Proceedings of the Swedish Orthopedic Society

Karlskrona, September 14–16, 1988

Editor: Karl Göran Thorngren
Department of Orthopedics
Lund University Hospital
S-221 85 Lund, Sweden

Hip

Coxarthrosis in farmers

Håkan Lindberg[1] and Bengt Axmacher[2]

Department of Orthopedics[1], Malmö General Hospital, Malmö, and the Swedish Farmers Safety and Preventive Health Association[2], Söderköping, Sweden

Introduction: In a previous epidemiologic study on coxarthrosis, we found no relationship between heavy work for decades in a shipyard and the occurrence of coxarthrosis. Recent studies on Swedish farmers, however, have suggested an increased prevalence of coxarthrosis in this group. The prevalence of coxarthrosis in the city of Malmö has been studied by examining colon radiographs. In the present study, we have used the same criteria of diagnosis to estimate the prevalence of coxarthrosis in farmers by examining the hip joint on radiographs of the colon and the urinary tract.

Subjects and methods: About 15,000 farmers and farmworkers from all of Sweden were questioned about previous radiographic examinations. Included in the study were 445 colon radiographs and 464 urograms. All of these were scrutinized by the same physician.

Results: In 565 male farmers, aged 40–64 years, 45 cases of primary coxarthrosis were identified. In a prevalence study in the same age group in the city of Malmö, there were 10 subjects with coxarthrosis among 1,250 male colon radiographs. The difference was statistically significant. Among 151 farmers' wives and female farmworkers within the same age group, 2 cases of coxarthrosis were found.

Conclusion: The outcome of this study suggests an increased prevalence of coxarthrosis in male farmers when compared with an urban population.

Hip motion and strength after conversion of arthrodesis to hip arthroplasty

Björn M. Persson, Ragnar Johnsson and Agneta Melander

Departments of Orthopedics, Helsingborg and Lund, Sweden

More than 180 hip fusions converted to total arthroplasty have been published. No one has, however, reported measurements of muscular strength. Breitenfelder (1975) demonstrated almost normal EMG patterns in patients with arthrodesed hips. Of 13 arthrodesed hips that had been converted to THA in Malmöhus County between 1971 and 1984 (Table 1), all but 2 patients were satisfied subjectively. One patient was stiff again after an infection and 1 patient was subjectively dissatisfied owing to hip instability. One had dislocated twice and had an open reoperation. None had been removed. We could reexamine eight with complete measurement of bilateral motion and strength at the hip and knee.

Results: Totally, 10/13 patients had hip flexion ≥85°. The mean hip strength in extension was 83 (45–150) N. The mean hip strength in flexion was only 10 (0–20) N. When compared with a healthy contralateral hip, there was no difference in strength of extension, but flexion was about half as strong.

Table 1. Results of THA in arthrodesed hips

Case	Born	Sex	Fusion	THA	Flexion	Satisfied	Extension	Flexion
1	1915	F	-66	-71	90°	yes	50 N	20 N
2	1914	M	-69	-73	90°	yes	–	–
3	1912	F	-61	-77	95°	yes	45 N	10 N
4	1939	F	-69	-77	90°	yes	–	–
5	1919	M	-37	-78	76°	yes	150 N	15 N
6	1931	F	-55	-78	110°	yes	70 N	< 10 N
7	1905	F	-52	-79	45°	yes	—	–
8	1921	F	-69	-80	85°	yes	65 N	20 N
9	1937	F	-68	-81	90°	no	–	–
10	1915	F	-62	-81	120°	yes	65 N	< 10 N
11	1920	M	-60	-81	0°	no	–	–
12	1918	M	-26	-82	90°	yes	90 N	10 N
13	1920	M	-24	-84	100°	yes	130 N	10 N

Knee strength in flexion and extension did not differ between the two sides. The weak hip flexion found may be due to iliopsoas and rectus lesions created at arthrodesis combined with long-standing inactivity.

Total hip arthroplasty in congenital dislocation of the hip: A minimum follow-up of 5 years.

Hans O. Fredin, Lennart Sanzén, and Lars Unander-Scharin

Department of Orthopedics, Malmö General Hospital, S-214 01 Malmö, Sweden

See abstract in proceedings of the Scandinavian Orthopedic Association, 44th Assembly, Århus, Denmark, June 8–11, 1988, *Acta Orthop Scand* 1988;59 Supplement 227.

LMPCH — Low modulus, porous polyethylene-coated hip prosthesis: A 4 year follow-up

Lars Nistor and Gudmund Gudmundsson

Department of Orthopedics, Kärnsjukhuset, S-541 85 Skövde, Sweden

The long-term results of cemented THR (Total Hip Replacement) and the uncertain outcome of revision surgery make this type of THR questionable in younger, active patients with severe hip derangement. The search for a more durable fixation has led to the development of uncemented press-fit prostheses with or without different porous coatings. Some appear to be promising solutions, although they will, given time, undoubtedly create problems of their own. We have chosen a prosthesis with a low modulus of elasticity to avoid stress shielding of the femur, and with a bone-saving design that, in case of failure, makes extraction possible without excessive bone destruction.

We have used the LMPCH prosthesis since 1983 in 100 hips in relatively young patients. So far 75 hips (mean age 48 (32–60)) years have been followed for 2–4 years. Early complications (thromboses, luxations, and fractures) were but few and did not affect the results. Two hips were revised after 2 years.

The patients were evaluated with the Harris hip score. Pain was the main reason for surgery. The mean pain score preoperatively was 14 and increased to 41 (20–44) including the two failures at 1 and 2 years, and was 42 (30–44) at 3 and 4 years. The function score showed a similar increase; 25 preoperatively, 41 at 1 year, and 43 at 3 years. Range of motion also increased. The radiographic follow-up showed a small subsidence in some cases, confirmed with roentgen stereophotogrammetric analysis in 10 hips, mostly not measurable on plain radiographs. In all the patients an increased density of the bone was seen in the calcar region, and a dense zone of bone developed, which surrounded the stem and possibly penetrated into the porous coating. The stable appearance of this zone in the absence of cortical bone reaction and pain in-

Even if the follow-up is short and there have been two failures so far, the results are very good and have encouraged us to continue this clinical trial and to broaden the indications.

Primary stability of revision total hip arthroplasty: A roentgen stereophotogrammetric analysis

Finnur Snorrason and Johan Kärrholm

Department of Orthopedics, University Hospital, Umeå, Sweden

Introduction: We investigated the primary stability of cemented hip prostheses in a group of patients who had required revision of the arthroplasty because of mechanical loosening.

Patients and methods: Sixteen hips (16 patients) were revised using the Lubinus SP prosthesis and gentamicin cement. The primary arthroplasties were surface replacements in four hips, two were cementless Mittelmeier prostheses, and in 10 hips the initial arthroplasty was a cemented Brunswik or Lubinus prostheses. Both components were revised in 13, and only the femoral component in 3 hips. At revision, tantalum balls were implanted into the pelvic bone and into the proximal femur. Roentgen stereophotogrammetric analysis was used to measure the migration of the prosthetic components during the first postoperative year.

Results: Ten out of 13 acetabular components migrated in the cranial and/or medial direction. The mean cranial migration was 0.8 (0.3–2.2) mm. Distal migration of the femoral component occurred in nine hips on an average of 0.9 (0.3–1.8) mm. Six femoral components did not show significant migration during the first postoperative year. Four of these were revisions after surface replacement, and in 2 cases the primary arthroplasty was a Brunswik prosthesis.

Conclusion: The stability of revision arthroplasties seems to be inferior compared with primary arthroplasties using a stemmed prosthesis. Surface replacements of the femoral head do not seem to jeopardize the stability of a subsequently implanted stemmed revision prosthesis.

Is routine use of suction drainage in total hip arthroplasty necessary?

