Acta Orthop Scand 57, 176–191, 1986

Proceedings of the Danish Orthopaedic Society

Copenhagen, October 25–26, 1985

Editor:
Peter A. Frandsen

Centralsygehuset
DK-6700 Esbjerg

Tumours

Osteogenic sarcoma: An analysis of radically operated cases

Hans Skovgaard Poulsen & Søren Bentzen

The Institute of Cancer Research, University of Aarhus and The Orthopaedic Hospital, Aarhus

This study consists of 91 cases which were admitted at the Tumour Centre of Aarhus during a twenty-five year period. To qualify for the present study, the proliferating cells of the neoplasm must have produced osteoid substance or material histologically indistinguishable from it. The material was divided into histological categories according to the predominant malignant type of cell i.e. osteoblastic, chondroblastic, fibroblastic and teleangiectatic osteosarcoma. The patients were staged by physical, X-ray, and CT-scan examination. Of the 91 cases 63 patients could be microscopically radically operated. Approximately 30 per cent of these patients were alive 10 years after the primary treatment. When the cases were divided according to histological features, it was observed that patients harbouring osteoblastic tumours fared worse when compared to those with non-osteoblastic tumours (10 years crude survival rates were 20 per cent and 58 per cent, respectively). In addition, it was observed that the advanced stage patients with a long disease-free interval did better than those with a short disease-free interval.

Chondrosarcoma: Increasing grade of malignancy in local recurrence

O. Myhre Jensen & Ingrid Bayer Kirstensen

Institute of Pathology, Aarhus County Hospital, Aarhus

A consecutive series of 44 chondrosarcomas comprised 3 mesenchymal, 1 clear-cell and 40 classical chondrosarcomas. In the intial specimens of the 40 classical chondrosarcomas 19 were grade 1, 14 grade 2 and 7 grade 3. Eighteen patients with classical chondrosarcomas developed local recurrences, 8 of them more than once. Twelve of the 18 patients had a higher grade of malignancy in the recurrence than in the initial tumour. Only 4 patients with chondrosarcomas, which were initially grade 1 and 2, had an unchanged grade of malignancy at recurrence. Because of the high recurrence rate in chondrosarcoma and the risk of increasing grade of malignancy in the recurrence we recommended that initial tumours should be treated with radical surgery (block excision, amputation) even in low grade malignancies.

Ewing's sarcoma – a retrospective analysis of prognostic factors and treatment results

S. Daugaard (1), L. Munk Sunde (2), C. Kamby (1), T. Schiødt (3) & O. Myhre Jensen (4)

Dept. of Oncology I, The Finsen Institute, Copenhagen (1), Dept. of Orthopaedics, Hospital of Orthopaedics, Aarhus (2), Dept. of Pathology, Rigshospitalet, Copenhagen (3), and Institute of Pathology, County Hospital of Aarhus, Aarhus (4)

The material consists of 87 patients (60 male, 27 female) with histologically confirmed Ewing's sarcoma, referred for treatment during the period 1962–83. Peak incidence was in the 2nd decade of life, patient age 16 (1–62) years. The commonest sites of the primary tumour were the pelvis (31 per cent) and the femur (22 per cent). Thirteen patients had metastases at the time of diagnosis. Of the remaining, 74 received adjuvant radiotherapy and 32

adjuvant chemotherapy. Neither age nor sex was found to have any influence on relapse-free survival (RSF) or total survival (TS). Metastatic disease at the time of diagnosis shortened TS to 6 months, (median) compared with 23 months for localized disease. The tumour site did not exert any significant influence on TS, although pelvic localization was associated with a slightly shorter median survival.

Adjuvant chemotherapy prolonged RSF from 5.5 to 16 months (median), but TS was not improved significantly. Likewise, adjuvant radiotherapy in doses exceeding 50 Gy slightly prolonged RSF but not TS. Interestingly, local recurrence occurred in 40%, independent of the radiation dose. Two patients developed secondary malignancies in the irradiated areas (one fibrous histocytoma and one osteogenic sarcoma).

Long term results of treatment of giant-cell tumour

Gunner Barfod, Gunnar Lausten, Søren Daugård, Torben Schiødt & Bjarne Lund

Departments of Orthopaedic Surgery, Oncology and Pathology, Rigshospitalet, Copenhagen

A consecutive series of 30 patients with giant-cell tumours were treated with curettage, wide local resection and radiotherapy. The average follow-up time was 10 years.

All tumours were reviewed histologically and graded according to Jaffe.

At follow-up 5 patients had died from the disease. One or more recurrences were found in 11 patients, 7 patients had two or more recurrences. In 3 patients the recurrences were observed after 5–14 years.

Four patients who died of the disease showed progression in the grade of the malignancy from the first to the last histological examination.

Conclusion: It is important to perform radical surgery at recurrence of the disease. The follow-up period must be life long.

Major amputations of the lower extremity for malignant tumours

Bjarne Lund, Gunnar Barfod & Peter Jørgensen

Department of Orthopaedic Surgery, Rigshospitalet, Copenhagen

In a follow-up study of 70 patients with a malignant tumour treated with a major amputation of the lower extremity special interest was directed towards the rate of surgical complications and the rehabilitation of the patients. Thirty-two patients had a hemipelvectomy and 38 patients a disarticulation of the hip joint.

The most common tumour was osteogenic sarcoma (38 per cent) together with chondrosarcoma and fibrosarcoma (14 per cent), while the remaining patients had 12 different types of tumour.

There was no peroperative mortality. The mean blood-loss in hemipelvectomy was 9 units of blood, and the mean duration of operation was 4 hours. The postoperative infection rate correlated with the duration of the operation and was higher in the patients who were hemipelvectomised than in the patients with hip disarticulation.

Five of the patients had a minor skin-necrosis around the wound. Thirty-seven of the patients used their prosthesis daily, but 17 patients could not be mobilized at all.

Enzyme histochemical investigations on bone and soft tissue tumours

O. Myhre Jensen & K. Bendix-Hansen

The Institute of Pathology, Aarhus County Hospital, Aarhus

Staining for three hydrolytic enzymes was performed on frozen sections and/or imprint smears of unfixed specimens from about 100 bone and soft tissue tumours. Osteosarcomas, both intra- and extraosseous, and haemangioendotheliomas gave a strong reaction for alkaline phosphatase. Acid phosphatase was found in almost every tumour type except Ewing's sarcoma and chondromyxoid fibroma. A strong reaction characterized giant cell tumours and malignant fibrous histiocytoma. The same two tumour types gave a strong reaction for non-specific esterase, which could be completely inhibited by the addition of fluoride. Staining for the enzymes mentioned is simple and reliable whenever fresh, unfixed tumour specimens are avaible and may provide helpful diagnostic features for the classification of bone and soft tissue tumours.

