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Department of Orthopaedic Surgery,
Lund University Hospital, S-221 85
Lund, Sweden

Spinal problems

The epidemiology of work factors related to low back pain in men and women

Hans-Olof Svensson & Gunnar Andersson

Department of Orthopaedic Surgery I, Sahlgren Hospital, Göteborg, Sweden

Epidemiological surveys indicate that low back pain (LBP) is about as frequent in women as in men, in spite of the obvious differences in biological, social and work factors. The relationship of LBP to different work factors including physical demand and psychological effects of work has been studied in two cross-sectional groups – consisting of 940 men, aged 40-47 years, and of 951 women, aged 38-49 years.

In the statistical analysis, data were compared for individuals without a history of LBP and individuals who at some time in their lives experienced LBP (the life-time incidence group). The correlation tests were performed in two steps – firstly by a univariate analysis and secondly by an analysis of covariance. $P < 0.05$ was considered significant in two-sided tests. **Results.** Seventy-six per cent of the men and 81 per cent of the women participated. The life-time incidence of LBP among the men was 61 per cent and among the women 65 per cent. In males, five variables had a direct relationship to LBP: less overtime, more monotony, frequent lifting, heavy physical activity and a high level of worry or tension at the end of the day.

In females, three variables were directly correlated to the occurrence of LBP: less responsibility, a high level of worry or tension at the end of the day and extreme fatigue at the end of the day.

Conclusions. Physically related work factors seem to be more important in relation to LBP among men than among women. The findings may be explained to some degree by differences in work tasks and working conditions. Psychologically related factors are important in both sexes.

The relationship of low back pain, pregnancy and gynaecologic disease

Hans-Olof Svensson, Gunnar Andersson, A. Hagstad & P-O. Jansson

Department of Orthopaedic Surgery I and
Department of Obstetrics and Gynaecology,
Sahlgren Hospital, Göteborg, Sweden

Many women experience low back pain (LBP) during pregnancy. The extent of the problem is poorly documented. The influence of gynaecologic disturbances on the occurrence of LBP has not been fully investigated.

Material and methods. A random sample of 1746 women, 38-64 years old, was asked to participate in a study in which LBP, obstetric and gynaecologic factors were investigated. The women were divided into two groups, 38-49 years old, and 50-64 years old, respectively. In the statistical analysis, data for individuals without a history of LBP were compared with data from individuals who had had LBP (the life-time incidence group). The correlation tests were performed in two steps, firstly by a univariate analysis and secondly by an analysis of covariance. $P < 0.05$ was considered significant in two-sided tests. A prevalence group had on-going LBP.

Results. Eighty-one per cent participated. The mean life-time incidence of LBP was 66 per cent, and the prevalence was 35 per cent. Eighty-six per cent had been pregnant and 27 per cent in both the incidence and prevalence groups had suffered from LBP during pregnancy. In the prevalence group, 51 per cent experienced aggravation of LBP during menstruation.

In the younger group, a statistically significant correlation was found between LBP and the number of abortions, and in the analysis of covariance this variable bore a direct relationship to LBP.

In the older age group, four variables were correlated to LBP: live births, abortions, curettage and

symptoms of menopause. In the analysis of covariance the number of live births and menopausal symptoms were directly related to LBP.

An *in vivo* study of vibration transmission in the lumbar spine

Gunnar Andersson, M. Panjabi, L. Jörnérus & E. Hult

Department of Orthopaedic Surgery, Sahlgren Hospital, Göteborg, Sweden, and Department of Surgery, Yale Medical School, New Haven, USA

A study was performed to identify frequencies at which resonance of lumbar vertebrae occurs.

Material and methods. Five healthy volunteers were exposed to pure sinusoidal vibration when sitting. Two acceleration amplitudes were used: 0.1 and 0.3 g (1 and 3 m/s). The frequency input ranged from 2 to 15 Hz. Vibration on the spine was measured at three different points: two lumbar vertebrae and the sacrum. A K-wire was threaded about 10 mm into the spinous processes of the two vertebrae and the sacrum. They were oriented to lie in the mid-sagittal plane. A specially designed plane-motion, three-accelerometer transducer (PAT) was placed on each of the pins of the vertebrae, and a single-axis acceleration transducer was rigidly fixed to the sacrum pin, making it possible for the first time to measure the dynamics of the vertebrae *in vivo*. The output for each PAT was transformed to its corresponding vertebral body using a mathematical model, and the translation accelerations were calculated.

Results. The frequency characteristics for the same lumbar vertebrae differ quite dramatically in different directions. The transmission function for the axial acceleration increased from a value of about 1 at 2 Hz to a peak of 1.5 at about 4 to 5 Hz, then decreased to about 0.5 between 9 and 14 Hz. The disc plane acceleration of the vertebrae, however, increased continuously. Finally, the rotary acceleration of the vertebrae changed only a little, reaching a maximum at around 8 Hz.

Discussion. The results indicate that the vibration motion pattern along the spine is frequency-dependent. Further, although the body was excited by simple sinusoidal vertical acceleration, the vertebral motions produced were complex. The vertebrae not only accelerated in the direction of the input, but also perpendicular to it and in addition had rotatory components. Under the circumstances examined here, resonance appears to occur in the vertical and rotatory direction around 4.5 Hz, while the horizontal resonance is above 15 Hz.

Bacterial spondylitis. A review of 10 years of patient records from Örebro

Per Olcén, Heinz Kogler, Ingrid Brånvall & Pelle Jacobsson

Departments of Infectious Diseases, Orthopaedics and Radiology, Medical Centre Hospital, Örebro, Sweden

Bacterial spondylitis was diagnosed in 15 females and 14 males during 1974–1983. The mean age was 60 years. In 16 patients the causative agent was *S. aureus*, in two *Salmonella*, one *E. coli*, one *M. tuberculosis*, one *Str. agalactiae*, one *Kingella Kingae*, two probably *M. tuberculosis* and in five cases the causative agent was not firmly established.

On admission, one third of the patients had fever. Most of the patients had normal leucocyte counts. The ESR was, however, high or very high, as was the level of C-reactive protein. A wide range of diseases had been discussed on admission and in only one third of the cases had spondylitis been suspected.

The time from the start of symptoms to diagnosis varied from 9 to 250 days (mean 70).

The treatment for non-specific spondylitis was initially antibiotics intravenously for 3–4 weeks, followed by oral administration for up to 6 months or more.

Six of the 29 patients died during treatment of the spondylitis. In six of the 23 survivors a vertebral fusion developed with or without gibbus. One patient developed paraplegia which did not improve after laminectomy. Three patients had reversible signs and symptoms of root affection, and in the remaining 13 patients no sequelae were documented.

Transpedicular external fixation of the lumbar spine. Technical considerations

Sven Olerud, Mats Hamberg, Göran Karlström & Lennart Sjöström

Department of Orthopaedic Surgery, University Hospital, Uppsala, Sweden

Stabilization of the lumbar spine from the dorsal aspect can be done with several different techniques. Among these, Harrington instrumentation and the Roy-Camille plate with transpedicular screws are examples of internal devices. Transpedicular external fixation for the treatment of vertebral fractures has been used by Magerl (1979). Dick (1980) developed a similar technique but the device is mainly used for internal fixation.