Krister Wulff, Peter Abdon, Lena Andersson and Kerstin Guldstrand

Department of Orthopedics, Surgical Clinic, Ystad Hospital, S-271 00 Ystad, Sweden

Method: In a prospective study of 34 patients (19 females and 15 males) who had a cemented primary hip arthroplasty performed by a single surgeon, 16 were supplied with a suction drainage (Drevac® 18) for 1–2 days, whereas 18 had their wounds closed without any drainage. The indication for arthroplasty was arthrosis (n 27), rheumatoid arthritis (n 1), or

Hemoglobin, hematocrit, and the circumference of the thighs were recorded preoperatively and postoperatively, together with the blood loss. The wounds were inspected during the hospital stay, as well as at follow-up after 60 days, when the range of hip motion was also recorded.

Results: Total blood loss and amount of blood transfusion were significantly larger in the group supplied with suction drainage compared with the one without (1,540 and 760 ml, respectively). There were no differences between the two groups in peroperative bleeding, time of surgery, hospitalization, change of hemoglobin, hematocrit, and thigh circumferences, wound complications, or range of motion at the time of the follow-up, when all the wounds were healed without signs of complications.

Conclusion: Routine use of suction drainage following primary total hip arthroplasty does not seem to be necessary. Two pints of blood can be saved by discarding drainage.

Aluminum-induced hip fractures: A hypothesis on bone fragility

Bengt Mjöberg

Department of Orthopedics, Lund University Hospital, Lund, Sweden

See abstract in Proceedings of the Scandinavian Orthopedic Association, 44th Assembly, Århus, Denmark, June 8–11, 1988, *Acta Orthop Scand* 1988;59 Supplement 227.

Hip fractures in northern Sweden 1973–1984

Sune Larsson and Paul Eliasson

Department of Orthopedics, Umeå University Hospital, S-901 85 Umeå, Sweden

Introduction: The incidence of hip fractures in Scandinavian urban areas has increased while changes in rural areas are less pronounced. We have studied the frequency and incidence of hip fractures in persons aged over 50 years in the mainly rural counties of Norrbotten and Västerbotten, Sweden, during the years 1973–84.

Patients and methods: The population increased from 490,688 to 509,709 with 30 and 32 percent, respectively, over aged 50 years. The medical and operation records for all the patients admitted for a hip fracture were reviewed. the patients were stratified by year of admission, sex, fracture type, and 5-year age-groups.

Results: The annual number of fractures increased from 511 in 1973 to 757 in 1984. The female:male ratio was unchanged, 1.9, while the cervical:trochanteric ratio increased from 1.6 to 1.8. The mean age for patients with femoral neck fracture increased from 74 to 77 years, and for trochanteric fracture patients from 75 to 78 years. An increase in the age-specific incidence occurred in both sexes over aged 75 years, while no change in incidence was seen in patients below 75 years of age.

Conclusion: Compared with age-specific incidence reported in Stockholm and Oslo, the present incidence rates were equal or only slightly lower. The incidence was higher than in comparable counties in northern Norway.

Remaining teeth and the risk of sustaining senile fracture of the hip

Jan Åström, Curt Bäckström and Göran Thidevall

Department of Orthopedics, Sundsvall Hospital, S-851 86 Sundsvall, Sweden

Occasional studies including our own indicate that elderly women have fewer remaining teeth than equally old men. For women a correlation between dental loss and osteoporosis has been demonstrated. Can dental mortality prognosticate the risk of sustaining senile hip fracture?

Material: In 1984, dental status of 14,375 inhabitants of Västernorrland older than 64 years — constituting 29 percent of the county's population of that age — was recorded and computerized. Between 1984 and 1987, 1,936 inhabitants born before 1920 were treated for hip fracture. The ratio women:men was 2.6. Of them, 566 (29 percent) had had their dental status recorded in 1984.

Methods: Totally, 14,375 dental subjects were divided according to sex and year of birth. Individuals born before 1894 were excluded. Each age-group was divided into three equally large subgroups, classified in declining order for subjects' number of remaining teeth (t+, to, t–). By adding subgroups, three cohorts of equal size and similar age, T+, To, and T-, were obtained for both sexes. In all, 550 of the 566 hip fracture patients were classified according to type of fracture and cohort.

Results: See table 1.

Conclusion: In equally old elderly women, the third with the fewest remaining teeth has a more than twofold risk of sustaining a hip fracture compared with the third with the most remaining teeth. For men, this ratio is more than three to one.

Table 1. Number of fractures/cohort (T). Significance of differences

Sex	Fracture	T+(many teeth)	To (in-between)	T–(few teeth)	Total
Female	cervical	53 $p < 0,05$	84 $p < 0,05$	117	254
	pertroch.	28 $p = 0,05$	49 n.s |	70	147
	total	81 $p < 0,01$	113 $p < 0,01$	187	401
Male	cervical	14 n.s.	27 $p < 0,05$	49	90
	pertroch.	9 n.s	14 $p < 0,01$	36	59
	total	23 $p < 0,05$	41 $p < 0,01$	85	149

Magnetic resonance imaging in femoral neck fracture

Jon Ingvar Ragnarsson, Leif Ekelund[1], Johan Kärrholm and Sven-Ola Hietala[1]

Departments of Orthopedics and Diagnostic Radiology[1], University Hospital, S-901 85 Umeå, Sweden

Introduction: Magnetic resonance imaging has been reported to be a sensitive method for localizing avascular regions in the femoral head. This method has, however, almost exclusively been applied to nontraumatic cases. We have used MRI to study the healing course after femoral neck fractures. The results were compared with 99mTc-MDP scintimetry.

Patients and methods: Eleven patients (10 women, 1 man) with a mean age of 74 (66–80) years were investigated. Ten fractures were displaced (Garden III and IV). After closed reduction, internal fixation was performed with two cannulated titanium screws. Radionuclide studies with 99mTc-MDP isotope were done 2 weeks after surgery. MRI was performed with extremely low field magnetic resonance equipment (Acutscan 0.02T) one to several times in each patient.

Results: In 3 patients with an unfavorable scintimetric result (head-to-head ratio lower than 1.0), an area of low signal intensity developed proximally in the femoral head on the MRI studies. Eight patients had an isotope uptake ratio greater than 1.0. In 7 of them, the MRI studies were interpreted as normal. One patient with an insufficient osteosynthesis developed decreased signal intensity at the fracture site.

Conclusion: An early and detailed evaluation of the vitality of the femoral head is provided by 99mTc-MDP scintimetry. MRI enables delineation of an avascular area of the femoral head somewhat later, but before any radiographic signs of the osteonecrosis has appeared.

A new technique for internal fixation of dislocated cervical hip fractures decreases the need of primary arthroplasty

Lars Rehnberg and Claes Olerud

Department of Orthopedics, University Hospital, S-751 85 Uppsala, Sweden

Introduction: The aim of this paper was to study the frequency of irreducible fractures and also to see if the early complication rate could be lowered by introducing a new technique for internal fixation of cervical hip fractures.

Patients: The series comprised 231 patients (mean age 80 ±8 years). Seventy percent of the fractures were dislocated. The patients were randomly allocated to either traditional treatment with internal fixation using the von Bahr screws or a new technique, so called Uppsala screws.

Results: Only three of the 231 patients had irreducible fractures and were treated with primary arthroplasty. Early complications, defined as complications within 8 weeks after surgery, were analyzed in the entire series. With this definition, there were 11 early loosenings in the von Bahr group (n 112); and in the Uppsala group (n 116), there were two penetrations of the screws into the hip joint and 1 case of early loosening. After 1 year, there were 19 nonunions and two late segmental collapses in the von Bahr group (n 59) as compared with 5 and 4, respectively, in the Uppsala group (n 60). In the von Bahr group, 31 reoperations were performed during the first year postoperatively, while in the Uppsala group there were 10 reoperations.