Arthroplasty

Charnley arthroplasty in arthrosis secondary to unreduced or incompletely reduced congenital dislocation of the hip

Frank Linde & Jørn Jensen

Orthopaedic Hospital, Aarhus

A follow-up study was performed to estimate the prognosis of Charnley arthroplasty in patients suffering from arthrosis secondary to unreduced or incompletely reduced congenital dislocation of the hip. Re-examination was made in 124/129 hips 9 years (3–16 years) after operation. The median age of the patients at time of surgery was 50 years (23–77 years). The Eftekhar staging system was used for classification of the preoperative degree of dislocation. There were 76 stage B (incomplete type), 47 stage C (complete type) and 1 stage D dislocation (head never been in contact with the ilium).

Deep infection occurred in 3 cases. Fourteen hips had been revised (including infected hips). One of the infected hips was later converted to a Girdlestone pseudarthrosis due to persistent infection. Eighteen hips were painful and in another two patients walking ability was unsatifactory. Further more, 13 hips showed signs of aseptic loosening, but the patients were free from pain. From a critical point of view 47 (38 per cent) hips showed non-optimal results. However, the patients found the result excellent in 101 (81 per cent) hips (including the result of a revision arthroplasty). These overall results do not differ from results of Charnley arthroplasty in primary arthrosis of the hip. However, revision arthroplasty was performed significantly more frequently in stage C dislocation than in stage B dislocation.

Acetabular problems related to total hip arthroplasty following neoacetabular osteoarthrosis in congenital dislocation of the hips

Jørgen Steen Jensen, Jens B. Retpen & Carl C. Arnoldi

Department of Orthopaedic Surgery, Rigshospitalet, Copenhagen

The purpose was to identify the best acetabular technique in a clinical and radiographic follow-up (1–9 years) with respect to cup loosening, radiolucency in more than two cup zones or recurrent dislocations in a series of 65 patients.

Direct cementation into the neoacetabulum resulted in 5/21 revisions for cup loosening and 1/21 for recurrent dislocation. Radiolucency was observed in 2/21 cases. Cup support with cortical bone beams was followed by 3/15 revisions for cup loosening or dislocations, whereas 3/15 revealed radiolucencies. One of two cases with medial wall depression became loose and required revision.

Acetabular roof reconstruction with femoral head grafts needed revision for recurrent dislocation in 2/27 cases, one of which could be explained by malpositioning of the stem due to a previous femoral valgus osteotomy. No loosenings were encountered, but 1/27 had radiolucent zones.

A technical evaluation of the radiographs revealed that acetabular problems were correlated with the acetabular inclination angle, elongation of the leg, lack of proximal bone support for the cup and a valgus position of the stem.

Roof reconstruction seems to give the best results.

The reconstruction surgery is technically challenging, and a versatile prosthetic design programme is inevitable (45/65 needed special designs). Consequently, centralization of this treatment is advocated.

Total hip replacement in congenital dislocated hips

Kent Boll & Steen Kofoed

Department of Orthopaedic Surgery, Holstebro Hospital, Holstebro

The purpose of the study was to review the technical problems and the results of total hip replacement in untreated or insufficiently treated congenitally dislocated hips. The material consisted of 18 consecutive cases treated with Müllers dysplasia prosthesis. The indication for surgery was severe pain in all cases. The follow-up was 32 (12–66) months.

Dislocation occurred in 2 cases during the early postoperative period, and other postoperative complications occurred in 3 patients. None of these complications required operation, and recurrent dislocation did not occur.

One aseptic loosening of the femoral component required revision.

The degree of pain, range of movement and ability to walk were recorded preoperatively and at follow-up and classified according to d'Aubigne/Charnley. The reduction of pain was excellent or good in 89%, and all improved their ability to walk. The range of movement was increased in all but one case.

Conclusion: The use of Müllers dysplasia prosthesis in congenital hip dislocation can be recommended as a safe procedure with satisfactory short-term results.

Bone scintigraphy after total knee replacement

Benn Duus, Michel Boeckstyns, Lasse Kjær & Carsten Stadeager

Department of Orthopaedic Surgery, Hvidovre Hospital, Copenhagen

The aim of this study was to assess the relationship between bone scanning, radiography and clinical evaluation after total knee replacement. Forty-one patients underwent bone scanning with Tc-99 MDP, radiographic examination and clinical evaluation three, seven and twelve months after Townley knee replacement. Thirty-five patients (28 women, 7 men, age 68 (50–74) years) completed the schedule.

The scintigrams were assessed in four groups ranging from no to strong uptake, the radiographs were evaluated with respect to radiolucency.

Twenty-seven patients (group I) had no or negligible pain, 8 patients (group II) had considerable pain.

Sixty-three per cent of the patients in both groups presented scintigraphic uptake grade 2, 13 patients in group I and five in group II had increased focal uptake.

Twenty-five patients in group I and 8 patients in group II showed a radiolucent line under the tibial component, of which 14 and 4, respectively, increased during the study.

The results did not show any correlation between a painful knee prosthesis, scintigraphic uptake and radiolucency one year after total knee replacement.

Arthroscopy

Arthroscopic partial meniscectomy in patients over 50 years

Svend Boe & Henning Hansen

Department of Orthopaedic Surgery, Aarhus County Hospital, Aarhus

During a 2 year period 39/270 arthroscopic partial meniscectomies were in patients more than 50 years old. The arthroscopic findings were recorded prospectively. Thirty-six patients were re-examined according to the Lysholm knee score with a median observation time of 22 months. The ratio medial/lateral meniscus was higher than in younger patients and there were fewer bucket-handle tears and more degenerative lesions. The results were good or excellent in 75 per cent of the patients (mean score 87.2 ± 15.5). The type of lesion or the presence of chondromalacia patellae did not influence the results significantly. In the presence of radiographic signs of degenerative joint disease the results were slightly inferior, but the difference was not significant. The patients with arthroscopically demonstrated cartilage degeneration were significantly worse than those with normal cartilage ($P < 0.01$). Even in the presence of cartilage degeneration the mean score was 83, and 14/23 had good or excellent results. Of 9 patients rated fair or poor 4 felt that the operation had improved the knee considerably.

Our conclusion is that even in the presence of joint degeneration arthroscopic partial meniscectomy should be performed as in younger patients.

Arthroscopic knee surgery. Early results

Agnete Carlsen, Klaus Elholm & Dick Hansen

Department of Orthopaedic Surgery, Frederiksborg Hospital, Hillerød

Sixty-six patients were examined according to the Lysholm knee score 11 months after arthroscopic knee surgery. Fifty seven patients had a partial meniscectomy, seven has a murectomy and in three patients a synovial plica was resected.

There were no severe complications. The median hospitalization time was 2 days. Two weeks after surgery 56 of the patients had returned to work.

After meniscectomy, women obtained significantly lower knee scores than men. Neither the type and localisation of the lesion nor the age and occupation of the patient influenced the final results, which were comparable to the results after conventional arthrotomy.

Elbow arthroscopy in the diagnosis and treatment of loose bodies

Svend Boe

Department of Orthopaedic Surgery, Aarhus County Hospital, Aarhus

Elbow arthroscopy was performed in 35 patients on the suspicion of loose bodies. Supplementary preoperative diagnoses were osteochondritis in 8 cases, sequelae of fracture or dislocation in 7 and arthrosis in 6. A lateral approach was employed. Loose bodies were found in 13 cases. Preoperative radiographs were found to be falsely negative in 2 cases and falsely positive in 10 cases. Arthroscopic removal of loose bodies was successful in 6/10 cases. Arthro-

scopy improves the diagnostic accuracy and exploratory arthrotomies can be avoided. As experience is gained most loose bodies can be removed arthroscopically.