Percutaneous transpedicular external fixation was performed by us using parts from the standard Hoff-

mann system in combination with the compression-distraction rods of the Müller-Charnley device which is most often used for knee arthrodesis. With an image intensifier, and with the patient in a prone position, the pedicles of the affected vertebra are identified and the position of the screws indicated with K-wires. The direction of the K-wires has been further adjusted on the lateral view. After this, the K-wires are changed to 5 mm Schantz screws which are driven through the pedicles into the vertebral body and up to the anterior cortex with a Jacob's chuck.

In the sacrum the screws are placed close to and parallel to the sacro-iliac joint. In the horizontal plane the screws are parallel to the screws in the vertebra. The external parts of the screws are united to a rigid system which is adjustable with regard to compression and distraction.

The fixation procedure has been used as a diagnostic test for painful instability. It was possible for one patient to have the fixation system for as long as 10 weeks. Thus anterior fusions have been performed with brace-free rehabilitation.

Transpedicular external fixation as a diagnostic procedure for painful instability of the lower lumbar spine

Sven Olerud, Mats Hamberg, Göran Karlström & Lennart Sjöström

Department of Orthopaedic Surgery, University Hospital, Uppsala, Sweden

Chronic low back pain with or without sciatica can probably be caused by instability between the lumbar vertebrae and/or osteoarthritis in the intervertebral joints. Fusion of the affected segments is therefore sometimes performed. It is difficult to predict the outcome of this procedure and not uncommonly the pain persists after the operation.

To assess whether the instability is the cause of the pain, we did a rigid percutaneous transpedicular external fixation of the lower lumbar spine in ten patients with chronic low back pain. The pain was registered using a linear analogue scale and a pain-mapping test before and after the stabilizing procedure. The amount of analgetics taken by the patients before and after the operation was also registered.

In nine of the ten patients, almost total relief of back pain was noted as well as disappearance of the sciatica. The pain mapping test also showed a dramatic improvement. All nine patients could quit their heavy use of analgetics from the day after the stabilization.

Conclusion. Transpedicular external fixation of the lower lumbar spine as a diagnostic test for painful instability and intervertebral joint osteoarthritis has proved to be extremely decisive.

Arthroplasties

Long-term follow up with the Guepar hinge knee arthroplasty

Anders Hansson & Lars-Gunnar Brobäck

Department of Orthopaedic Surgery, Central Hospital, Eskilstuna, Sweden

Seventy-eight Guepar total knee replacements in 69 patients were evaluated in a prospective, longitudinal study. The mean follow up was 9 (6–11) years. Of the patients, 58 were women and 11 men. The mean age at operation was 64 (34–81) years. The diagnosis in 40 cases was rheumatoid arthritis, in one case SLE and in 28 cases osteoarthritis.

Failures were registered in 51 cases (65 per cent). Mechanical loosening, patellar dysfunction and deep infection were the main causes of failures.

This rate of failure is unacceptably high. It is concluded from our study that there are serious limitations to the use of fully constrained hinge total knee replacements. However, in a few elderly rheumatoid patients with severe instability and deformity, there could still be a place for this prosthesis.

Total hip replacement

Dick Larsson

Department of Orthopaedic Surgery, Central Hospital, Karlstad, Sweden

A 9-year follow-up study was made on a consecutive series of 278 patients who underwent total hip replacement during the years 1971–1976 at the orthopaedic surgical clinic in Karlstad. Primarily, 321 hips were operated on. The operations were performed in a conventional theatre. The surgeons wore conventional clothing. Prophylactic antibiotics were not given until 1974. All 228 surviving patients could be traced at the follow-up, and all but one attended for personal examination and radiography. Pain, walking ability and range of movement were evaluated, and grading of the results was according to the Merle-d'Aubigne numerical system as modified by Charnley.

No patient died from the operation. The primary

prosthesis was retained in 190 patients (228 hips). In 30 hips the primary prosthesis was exchanged at 36 reoperations (13 per cent). In another eight hips, the prosthesis was extracted (Girdlestone procedure). Reasons for revision arthroplasty were infection in 13 cases, aseptic loosening in 17 cases and fracture of the stem in four cases. Fracture of the femur and dislocation of the hip were the reasons in another two hips. Among those who underwent surgery after prophylactic antibiotics were given, revision arthroplasty followed in 13 hips (8 per cent). Deep infection was the reason for revision arthroplasty in 2 hips. In those hips where the primary prosthesis was left, the radiographic follow-up revealed signs of loosening in 25 hips, of which 12 were symptomatic. Subsidence was present in another 28 hips. Where revision arthroplasty was done, the radiographic evaluation revealed signs of loosening in seven hips. Four were symptomatic. No patient was satisfied with the Girdlestone procedure. If the Girdlestone group and those belonging to the functional group C (other circumstances but the coxarthrosis having influence on walking ability) were excluded, 172 patients out of 177 (97 per cent) were satisfied with the Charnley arthroplasty.

Shoulder replacement with the Neer device. A preliminary report of 11 cases

Lennart Hovelius & Bo Lundberg

Orthopaedic Department, Gävle Hospital, Gävle, Sweden

During November 1981–February 1984, we performed 11 shoulder replacements according to Neer on 10 patients at the orthopaedic department, Gävle Hospital. Bilateral surgery was done in one patient aged 45 owing to idiopathic osteoarthritis. This patient as well as a further six had both the glenoid surface and the humeral head replaced. In three cases we replaced the head only. The reason for surgery was shoulder pain owing to idiopathic osteoarthritis, rheumatic arthritis, arthritis as a sequel to shoulder instability, cuff arthropathy, humeral head collapse owing to radiation therapy and late sequelae to a four-part head fracture. Except for the last case, where the head dislocated inferiorly, no post-operative complications occurred.

At follow-up 4–30 months postoperatively, 9 of 11 cases were satisfied with the procedure (no pain and preserved or better range of motion than pre-operatively).

Although two cases were considered failures, we recommend the procedure.

Experience with the Neer hemi- and total shoulder replacement

Claes Petersson

Department of Orthopaedics, Malmö General Hospital, Malmö, Sweden

This paper reports experience with the Neer shoulder prosthesis. Twenty-five prostheses were inserted into severely damaged and painful shoulders of 21 patients. Seventeen shoulders were operated with hemi-arthroplasty and in eight shoulders total replacements were performed. Ten shoulders in nine patients (eight rheumatoid and one psoriatic) were available for a 2-year follow up, a mean of 28 months post-operatively. The assessment concentrated on pain relief and patient satisfaction but objective parameters of range of movement and shoulder stiffness were also recorded.

Three patients were pain-free and very satisfied with the operation, four patients with slight, occasional pain were also satisfied, whereas two patients with considerable residual pain and shoulder stiffness were dissatisfied with the result of the operation. Active elevation of the arm increased on average 23° (from 67° to 87°). Thus, 77 per cent of the operations resulted in subjective amelioration whereas, objectively, only a moderate improvement in range of movement was obtained.

Dynamics of the radiolucent zone around bone cement

Bengt Mjöberg, Holger Pettersson, Rolf Rosenqvist, & Anders Rydholm

University Departments of Orthopaedics and Radiology, Lund, Sweden

A radiolucent zone frequently appears at the bone-cement interface following arthroplasty. Several explanations for this have been suggested: vascular, thermal or cytotoxic injury, infection, reaction to wear products, metal sensitivity, micromovements and stimulation of macrophages by cement.

To study the development of the zone in a model where several of these causes are not applicable, we have analysed its appearance in cases of giant cell tumours of bone (GCT) treated by curettage and cementing.

Material and methods. Six patients, successfully treated by curettage and bone cementing for GCT, were followed by repeated radiologic examinations for mean 3.7 (2–6) years post-operatively.