Conclusion: Dislocated cervical hip fractures in elderly (99 percent in this series) can be managed with reduction and internal fixation. By a new technique for internal fixation, the complication rate has been lowered. Within the first postoperative year, about 15 percent had a total hip replacement procedure.

Fixation stability by osteosynthesis of femoral neck fracture: A comparison of two methods

Sven Holmberg, Mats Dahlborn[1] and Hans Ersmark

Department of Orthopedics and Radiology[1], Danderyd University Hospital, S-182 88 Danderyd, Sweden

Introduction: A stable fixation of the fracture is a prerequisite for healing of femoral neck fractures after osteosynthesis (OS). Although a great number of fractures are followed by vascular damage to the circulation of the femoral head with risk of bone resorption at the fracture site and late segmental collapse of the femoral head, stable fixation may facilitate ingrowth of new vessels leading to fracture healing. The purpose of this study was to test the stabilizing property of two types of devices on the development of early complications in terms of redisplacement and pseudarthrosis.

Patients and methods: Totally, 200 patients were randomly treated with either a Rydell nail (n 100) or two hook-pins (n 100). The average age, sex ratio, and ratio of fracture stages (Garden I–IV) was similar in the two groups. All the fractures were operated on by orthopedic specialists and followed clinically and radiographically at 6 and 12 months after the operation or until death.

Results: The mortality at 12 months in both groups was 20 percent. Among survivors, radiographic instability complications were recorded in 23 percent of the Rydell-nailed and 33 percent of the LIH-pinned fractures ($P < 0.5$). Instability complications in nondisplaced fractures were more common in nailed fractures (19 percent) than in pinned fractures (5 percent; $P < 0.05$). In displaced fractures 26 percent nailed fractures and 44 percent pinned ($P < 0.05$). developed instability complications within 12 months.

Conclusion: In our hands a four-flanged nail is superior to two hook-pins in preventing fixation complications of femoral neck fractures, although 23 percent instability complications as recorded for the Rydell OS is not a satisfactory result for modern orthopedic technology.

Surgical training improves the results of femoral neck fracture fixation

Lars T. Nilsson, Björn Strömqvist and K.-G. Thorngren

Department of Orthopedics, University Hospital, S-221 85 Lund, Sweden

Introduction: Holmberg et al. (1987) have shown that specialists in orthopedic surgery and general surgery have fewer complications following femoral neck fracture fixation than surgeons in training. We have compared the results when 6 surgeons performed all the operations in our department with the results when all the 35 surgeons in the department operated on the fractures.

Patients: Totally, 491 consecutive patients aged 79 (18–98) years were admitted to the department with a femoral neck fracture 1981–1985. The female/male ratio 2.9:1 and undisplaced/displaced fractures 1:2.4 was similar to previous investigations, 341 fractures were operated on by 6 trained surgeons and 150 operated on by more than 30"untrained" surgeons, all of them specialists in orthopedic surgery.

Methods: All displaced fractures had preoperative pin traction through the tibial tuberosity. They were usually operated on the day after admission on an extension table under fluoroscopic control. No primary arthroplasty was performed. Full weight bearing was encouraged from the day after the operation. The patients were followed at 4, 12, and 24 months postoperatively.

Results: Totally 28 percent of the patients were dead at 2 years. The rate of healing complications in the total material was 27/43 percent ($p < 0.01$). The number of secondary total hip replacements in patients operated on by trained surgeons/untrained surgeons in percent, was for undisplaced fractures (3.0/4.3) and for displaced fractures (15/22).

Conclusion: Surgical skill diminishes the need for secondary hip replacement.

Reference

Holmberg S, Kalén R, Thorngren KG. Treatment and outcome of femoral neck fractures. An analysis of 2,418 cases admitted from their own homes. *Clin Orth* 1987;218: 42–52.

Outcome after osteosynthesis of femoral neck fractures in relation to age and habitat

Karl-Göran Thorngren and Sven Holmberg

Departments of Orthopedics, Lund University Hospital and Danderyd University Hospital, Lund and Danderyd, Sweden

In a consecutive population-based material including all the cervical fractures in the Stockholm County Council catchment area during a 3-year period, the influence of age and habitat on the outcome after osteosynthesis of femoral neck fractures was studied. Among the 2,877 fractures, there appeared 10.5 percent early redisplacements, 9.8 percent nonunions, and 9.7 percent segmental collapses. A reoperation was performed in 18.3 percent of the patients. The total complication rate did not change much with increasing age. There was a minor tendency to increase in the early redisplacements (from 6 to 12 percent) and a decrease in the segmental collapses (from 15 to 7 percent) with increasing age. Younger patients and patients originally coming from their own homes had somewhat higher reoperation rates in relation to the frequency of complications, indicating higher demands on their hip function. Osteosynthesis remains the primary choice of treatment throughout the age groups.

Follow-up of hip fractures in primary health care

Karl-Göran Thorngren[1], Lars Borgqvist, Arne Jacobsson, Gun-Britt Jamlo[1], Lars T. Nilsson[1], Eva Nordell, Björn Strömqvist[1], Hans Wingstrand[1] and Bengt Scherstén

Departments of Orthopedics[1] and Community Health Science, Lund University Hospital, S-221 85, Lund, Sweden

See abstract in Proceedings of the Scandinavian Orthopedic Association, 44th Assembly, Århus, Denmark, June 8–11, 1988, *Acta Orthop Scand* 1988;59 Supplement 227.

Knee and foot

Unsuspected lateral meniscal tears in patients with clinically suspected medial meniscal tears as found on double-contrast arthrography and arthroscopy

Peter Abdon, Arnbjörn Arnbjörnsson, Niels Egund, Anders Lindstrand, Sten Odenbring and Holger Pettersson

Departments of Orthopedics, Ystad and Lund, and Diagnostic Radiology, Lund, Sweden

Introduction: Ireland et al. (1980) stated that the appropriate procedure in diagnosing medial meniscal tears was an initial double-contrast arthrography followed by arthroscopy. Results using this diagnostic approach are presented.

Patients and methods: In a prospective study, 46 patients with a clinical diagnosis of a medial meniscal tear, double-contrast arthrography followed by arthroscopy was used and the different findings compared.

Results: At arthrography 38 medial meniscal tears were found; four of them were false positive and another false negative compared with arthroscopy. Eleven medial menisci were normal. At both arthrography and arthroscopy, seven additional unsuspected lateral tears were found. In eight knees both menisci were normal and four lateral tears were found in knees with concomitant medial meniscal tears.

Discussion: The previously held belief that double-contrast arthrography is poor in detecting lateral meniscal tears could not be verified and the arthrographic accuracy well exceeded that of the clinical investigation indicating that arthrography is a reliable method in diagnosing both medial and lateral tears.

Conclusion: We believe that arthroscopy should be the initial diagnostic procedure in patients with a suspected meniscal lesion, but in patients with a negative arthroscopy and continuous knee problems double-contrast arthrography may be used to exclude the existence of a meniscal tear. Also, it may help the surgeon not familiar with the arthroscopic technique to plan the surgical approach as lateral tears may remain undiagnosed otherwise.

Reference

Ireland, J. Trickey E L, Stocker D J. Arthroscopy and arthrography of the knee. *J Bone Joint Surg* (Br) 1980;62:3–6.

Three-dimensional movements of the knee during active extension: An evaluation of patients with old tears of the anterior cruciate ligament

Håkan Jonsson, Johan Kärrholm and Lars-Gunnar Elmqvist

Department of Orthopedics. University Hospital in Umeå, S-901 85, Umeå, Sweden

Introduction: Previous in vitro investigations have indicated that high stresses are acting on the anterior cruciate ligament during active extension past 30°. The three-dimensional in vivo movements of the knee during extension have not, however, been previously investigated.

Patients: Twelve patients with arthroscopically verified tears of the anterior cruciate ligament were studied with roentgen stereophotogrammetric methods. Both the injured and the healthy knees were studied.