Hip fractures

Applied methodologies in studies of femoral neck fractures

Peter A. Frandsen

Department of Orthopaedic Surgery, Esbjerg Hospital, Esbjerg

From a survey of the literature of femoral neck fractures treated with osteosynthesis, it appeared that the result presented were based on four fundamentally, different methods of calculation. The basic principle in these four methods were:

1) crude rate of failure, 2) cumulative rate of failure, 3) crude rate of union, and 4) cumulative rate of union.

The four methods of calculation have been applied to four series of femoral neck fractures. Within each series, the results showed a gradual increase in the rate of failure as the different methods from 1 to 4 were applied.

Conclusion: As a mere shift in the method of calculation can increase or decrease the rate of failure by as much as 50%, it seems important that the authors should clearly describe the method applied to calculate the results, just as the readers should be aware of the different methods of calculation and the effect implied in each method on the results presented.

Garden's classification of femoral neck fractures. An assessment of the inter-observer variation in Garden's classification

Peter A. Frandsen, Erik Andersen, Frank Madsen & Thomas Skjødt

Department of Orthopaedic Surgery and Radiology, Esbjerg Hospital, Esbjerg

During the last decades Garden's classification of femoral neck fractures has been widely adopted. Although Garden's classification seemingly consists of four well-defined stages, a precise distinction has not been made between the different stages. The purpose of this study was to determine the inter-observer variation when examing an identical series of radiographs to classify them into their respective groups according to Garden's classification.

Radiographs of one hundred randomly chosen femoral neck fractures were studied by eight different observers.

Results: The radiographs were classified identically by all eight observers in only 22 cases. Another 45 cases were classified either as an undisplaced fracture (stage 1 and 2) or as a displaced fracture (stage 3 and 4) by all observers. Between the different observers the number of displaced fractures varied from 63 to 89.

Conclusion: The results of our study have shown that a panel of eight observers had a relatively poor ability to delineate the various stages of Garden's classification as the description of the classification in many cases left ample room for different assessment by different observers.

Necrosis of the femoral head following femoral neck fracture. Incidence, time of appearance and radiographic diagnosis

Peter Nordkild & Stig Sonne-Holm

Departments of Orthopaedic Surgery, Gentofte Hospital, Copenhagen

One-hundred-and-thirty femoral neck fractures treated with a sliding screw-plate or a sliding nail-plate were followed for up to 65 months postoperatively. By the life table method the incidence of femoral head necrosis increased by 5–10 per cent per year during the observation period. After 5 years 37 per cent of the patients with united fractures had developed necrosis of the femoral head. The necroses were all characterized by at least one of the following radiographical characteristics: a subchondral cortical depression, generalized subchondral fragmentation or isolated patches of sclerosis. It is concluded that estimation of the frequency of femoral head necrosis after femoral neck fracture requires long term follow-up and reliable, reproduceable radiographical criteria for femoral head necrosis. Because of the high mortality of patients sustaining femoral neck fracture, statistical methods employing censored data should be used.

The predictive value of bone scintigraphy after internal fixation of femoral neck fractures

Stig Sonne-Holm, Peter Nordkild, Martin Dyrbye & Jørgen Steen Jensen

Departments of Orthopaedic Surgery and Department of Clinical Physiology, Gentofte Hospital, Copenhagen

Persisting pain in the hip following internal fixation of femoral neck fracture is often caused by capital necrosis or non-union. In a randomized trial 35 patients had a 99^m Tc-MDP bone scintigraphy performed 6 weeks, 3, 6 and 12 months after internal fixation of a femoral neck fracture with a sliding screw-plate or sliding nail-plate. The purpose was to evaluate whether the bone scintigraphy could predict capital necrosis or non-union before the radiographic manifestation, which occurs rather late. The patients were followed for 44 (12–64) months. Radiographically capital necrosis occurred in 5 patients, and non-union in 6 patients. Bone scintigraphy showed decreasing activity through the first year postoperatively in uncomplicated cases ($p < 0.03$). It was, however, impossible to distinguish patients developing capital necrosis or non-union from patients with uneventful healing. There were no significant differences in scintigraphic appearance between groups at risk, i.e. Garden stage 3 and 4 fractures or sliding nail fixation and the control group. Conclusion: bone scintigrams can not sufficiently identify failure of internal fixation in femoral neck fractures during 6 weeks to 6 months postoperatively.

Trochanteric fractures – a prospective and comparative study between Ender nailing and sliding screw plate

Jesper Dalsgaard, Johannes Yde & Agnete Olsen

Department of Orthopaedic Surgery, Aalborg Hospital, Aalborg

A prospective study was performed in order to compare Ender nailing (EN) and sliding screw plate (SSP) osteosynthesis in trochanteric fractures.

The material consisted of 101 consecutive patients. Fifty-seven were operated by the EN method and 44 by the SSP method. Operation time was shorter and bleeding was less in the EN group. However, during the first six months 16 per cent were reoperated in the EN group compared with 7 per cent in the SSP group. Distal slipping occurred in 49 per cent in the EN group, but only 15 per cent had knee complaints. Deep infection occurred in two patients of the SSP group. Shortening of the leg was more pronounced in the EN group and walking ability was not as good as in the SSP group.

Upper extremity

Treatment of distal instability in the shoulder joint

Jørgen Ovesen & Jens Ole Søjbjerg

Biomechanics Laboratory, Orthopaedic Hospital, Aarhus

The purpose of the present work was to describe a method of treatment of distal instability in the shoulder joint by transposition of the coracoacromial ligament to the lesser tuberosity. The effect of this ligament transposition was investigated in two experiments. In the first experiment the subacromial space was measured radiographically, before and after cutting the vertical stabilizing structures and again after transposition of the coracoacromial ligament. It could be shown that the subacromial space was unchanged after transposition of the ligament.

In the second experiment the external rotation of the shoulder joint was measured under standardized circumstances, before and after cutting the structures stabilizing external rotation and again after transposition of coracoacromial ligament. This investigation showed that the transposition reduced external rotation in the first forty degree of abduction.

In two clinical cases of distal subluxation the method has been used. In both cases the subluxation was eliminated.

It is concluded that the method is satisfactory biomechanically, but further observation is necessary for clinical evaluation.

Vascular injuries in the extremities with special emphasis on microsurgical technique

Johnny Keller & Magne Juhl

Department of Orthopaedic Surgery, Aarhus County Hospital, Aarhus

Microsurgical technique has made replantations and revascularizations possible. The aim of this study was to analyze the causes of traumatic vascular injuries, the mechanism of the injury, the use of microsurgical techniques and the results after replanta-

tion and revascularization. During the period 1.4.73 to 24.1.85, 235 traumatic vascular injuries were treated in our department. In 184/235 cases the injury was a guillotine or local crush injury. Microsurgical technicques were used in all 129 finger operations and in 72/106 other operations. Replantation was successful in 6/19 complete amputations, and revascularization was successful in 11/12 incomplete amputations. After compromised circulation revascularization was successful in 48/55 operations. In the treatment of hand injuries there is a need for microsurgery, not only for replantations but also for revascularization.

