.

Interindividual significant difference in the heel pad damping shock absorbency

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Previous studies have shown the shock absorbency in the best external shock absorbers was only 60 per cent of that of a cadaver heel pad (Jørgensen & Bøjsen-Møller 1985). The purpose of the present study was to investigate whether there were interindividual differences in heel pad shock absorbency.

Eight heel pads were tested (mean 38 h postmortem). Age 64 (44–85) years. A combined design of drop tests on an AMTI computerized force platform was used. Heel strike was imitated by dropping a 1.615 kg missile from a height of 10 centimeters, giving an impact velocity of 1.42 m/s.

Results: The tests revealed a significant ($P < 0.01$) variation in heel pad shock absorbency with variations of the peak penetration force from 533 N to 1,160 N (x 2.2), the average penetration force with a factor of 1.8 and the restitution energy with a factor of 1.7. This implies that the shock absorbency in the heel pads varied from being inferior to more than a 100 per cent increase compared with the best external shock absorbers. This difference in heel pad shock absorbency might explain why some persons are more prone to shock-dependent overuse injuries.

The HPC-devise – a method for quantitating the heel pad shock absorbency

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In vitro studies have shown wide variation in cadaver heel pad shock absorbency, and heel pad shock absorbency loss has been seen in athletes with overuse injuries. The need for a method for quantitation of the heel pad shock absorbency is imperative for the clinical research concerning the connection between heel pad shock absorbency and body load. The development and tests of such a device was the purpose of this study.

Material and method. The HPC (Heel Pad Compressibility) device was constructed. Its principle is constant velocity compression of the fixed heel up to a preset point followed by decompression. The consumption of electric current versus time represents the energy cost, which is proportional to the shock absorbency. Six heels (3 persons) were tested 10 times under the same conditions, and 68 soldiers were screened for "soft heel pads."

Results. The HPC was found to be reproducible ($P < 0.001$) and able to quantitate the heel pad shock-absorbency ($P < 0.001$). The screening tests revealed that 30/126 heels were extremely low in shockabsorbency, and this correlated to the findings at palpation ($P < 0.05$).

Conclusion. The HPC device is a repoducible method for quantitation of the shock absorbency of the heel pad.

An evaluation of osseous circulation through a measurement of pO_2 and pCO_2 in arthrotic and nonarthrotic bone

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In arthrosis the intraosseous pressure is elevated because of obstruction of the venous drainage. In order to clarify the possible changes in the circulatory parameters of oxygen (pO_2) and carbon dioxide (pCO_2), we have measured the partial pressures of these gases by mass spectrometry together with recording of the intraosseous pressure of the femoral head in patients with hip arthrosis and a healthy contralateral hip serving as a control. Ten measurements showed that the pO_2 was 40±6.1 mmHg in the diseased and 60±6.4 mmHg in the normal head, whereas the pCO_2 was 50.5±3.3 in the diseased and 47±3.1 in the normal femoral head. The intramedullary pressures were nearly twice as high in the diseased as in the normal head.

The difference in intramedullary pressure and oxygen partial pressure between the two heads was significant ($P < 0.005$), whereas the difference in CO_2 tensions was insignificant.

The result is a function of disturbance in the vascular structure.

The relationship between ^{99m}Tc-diphosphonate blood pool imaging and static bone scans in nonseptic and septic arthritis of the immature knee

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Dynamic ^{99m}Tc-diphosphonate scintigraphy enables an in vivo assessment of intraosseous blood flow changes, whereas the 2-hour bone uptake of tracer essentially images changes in metabolism. A comparison of these two scanning principles in the diagnosis and differentiation of early septic and nonseptic arthritis of the juvenile dog's knee was made.

A unilateral staphylococcal gonarthritis (N = 9) and a nonseptic Carragheenan gonarthritis (N = 6) were examined by computerized dynamic and static scintimetric techniques.

At 2 days of septic arthritis, 4 dogs exhibited no or only slight static changes, while the dynamic studies revealed an increased flow in the epiphyseal region (ratio 1.4–1.9). The 5 cases of septic arthritis with definite static changes all showed a moderate decrease in growth-plate uptake, whereas the corresponding dynamic uptake varied. Both the static and dynamic epiphyseal uptake showed great variations. In early nonseptic arthritis at 2 weeks, a uniform decrease in static growth-plate uptake (ratio 0.8) was seen, whereas the dynamic studies only showed a marginal reduction. At this stage, no epiphyseal changes were found.