Methods: The patients were sitting performing an extension of the knee with a load of 30 N at the ankle. Range of movement was from 30° of flexion to full extension. The knee motions were recorded with two film exchangers at a speed of 2 or 4 frames per second. Translations and rotations of the tibia in relation to femur were studied.

Results: At the beginning of the extension, all the the knee rotated slightly internally and then externally. Simultaneously, abduction occurred in all the knees. No significant difference in tibial rotations between the injured and the intact knees could be observed. The tibial intercondylar eminence of the injured knees moved, on an average, 2–3 mm more anteriorly and distally than in the healthy knees.

Conclusions: During active extension, most patients can control tibial rotations albeit absence of the anterior cruciate ligament, whereas it seems more difficult to actively compensate for decreased resistance to translatory forces in the anterior and distal directions.

Knee ligament reconstruction using the Leeds Keio Dacron ligament

Gösta Linge and Peter Jörgsholm

Department of Orthopedics, Central Hospital, S-371 85 Karlskrona, Sweden

Since December 1986, the Leeds Keio Dacron ligament has been used in our department for reconstruction of knee ligaments.

Up to February 1988, Dacron grafts have been used in 18 knees in 17 patients. In all the cases, reconstruction of the ACL has been performed. In 3 cases the MCL has also been reconstructed and in 2 of those the PCL as well.

The operations have been performed by 1 surgeon using the original technique, but in most cases without dislocating the patella. Postoperatively, the epidural anesthesia has been continued for 24 hours with passive motion of the joint from 50 to 80°. Thereafter, the patients have been equipped with an ECKO brace allowing motion between 45 and 90°, and active muscular training has been instituted. After 6 weeks, the brace has been unlocked, and the patients have continued to wear them for 6 months postoperatively.

Results: The postoperative course has been more satisfying to the patients than with the method used earlier, and the primary results have been encouraging.

Complications: One superficial infection with *Staphylococcus albus* received antibiotic treatment and healed. In 2 patients there have been signs of fibular nerve pressure due to the brace. Both have been reversible.

Load tolerance in synthetic ligament fixation

Lars Good, Jan Gillquist, Magnus Odensten and Stefan D. Tarlow

Department of Orthopedics, Regional Hospital, S-581 85 Linköping, and Alabama Sports Medicine and Orthopedic Center, Birmingham, Alabama, USA

The tensile properties of synthetic ligaments are well documented by the manufacturers. One uncontrolled variable, when using these materials in knee ligament reconstruction, is the strength of the fixation immediately following surgery. With the purpose to evaluate different types of bone ligament couplings, and establishing guidelines for postoperative mobilization, the following laboratory model was designed.

Material and methods: Two looped and one unlooped ligament were fixed to fresh calf ulnae in different modes. Fixation devices used included two different barbed staples, two different cortical screws, and three prototype devices. The failure at the bone ligament interface was registered under tensile load created in an Alvetrone.

The load did not exceed 2900 N, thus kept well below the strain tolerance of the synthetic ligaments, but well over that of the normal human anterior cruciate ligament.

Results: Combining barbed staples with an unlooped ligament, failure occurred between 300 and 1300 N. Lower val-

ues were obtained for single staples and higher for double staples and wrapped back ligaments. The ligaments always slid under the staples. Barbed stapled fixation in a looped ligament failed by pulling out at 1200 N. Screw fixation of looped ligaments did not fail unless the cortical screw was placed in spongious bone, but in some cases the thinner screw used was bent. The prototype devices failed by sliding in the same range as the barbed staples. Submaximal failure, viz., staccato movements 1–2 mm before actual continuous sliding began, was recorded in almost all the staple fixations.

Conclusion: When choosing a staple fixation in ligament surgery, initial mobilization strain must be kept low to avoid increased laxity before the ligament is firmly affixed in the bony channels.

Precision in high tibial osteotomy: Presentation of a guide instrument

Sten Odenbring, Niels Egund, Anders Lindstrand and Björn Tjörnstrand

Department of Orthopedics, Lund University Hospital, S-221 85 Lund, Sweden

Introduction: To achieve a high accuracy in correction of high tibial osteotomy, a guide instrument has been constructed by Tjörnstrand.

Patients and methods: Totally, 41 patients (series A) with medial gonarthrosis were subjected to high tibial osteotomy using the guide instrument. In another series (series B) of 51 patients (52 knees), tibial osteotomy was performed using a controlled freehand technique without any guide instrument. The intended wedge was calculated from a whole lower limb radiograph in both groups. The correction aimed at was an overcorrection in valgus of 4°. Results were recorded as achieved osseous correction and change of osseous correction during healing.

Results: In series A, all corrections fell within ±4°and 40/41 within ±3°of the intended correction. In series B, 47/52 were within ±4°and 44/52 within ±3°of aimed correction. At follow-up 1 year after surgery, change of osseous correction was within ±4°in 41/41 and within ±3°in 39/41 in series A. In series B, change of osseous correction was within ±4°in 44/52 and within ±3°in 38/52.

Conclusion: Tibial osteotomy can be performed with a high accuracy with this guide instrument There is less change in osseous correction during healing when using the guide instrument.

Effects of preoperative physiotherapy in unicompartmental prosthetic replacement of the knee

E. Wersäll-Robertsson, L. Weidenhielm, E. Mattsson and L.-Å. Broström

Department of Orthopedics, Karolinska Hospital and S:t Görans Hospital, Stockholm, Sweden

Twenty-one patients, 11 men (mean height 177 cm, mean weight 81 kg) and 10 women (mean height 166 cm, mean weight 75 kg), with moderate medial gonarthrosis were operated on with a cemented unicompartmental Brigham prosthesis. Eleven patients were randomized to standardized preoperative physiotherapy mainly aiming at improving muscle strength in the thigh. Postoperatively, all the patients had the same physiotherapy. Clinical assessment (pain, stability, ROM) was supplemented with isokinetic torque measurements of the quadriceps and hamstring muscles with a Cybex II dynamometer and measurements of walking efficiency (oxygen cost) at convenient walking speed. Assessments were performed upon entering the study, immediately before, and 3 months after surgery.

Results: Five patients stated they had improved knee stability after preoperative physiotherapy versus none in the untreated group. After surgery, pain was equally reduced in both groups. Objective assessment of ROM and knee stability did not disclose any major difference between the groups. Isokinetic measurements of muscle strength did not show any difference between the groups regarding peak value or value at 30 or 60° of knee flexion. Convenient walking speed was increased, pain during walking, and oxygen cost of walking were decreased, but only in the patients without preoperative physiotherapy ($P < 0.01$).

In summary, this study did not show any major beneficial effect of preoperative physiotherapy.

Talonavicular arthrodesis in the rheumatoid foot

Jacob Kaij, Peter Ljung, Holger Pettersson[1] and Urban Rydholm

Department of Orthopedics and Radiology[1], Lund University Hospital, S-221 85 Lund, Sweden

Introduction: Arthritic destruction of the subtalar joints is a common cause of pain in the rheumatoid hindfoot. The process often starts in the talonavicular joint.

Patients and methods: Nineteen feet with painful arthritic destruction of the talonavicular joint were operated on. A bone plug from the iliac crest was used, and the arthrodesis was fixed with a staple in seven feet. A below-knee cast was used for 6 weeks, and weight bearing was allowed after 3 weeks. In patients with radiographic signs of arthritis in the talocalcaneal and/or calcaneocuboidal joint, or with valgus deformity of the hindfoot, a triple arthrodesis was performed. The 19 feet operated on with talonavicular arthrodesis were evaluated after a mean follow-up of 42 (11–72) months. All the patients were examined clinically, and radiographs of 17 feet were obtained at follow-up.