Lower extremity

Prognosis of lower limb amputees

Peter Helm, Thim Engel, Anette Holm, Viggo B. Kristiansen & Svend Rosendahl

Department of Orthopaedic Surgery, Hvidovre Hospital, Copenhagen

The purpose of this study was to analyse the influence of pre- and postoperative factors on functional ability, social dependence, and survival rate in lower limb amputees.

Between 1976–79, lower limb amputation was carried out in 257 patients. At the turn of the year 1980/81, the 107 surviving patients were interviewed. Multiple regression analysis revealed that age, above-knee or bilateral amputation, pain, and increased preoperative social dependence were all unfavourably associated with functional ability. Only age and pre-operative social dependence correlated with post-operative social dependence. No significant associations were found with cause of operation, presence of competitive disease, or sex. The results emphasise the importance of proper prosthetic fitting and the abolition of pain.

After 5–8 years, 220 (86%) had died. Age at operation and preoperative social dependence showed strong negative associations with the period of survival. Neither the cause nor the level of amputation were associated with survival, when controlling for the effect of the other factors in the model. Compared with a normal population of similar age distribution, the mortality rate was markedly increased during the first two years.

Non-operative treatment of complete rupture of the medial collateral ligament of the knee

Jan Sæther & John Gelineck

Department of Orthopaedic Surgery and Department of Roentgenology, Holstebro Hospital, Holstebro

In a prospective study 25 consecutive patients with a complete isolated rupture of the medial collateral ligament (MCL) of the knee were treated by immobilization of the knee in a plaster cast for two weeks followed by a cast-brace for another four weeks. Four months later the patients were examined by gonylaxometry and evaluated by Marshall's knee injury score. Thirteen patients treated earlier by surgery for rupture of the MCL were examined.

The mean valgus laxity was 0.7 (0–9) millimeters, in the patients treated non-operatively and 1.3 (0–3) millimeters in the operated group.

In the non-operated group 65 per cent of the patients had an excellent or good result, 5 per cent had a fair result and 30 per cent a poor result. In the operated group 66 per cent of the patients had an excellent or good result and 34 per cent a poor result.

In complete rupture of the medial collateral ligament non-operative treatment seemed superior to operative treatment, as the valgus stability was better and the rehabilitation period was shorter.

Chondromalacia and the patellofemoral pain syndrome

Niels Hejgaard

Department of Orthopaedic Surgery, Rigshospitalet, Copenhagen

It is still debated whether chondromalacia patellae has any significance in the pain mechanism in patients suffering from typical patellofemoral pain. In 124 knees the grade of chondromalacia was evaluated by arthroscopy. A parametric correlation analysis showed no significant correlation between the grade of chondromalacia (0 = normal cartilage, I = closed chondrosis, II = open chondrosis, III = arthrosis) and the following variables: Intraosseous pressure in the patella (mm Hg, range 0–64), pain score (visual analogue scale, range 0–100), age (years, range 16–45). The pain score was well correlated to the number of previous operations whereas no correlation was found between intrapatellar pressure and the pain score. As no obvious pain triggering mechanism could be found in this group of patients a

strictly conservative approach is recommended in treatment of the patellofemoral pain syndrome. In diagnosing chondromalacia one must keep in mind its absolute lack of significance in predicting the origin of pain. It is postulated that the source of pain is a diffuse aggravation of local nociceptive reactions in the periarticular soft tissue. A step-wise rehabilitation programme should be started in the very early phase of this potentially disabling syndrome. Surgery alone seems to create a vicious circle in these painful and vulnerable knee joints.

Anterior tibial muscle flap with preserved function

Flemming Møller-Larsen & Niels Christian Petersen

Department of Plastic Surgery, Municipal Hospital, Aarhus

To solve the difficult problem of exposed tibial bone we have employed a new method, in which the anterior tibial muscle is partially split longitudinally from behind and the tibial part of it is elevated to cover the anterior surface of the tibia.

The method has been developed by cadaver dissections and has been utilized in three cases with three years' follow-up. Even considering the limited number of patients, the following advantages seem established:

The operation is simple. The flap is in close proximity to the defect, and large incisions and undermining are avoided.

The flap easily matches long areas of tibial exposure, and all the muscle flap tissue is utilized for cover of the defect.

The aesthetic and functional results were good, and secondary corrections were unnecessary.

The splitting of the anterior tibial muscle causes no important reduction of the function of the muscle.

Operative treatment of lateral ankle and subtalar joint instability

Eilif Larsen

Department of Orthopaedic Surgery, Gentofte Hospital, Copenhagen

An operation which can stabilize both lateral ankel and/or subtalar joint instability was used in a series of 38 patients (40 cases). All patients suffered from lateral instability of the ankle joint, and in addition 11 of the 40 cases had unstable subtalar joints.

Pre-operatively and at 9 month follow-up the patients were evaluated with standardized radiographical methods for anterior rotational talar displacement and talar tilting. At follow-up all patients had a highly significant reduction of the radiographically measured instability including five patients with some clinically demonstrable anterior rotational instability. No subtalar instability could be demonstrated and functionally the results were good in all patients.

Post-operative limitation of supination between 10 and 20 degrees could be demonstrated in all patients, but was without functional significance. Complications were few.

The operation is simple and is recommended for lateral chronic ankle instability and for subtalar joint instability.

The significance of the heel pad as shockabsorber

Uffe Jørgensen & Finn Bojsen-Møller

Department of Orthopaedic Surgery, Herlev Hospital and The Panum Institute, University of Copenhagen, Copenhagen

During repeated heel strikes the human body is subjected to impulsive loading, which seems associated with the development of sufferings in the locomotor system. In order to reduce the loads at heel strike external shock absorbtion has been introduced with success. Internal shock absorbtion, beginning in the heel pad has drawn increased attention in the last years. In order to compare internal- to external shock absorbtion, drop tests were performed to determine the factors in the shoe-heel interactions between EVA foam sole, Sorbothane® inserts and specimen of a human heel, and the lower leg of a living test person. A 1,615 kg load with an attached accelerometer, was dropped 6 times on each test specimen, placed on an AMTI-computerized biomechanics platform. The mean force reduction was significantly ($p < 0.01$) greater in the heel pad compared to EVA ($\times$ 1.5) and Sorbothane® ($\times$ 2.5) and the heel pad alone represented 70 per cent of the passive shock absorbtion in the lower leg.

Conclusion: The heel pad is the most important factor in shoe-heel interaction and thus decisive for shock absorbtion in the lower leg.