Thus, the earliest change in septic arthritis was an increased flow in the epiphyseal region visualized on dynamic scans, whereas the outstanding feature of early nonseptic arthritis was a depressed growth-plate metabolism revealed on static scans.

Dynamic and static joint scintimetry carry supplementary information and both should be included in a radionuclide examination of a juvenile joint.

Tissue oxygen tension in ischemic skin flaps during isovolemic hemodilution

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The purpose of this investigation in dogs was to determine whether tissue oxygen tension in ischemic skin flaps can be raised by isovolemic hemodilution to a Hct below the normal range. The tissue oxygen tension ($PscO_2$) was measured polarographically by platinum/silver-silverchloride needle electrodes mounted in oxygen permeable Silastic tubes implanted subcutaneously in rectangular thoracic random pattern flaps and in normal skin. Isovolemic hemodilution from Hct 0.40–0.10 was achieved by stepwise replacement of whole blood with dextran 40 (N = 4) or dextran 70 (N = 6). Central hemodynamic parameters were monitored continuously.

In moderately ischemic flaps, the mean $PscO_2$ of 4.0 remained unchanged in the Hct interval 0.40–0.20. In severely ischemic flaps, the mean $PscO_2$ of 1.7 remained unchanged between Hct 0.40 and 0.10. $PscO_2$ in normal subcutis was 5.5 between Hct 0.40 and 0.25. A nonsignificant increase of 15 per cent was encountered in the interval 0.25–0.12, below which $PscO_2$ was compromised. Systemic arterial, pulmonary arterial, and central venous pressures remained unchanged throughout the experiments. An increase in stroke volume and heart rate contributed equally to the compensatory increase in cardiac output at all levels of hemodilution.

In conclusion, moderate and even severe hemodilution poses no threat to the tissue oxygen tension as long as cardiac reserves are available. This study did not, however, demonstrate any beneficial effect of hemodilution on tissue perfusion as measured by the tissue oxygen tension.

Epidemiology

Upper extremity amputation. A nationwide survey (1978–1983)

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Since 1976, the Danish Amputation Register (DAR) has recorded all upper (UEA) and lower (LEA) extremity amputations in Denmark (excluding fingers and toes). The aim of the present study was an analysis of upper extremity amputations for the purpose of delineating the absolute size of the problem and assessing differences from LEA.

The average total number of UEA per year was 76 as compared with 2404 LEA.

In the total UEA group the majority of patients were between 20 and 65 years of age compared with LEA where the majority were from 60 to 85 years of age. Trauma accounted for close to half of all UEA, followed by malignant tumors with almost 20 per cent. Amputation at the transmetacarpal and carpal levels constituted about 50 per cent of all UEA. The vast majority of UEA patients were dismissed from the hospital between 1 and 15 days postoperatively.

In conclusion, UEA constitutes 3.2 per cent of all major amputations in Denmark. The patients are younger and the distribution according to etiology differs markedly from LEA. UEA is generally carried out at a more distant level than LEA and the duration of hospitalization and hence the consumption of resources in general is much lower in UEA.

The epidemiology of sports injuries in Denmark: A prospective individual injury registration

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In order to find the incidence and to estimate the total number of sports injuries and their consequences, a prospective individual injury registration was undertaken.

By random sampling, 47 per cent of the organized sports in Denmark was covered. Throughout the season, sports-specific questionnaires, developed and tested in pilot studies, were used for injury registration. Seventy-seven per cent (1,500/1957) could be followed throughout the season.

The injury incidence per player (injuries/1,000 hours) was 4.1 in soccer, 8.3 in handball, 4,1 in volleyball, 4.7 in ice hockey, 2.9 in badminton, and 2.8 in tennis. The total number of injuries in the organized sports in Denmark can be estimated to 1.59 million. About half of the injuries were seen by a physician – equivalent to 2,178 injuries per day, of which 40% (871) were treated in casualty wards. This accords with the existing casualty registrations

Based on the investigation, the total number of injuries in organized sports in Denmark would appear to include 31 per cent of the population.

Karate injuries

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The study was undertaken to increase the knowledge of frequency, severity, and pattern of injury during karate competition. Karate injuries sustained in nine national tournaments were analyzed. All the injuries were examined and recorded by one of the authors. Totally, 647 athletes participated in 860 matches. In all, 177 injuries were sustained by 133 athletes, with an incidence of one injury in 4.9 matches. Head and facial injuries were the most common type (78%). Punches caused 75 per cent of all injuries and kicks 10 per cent. Classified by diagnosis, the most frequent injuries were contusions, lacerations, and epistaxis. Seven per cent were fractures; of these, nasal fractures were the most common type.