Results: Preoperatively, 17 feet were severely and 2 moderately painful. At follow-up, 13 feet were painfree, 4 slightly painful, and 2 moderately painful. Radiographic union was evident in 10 out of 17 feet, including all seven arthrodeses fixed with a staple. Preoperative radiographs were available for comparison in 14 cases. Seven feet showed a slight progress of arthritic signs in the talocalcaneal and/or calcaneocu-

boidal joint. One foot showed moderate progress, while six feet showed no progress.

Conclusion: Talonavicular arthrodesis gives good results and has a definite place in the treatment of the painful rheumatoid foot.

Achilles tendon lengthening — a simple operative technique

S. Friberg, H. Dahlström and F. Snorrason

Department of Orthopedics, University Hospital, S-901 85 Umeå, Sweden

Since 1985, we have used a new technique for lengthening of the Achilles tendon in 45 children (ages 4 months-14 years). The preoperative diagnosis varied from congenital short Achilles tendon, residuals after congenital pes equinovarus, to deformities due to spastic and flaccid paralysis. The operative procedure implies a Z-lengthening through two small skin incisions. The tendon is brought out through the incisions and transected by 60 percent from the lateral and medial sides, respectively. The tendon lengthening is produced by forceful dorsiflexion of the foot with the knee at first flexed and then slowly extended. The incisions made in the tendon will permit it to rupture in the sagittal plane and the lengthening occurs inside an intact tendon sheath. The amount of lengthening is automatically adjusted to the range of movements in the knee and ankle joints. Postoperatively, the children were mobilized in weight bearing below-knee casts for 3–4 weeks depending on their age.

The technique is simple and safe. No complications occurred. In all the children the goals of the operation were achieved.

Prophylactic antibiotics in amputations

Rolf Norlin[1], Lennart Nilsson[2], Steffan Ånséhn[2] and Aril Frydén[3]

Departments of Orthopedics[1], Clinical Bateriology[2] and Infectious Diseases[3], University Hospital, S-581 85 Linköping, Sweden

Introduction: Prophylactic antibiotics are widely used in orthopedic surgery. The presence of bacteria may influence wound healing, and prophylactic antibiotics are worth studying.

Material and methods: All the planned amputations due to vascular disease were included. If any antibiotic was given less than 72 hours before the operation, that particular amputation was excluded. Randomization was performed to no prophylaxis or Claforan®(cefotaxim) 2 g x 3 for 1 day. Bacteriological cultures were taken before, during, and after surgery. Several samples were taken for concentration tests of cefotaxim.

Results: The overall healing rate following prophylaxis was 82 percent as compared with 58 percent in the group without prophylaxis. For below-knee amputations, the figures were 52 percent and 14 percent, respectively. All the patients treated showed adequate concentration levels of cefotaxim in blood, muscle tissue, and drainage fluid. Preoperative cultures showed growth of *Staphylococcus aureus, E. coli, Proteus* , and *Bacteroides* . All the postoperative cultures in the treated group were negative.

Conclusion: Prophylactically administered Claforan in amputations seems to increase the chances for uneventful healing of the wound. This is supported by the fact that cefotaxim is found in adequate concentrations in treated patients and that their postoperative cultures are negative.

Spine

Diagnostic lumbar nerve root anesthesia

Bo Jönsson, Björn Strömqvist, Mårten Annertz[1], Stig Holtås[1] and Göran Sundén

Departments of Orthopedics and Diagnostic Radiology, Lund University Hospital, S-221 85, Lund, Sweden

Introduction: Diagnostic infiltration of a lumbar root sleeve in combination with deposition of contrast medium within the sheath has previously been described in cases with disc herniation and with repeated surgical procedures. In the present investigation, lumbar nerve root anesthesia was performed without injection of contrast medium in cases with unilateral sciatica and minor or no findings on myelography, CT, and MRI.

Patients and methods: A total of 100 injections of 78 patients with sciatic pain were evaluated. Totally, 3–5 cc of 1 percent Carbocaine was injected just outside the intervertebral foramen of the nerve to be investigated. The neurologic state of the patient before and 1 hour after anesthesia was compared. Induced sensory or motor deficits were recorded, as well as the patient´s own assessment of the effect of the anesthesia on his sciatic pain.

Three categories of patients were investigated.

1. Patients with unilateral sciatic pain and normal findings o myelography and/or CT or MRI (n 51).
2. Patients with minor myelographic findings that possibly, but not necessarily, explained the patients symptoms (n 40).
3. Patients with multiple pathologic findings on myelography (n 9).

Twelve infiltrations were performed around the L4 root, 68 around the L5 root, and 20 around the S1 root.

Results: In 87 percent of the patients the nerve block inflicted temporary sensory and/or motor disturbance within the dermatome anesthetized. In total, 51 percent experienced total, 31 partial, and 18 no pain relief after injection. In the latter group were all the patients without sensory or motor impairment after anesthesia. The failed diagnostic injections were distributed evenly between L4, L5, and S1 blocks.

No side effects of the procedures have been noted.

Patients with total or marked pain alleviation after root injection were offered an operative decompression of the nerve root involved. To date, this has been carried out in 21 patients, and the early (4–12 months) results of this decompression seem to be comparable to conventional disc surgery.

Conclusion: Anesthetizing the lumbar nerve root outside the intervertebral foramen with a few cubic centiliters of Carbocaine is a safe procedure without side effects, which can be considered in the preoperative evaluation of patients with sciatic pain and minor or no radiographic findings.

Anomalous lumbosacral articulations and low back pain: Evaluation and treatment

Björn Strömqvist and Bo Jönsson

Department of Orthopedics, Lund University Hospital, S-221 85 Lund, Sweden

Introduction: Spondylolysis and spondylolisthesis are the only anomalies of the lumbar spine that have an established correlation with low back pain. This presentation concerns patients with unilateral articulations between the transverse process of the last lumbar vertebra and the sacrum, seeking medical advice because of low back pain. Evaluation and results of resection are presented.

Patients: Eleven patients, five of whom were males, with a mean age of 39 (13–76) years. All the patients had low back pain with a duration of 1–10 years. Four of the patients reported earlier episodes of sciatica. Only patients with unilateral anomalous articulations were included, 3 of whom had left-sided and 8 right-sided articulations. In 4 cases the transverse process articulated to the sacrum only and in 7 cases to the sacrum, as well as to the iliac bone.

Methods: 99m-Tc MDP scintimetry was performed with registration over the pelvis in 8/11 cases. Injection of a local anesthetic into the articulation was performed in 10/11 cases under fluoroscopy, and the effect on the patients' low back pain was evaluated.

Resection of the transverse process was performed in all the patients.

Results: Scintimetry showed no focal uptake increase in any of the 8 cases investigated. Injection of a local anesthetic into the articulation gave total or partial alleviation of pain in 9/10 cases.

At follow-up 6 to 30 months postoperatively, 7 patients were totally free from pain and 2 reported partial alleviation. Two patients had unchanged symptoms: viz., the patient in whom local anesthesia in the joint had no effect on the symptoms, a 76-year-old male with associated degenerative changes of the spine, and a 14-year-old swimmer with an otherwise healthy spine.

Conclusion: In patients with unilateral anomalous lumbosacral articulations and low back pain, resection of the transverse process may be a worthwhile procedure provided that the spine is otherwise healthy and that anesthetizing the articulation relieves the pain temporarily.

Surgical findings in spinal injuries: Correlations with radiographs and pathoanatomy

Halldor Jonsson Jr[1], Marianne Petrén-Mallmin[2], Håkan Sandler[3] and Wolfgang Rauschning[1]

Departments of Orthopedics Surgery[1], Radiology[2], and Forensic Medicine[3], Uppsala University and University Hospital, S-751 85 Uppsala, Sweden

Advances in the management of patients with spinal trauma and refinements of spinal instrumentation in recent years have entailed a more active approach to patients with traumatic and pathologic fractures. Concurrently, substantial improvements in computerized diagnostic imaging modalities, increasingly facilitate preoperative assessment of spinal derangement. The notorious lack of analysis of spinal trauma during autopsies and limitations of surgical exposures have hampered valid pathoanatomic correlations with diagnostic radiographs, CT, and MR scans.