Results. The radiolucent zones between cortical bone and cement increased in width up to 0.5 mm during

the first 6 months after surgery and then remained stationary. During the same period the zone adjacent to cancellous bone increased in width up to 2.5 mm and became surrounded by a sclerotic rim. In two cases the zone adjacent to cancellous bone diminished by 1–1.5 mm during the first 2 years after surgery. There was a positive correlation between the maximal width of the zone adjacent to cancellous bone and the volume of cement fillings.

Conclusion. Our findings indicate that the radiolucent zone is caused by thermal necrosis.

Clinical relevance. Mechanical loosening of cemented arthroplasties may be reduced by a diminished amount of cement and by heat abductors.

Incorporation of autoclaved autologous bone supplemented with allogeneic bone matrix

Peter Köhler & Andris Kreicbergs

Department of Orthopaedic Surgery, Karolinska University Hospital, Stockholm, Sweden

The incorporation of resected, devitalized (autoclaved) and reimplanted ulnar segments supplemented with BMP (Bone Morphogenetic Protein = allogeneic bone matrix) was studied and compared to substitution of corresponding defects of the contralateral ulna by allogeneic bone grafts also supplemented with BMP in rabbits.

The study included seven adult rabbits. The transversally resected specimens were 2 cm in length, corresponding approximately to the middle third of the ulna. Substitution of the defects was performed by merely reinserting the resected, autoclaved (121°C/20 minutes) specimen into the defect of one side and placing the allogeneic bone graft into the defect of the other side without any fixation. Equal amounts of BMP were added to both types of implants intramedullarily as well as outside the specimens.

The incorporation process was studied 4, 8, 12 and 16 weeks post-operatively by radiography, bone scan (^{99m}Tc) and bone mineral determination (mass absorption measurement-emission source: ^{125}J) along a defined part of each specimen.

Radiographically, all 14 implants, regardless of type, were clearly incorporated after 16 weeks without signs of pseudo-arthritis in any of the corresponding 28 osteotomies. Bone scan disclosed the highest uptake at 4 and 8 weeks, followed by a marked decrease at 12 weeks and a slow return to normal activity a 16 weeks in both types of implants. The bone mineral content of the specimens reached a maximum 8 weeks post-operatively, followed by a

slow continuous decrease during the remaining 8 weeks of the study. The autoclaved autologous implants at 8, 12 and 16 weeks consistently exhibited a 10 per cent higher ($P < 0.001$) bone mineral content than the allogeneic implants.

Our study indicates that reimplantation of resected and devitalized bone supplemented with BMP may offer an alternative to allogeneic bone grafting in the treatment of lesions requiring extensive local resection.

Fractures

Effects of changes in strategy in the treatment of femoral neck fractures during a 17-year period

Leif Ceder, Björn Strömquist & Lars Ingvar Hansson

Department of Orthopaedics, University Hospital in Lund, Lund, Sweden

In a 17-year perspective, the total annual number of femoral neck fractures increased as well as the mean age of the patients and the proportion of males in the Lund area. In spite of this, the total number of hospitalization days through the period was reduced. The change in treatment policy from primary prosthetic replacement of the femoral head in fresh femoral neck fractures to internal fixation with early weight-bearing reduced the mean hospitalization time during the first period. An active rehabilitation programme, which involved co-operation with community health care personnel from the admission of the patient, increased the discharge rate home without increasing the hospitalization time during the second period. Further reduction of the mean hospitalization time to about 2 weeks was achieved with a refined, less traumatic, osteosynthetic technique (hook-pins) in the third period.

When are patients with hip fractures operated?

Thomas Dolk

Orthopaedic Department, Regional Hospital, Örebro, Sweden

The number of patients with hip fractures is increasing in Sweden, making greater demands on operative and ward resources. A national inquiry was carried out regarding the situation in 1983, to determine if these patients were operated early.

All 90 hospitals (92 treatment units) answered the questionnaire. The patients were operated on in 19 per cent of the hospitals in the evenings but in only two hospitals during the night. Sixty-eight per cent of the units performed operations on Saturdays and 57 per cent on Sundays.

There were only minor differences between hospitals with large numbers of hip fractures (over 300/year) and those with small numbers (less than 100/year). The ward resources (hip fractures/bed) did not significantly influence operative policy, and there was no difference between orthopaedic and general surgical units in operating activity.

This study shows that the policy in Sweden today is to operate on patients with hip fractures as early as possible, even during evenings and weekends. The patients ought to benefit from this policy.

When should the patient with a hip fracture be operated?

Thomas Dolk

Orthopaedic Department, Regional Hospital, Örebro, Sweden

The hope of reducing healing complications has been the main indication for early operations on cervical hip fractures in the past. No one has so far presented definite proof of the value of this policy.

The increasing numbers of patients with hip fracture and their rising age raises the question whether the patient benefits from an early operation.

In a prospective, consecutive series of 282 patients with hip fractures followed for 2 years (1973–1976), a multiple discriminant analysis was performed regarding prognostic factors.

We found that patients who fractured their hips on Mondays–Wednesdays and Sundays had a significantly shorter hospital stay compared with patients who sustained fractures on Thursdays–Saturdays, because operations were usually postponed during weekends.

The hospital stay increased significantly when the operation was postponed during the first 4 days after arrival. Waiting time before operation influenced post-operative complications, especially heart problems and confusion, and also influenced discharge to the patients own homes. Fracture healing and mortality were not adversely affected.

This study shows that patients with hip fractures should be operated on as soon as possible, and that patients operated on early have a better prognosis for rehabilitation and a shorter hospital stay.

Treatment of intracapsular fractures of the hip with sliding compression screw system

Torbjörn Ambré, Carl-Axel Cedell & Stefan Söderlundh

Department of Orthopaedic Surgery and Department of Radiology, Central Hospital, Växjö, Sweden

One hundred and four unselected patients with medial fracture of the femoral neck were operated on with a sliding compression screw system in a prospective follow-up study. Eighty-one patients were followed for more than 1 year, unless complications necessitated earlier application of a hip prosthesis. Bone healing was noted in 70 per cent of the patients. Contrary to earlier reports in the literature, the sliding compression screw system gives good treatment results and is quite equal to many other established methods of osteosynthesis.

Lower limb fractures and registration for alcoholism

Olof Johnell, Hans Kristenson & Inga Redlund-Johnell

Departments of Orthopaedic Surgery, Alcohol Diseases and Diagnostic Radiology, Malmö, Sweden

During 2 consecutive years (1980–1981), 607 individuals with lower limb fractures were operated as in-patients. Half of the individuals (315) were women and only 14 of them had an earlier registration for alcoholism. In the 292 men, however, 73 men or 25 per cent, had been registered at the Department of Alcoholic Diseases (RAD) at least once during a period of 13 years. The highest registration frequency (30 per cent) was noted for malleolar fractures in men. In males, 30–50 years of age, 37 per cent had been RAD; the highest registration (44 per cent) was noted for fracture of the tibial diaphysis. Males with fracture of the proximal end of the femur between 16–80 years of age were RAD in 23 per cent. In men with malleolar fractures who were RAD, the occurrence of bimalleolar fracture was significantly increased compared to those not registered.