Measurements of bone mineral content in patients with spinal cord injuries

Hans Bohr, Fin Biering-Sørensen, Henrik Kjærulff & Ole Schaadt

BMC laboratory and Clinic for paraplegics, Rigshospitalet, Copenhagen

Determinations of Bone Mineral Content (BMC) in the lumbar spine, the femoral neck and shaft and in the proximal part of the tibia were made on patients with paraplegia and tetraplegia after spinal cord injuries. The measurements were performed by dual-photon absorptiometry with a precision of 2–3 per cent, expressed as the coefficient of variation. In 6 patients, 5 paraplegics and 1 tetraplegic, determinations of BMC were repeated 3–10 times from 9 days to 2 years after the injury, and in 18 patients single determinations were made 1–23 years following the accident.

It was shown that BMC of the lumbar spine was not significantly affected, while BMC of the femoral neck and shaft as well as of the proximal tibia decreased almost linearly with time during the first year. For the femoral neck the fall in BMC during the first year amounted to about 20 per cent, for the femoral shaft to about 10 per cent, and for the proximal tibia to about 40 per cent. After the first year the fall in BMC gradually diminished, but after 5 years further decrease could be demonstrated in the femoral shaft and in the proximal tibia, probably because these parts of the skeleton were less exposed to weight bearing.

Epidemiology

A hip and knee pain questionaire for epidemiological studies

Stig Sonne-Holm, Peter Nordkild & Gorm Jensen

Departments of Orthopaedic Surgery, Gentofte Hospital and Rigshospitalet, Copenhagen

A questionaire for population screening of osteorarthrosis of the hip and/or knee with 45 questions regarding the localization of the pain, type of pain as well as loss of functions was tested on 5 different categories of patients and a control group. The questionaire was tested on 52 patients awaiting arthroplasty for arthrosis of the hip, 50 patients awaiting arthroplasty for arthrosis of the knee, 48 patients awaiting arterial grafting for claudication, 60 patients treated with anticoagulants for deep venous thrombosis of one of the lower extremities and 50 patients with protrusion of an intervertebral disc verified by myelography. 42 patients visiting the out-patient clinic for Hand Surgery were used as a control group. All patients in this study were examined to ascertain that they were suffering from only one of the above mentioned diseases. None of the 45 questions were specific for a certain disease, but the differences between the answers and the groups of patients were highly significant. Analysis by a log-linear regression model showed that it is possible, by demanding a specific combination of positive answers, to employ the questionaire as a diagnostic tool in population screening for osteoarthrosis of the hip and/or knee.

Experimental orthopaedics

The influence of indomethacin on bone remodelling

Johnny Keller, Flemming Melsen, Troels T. Andreassen, Cody Bünger, Bue Bak & Ulf Lucht

Institute of Experimental Clinical Research, University of Aarhus, Aarhus

Indomethacin is a known inhibitor of the synthesis of prostaglandins and may influence the internal reorganization of bone (bone remodelling). Whether this is due to altered differentiation or function of osteoclasts and/or osteoblasts is not clear. To elucidate the remodelling during indomethacin treatment a tibial osteotomy model was performed in 10 rabbits. The cellular function following double labelling with tetracycline was investigated after 1, 2, 4 and 6 weeks at various distances from the osteotomy in the preexisting bone. This pilot study showed an increased porosity of cortical bone throughout the 6 weeks study. The porosity was significantly lower in indomethacin treated animals compared to placebo treated animals, as all 5 indomethacin treated animals had decreased porosity values compared to their respectively placebo ones. This must be due to either a decrease in activation frequency (differentiation of osteoclasts from precursor cells) and/or a direct reducing effect of the drug on the osteoclastic activity. Bone formation evaluated from tetracycline labelling was seen after two weeks indicating the lifespan of the resorptive phase. The cellular activity of bone formation studied after 4 and 6 weeks suggests that indomethacin has a reducing influence. Further studies comprising more animals are necessary.

Metabolic changes in juxta-articular bone in relation to increased intra-articular pressure

Henrik Ewald, Ida Elisabeth Holm, Jens Bülow & Cody Bünger

The Orthopaedic Hospital and Institute of Experimental Clinical Research, University of Aarhus, Aarhus

The purpose of the present study was to investigate aspects of metabolic changes in juxta-articular bone during various degrees of knee joint tamponade.

In six dogs, aged 3–4 months, Radner biopsy cannulae were inserted bilaterally into the distal femoral epiphyses to record intra-osseous pressures (IOP). 1 ml blood samples were withdrawn from the bone cannulae and from the brachial artery and the central vein for determination of pO_2, pCO_2, pH, and lactate. The possible influence of prostaglandins was indirectly assessed by inhibition of the prostaglandin-synthesis. Knee joint tamponade was performed in one knee and subsequently, after administration of indomethacin 7,5 mg/kg i.v., in the other knee. The tamponade amounted to 50% and 150% of mean arterial pressure (MAP) for 30 minutes.

During tamponade (50% of MAP) the IOP was significantly increased but no changes were seen in the other parameters indicating the presence of autoregulatory mechanisms. At tamponade (150% of MAP) no further increase was seen in the IOP; however, pO_2 and pH were significantly decreased, whereas pCO_2 and lactate were significantly increased ($P < 0.05$). After administration of indomethacin the same changes were observed; however, the changes in pCO_2 and pH were non-significant.

In conclusion, the present study suggests that autoregulatory mechanisms for subchondral bone blood flow exist. The nature of these mechanisms is probably of metabolic origin since accumulation of vasoactive metabolites occurs. No effect of prostaglandins could be determined from this study.

The subchondral bone lesion in Carragheenan-induced arthropathy of the immature dog knee

Ida Elisabeth Holm, Estrid Bünger, Flemming Melsen & Cody Bünger

The Orthopaedic Hospital, Institute of Experimental Clinical Research, University of Aarhus and Institute of Pathology, Aarhus County Hospital, Aarhus

The aim of this study was to obtain a quantitative measure of the alteration in the structure of juxtaarticular subchondral bone following chronic synovial inflammation and elevated joint pressure.

Unilateral arthritis of the knee was induced by repeated intraarticular injections of Carragheenan solution for 10 weeks in 14 mongrel puppies. After sacrifice a histomorphometric analysis of the subchondral bone of the medial femoral condyle was performed blindly in both knees of each dog. Bone formation rate (BFR) was measured from tetracycline double-labellings.

The articular cartilage thickness was significantly increased in the arthritic knees. The subchondral epiphyseal trabecular bone volume (VTB%) showed decreasing values towards the central epiphysis ($P < 0.01$) in both arthritic and control knees, but in arthritis both the VTB% and the trabecular thickness were decreased ($P < 0.01$). No differences in osteoid covered surfaces or in relative resorptive surfaces were encountered. A high BFR value indicated an increased bone turn over in the arthritic subchondral bone.

Total and segmental blood flow of the femoral head epiphysis in coxitis at rest and during exercise

Kjell Sølund, Cody Bünger, Frederic Joyce & Henrik Schrøder

The Orthopaedic Hospital and Institute of Experimental Clinical Research, University of Aarhus, Aarhus

The pathogenetic role of elevated joint pressure and synovial inflammation in the development of ischaemic lesions of the femoral head in Calvé Perthès disease and in transient synovitis of the hip is not yet settled.