Specimens from patients who previously had undergone operations for spinal injury or metastases were obtained during pathologic or forensic routine autopsy. Preparation included meticulous positioning, injection for arterial contrast, and freezing in situ according to a special protocol. For accurate visualization of bony injury, high resolution CT of the specimens was performed in different planes. The frozen specimens were then sectioned through on a heavy-duty sledge cryomicrotome. During cryoplaning, photographic images of the entire specimen were obtained at submillimeter intervals. In addition, high-power, close-up images were taken to disclose minute pathoanatomic changes.

Evaluation included comparison of the clinical symptoms and signs, intraoperative observations, and correlations of in vivo radiographs and scans with in vitro specimen radiographs, as well as an independent assessment of these data with the actual structural damage to the vertebral column and spinal soft tissues. Particular interest was focused on the adequacy of reduction and decompression, as well as stable and secure placement of the internal fixation devices and the accuracy and limitations of current diagnostic imaging modalities.

CT and MRI in the diagnosis of spinal metastasis: Possibilities and limitations

Marianne Petrén-Mallmin[1], Halldor Jonsson Jr[2], Rickard Nyman[1] and Wofgang Rauschning[2]

Departments of Diagnostic Radiology[1] and Orthopedics[2], University Hospital, S-751 85 Uppsala, Sweden

Patients with spinal metastasis are often candidates for surgical treatment because of intractable pain and neurologic symptoms in spite of oncologic treatment. The evolution of modern surgical treatment demands more detailed radiological investigations for analysis of surgical indication and selection of method for intervention.

After bone scintigraphy and radiography of the spine, MRI and CT are performed. MRI is best to show the dissemination of the metastasis in the soft tissues including the spinal canal and growth in the bone marrow, but better information is needed about the variations in signals in the different tissues. CT provides best information about the bony structure, and is targeted on the relevant segment.

Postmortem, the spinal segments are taken out at autopsy and analyzed in detail with high-resolution CT followed by cryosectioning and multiple drill biopsies for histopathologic diagnosis.

The in vitro results are correlated with the in vivo radiologic scans to make a more exact interpretation of the MRI and CT scan possible in the future.

Operative treatment of thoracolumbar pathologic fractures

L. Sjöström, H. Jonsson, G. Karlström and S. Olerud

Department of Orthopedics , University Hospital, S-751 85 Uppsala, Sweden

Pathologic fractures of the thoracolumbar spine constitute a major problem for patients with metastatic malignant disease. Severe local pain and rhizopathic pain often make the patients bedridden and create a need of hospitalization and advanced pain-relieving measures. There is a high risk of development of paraplegia. Treatment must be aimed at stabilization of the spine to reduce pain and, in the presence of paraparesis, at decompression of the neural tissue. Treatment options include radiation, laminectomy with posterior stabilization, anterior decompressive and stabilizing operations, and combined anterior and posterior procedures.

We have operated on 37 patients with pathologic fractures during the years 1981–87. Thirteen patients had fractures in the thoracic spine and 24 in the lumbar spine. Hypernephroma was the most common primary tumor. Twenty patients presented with varying degrees of paraparesis, including 11 of 13 patients with thoracic fractures. During the first few years in this series, the standard treatment was posterior stabilization with Roy-Camille plates or Harrington rods combined with laminectomy when there was a neurologic deficit. The pain relief achieved was good, but the effect on the paraparesis was variable and often transient.

The treatment has gradually shifted towards use of posterior transpedicular stabilization in combination with anterior decompression when there is a manifest or imminent paraparesis. This has resulted in an increased improvement rate and less risk of recurrent paraparesis. The new transpedicular fracture instrumentation has also made it possible to decompress the dura by posterior reduction of the pathologic fractures, thus creating an alternative to anterior decompression for the severely diseased patients where an anterior decompression may be a major surgical procedure.

Causes and consequences of cervical strain

Christer Hildingsson, Ulf Björnstig[1] and Göran Toolanen

Departments of Orthopedics and Surgery[1], University Hospital, S-901 85 Umeå, Sweden

Introduction: Epidemiologic data for cervical strain (AIS 1) including all types of injury mechanisms are poorly described in the literature. The purpose of the present study was to described epidemiologic factors in patients with a history of cervical strain.

Patients and methods: Totally, 140 patients suffering from cervical strain were interviewed when treated at our hospital, and hospital and social security insurance records were studied. The assessment of treatment costs was based on the hospital account for 1985.

Results: The highest injury incidence was in the age group 20–29 years. This was especially pronounced for the males. Almost half of the males were in this group compared with one fourth of the females. The cause of injury was traffic accidents in 69 percent, falls in 17 percent, and other accidents in 14 percent. Concomitant injuries occurred in 20 percent. Inpatient treatment was required in 16 percent, with a mean of 5.3 days. Twenty-nine percent received sickness insurance benefits for a mean of 75 days. The calculated total cost was 1.04 million SEK. Costs for sickness benefits were 0.61 million SEK, with the mean amount received per person 15,000 SEK.

Trigeminal sensory impairment after whiplash injury of the cervical spine

C. Hildingsson, M. Knibestöl, G. Toolanen and O. Ahlgren

Departments of Orthopedics and Clinical Neurophysiology[1], University Hospital in Umeå, S-901 85 Umeå, Sweden

See abstract in Proceedings of the Scandinavian Orthopedic Association, 44th Assembly, Århus, Denmark, June 8–11, 1988, *Acta Orthop Scand* 1988;59 Supplement 227.

Neck and shoulder complaints after car accidents compared with occupational related disorders among sewing machine operators

S. Blåder[1], O. Bunketorp[2], M. Lindh[3], G. Markhede[2], I Olsson[2] and B. Romanus[2]

Departments of Orthopedics, Central Hospital[1], S-501 14 Borås, Östra Sjukhuset[2], S-416 85 Gothenburg, and Medical Rehabilitation[3], Sahlgren Hospital, S-413 45 Gothenburg, Sweden,

The aim of the study was to describe frequencies, diagnoses,

and complaints caused by traffic accidents and compare the diagnoses and complaints in this group with those of sewing-machine operators with neck and shoulder symptoms and with controls.

Subjects and methods: During 1 year, car accidents in the Gothenburg region were investigated; and 106 car occupants treated at hospitals because of neck and shoulder pain after such accidents were followed up with a questionnaire. Twenty-seven persons with persisting neck and shoulder complaints were clinically examined after 2–4 years. A complaint index was used to grade the symptoms. The complaints in these 27 patients were compared with those found in 131 sewing-machine operators and 119 controls.

Results: The dominating diagnosis in all three groups was tension neck syndrome. After car accidents, we also found high frequencies of cervical syndromes and segmental nerve root disturbances. The complaint index was greater for persons injured in traffic accidents. The risk of neck and shoulder complaints was about twice as high after rear-end collisions compared with other directions. If neck and shoulder problems remained after 3 months after the accident, 90 percent had complaints after 3 years, and if segmental nerve root disturbances were found initially the risk of persisting problems was high.

Conclusions: Persisting neck and shoulder complaints are often of a more severe nature and of a different diagnostic spectrum in patients injured in traffic accidents compared with occupational-related disorders of the neck and shoulder in sewing-machine operators and controls.

Effect of age and menopausal status on the bone mineral density of the lumbar spine

L. R. Hedlund[1] and J. C. Callagher[2]

Department of Orthopedics, Huddinge University Hospital, S-141 86 Huddinge, Sweden, and Creighton University[2], Omaha, Nebraska, USA

Introduction: Understanding the normal change in bone mineral density (BMD) of the spine with age is important for designing preventive measures against the development of spinal osteoporosis. Previous studies using dual photon absorptiometry (DPA) and quantitative computed tomography have shown conflicting results regarding age at peak BMD and the effect of the menopause on the lumbar BMD.