Upper extremity

Tumours and tumorous processes in hands and wrists

Hans Rahme, Bengt Östlund & Jan Holm-Glad

Clinic of Hand Surgery, Regional Hospital, Örebro, Sweden

A considerable number of patients referred to the Clinic of Hand Surgery in Örebro have tumours and tumour-like conditions in the hands and wrists. During the period 1974–1981, 811 such conditions were operated on at the hand surgical clinic. The material contained 725 tumours, classified and localised by means of case records. The study was retrospective and thus does not allow any conclusions concerning incidence or frequency of recidives. Not unexpectedly, the most common condition turned out to be the dorsal ganglia, followed by ganglia in other locations. The ganglia made up 60 per cent of the tumours. The following groups were below 10 per cent each: epidermoid inclusion cysts 9 per cent, haemangiomas 4 per cent, giant cell tumours of tendon sheath 4 per cent, fibrous lesions 3 per cent, tumours of bone and cartilage 2 per cent, pyogenic granulomas 2 per cent, nerve tumours 2 per cent, malignant tumours 1 per cent, lipomas 1 per cent and glomus tumours 1 per cent. Among other diagnosis were lymphangioma, Heberdens nodes and warts.

To sum up, tumours of the hand and wrist are often benign, have a typical location and character, and call for surgery more often for functional or aesthetic reasons than for the risk of malignancy. Nevertheless, the nearly 2 per cent of tumours which are malignant call for a surgeon's special attention.

Adult arm amputees in Örebro County

Eva-Lena Johansson, Britt Lingårdh & Kerstin Grevholm

Region Hospital, Örebro, Sweden

A minimum of 86 persons with an arm amputation live in the area. Of these 72 were caused by trauma and 14 by birth; 71 are men and 15 are women. The average age at the time of trauma was 29.9 years and is now 55.9 years. The average age for those with a congenital disease is 32 years.

Seven accidents have occurred since 1980, which is more than in earlier periods. Fifty-five patients have received mechanical prostheses, 16 myo-electrical, and 3 none. Forty-two persons have not asked for any orthopaedic-technical service since 1979.

Discussion. The arm amputees are at an active age but many do not ask for any service. How well are we succeeding in the application of arm prostheses? Is the number of cases increasing? Is there an alternative with rehabilitation without prosthesis?

Lower extremity

The course of partial ACL tear

Magnus Odensten, Jack Lysholm & Jan Gillquist

Department of Orthopaedic Surgery, Regional Hospital, Linköping, Sweden

The occurrence of partial ruptures of the anterior cruciate ligament (ACL) has been described by Liljedahl et al. (1965), Jackson & Dandy (1976), O'Connor (1977) and Noyes et al. (1980). Small series of patients with partial ACL ruptures have been reported by McDaniel (1976) and Farquharson-Roberts & Osborne (1983), but no long-term follow-up studies have been presented.

In the present study, 21 consecutive patients (4 women and 17 men, mean age 28.3 ± 10.7) were followed up for an average of 6 years after injury. All had a partial tear of the ACL. In addition, nine patients also had a tear of the medial collateral ligament and two a tear of the lateral collateral ligament. In eight patients there was a rupture of the posterior oblique ligament, and three patients had a meniscus tear. All patients underwent arthroscopy and clinical examination under anaesthesia. All associated lesions were sutured and the partial ACL rupture was treated conservatively. The follow-up included physical examination and evaluation by a knee function score (Lysholm & Gillquist 1982). At 73 ± 21 months after operation the mean score was 93 ± 6 points. All patients were rated over 82 points (excellent-good). Three patients had an unstable knee but the score was high. Thirteen patients also had an early follow-up 24 months after operation. At this time the mean score was 92 ± 10 points. The score was unchanged at the late follow-up.

The course and long-term results of partial tear of the anterior cruciate ligament are favourable, whereas total rupture ultimately leads to significant problems in a high proportion of cases (Odensten et al. 1984). It is thus important to make a full diagnosis in order to predict the outcome and select the right treatment.

Surgery of the posterior cruciate ligament (PCL) using the postero-medial transcapsular "over the tibial top" approach

Lennart Hovelius, Olle Hägg, Anders Svanström & Gunnar Westerlind

Department of Orthopaedic Surgery, Gävle Hospital, Gävle, Sweden

The intra-articular inferior part of the PCL is easily visualized through a postero-medial arthrotomy. The extra-articular part of the PCL attaching posteriorly on the tibia can be reached at the same time from the medial side by dissection behind the tibia below the tendon of the semi-membranous muscle when the popliteus muscle is detached from the tibia. Sutures in the PCL and/or tendons used for augmentation can be pulled through the posterior capsule anatomically following the PCL distally or proximally. Since February 1980, we have used this combined medial approach when repairing PCL ruptures in 11 patients (3 chronic, 8 acute cases) at the Orthopaedic Department, Gävle Hospital.

In cases with chronic injury we utilized the tendons of both the semi-tendinosus and gracilis muscle for intra-articular repair. Acute ruptures were usually augmented with the semi-tendinosus tendon alone. One patient had PCL rupture with avulsion of bone from the tibia treated by this approach.

No post-operative complications occurred. At follow-up (18–48 months), the cases with chronic ruptures were satisfied with the procedure and the posterior sag had decreased from ++ to 0–+. In seven out of eight acute cases the result was good or excellent 6–36 months after surgery (posterior sag (0–+)). One case was considered a failure owing to persistent insufficiency of the ACL and lateral ligaments.

Femoro-patellar pain syndrome treated with anterior advancement of the tibial tuberosity

Jon Karlsson, Olle Lansinger & Leif Swärd

Department of Orthopaedic Surgery II, University of Göteborg, East Hospital, Göteborg, Sweden

Degeneration of the cartilage of the patella, known as chondromalacia patellae, is a well-known syndrome of pain in the anterior part of the knee. The pain mechanism has never been well explained, and it has been shown that the severity of the cartilage damage often does not correlate well with the subjective symptoms. Several operative treatments for

the femoro-patellar pain syndrome have been used with varying success.

Experimental and biomechanical studies have shown that anterior advancement of the tibial tuberosity considerably reduces the mechanical load in the femoro-patellar joint. Encouraged by the favourable results presented in the literature, the tibial tuberosity advancement procedure has been performed in 75 patients with painful femoro-patellar syndromes.

The follow-up comprised 72 patients re-examined 1.0–5.0 (mean 2.5) years post-operatively. Results were excellent or good in 41 patients (57 per cent), fair in 14, and poor in 17 (24 per cent).

A correlation between the results and the cartilage damage was found. The best results were obtained in Outerbridge's Groups I and II, and the worst in groups III and IV. Results were better for men than women, especially in the younger groups. In seven patients successive lowering of the patella was noted. In all these patients the results were poor.

The high failure rate is disturbing and our conclusion is a warning against a too frequent use of the anterior tibial tuberosity advancement procedure. Careful pre-operative planning is necessary, with arthroscopy and radiographic examination playing an important role.

As the femoro-patellar pain syndrome has several causes, of which malalignment of the patella is the most important, these patients should be approached by establishing a specific diagnosis and applying a specific treatment.

Non-surgical treatment of total ruptures of the Achilles tendon

Anders Lindbäck, Torbjörn Andersson & Bo Althoff

Department of Orthopaedic Surgery and Radiology, Region Hospital, Örebro, Sweden

The treatment of total subcutaneous rupture of the Achilles tendon is still under discussion. Comparing surgical and conservative treatment, in some reports the frequency of major complications is almost the same. However, there are also reports where the frequency of re-rupture in the conservatively treated Achilles tendon is as high as one third. In this conservatively treated material the purpose was: to find the frequency of re-rupture when all patients were informed; to follow a simple rehabilitation programme; to determine if it was possible to judge the condition of the healing by ultrasonic scanning.