We have studied the regional blood flow (RBF) in the hips of 10 mongrel puppies, aged 5 months with unilateral coxitis. RBF was measured by a microsphere technique in chronically instrumented dogs at rest, during exercise training at 4 km per hour and 30 min postexercise. RBF of the femoral head was measured separately in the infero-medial, the posterolateral and in the antero-lateral segments bilaterally.

The joint pressure at neutral position of the hip in supine dogs was 25 (4–63) mmHg in the arthritic hips versus −3 (−12–3) mmHg in the control hips. At rest RBF in all segments of the femoral head and the joint capsule was significantly increased. Within the arthritic femoral heads the infero-medial seg-

ment was most richly perfused ($P < 0.05$). Exercise caused a 45 per cent reduction of RBF in all cancellous bone areas of both the normal and the arthritic hip ($P < 0.05$). Postexercise RBF was still low in the arthritic femoral head, while it returned to normal in the control femoral head.

It is suggested that in coxitis a risk of ischaemia in the metabolically high demanding femoral head is present during exercise. No individual segment of the femoral head epiphysis showed increased vulnerability in coxitis at rest and during exercise.

99mTc DPD uptake in experimental suppurative arthritis in immature dog knees

Vibeke E. Knudsen, Ebbe Stender Hansen, Ida Holm, Henrik Ewald, Ivan Noer, Sten Bach Christensen & Cody Bünger

Orthopaedic Hospital, Aarhus. Institute of Experimental Clinical Research, University of Aarhus. Department of Clinical Physiology, Randers Hospital. Department U, Rigshospitalet, Copenhagen

This study is part of an investigation of juvenile knee-arthropathies in dogs, involving the 99mTc DPD uptake in suppurative arthritis, non-suppurative arthritis and haemarthrosis. The aim of this part was to:

1. Create a reproducible model of experimental suppurative arthritis.
2. Localize and quantify the initial scintigraphic changes.

Unilateral arthritis of the knee was induced by a single intraarticular injection of 10^6 Staph. aureus phagetypes 95 and 82 in 8 mongrel puppies. After 2 days static bone scans were made and evaluated by a computerized scintimetric technique. The intraarticular pressure was measured with a fluid filled electromanometric pressure recording system. To avoid disseminated infection systemic antibiotics were administered after the inoculation.

The scintigraphic changes in the knees varied from increased uptake in all regions of adjacent bones, to unchanged 99mTc DPD uptake in spite of fulminant joint infection. In one dog an ischaemic lesion of the distal femoral epiphysis with lack of 99-mTc DPD uptake was found. The intraarticular pressure varied from 20–30 mmHg.

These scintigraphic changes differed from the observations in non-suppurative arthritis and haemophilic arthropathy, in which decreased uptake of 99-mTc DPD in the growth plates was the early change in all cases.

In conclusion the present series show that the early scintigraphic changes in juvenile arthritides differ according to aetiology. However negative bone scans may be obtained in spite of fulminant joint infection, when early antibiotics are given.

Septic arthritis. The natural course in rabbits

Per Riegels-Nielsen, Niels Frimodt-Møller & Jørgen Steen Jensen

Dept. of Orthopaedic Surgery, Rigshospitalet and Statens Seruminstitut, Copenhagen

The present infection model was developed in order to disclose the time related changes in the course of untreated septic arthritis.

87 rabbits were infected in one knee with Staph. aureus. No treatment was instituted and the animals were killed at different periods from 1 to 94 days. The intraarticular temperature was measured and the lysosomal reaction was examined semiquantitatively. The joint destruction was evaluated macroscopically and microscopically in serial sections of the patella stained with Haematoxylin-Eosin and Safranin-O.

From the fifth day marginal erosion and undermining of the cartilage border was observed. This process continued gradually with total joint destruction after five weeks. The GAG-depletion could be visualized from the surface of the cartilage after two days and was total after two weeks.

In septic arthritis the synovial tissue demonstrated increasing destructive characteristics and the first signs of irreversible changes in the cartilage were demonstrated from the fifth day. Thus, early and aggressive treatment is mandatory.

Antibiotic penetration of normal and infected knee-joints. An experimental study in rabbits

N. Frimodt-Møller, P. Riegels Nielsen & J. Steen Jensen

Dept. of Antibiotics, Statens Seruminstitut and Dept. of Orthopedic Surgery, Rigshospitalet, Copenhagen

Diffusion of penicillin (P), cloxacillin (CC), clindamycin (CM), and netilmicin (N) into synovial fluid (SF) and tissue (ST) was investigated in rabbits. Twenty-

four New Zealand white female rabbits (2–2.5 kg) were inoculated with 10^3 colony forming units of *S. aureus* in the right knee, while the left (saline-injected) knee served as control. Forty-eight hours later, when purulent arthritis was manifest in the right knee, the drug studies were performed. After i.m. injection of single-doses (6 rabbits per drug) antibiotic concentrations were determined at various intervals in serum, SF and ST in both knees.

Antibiotic concentrations achieved in SF relative to those in serum were calculated as the ratios (in %) of the AUC(SF) (area under the concentration curve in SF) to AUC(serum), and were for the infected joints: CM, 81%; N, 54%; P, 52%; and CC, 14%, respectively. The corresponding ratios for the non-infected knees were 2–3 times lower. Similarly, antibiotic concentrations in ST were measurable only in infected knees. In spite of its relatively low penetration into SF, CC concentrations were maintained for a longer period in both SF and ST than the other drugs, reflecting its higher protein binding.

Therefore, these antibiotics when administered parenterally diffuse readily into SF and ST of infected joints resulting in sufficient activity against most common pathogens found in septic arthritis.

Penetration of flucloxacillin into chronic leg ulcers and the effect on the bacteria

Jens Stürup, Torben Sandberg Sørensen, Torsten Slotsbjerg & Bo Hofmann

Department of Orthopeadic Surgery and Department of Clinical Microbiology, Frederiksberg Hospital, Copenhagen

The aim of the present work was to study the penetration of flucloxacillin into chronic leg ulcer secretions and to investigate the effect of the antibiotic on the bacteria in the ulcers. Six patients with *Staph. aureus* contaminated chronic leg ulcers took part in the study. The minimum inhibitory concentration (MIC) of flucloxacillin against the strains of *Staph. aureus* were found to be 0.5–1.0 μg/ml (broth dilution method). The patients were given flucloxacillin 1 g × 3 for three days. The concentration in serum and ulcer secretions was measured following the first and the seventh dose. The secretion concentrations of flucloxacillin were found to be constantly below serum concentrations. However, the concentrations in ulcer secretions were above MIC-values for the *Staph. aureus* for 6 (5.5–7) hours following the first dose and for 7.5 (5.5–8) hours following the seventh dose. The effect on the concentration of staphylococci in the ulcers was measured by bacterial counting before and during the flucloxacillin treatment. The number of *Staph. aureus* was during the period of treatment reduced to about 0.1% of the initial amount.

By the administration of flucloxacillin 1 g × 3 daily wound concentrations are achieved which exceed MIC-values for the isolated *Staph. aureus* and the number of staphylococci in the ulcers are markedly reduced.