Patients and methods: BMD of the lumbar spine (L2-L3) was measured by DPA (Lunar DP4, cv 2 percent) in 186 normal Caucasian women aged 20–84 years.

Results: Peak BMD of spine, 1.35 ±0.14 g/m^2(mean ±SD) was observed between ages 20–29 years. To examine the effect of menopause, we compared premenopausal and postmenopausal women of similar age (40–49 y) and found significantly lower BMD in the postmenopausal women (1.30 ± 0.14 g/cm^2 vs 1.19 ±0.15 g/cm^2 ($P < 0.05$). In premenopausal women aged 20–52 years, linear regression analysis showed a slight, but nonsignificant decrease in spinal BMD with age of 0.0027 g/cm^2 per year (0.20 percent/y), whereas in postmenopausal women, aged 42–84 years, BMD decreased significantly by 0.0081 g/cm^2 per year (0.63 percent/y), $P < 0.01$. Thus, the change in lumbar BMD was three times greater after the menopause.

Conclusion: The preliminary results show that peak spine density occurs in the 20s and that the menopause also has a significant effect in determining BMD in later life.

Upper extremity

Clinical and radiographic findings in patients operated on for shoulder dislocations

E. Posch, M. Kronberg, L.-Å Broström and V. Söderlund

Departments of Orthopedics and Radiology, Karolinska Hospital, S-104 01 Stockholm, Sweden

During 1981–86, 67 patients were operated on for recurrent shoulder dislocations. Fifty-two patients (37 men and 15 women) were accessible for clinical and radiographic examination in 1987. The mean age was 30 years. The dislocations were of traumatic anterior type in 47 patients and of posterior type in 3 patients. Two patients had generalized joint laxity and symptoms of anterior dislocations.

Method: The angle of humeral head retroversion was measured from a semiaxial radiograph. The range of motion was measured with a goniometer in the standing position. External and internal rotation was measured in the neutral and the 90°abducted position in both the coronal and the scapular plane.

Results and conclusions: The average angle for humeral head retroversion in patients with anterior dislocations was 24°. This angle is less than that for healthy subjects (25–36°, 99 percent confidence). The two patients with generalized joint laxity had angles of 13 and 15°, respectively. Redislocation occurred in seven shoulders, but 48 of 49 patients with anterior dislocations experienced benefit from the operation. Independent of surgical technique, the rotation was decreased after surgery compared with the contralateral shoulder and to reference values for healthy subjects.

Surgical treatment of recurrent anterior dislocation and subluxation of the shoulder

G. Toolanen[1], A. Kjellgren[2], H. Olsson[2] and B. Högström[3]

Departments of Orthopedics[1], University Hospital, S-901 85 Umeå, Surgery[2] and Diagnostic Radiology[3], Skellefteå Hospital, S-931 86 Skellefteå, Sweden

See abstract in Proceedings of the Scandinavian Orthopedic Association, 44th Assembly, Århus, Denmark, June 8–11, 1988, *Acta Orthop Scand* 1988;59 Supplement 227.

Trauma of the wrist: Fracture of the carpal scaphoid and suspected ligament disruptions — a 1-year follow-up

Aina Danielsson, Hans Rahme, Ola Vikerfors, Zia Emami Ahari and Jan Trella[1]

Departments of Orthopedics and Radiology[1], Central Hospital, S-721 89 Västerås, Sweden

Introduction: Many patients with radial wrist tenderness after trauma are treated with a forearm scaphoid cast, although initial radiographs of the scaphoid bone are normal. The aim of this study was to see how many had a fracture, and whether those who did not have a fracture showed signs of a past ligament disruption.

Patients and methods: All the patients from November 1985 to November 1986 who received a forearm scaphoid cast as a result of a diagnosed or suspected fracture of the carpal scaphoid were examined 1 year later with clinical examination and routine radiographs of the wrist and scaphoid (with comparative films of the contralateral side). Fifty patients could be followed up.

Results: Totally, 29/50 had a fracture of the scaphoid; 23 of these were seen on primary radiographs. After 2 weeks in a cast; five more fractures were detected radiographically, and another one was detected with scintigraphy. The fracture types were 19 undisplaced waist fractures, five fractures of the scaphoid tuberosity, and five others. At the follow-up, 8/29 patients in the fracture group had symptoms: 1 pseudarthrosis, the rest were healed. In all, 21/50 patients did not have a fracture. Of those, 11/21 had symptoms 1 year after the trauma: mostly pain on movement or at work. There were no radiographic signs indicating instability.

Conclusion: Although late diagnosis of scaphoid fracture was made in 6 patients, 21 patients were put in a cast unnecessarily. Late symptoms occurred in 27 percent of the patients with a fracture and in 52 percent of those without a fracture. Our suspicion that ligament disruption could have been a cause of symptoms in this second group could not be verified radiographically.

Scintigraphy — an adjuvance to early diagnosis of fractures of the scaphoid

Kenneth Karlsson and Lars Sjöstrand

Department of Orthopedics, Central Hospital, S-371 85 Karlskrona, Sweden

Introduction: Radiographic diagnosis of scaphoid fracture not seldom poses problems. A negative initial radiograph does not exclude fracture, but is usually repeated 3 weeks after the trauma. Meanwhile, the hand is retained in a cast. To minimize time of bracing, a model was thus launched as follows.

Method: In patients with local symptoms and a negative radiograph after fresh trauma, a technetium scintigraphy was performed on the 7th day. If scintigraphy was normal, casting was terminated. Otherwise, casting continued and a new radiograph was obtained 2 weeks later.

Patients: During 1985–87, 118 patients presented primary clinical suspicion of a scaphoid fracture and a normal radiograph. Seventy-seven were men and 41 were women. The age distribution was 9–84 years.

Result: Of the 118 patients, 38 presented a positive scintigraphy. At reevaluation of the primary radiograph, nine fractures were detected. Repeated radiography revealed another seven fractures.

Twenty-eight cases had a scintigraphic uptake increase localized to the distal radius (13), CMC I (5), trapezium (5), and other sites (5).

Sixty-one patients with normal scintigraphy could terminate casting and begin mobilization 1–2 weeks post trauma. Fifteen patients continued casting owing to additional orthopedic diagnosis.

Conclusions: 1) In about 50 percent of the patients with primary symptoms, immobilization could be shortened with the addition of scintigraphy. 2) Scintigraphy not seldom focused on other injuries.

Pediatric orthopedics

Congenital dislocation of the hip: Problems in the early diagnosis and treatment

Arne Bach and Anders Hammer

Department of Surgery, County Hospital, S-292 00 Karlshamn, Sweden, and Department of Orthopedics, Kolding Hospital, DK-6000 Kolding, Denmark

We have conducted an analysis of children born alive in three regions in Denmark in 1983 (Central Hospitals of Næstved and Herning, as well as entire Vejle County with its five hospitals).

The material comprises 5,816 children (11.5 percent of the total 50,821 in Denmark). The diagnosis of CDH was established in 36 cases of all the referred children with suspected CDH (15.3 percent of the totally 235 cases in Denmark).

The incidence in the material was 0.6 (0.4–1.0) percent in comparison with the overall incidence of 0.5 percent. The relatively high incidence reflects overtreatment.

The analysis showed 1) that the hip instability test conducted as indicated by Ortolani and later by Barlow and von Rosen in the perinatal period and not demonstrating instability did not exclude that the diagnosis of CDH could be established by later examination; 2) that a small number of children with CDH needed more than 3 months to achieve stability of the hip in spite of splintage. It is important that the test is uniformly conducted and the difficulties interpreting the results are underlined. Later prophylactic examinations may be needed. The other important clinical signs of CDH (limitation

of abduction, difference in leg length and asymmetry of the legs and hips) are stressed.