Material and methods. Thirty-two consecutive patients with total subcutaneous rupture of the Achilles tendon were followed prospectively. There

were 29 men and three women, whose ages ranged from 26 to 69 years, with a mean age of 43 years. Most patients sustained their rupture during sporting activities. All patients were treated in a plaster with the foot in equinus for 4 weeks and then with the foot in a neutral position for another 4 weeks. They were then given a 2.5 cm heel lift for 4 weeks. Ultrasonic scanning was done before the first cast was applied and then when the final cast was removed. The patients were also examined clinically at 4-week interval until 5 months after the injury. They were instructed to follow a rehabilitation programme. The follow-up time ranged between 6 and 24 months (mean time 14 months).

Results. The patients had regained almost normal mobility in the ankle joint at 16 weeks after the injury when tested with a straight knee. All patients with primary healing were satisfied. The Achilles tendon was broader on the injured side. Re-rupture occurred in four patients.

Conclusions. The conservative treatment of total subcutaneous ruptures of the Achilles tendon gave a good result in most patients. Ultrasonic scanning gave no information about the condition in the tendon which would make it possible to prognosticate re-rupture.

Proximal metatarsal osteotomy for relief of metatarsalgia

Stefan Zäll & Bo Althoff

Department of Orthopaedic Surgery, Region Hospital, Örebro, Sweden

Metatarsalgia with associated clavus formation is a common problem in orthopaedic patients. This disability is usually treated conservatively, but when conservative treatment fails, surgical treatment may be indicated. Several surgical procedures have been described such as excision of the metatarsal head, condylectomy and various forms of osteotomy. The purpose of this investigation was to find the long-term result of metatarsalgia treated with a proximal oblique osteotomy of the metatarsals.

Material and methods. Eighteen feet in 15 patients were operated on. The patients' feet were examined clinically and radiologically, and the foot prints were registered photographically in a podometer. The age of the patients ranged between 18 and 76, (mean 51) years. The follow-up time ranged between 38 and 90 (mean 61) months.

Results. At follow-up, there was no pain in six feet, occasional slight pain at loading in seven, regularly some pain at loading in two and regularly disabling pain in three. In the patients' own opinion, five feet

were very successful, six improved, one was unchanged and five were unsuccessful. Callosities were found pre-operatively under 28 metatarsal heads and at follow-up under 22.

Conclusion. Proximal oblique metatarsal osteotomy often results in a less painful foot but with time there is a tendency for recurrence of callosities under neighbouring metatarsals.

Major bleeding after femoral fracture treated by radiological embolization technique

Anders Kristoffersson, Sven Friberg & Lars Nordmar

Departments of Orthopaedic Surgery and Diagnostic Radiology, University Hospital, Umeå, Sweden

A 76-year-old man was presented with a fracture of his right femur causing severe bleeding from a branch of the profunda femoris artery. The bleeding was successfully treated using internal arterial embolization with steel coils.

Massive arterial bleeding in association with fractures can occur as a result of the trauma or a surgical procedure. Uncontrolled haemorrhages have mainly been reported as complications to major pelvic and femoral fractures. So far, open surgery has been the treatment of choice. However, the surgical procedure is often extensive, and complications are well known.

In recent years, selective internal arterial deposition of Gelfoam or steel coils, performed during diagnostic arteriography, has been proved to be an effective method of producing arterial thrombosis. The technique is highly selective and permits occlusion of branches of an artery. In orthopaedic surgery, good results have been reported in association with major bleeding after pelvic fractures. In our opinion, internal arterial thrombotization is the method of choice for treating major haemorrhages from arteries which can be occluded without endangering the tissue involved.

Reconstructive surgery should be reserved for arterial lesions where an intact vessel is imperative for normal function.

Late diagnosis of CDH

Why are there still many late-diagnosed cases of CDH, and what can be done?

Kurt Palmén

Träslövsläge, Sweden

During the years 1980–1983, we treated 277 cases of late CDH (a preliminary number) at our orthopaedic departments in Sweden. Most cases were discovered at the age of 1–6 months at health controls in Child Health Centres.

Sixty-eight cases (25%) were diagnosed after the age of 6 months. These children's records and x-rays were scrutinized, and interview forms were given to their parents. Four of these had family heredity for CDH, 41 had dislocation and the rest subluxation. Only three were bilateral. At least 84 per cent had limited abduction; six of the younger ones had subluxation and hip instability. All were controlled regularly in the Child Health Centres. Eight cases were diagnosed only after reaching 2 years of age, two as late as 5–6 years old. Forty cases were diagnosed after the age of 1 year, i.e. one case in 10 000 newborns. This number may seem small but most of them ought to have been discovered earlier. Thirty-one of these cases had total dislocation. In all probability they had shown symptoms prior to the point of diagnosis and should at least have been discovered at the 10-month control in the Child Health Centres, if, indeed, the hip joints were examined at that time.

In many cases the parents suspected that something was wrong with the child's leg/hip and also pointed this out, sometimes repeatedly, before the child was referred to an orthopaedic department.

In order to reduce the number of late-diagnosed cases, the following organisational measures are important:

I. At birth: a) examination of the hip joint by an experienced paediatric consultant, b) co-operation with an experienced orthopaedic consultant, c) early and repeated follow-ups of children running increased risks of CDH, such as familial heredity and suspected instability of the hip which had not been treated.

II. In the Child Health Centres: a) continued information to all doctors, b) examination of the hip joints at each regular health control, c) listening to the mother's observations, d) special attention should be paid to unilaterally limited abduction of the hip and to leg shortening, e) co-operation between the orthopaedic departments and the Child Health Service, f) reports on all CDH cases from the orthopaedic departments to the maternity wards, the Child Health

Centres and the chief physicians of the Child Health Service, g) annual compilations of all late-diagnosed cases, which will be the basis of continued information.

Palmén, K. Prevention of congenital dislocation of the hip. *Acta Orthop Scand* 1984, **55**, Suppl. 208.

Sonography – A new method for objective measurement of hip instability in infants

L. Öberg, H. Dahlström & S. Friberg

Departments of Radiology and Orthopaedics, University of Umeå, Sweden

The technique for ultrasonic diagnosis of the hip joint in new-borns and infants was presented. The infants were examined with the hips in the frog position. A 7.5 MHz scan transducer connected to a B-mode real-time ultrasonic device was placed anteriorly over the hip joint, producing a two-dimensional picture in the horizontal plane of the acetabulum, caput femoris and collum femoris.

The method permitted an exact evaluation of the anatomy of the hip joint. The technique further gave the opportunity to visualize the dynamics of the unstable hip joint and permitted an exact description of the relation between the femoral head and the acetabulum, i.e. the degree of instability.

The results of the ultrasonic investigation of the hip joints in children with primary or late diagnosis of CDH as well as hip instability in children with myelomeningocele were presented.

Arthrography as a guide in treatment of congenital dislocation of the hip

Torsten Lönnerholm & Åke Hjelmstedt

Departments of Diagnostic Radiology and Orthopaedic Surgery, University Hospital, Uppsala, Sweden

Bilateral hip arthrography has been consistently performed since 1972 in all new cases of CDH diagnosed after the neonatal period. The examination was made after 5–14 days of traction in order to overcome muscle contractures. In some cases adductor tenotomy was done before the arthrography.

The aim was to get a detailed view of the anatomy of the hip joint and to establish the presence or absence of any obstacle to closed reduction. The exam-

ination was done under general anaesthesia, and closed reduction, if possible, was carried out at the same time by the orthopaedic surgeon.