Most of the injuries (63%) required no treatment; 20 per cent were treated by the attending physician; and 17 per cent were admitted to a casualty ward. Only 21 of the 133 injured athletes had to discontinue competition. Five cases of cerebral concussion were recorded.

There were significantly more injuries among the lower ranked and less experienced athletes, indicating that injuries became less frequent with increased tournament experience and increased rank.

In order to lower the injury rate, mandatory use of protective padding of fists and/or face is recommended.

Bicycle injuries in a rural community

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This survey describes bicycle accidents with casualties in a predominantly rural area visited by many tourists.

Methods: On Bornholm (population 70,000) from May through September 1985, ad hoc data were collected by a questionnaire study. Injured bicyclists, recorded by the hospital or practitioner, were included. For the bicycle tourists, a 165 kilometer network of bicycle roads and paths has been established.

Results: A total of 196 injured bicyclists were recorded. Only 8.7 per cent of these were recorded by the police. Among 99 bicycle accidents in which residents were involved, 69 per cent occurred in urban areas, whereas among 57 accidents in which tourists were involved, 83 per cent occurred in rural areas. Type of accident: single, 77 per cent; collision with another bicycle, 15 per cent; collision with a motor vehicle, 8 per cent.

The most common cause of accident in rural areas is pavement, 37 per cent, whereas in urban areas other road users caused 30 per cent. Inattention was an additional cause in 35 per cent. In rural areas, the road was often described as uneven, loosely paved, and downhill. The injuries sustained by natives and tourists (in parentheses) were as follows: soft-tissue lesions of the extremities and head, 69 per cent (52%); fractures of extremities, head and concussion, 18 per cent (35%). Hospitalization was required in 9 percent (14%) of the accidents.

Attempted suicide and wrist slashing

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The study concerns patients who after a suicide attempt by wrist slashing were admitted to the emergency room at Odense Hospital. From a well-defined catchment area, 176 persons tried to commit suicide in this way over a 3.5-year period. The incidence of attempted suicide was calculated to be 28 per 100,000, with a male/female ratio of 1.3:1.

The highest incidence was found in persons between 20 and 30 years of age.

The patients were followed over a median observation period of 36 months, and during this period 5 succeeded in committing suicide. Some of these persons made more than one attempt by wrist slashing. Consequently, the total study comprises 191 cases. In 133 cases, the lesions to the wrist were "hesitation marks," and only 18 patients had serious lesions of tendons, nerves, and blood vessels.

Psychiatric consultation was offered to all patients, but only 131 were actually seen by a psychiatrist, and 35 were admitted to the psychiatric department, mainly with psychotic disorders (11) or borderline disease (11). Within 1 year, 45 patients repeated a suicide attempt and were treated at the emergency room at Odense Hospital. Predictors for future suicidal risk are, in other studies, found to be psychotic disorders, "chronic crisis people" especially with abuse problems, and previous attempts with high intention. In this study, people with deep lesions of the wrist were statistically more prone to re-

peat suicidal behavior. It appears from the case histories of the 5 dead persons to be difficult to use the information from these predictors in the everyday work at the emergency room.

It is suggested that all patients treated in an emergency room after self-destructive behavior should be seen by a psychiatrist.

Traumatology

Patients with severe head injury primarily treated at hospital without a neurosurgical special unit.

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In a retrospective study, 94 patients with severe head injury as defined by Jennett et al. were investigated: absence of eye-opening, absence of normal talking, and absence of obeying orders the first 6 hours after injury. The patients were primarily treated at a hospital without a neurosurgical unit or CT. In attempt to estimate an outcome prediction for these comatose patients, the following parameters were compared with outcome: age, pupil reaction, deep reflexes, respiration, and mean blood pressure at arrival.

The result was classified at least 1 year after injury according to Pazzaglia et al.'s definition for social reintegration: good, return to normal life and work, although some small psychologic or neurologic deficit could remain; bad, moderately to severely handicapped or vegetative; or dead, as a direct or indirect result of the head injury.

At the follow-up, 28 per cent were dead, and 17 per cent survived in a moderately to severely handicapped or vegetative condition. A positive correlation between increasing age, affection of pupils, and affection of spontaneous respiration and outcome was found.

Two different periods (1978–1980 and 1981–1982) with similar groups of severe head injuries were compared concerning outcome, treatment, and transfer to a special unit.

A better outcome in the latter group showed that improved clinical assessment and early determination of treatment and transfer were important for the outcome in these patients.