Experimental instability of the elbow following transsection of the medial collateral ligaments

Jens Ole Søjbjerg, Jørgen Ovesen & Strange Nielsen

Biomechanics Laboratory, Orthopaedic Hospital, Aarhus

The object of the present study was to evaluate the contribution of the medial collateral ligaments to the stability of the elbow.

A standard experimental setup was used to measure the mobility patterns of ten osteoligamentous preparations.

In the first series a mean valgus instability of 11.6° (SEM 4.8°) was found at 60° flexion after cutting the anterior oblique collateral ligament. Cutting the posterior oblique ligament did not change the stability.

In the second series the capsule and posterior oblique medial collateral ligament were cut first. This did not increase the valgus instability. After cutting the anterior oblique collateral ligament a maximum instability of mean 21.2° (SEM 6.0°) was found at 60° flexion.

In both series the elbows were stable at 0–20° flexion and flexions greater than 110°.

The study has shown that the elbow has an inherent articular stability at flexions < 20° and > 110°, independent of the medial collateral ligaments and capsule.

In the position of function (30°–100°), the prime stabilizer of the medial side of the elbow joint is the anterior oblique part of the collateral ligaments.

Determination of the stiffness of trabecular bone specimens

Frank Linde & Ivan Hvid

Biomechanics Laboratory, Orthopaedic Hospital, Aarhus

The stiffness of trabecular bone specimens is usually determined by a single destructive test. However, it has been shown by non-destructive testing, that this

determination is inaccurate and poorly reproducible because of the viscous properties of trabecular bone. It has also been shown that the stiffness increases by repetitive compression. The purpose of this experimental study was to determine the number of compression cycles necessary to reach a steady state with regards to viscoelasticity and thereby to propose a new technique for determining the stiffness of trabecular bone.

Trabecular bone specimens (n = 25) were machined from human cadaveric tibial epiphyses. The bone specimens were tested by non-destructive axial compression to 50% of the estimated ultimate strength with a strain rate of 0.01 sec^{-1}. Each specimen was loaded 30 times with 10^{-1} Hz frequency. The stiffness (E) was determined as 5-double measurement $\sum_{n}^{n+4} E$. The average increase between $\sum_{1}^{5} E$ and $\sum_{6}^{10} E$ was 9.3% ($p < 0.01$) and between $\sum_{6}^{10} E$ and $\sum_{11}^{15} E$ was 4.9% ($p < 0.01$). No significant alterations were observed between $\sum_{11}^{15} E$ and the following $\sum_{n}^{n+4} E$, implying that the steady state was reached after compression no. 10. The test was repeated after 3 hours' rest. The bone specimens showed the same behaviour as in the first test, but the reproducibility rose with an increasing number of compression cycles. It is proposed that the stiffness of trabecular bone specimens is determined by repetitive non-destructive compression with 10^{-1} Hz frequency as 5-double measurement at steady state $\left(\sum_{n}^{n+4} E\right)$.

Load bearing capacity in total ankle joint replacement

Niels Christian Jensen & Ivan Hvid

Biomechanics Laboratory, The Orthopaedic Hospital, Aarhus

The influence of simple design variations on the compressive load bearing capacity of tibial and talar prosthetic components in total ankle joint replacement was investigated in an attempt to suggest improvements to current prosthetic designs.

Eighteen paired ankle joint preparations were fitted with three types of tibial components and two types of talar components according to a system that avoided the influence of bone strength differences between sides. The tibial components were: a simple polyethylene block (type I) to which a steel tray (type II) or a steel tray with a 10 cm intermedullary peg (type III) could be added. Steel components, flat or with a 1.2 cm peg towards the bone, were used at the talus. The components were cemented with polymethylmetacrylate. The tibial and talar components were tested separately in an Instron® universal material test machine at a constant compressive deformation rate of 2 mm min^{-1}. The tests were documented by load-deformation diagrams from which the maximal load at failure and the stiffness coefficient were deduced.

The results in the groups were compared by a paired statistical test. The tibial component with an intermedullary peg tolerated significantly higher loads before mechanical failure than the two other designs that were equal in load bearing capacity. However, the stiffness coefficients did not differ between the three designs suggesting a low resistance to shearing forces along the intermedullary peg. The talar components were equal in load bearing capacity and stiffness.

It was concluded that a better mechanical performance leading to a lower incidence of symptomatic mechanical loosening might result from the addition of a steel tray and a stem in total ankle joint systems.

Finite element stress analysis of ankle-endoprosteses

Jette Falsig, Ivan Hvid & Niels Christian Jensen

Department of Civil Engineering, Aalborg University Center, and Biomechanics Laboratory, The Orthopaedic Hospital, Aarhus

The study was undertaken to examine design variants in total ankle arthroplasty, an area that has produced discouraging results with current arthroplasty designs. Finite element analysis was exploited to compute stresses in the distal tibia fitted with three endoprosthetic models. The basal element in the prosthetic models was a polyethylene block (Young's modulus 1.0 GPa) (variant I) that could be extended to include a steel tray (modulus 200 GPa) (variant II), or a steel tray with a cylindrical medullary stem (variant III). Fixation of compounds was made with polymethylmethacrylate bone cement (modulus 2.1 GPa). The model was three-dimensional, the geometry being reproduced from measurements on an anatomical specimen. Bone was modelled as a composite structure consisting of cortical bone (modulus 15.0 GPa) and trabecular bone that was either modelled homogenously with a constant modulus of elasticity or heterogenously as in the natural structure.

The results were sensitive to the chosen distribution of stiffness of trabecular bone. Lower stresses were computed when physiological heterogeneity was modelled. Normal- and shear-stresses were close to the expected fracture threshold of trabecular bone in variant I. Stresses were reduced slightly when a metal tray was introduced, while the addition of central stem resulted in marked reduction of the level of stress in trabecular bone as a result of stress bypass to proximal cortical bone.

It was concluded that a desirable reduction of stress flow through trabecular bone at the distal tibia can be achieved by modyfying prosthetic design.

Accident prevention

Epidemiological methods in injury research

Thorsten Kruse

Department of Health Economics and Public Health, Odense University, Odense

Studies of injuries published in the medical literature are predominantly descriptive, aiming at elucidating:

- the incidence of selected types of injuries
- the severity of sustained lesions
- the efficacy and effectiveness of various treatments
- late effects (e.g. residual impairment)

We are dealing with empirical documentation based on types of information (variables) normally contained in the routine registrations of the health care system, sometimes supplemented by indices based on *ad hoc* measurements, e.g. elements of the Sickness Impact Profile and the like.

In recent years interest in studies on injury-causation has led to the application of analytic techniques to the research process. Such procedures however, imply that certain new variables, which are not commonly covered in routine recordings have to be included.

The classical epidemiology is percieved as the primary research tool for obtaining information about etiology, possible associations between persons at risk, mechanism and setting, – and the "disease" under study. These techniques have also shown of value, when approaching issues on health care administration, setting priorities in health policy etc.

The paper stresses the importance of understanding how the research question dictates both the analytic methodology and the type(s) of data needed. Examples are given to illustrate how the health care system can contribute both to studies on etiology and to studies on various types of intervention.