The examination was always bilateral using a standardized technique in standard projections and with attempts at provocation and reduction.

Representative arthrograms were demonstrated and difficulties in the interpretation pointed out.

The effect of adductor tenotomy and progressive traction in CDH

Lars Danielsson & Bo Nilsson

Department of Orthopaedic Surgery, Malmö General Hospital, Malmö, Sweden

In 44 hips of children born in Southern Sweden, the neonatal diagnosis of CDH had been missed. A programme of treatment was applied which included tenotomy of the adductor tendons followed by traction – longitudinal and later with abduction – for 4 weeks, fixation (plaster, Hexelite) for 6 months and Pavlik's harness for an additional 4 months. Open reduction was needed in five hips. Aseptic necrosis had occurred in one hip at the time of follow-up (1–6 years). The development of the hip (femoral head and acetabulum) so far has not deviated from earlier observations, and the previously suggested lower limit for age of diagnosis when pelvic osteotomy is needed (1.5 years) tends to be confirmed in this series.

Innominate osteotomy *ad modum* Salter in Sweden. A preliminary report

Göran Hansson

Department of Orthopaedic Surgery, County Hospital, Halmstad, Sweden

During the 15-year period between 1963 and 1977, a total of 85 hips in 78 children and young adults with congenital dislocation of the hip joint (congenital dislocation, subluxation, or dysplasia) were operated on in Sweden with innominate osteotomy (IO) *ad modum* Salter. Prior to the IO, 14 patients had had no treatment, whereas 64 had been treated with closed reduction and/or surgery. The IOs were performed by 27 surgeons at 18 departments of orthopaedic surgery. The age when the IOs were performed was 1.2–5 years in 63 patients and 6–22 years in 15 patients.

Results of radiographic re-examination 7–21 years after IO will be presented later.

Failure of early abduction treatment

Åke Hjelmstedt

Department of Orthopaedic Surgery, University Hospital, Uppsala, Sweden

Since 1972, arthrography has been performed on all cases of hip instability that remain or are diagnosed after the neonatal period.

Sixteen cases of failure of early abduction treatment were examined and treated at the University Hospital in 1973–1982. In seven patients closed reduction was successful but in two a Salter osteotomy was done later owing to slow mineralization of the acetabular roof. In nine patients the arthrography revealed that closed reduction was impossible owing to narrowing of the capsule, and open reduction was therefore done.

The reasons for failure of early abduction treatment were: a) insufficient primary immobilization, b) pronounced joint laxity, c) breech position and oligohydramnios, or d) unknown factors.

It is important that those exceptional failures are diagnosed early – preferably within 2 months. Arthrography should be done at an early stage to reveal any obstacle to closed reduction.

Legg-Calvé-Perthes disease

The role of Technetium scintigraphy in the evaluation of Perthes disease

Bo Sahlstedt & Åke Hjelmstedt

Departments of Diagnostic Radiology and Orthopaedic Surgery, University Hospital, Uppsala, Sweden

The authors have performed technetium scintigraphy in 31 hips with clinically suspected and radiologically verified coxa plana. The purpose of the study was to estimate the extent of the necrosis of the femoral head, which can be very difficult with conventional radiography in early cases with a short clinical history. The scintigraphy was done 2–3 h after the intravenous administration of 100–150 MBq ^{99m}Tc MDP. A view of the entire pelvis was obtained with a parallel hole collimator. Then the hips were individually examined with a pinhole collimator in strict frontal and Lauenstein projection. The images were always compared to conventional radiographs. When scintigraphy was performed during the first 3–4 months after the onset of the clinical symptoms, it always demonstrated the avascular part of the epi-

physeal plate of the femoral head quite well. After the onset of revascularisation of the head, the method was less valuable in this aspect. No false positive cases were noted.

The role of arthrography in the evaluation of Perthes disease

Bo Sahlstedt & Åke Hjelmstedt

Departments of Diagnostic Radiology & Orthopaedic Surgery, University Hospital, Uppsala, Sweden

Hip-joint arthrography was performed in more than 40 children with Perthes disease. The purpose was to study the deformation of the femoral head and the acetabulum and to find subluxation tendencies and extrusion of fragments from the lateral part of the femoral head, frequently found in plain radiographs. The examinations were usually performed under general anaesthesia. Following anterior puncture of the joint, 45 per cent Urografin was infused from an infusion aggregate roughly 1 m above the examination couch. This procedure usually prevents extra-articular contrast leakage. The joints were examined in frontal, lateral and Lauenstein projections. In order to find any incongruity, inward and outward rotation of the leg was also added to the standard projections. It was thus also possible to some extent to foresee the effects of any later correction osteotomy. No failures or adverse reactions were noted.

Ultrasonography and CT in the diagnosis of hip-joint effusion in the child

Hans Wingstrand, Nils Egund, Holger Pettersson & Göran Sundén

Departments of Orthopaedics and Radiology, University Hospital in Lund, Sweden

Hip-joint effusion with an ensuing increase in intracapsular pressure causing disturbance in blood-flow to the proximal femoral epiphysis is under discussion as a possible aetiological factor in Legg-Calvé-Perthes' disease. Conventional radiographs do not offer sufficient information about the presence of an effusion. The purpose of this study was thus to evaluate the diagnostic capacity in computed tomography (CT) and ultrasonography with regard to hip joint effusion in the child.

Patients and methods. Ten consecutive cases with the clinical symptoms of transient synovitis were examined supine with the hips in a neutral position.

Ultrasonography was performed from the ventral aspect of the hip in a plane through the axis of the neck of the femur, and CT in a transversal plane across both hips. The maximal distances from the ventral aspect of the neck of the femur to the capsule recorded in ultrasonography and CT were correlated to one another.

Results. With the use of ultrasonography, the anatomical structures of the ventral aspect of the hip: acetabulum, joint space, epiphysis, growth plate, neck of femur and joint capsule, were clearly identified. In five cases there was an intracapsular effusion. Effusions were all located ventrally-medially along the neck of femur where a maximum distension of the capsule was measured, ranging from 0–10 mm. The correlation between CT and ultrasonography was good, and in no case did the difference exceed 1 mm. In two cases the hip was aspirated, and intracapsular pressures of 50 and 100 mm Hg were recorded prior to aspiration of 5 and 5.5 ml, respectively.

Conclusions. Hip-joint effusion in the child is primarily located ventrally-medially along the neck of the femur. Ultrasonography is a reliable diagnostic tool for evaluation of hip-joint effusion and can be recommended as the method of choice, replacing diagnostic aspiration or CT.

Early prognosis in Legg-Calvé-Perthes disease

Preliminary results in a prospective multicenter study

Hans Wingstrand, Lars Danielsson, Holger Pettersson & Göran Sundén

Departments of Orthopaedics and Radiology, University Hospital in Lund and Department of Orthopaedics, Lund University, Malmö General Hospital, Malmö, Sweden

In the last decade the prognostic criteria generally used in LCPD are the "head at risk" signs suggested by Catterall. However, in clinical practice they have not proved satisfactory as an early prognostic tool. The purpose of this study was primarily to evaluate a prognostic method suggested by Danielsson et al. with respect to early radiological outcome.

Patients and methods. In a multicenter study involving 22 orthopaedic departments in Sweden, 143 patients were diagnosed over a 30-month period. Boys/girls = 110/22, mean age boys = 5.4 years, mean age girls = 5.9 years. Patients had only symptomatic initial treatment and were followed with serial radiological and clinical examinations at 6 weeks, and 3,

6, 12 and 24 months. At 3 months after diagnosis, the following prognostic factors were considered: lateralization, metaphyseal width, acetabular height and acetabular width. These factors were evaluated statistically in a discriminant analysis yielding a prognostic index in the individual case. Patients with a "poor" index were recommended for active treatment.

Results. Based on the prognostic index at 3 months, 77 per cent had a "good" prognosis (boys = 76 per cent, girls = 82 per cent) and had only symptomatic treatment. 23 per cent had a "poor" index and were recommended the active treatment preferred at the specific departments: derotation-varisation osteotomy, Salter osteotomy, adductor-psoas tenotomy or abduction brace. In the age groups 0–3 years, 4–6 years, 7–9 years and above 10 years, 8 per cent, 21 per cent, 31 per cent and 60 per cent respectively had a "poor" index suggesting a worse prognosis with increasing age.

Discussion. The outcome in the prognostic evaluation at 3 months with regard to "good"/"poor" proportion and with regard to age distribution is reasonable, figures being in accordance with the natural history of the disease. Although it is too early yet to assess the final radiologic appearance after healing in this material, preliminary findings suggest an early prognostic capacity of this method. In the actively treated group of patients, results with derotation-varisation osteotomy seem significantly better than results with Salter osteotomy.

The natural history of Mb Perthes – the long-term prognosis

Richard Wallensten

Department of Orthopaedic Surgery, Karolinska Hospital, Stockholm, Sweden

In previous long-term studies of Perthes disease, various investigators have followed up patients after conservative or no treatment for periods of 10–40 years in order to describe the natural history and the radiological evolution of the disease and to find out to what degree the symptoms of osteoarthritis develop.

In our study (Stulberg, Cooperman & Wallensten, J.B.J.S. 63-A, 1095–1108, 1981), 88 patients, who initially were not treated or treated with non-weight-bearing, were followed up 30–60 (mean 40) years after the initial stage of the disease. The mean age at follow-up was 47 years. For the clinical evaluation the Iowa Hip Rating and the Harris Hip Rating scales were used.

In the clinical study 85 per cent of the patients were pain-free (Iowa Hip Rating 32.5 out of 35 pos-

sible), and showed good function (Iowa Hip Rating 33.6) and range of motion (Harris Hip Rating 5.0 out of 6 possible).

In the radiographic study we found development of osteoarthritis in 50 per cent of the patients. The material could be subdivided into five classes where development of osteo-arthritis was most common when the femoral head became flat without associated remodelling of the acetabulum, "aspherical incongruity".

In our study, as in those of previous investigators, some prognostic factors which indicate a poor radiographic end-result were found: late onset of the disease (6–8 years), total head involvement, lateral subluxation, ossification lateral to the epiphysis, primary irregular head, aspherical incongruity, and long subchondral fracture (crescent sign).

In spite of a poor radiographic result, the development of osteoarthritis rarely starts before the age of 45–50 years, and clinical symptoms even later. The natural history of Perthes disease is thus more benign than that of CDH or slipped capital epiphysis.

Diabetic foot complications

Some new aspects of diabetic gangrene

Folke Lithner

Department of Medicine, University Hospital, Umeå, Sweden

Diabetic gangrene has been studied at our department for a long time, and the following recent findings are of general clinical interest:

1. Most diabetics with distal gangrene had pronounced peripheral oedema, in particular caused by congestive heart failure, but also by other causes such as deep venous thrombosis. The oedema generally preceded and probably precipitated the gangrene.
2. Localization of the gangrene was of utmost importance for the risk of subsequent amputation; thus the frequency of lower leg or thigh amputations in different localizations was: toes 22 per cent, interdigital spaces 42 per cent, dorsa of the feet 6 per cent, metatarsal heads 10 per cent and the heels 32 per cent.
3. Skeletal, osteolytic and aseptic lesions in the diabetic feet ("diabetic osteopathy" or "Charcot joints") were closely connected to the occurrence of cutaneous gangrene, as 30 per cent of these patients had such skeletal lesions. If neglected, they had disastrous effects on the normal architecture of the foot.

However, their existence was a significant sign of a good prognosis for the non-surgical healing of the concurrent distal gangrene, probably because they only occurred in feet with a good blood supply.

The podometric view of diabetic feet

Rune Brodén & Stig Jarsin

Departments of Orthopaedic Surgery and
Orthopaedic Technology, Örebro, Sweden

Eighty-six patients (46 women and 40 men) with diabetes mellitus were examined on a podometer. The patients were between 17–19 (median 48.5) years old. Their soles were photographed standing on the podometer.

Three types of stress pattern were found:

1. "Normal" load on the great toe, fore-foot, lateral foot-edge and heel; 49 patients (57 per cent) had this pattern.
2. Small weight-bearing areas on the fore-foot and the heel; 27 patients, 18 women and 9 men (31 per cent) belonged to this group.
3. Loading on almost the entire sole was found in 10 patients (12 per cent).

In a non-diabetic control group, 85 per cent had a stress pattern of type I, 5 per cent type II and 10 per cent type III.

No shoe-technical measures were considered necessary for 72 patients (86 per cent). In six cases (7 per cent) the shoes were changed, e.g. lasting and role sole. Six further patients (7 per cent) were given foot beds (Pryx) after individual plaster of Paris modelling. The aim is to examine and photograph the feet of these patients after 1–2 years, and in this way discover abnormal stress markings and prevent the development of ulcers.

Arterial reconstruction – pre-requisites and results in patients with diabetes mellitus

David Bergqvist

Department of Surgery, Malmö General Hospital,
Malmö, Sweden

The diabetic patient was discussed from the point of view of the vascular surgeon, with data from the literature and own experience critically analysed. First a short overview was made of diabetes in patients undergoing different types of vascular surgery and the special precautions required. Then the arterial status and the prognosis for the extremity in patients with severe juvenile diabetes leading to terminal uraemia were summarized. The main discussion

focused on the treatment of diabetic patients presenting with rest pain and/or gangrene. Indications for surgery, methods for pre-operative evaluation, surgical possibilities, post-operative treatment and results *quoad vitam* and *quoad extremitatem* were discussed. As a general conclusion, indications for reconstructive surgery do not differ between diabetic and non-diabetic patients. Because of the generalized character of the disease, unilateral ischaemia must be treated aggressively from a reconstructive point of view to avoid later double amputation.

Foot ulcer and gangrene. Experience of Wagner's treatment program for the diabetic foot

Mats Håkansson, Acke Jernberger, Anders Starkhammar & Dagny Tryggö

Department of Orthopaedic Surgery, Norrköping,
Sweden

At the foot clinic in Norrköping, 296 patients were treated during 1983. Eighty-nine patients with arterial insufficiency but without diabetes had a mean age of 79 years, while 155 patients with a mean duration of diabetes of 13.8 years had a mean age of 71 years. Thirty-nine of the diabetics underwent amputation before and 29 (19 per cent) during 1983, and 24 (15 per cent) died. Ulcers and gangrene were treated with protective fenestrated walking casts, walking beds and treatment shoes.

Of 91 feet with an ischaemic index over 0.45 (mean value 0.82) (ankle blood pressure/arm blood pressure) and a mean age of 67.3 years, 60 feet healed in a mean time of 4.7 months, and 9 are healing. Seven patients died and three underwent amputation during 1983, and two more this year. Three patients were lost.