The character and extent of the accident problem with regard to the WHO-document HFA-2000

Poul Ejnar Jensen, Jens Lauritsen & Erik Nordentoft

Department of Orthopaedic Surgery, Odense Hospital, Odense

The aim of the HFA-2000 document is to reduce the number of deaths caused by accidents by at least 25 per cent before the year 2000 and to reduce specific types of accidents. Since 1979 Denmark has fulfilled the demand of the document in the traffic field. Altogether accidents are responsible for only 4 per cent of the total number of deaths, but death caused by traffic accidents is constantly responsible for about 14 per cent of the loss of living years. Thus, a calculation of the loss of living years seems to be a better parameter for measuring the effect of implemented arrangements.

Domestic accidents are the second most frequent cause of injury and are a relatively frequent cause of death in the age group 65 years and above. Too little is known about the causal relationships in home accidents, especially about falls in elderly people. Further investigation and more detailed recordings are necessary before prophylactic arrangements can be made

In Denmark there are only about 100 fatal occupational accidents per year and to reduce this number by at least 50 per cent, which is the target, will be almost impossible. It will be possible to lower the number caused by machines and falls. To achieve the overall target of reducing accidental deaths by 25 per cent it will be necessary to reduce the mortality from traffic accidents further and to carry out special programmes for elderly people.

How can the Health Authorities make a contribution in order to obtain the reduction of the prescribed number of accidents with the programme "Health for All, Year 2000"

Kirsten Nielsen, Bachelor of Commerce, President of the Danish Consumers Council

The Danish Consumers Council, Købmagergade 7, Copenhagen

An example in Norway from the island Værøy has shown that the preventive work has *reduced the number of accidents* by 29 per cent. A number of institutions within the health field have participated.

On the basis of a study in an area in Norway (Vestfold) the method used to record all accidents is described; including reports from hospitals, emergency services, general practitioners, dentists and health visitors.

The study is now completed and the intention is to analyse the material to form the basis of the actions that have to be taken in order to prevent accidents.

Interdisciplinary collaboration among health visitors, planners, volunteers, and policitians in the area will be established to make an analysis of risks in the individual areas: in the traffic, at the schools, etc. Furthermore, several subject studies and follow up studies have been started.

The Consumer Council imagines that, in the individual regional communities, a top-ten list could be made of the types of accidents that are most frequent and most serious, as well as a top-ten list of the most dangerous products involved in accidents. The last-mentioned list should be made in order to put an end to dangerous products both nationally and internationally.

The Consumer Council works on a European and international basis by participating in an "Interpol-system", the aim of which is to warn against dangerous products. It is most important that the Consumer Council receives information about dangerous products in order to have them withdrawn from the market.

The making of a top-ten list is to be seen as a practical result of the whole registration system and a means of getting *everybody* involved in the preventive work.

Trampoline training injuries

Anders Hammer

Institute of Medical Physiology B, University of Copenhagen and Orthopaedic Department, Næstved

Two studies are presented.

In the first, 201 trampoline accidents were analysed. In the second, 50 cases of severe spinal lesions caused by trampolining, were analysed.

The biomechanics and physiology of trampoline jumping is evaluated. Mismatch of a multitude of sensory impulses (visual, tactile, and others) with impulses from the vestibular apparatus converging toward the orientation centres of the brain may result in disorientation and inadequate motor reactions as seen at the time of the trampoline accidents.

A G-induced split second loss of consciousness is another possible explanation of the trampoline accident.

The need for accurate records of injuries to pupils in physical education lessons is stressed.

Less dangerous pursuits than trampolining as a school-sport and recreational activity are recommended.

Riding accidents in the county of Frederiksborg – a one year prospective study

Morten Kramhøft, Anne-Grete Kjersgaard, Steffen Kramp, Benny Rosenberg & Søren Solgaard

Department of Orthopaedic Surgery, Hillerød Hospital, Hillerød

In a prospective study of 464 riding accidents registered in the county of Frederiksborg, thirty per cent sustained serious lesions (fractures, lesions of head, chest and abdomen). Two patients died, and 12 per cent were admitted to hospital for a median of two days. Compared to earlier investigations the pattern of injuries was unchanged. The incidence of injuries was unrelated to previous riding experience and the use of riding helmet and boots. The frequency of riding accidents among "registered" riders has fallen during the last ten years (0.2 accidents per 1.000 riding lessons), probably due to better instruction at the riding clubs.

It is estimated that riding accidents are the cause of 1.000 days lost through illness in Denmark.

The estimated expenses in Denmark were calculated to at least 8 million danish crowns.

Playground equipment accidents

Søren T. Christensen

Accident Analysis Centre, Municipal Hospital and County Hospital, Aarhus

July 1979 to June 1980 a total of 466 children were injured when playing on playground equipment. An in-depth investigation was performed at the place of accident. The incidence for children 0–14 years was 9.3/1000 children/year with a maximum in the age group 4–5 years. The sex ratio boys/girls was 1.4. Swings, climbing frames and slides were responsible for 64 per cent of the accidents. The serverity of the lesions were divided according to the Abbreviated In-

jury Scale (AIS). This showed "minor" injuries in 70 per cent, "moderate" injuries in 22 per cent and "severe not life-threatening" injuries in 8 per cent.

Falls constituted 71 per cent of the accidents and resulted in the more severe lesions. The fall height ranged from 0 to 350 cm. Surfaces with sufficient shock absorbing properties were found in only 22 cases (6.7 per cent).

The cause of accidents is described in relation to playground equipment, environmental factors and the persons involved.

Prevention implies *education* of children, parents and professional people connected to the playground, and improvent in the *standards* for playground equipment and the environment around the playground equipment.

Accidents caused by up-and-over doors

C. F. Larsen, K. E. B. Nielsen & A. J. Hansen

Departments of Orthopaedic Surgery, Odense Hospital, Odense

During the period 8.1.1980–30.4.1983, 26 persons were treated in the casualty department, Odense University Hospital, for lesions caused by accidents with up-and-over doors. The mechanism of injury was the same in nearly half of the accidents. The supporting bolt broke on account of wear-and-tear or corrosions. Two patients sustained serious lesions of the face requiring operation. The remaining patients could be treated as out-patients. A brief description of the function of the doors is given.

As prophylactic measures, the following are proposed: alterations in construction, better instructions for the use and marking of the doors with information on maintenance. Compulsory approval of the different types of doors would be desirable but is not realistic from the point of view of the resources available.

Accidents with rotary lawn mowers and electric hedge cutters

Hans R. I. Jørgensen & Claus Falck Larsen

Departments of Orthopaedic Surgery and Accident Analysis Centre, Odense Hospital, Odense

Thirty cases of rotary lawn mower accidents were surveyed. Twenty-seven sustained hand lesions and of these two had traumatic amputation of a finger. Accident mechanism were almost identical. Trying to remove grass from the grass exhaust the patients were hit by the turning blade.

Twenty-six patients were injured in accidents with electric hedge cutters. Of these twenty-two patients had finger lesions.