Of 41 feet with an ischaemic index below 0.45 (mean value 0.32) and a mean age of 76 years, 17 healed in a mean time of 6.7 months and seven showed some healing tendency, 15 were amputated and three patients died. The difference in mean age supports our observation that the ischaemic index continuously decreases with age.

Most of the ulcers were located in pressure points, which supports our impression that mechanical factors, mostly from shoes, are one of the most important factors in producing foot ulcers.

The results can roughly be evaluated from a decrease of thigh amputations from 9.9 to 9.0/100 000 inh./year with a simultaneous total increase in amputation rate from 31.2 to 60.8/100 000 inh./year, while the mean age at amputation increased from 75 to 80 years.

The gangrene-afflicted patient in Stockholm

Pelle Netz, Margareta Kronberg & Andre Stark

Departments of Orthopaedic Surgery, Danderyds Hospital and the Karolinska Hospital, Stockholm, Sweden

Amputations carried out in 1978 in Stockholm were analysed. A disturbingly high frequency of above-knee amputations was noted at clinics of both General and Orthopaedic Surgery. Below-knee amputations had largely been performed using the "Fish-mouth" technique, and a few patients were given a plaster cast per-operatively.

In view of this, amputation routines were changed during 1980 at Danderyds Hospital. Amputations which took place at the hospital during 1979 and 1981 were subsequently studied, looking at, among other things, the basic disorder, age and amputation level.

During 1981, amputation levels were improved distally, while the incidence of Syme, below-knee, through-knee, or above-knee amputations was relatively low in diabetic patients (8/100 000 inhabitants). Pre-operative care (co-operation with Clinic of Internal Medicine), per-operative and post-operative methods, and an interest in amputation surgery, are probably crucial if amputation levels are to be distalised.

363 amputations on the lower limb

Rune Brodén

Department of Orthopaedic Surgery, Regional Hospital, Örebro, Sweden

A retrospective study of major amputations during 1977-1981 was made at the Clinic of Orthopaedic Surgery in Örebro.

Figures are presented on frequency, age and sex distribution, diabetes mellitus, vessel surgery, anaesthesia, amount of bleeding, operating time, prosthesis equipment and rehabilitation level. 70 per cent of the amputations were below-knee, 30 per cent above-knee and only 0.7 per cent through-knee. 99 per cent of the amputations were made because of occlusive arterial disease. 40 per cent of the below-knee amputees could be trained to walk with a prosthesis. Only 15 per cent of the above-knee amputees were able to walk after the amputation.

Shoe-technical treatment of neuropathic feet

Hajo Schmidt

Een Holmgren Orthopaedic Co, Uppsala, Sweden

All diabetic feet with impaired sensibility and circulation need either shoe-technical alterations or orthopaedic shoes. Many patients are not aware of their impaired sensibility and expose their feet to mechanical stress in unsuitable commercial shoes. Particularly when deformities are present, it is important to have shoes with sufficient height and width for the toes as well as for the heel. Callus formation with a tendency to ulcerate on the sole of the foot over prominent metatarsal heads needs a special, custom-made footbed with adequate support as well as local relief. The foot should be firmly fixed in the shoe to avoid friction stress. The sole of the shoe has to be stiffened.

Early treatment of diabetic feet and improved information to the patients, would make it be possible to reduce the number of ulcerations and severe complications of diabetic feet.

Hyperbaric oxygen therapy – an alternative?

Per-Olof Barr

Rosenlund Hospital, Stockholm, Sweden

Hyperbaric oxygen therapy (HBO) is a method for increasing oxygen content and oxygen tension in arterial blood. HBO is applied by breathing oxygen at an elevated pressure of 2-3 ata (atmospheres absolute) in a hyperbaric pressure chamber. The oxygen is to be handled as a drug, and the normal dosage is one or two 1-h sessions per day. The need for an increased oxygen-carrying capacity of the blood is evident in cases where, for example, impairment in the flow of the circulating blood results in tissue hypoxia to a more or less serious degree. As the diabetic foot, especially in the elderly patient, often suffers from non-healing ulcers or even gangrene due to impaired blood flow, it is evident that HBO might be of value in these cases.

HBO has, in fact, been used for a long time on these indications. The theory works, but not in all cases. A minimum of remaining circulation is, of course, required, and an adequate treatment programme has to be applied. In successful cases the ulcers heal uneventfully, and toe gangrene and occasionally forefoot gangrene can be induced to dry up and separate spontaneously without any surgical in-

tervention. The bony structures do not separate in the joints, but in the middle of the bone, leaving a well-perfused marrow surface for rapid healing. New ulcers or gangrene may appear as the patient grows older, but they nearly always appear not on the same site but on another toe or part of the foot, or maybe the other foot.

Use of distal pressure recordings and fluorescein angiography for determination of therapy in the gangrenous diabetic foot

Anders Stenström & Hjalti Björnsson

Department of Orthopaedics, University Hospital, Lund, Sweden

The clinical picture of diabetic gangrene in the foot is generally of little value for alternatives in therapy like local wound treatment, plaster treatment, partial amputation in the forefoot or below-knee amputation. In order to choose the correct therapy for diabetic gangrene in the foot, we have combined the clinical picture, distal pressure recordings from the big toe and the ankle, and fluorescein angiography. Whereas the pressure in the big toe gives only local information concerning the circulation in the forefoot, fluorescein angiography shows the cutaneous circulation in the entire sole of the foot.

Material and methods. Strain gauge or doppler technique was used to measure the arterial pressure in the big toe and the ankle. Fluorescein was injected intravenously and the arrival of fluorescein at the sole of the foot was registered photographically with a sequence of photos during 15 min. The information gained at fluorescein angiography was compared with the pressure in the big toe and the ankle.

The clinical picture was judged according to Wagner's classification in six different grades. Twenty-nine diabetic patients with impaired circulation and wounds in the foot were examined. Three patients had bilateral wounds. Six patients (average age 45 years) had juvenile diabetes (duration 6.5 years) and

23 patients (average age 45 years) had adult diabetes (duration 19 years).

Results. Twenty-three patients showed severe disturbance of blood pressure in the big toe with an ischaemic index below 0.35. Five patients had an ischaemic index between 0.5 and 0.7. Out of six patients with a toe-pressure below 20 mmHg only one healed whereas five were amputated below knee. When the toe-pressure was above 20 mmHg only one patient was amputated, whereas the other 22 patients healed with conservative therapy. There was a relatively good correspondence between decreased perfusion pressure and delayed arrival of fluorescence to the foot and a significant ($p = 0.01$) correlation between toe-pressure/ankle-pressure and the initial fluorescence. Hyperfluorescence was noted in areas with inflammatory reaction.

Fluorescein angiography and distal pressure recordings, especially in the big toe, are of value for the correct choice of therapy in diabetic patients with gangrene or disturbed blood circulation in the foot.

Distal status of the hand and foot

Thomas Dolk

Orthopaedic Department, Regional Hospital, Örebro, Sweden

Examination of the extremities was presented in a poster emphasizing the following features: inspection of spontaneous resting position, and active flexion and extension; palpation of sweat secretion, capillary blood flow, passive stretching, pulses and compartment tension; testing of sensation by means of tuning fork (256 cps), light touch (cotton wool swab), and moving 2-point discrimination (paperclip).

Sensory testing is very important and difficult. Subjective sensory alterations should be asked for! Observe mimicry, especially in children. Avoid painful stimuli unless absolutely necessary. Remember areas of peripheral sensory distribution for each nerve.