It is advisable to perform radiographic examination 2 weeks after removal of the splint.

Late diagnosed hip joint displacement: Follow-up of treatment

Kurt Palmén

Hajvägen 28, S-43 203 Träslövsläge, Sweden

The aim of this examination has been to correlate radiographic treatment results with the age at initiation of treatment.

Patients: Totally, 157 cases comprising all the cases of hip joint displacement (subluxation and total dislocation) in different age groups at all orthopedic departments: A) 51 cases during 1984 (1–6 months old); B) 37 cases during 1982–85 (7–11 months old); C) 36 cases during 1982–85 (older than 12 months); D) 33 cases during 1984–85 (1–8 months old, with unilaterally limited hip abduction and uncertain subluxation).

Method: Case records and radiographs have been studied. The follow-up period has varied between 2 and 6 years.

Results: See Table.

The follow-up period has been rather short, but 80/124 (65 percent) of the hips have been judged to be normal. The 19 cases of dysplasia need further follow-ups.

Conclusion: The study has shown that the results are superior if diagnosis can be established and treatment started before the age of 6 months

Table

	Group			
	A	B	C	D
Normal hips, or very slight dysplasia	45	26	9	0
Still remaining acetabular dysplasia	4	6	10	0
Necrosis of the femoral head/neck	2	6	4	0
Pelvic osteotomy (* one also necrosis)	0	1*	14*	0

Magnetic resonance imaging (MRI) in Legg-Calvé-Perthes disease

Hans Wingstrand, Niels Egund[1], Holger Pettersson[1] and Carin Thambert

Department of Orthopedics and Radiology[1], University Hospital, S-221 85 Lund, Sweden

Introduction: Early radiographic prognosis constitutes a major clinical problem in Legg-Calvé-Perthes Disease (LCPD). Several attempts have been made to identify early prognostic signs, but these signs usually appear too late to enable effective treatment. Indication for surgical treatment is poor containment of the epiphysis with threatening anterolateral deformation of the epiphyseal cartilage and subsequent joint incongruence. Previously, this had to be verified with arthrography, which is not suitable for repeated examinations. Our purpose was to evaluate the potential of MRI in this respect and to assess the extent of the necrosis and the degree of revascularization.

Patients and methods: In all, 15 children in various stages of the disease were examined. The age varied between 5 and 11 years. In 10 of the children, MRI was performed prior to arthrography. MRI was performed on a system operating at 0.3 Tesla. A surface coil was wrapped around the hips. The slice thickness was 5 mm. T1- and T2-weighted frontal multislice sequences were obtained.

Results: The MRI findings with regards to the epiphyseal cartilage contour and the degree of containment within the acetabular labrum correlated well with the arthrographic information. In addition, MRI visualized the increased thickness and shape of the epiphyseal and acetabular cartilage and provided information about synovitis and intracapsular fluid. The extent of the epiphyseal necrosis in the early cases could be assessed as well as the degree of revascularization in the later stages of the disease. Metaphyseal involvement and areas of local growth arrest in the growth plate in the later cases were detected.

Conclusion: MRI provides early information about the extent and localization of the epiphyseal necrosis and of cartilage overgrowth, threatening lateralization of the head of the femur subsequently with deformation and joint incongruency. It also provides information about the revascularization within the epiphysis. MRI is a useful tool in the monitoring and prognostication of these children.

The Swedish experience with Salter's innominate osteotomy in the management of congenital subluxation and dislocation of the hip joint

Göran Hansson[1], Bo Althoff[2], Per Bylund[3], Bo Jacobsson[1], Anne-Marie Löfberg[2] and Torsten Lönnerholm[2]

Departments of Orthopedics[1] and Diagnostic Radiology[2], University Hospital, S-751 85 Uppsala, Sweden, and Departments of Orthopedics, Karolinska Hospital[3], S-104 01 Stockholm, and Regional Hospital[4], S-701 85 Örebro, Sweden

Introduction: The aim of this study was to review the first 15 years experience in the whole of Sweden with Salter's innominate osteotomy (IO) in the management of congenital subluxation and dislocation of the hip joint (CDH).

Patients and methods: Between 1963 and 1977, 79 patients with CDH were operated on with a total of 86 IOs in Sweden. In total, 76 patients with 83 abnormal hips treated with IO were available for reexamination. The radiographic

results were classified according to Salter's modification of Severin's classification.

Results: At reexamination 11 (2–23) years after the IO, the overall radiographic results were classified as excellent or good in 41 percent of the hips and as fair or failure in 59 percent. The best results were seen in subluxated hips previously not treated (2) or treated with closed reduction only prior to the IO (18) in patients operated on before the age of 5 years. In this group excellent or good results had been obtained in 18/20 hips. The poorest results were obtained in hips operated on for residual subluxation (16) or dislocation (12) after previous hip surgery — fair or failure in 26/28 hips.

Conclusions: We conclude that the IO will offer excellent results in subluxated hips previously not operated on when performed before the age of 5 years. In dislocated hips the results will be less successful. When the IO is performed before the age of 5 years on hips previously not operated on by a surgeon familiar with this technically demanding operation, excellent results can, however, also be obtained in dislocated hips. When previous surgery has failed to restore normal hip development, the chances of improving hip development by the IO will, on the other hand, be very limited.

Growth of the femoral neck and greater trochanter after physiolysis of the hip

Gunnar Hägglund, Birger Bylander, Lars Ingvar Hansson† and Göran Selvik

Departments of Orthopedics in Lund and Umeå, and Department of Anatomy in Lund, S-221 85 Lund, Sweden

Four boys with unilateral and 2 boys with bilateral physiolysis of the hip were treated by hook-pinning without reduction of the slipped side and prophylactic hook-pinning on the unslipped side. Two boys were aged 12 years at operation, 3 were aged 13, and 1 aged 14 years. The 14-year-old boy had a bilateral, chronic, severe slipping; the other 5 boys all had a slipping of less than one third of the diameter of the femoral head. During the operation tantalum balls were inserted into the epiphysis, into the base of the femoral neck, and into the top of the greater trochanter in both hips. The children were followed with roentgen stereophotogrammetric examinations until growth-plate closure of the femoral neck.

Ten hips showed growth in length of the femoral neck between 9.7 and 15.2 mm. These 10 hips also showed growth of the greater trochanter ranging from 8.1 to 13.5 mm. There was no difference in growth between the slipped and the unslipped hips. In the oldest boy, no significant growth of the femoral neck or the greater trochanter occurred. He had a bilateral chronic slipping with onset of symptoms at least 1 year before pinning. The absence of growth in this boy could be due to normal cessation of growth. None of the hips showed segmental collapse or chondrolysis.

Physiolysis of the hip is sometimes seen at an early age when there is a considerable remaining growth of the femoral neck. The hook-pin allows continuous growth and normal development of these hips without the limitation of abduction often seen after physiodeses.

Ischemic necrosis of the proximal femoral epiphysis in juvenile chronic arthritis (JCA) of the hip

Hans Wingstrand, Masahiro Kobayakawa, Urban Rydholm and Holger Pettersson[1]

Departments of Orthopedics and Radiology[1], University Hospital, S-221 85 Lund, Sweden

Introduction: Synovitis with subsequent painful increase in intracapsular pressure is common in JCA. The purpose of this study was to estimate the frequency, as well as to discuss, the etiology of radiographic signs of ischemic necrosis in JCA.

Patients: Totally, 206 children were treated as inpatients at the juvenile rheumatoid arthritis (JRA) center in Lund in 1982 and 1983. Thirty-six (15 boys and 21 girls) had AP and Lauenstein view radiographs due to pain. The age at onset of the disease was 5 (1–13) years. Twenty-four children had been or were on oral corticosteroids. All the children had bilateral arthritis.

Methods: The radiographs were classified in Group 1: *Obvious* necrosis, i.e., condensation, fragmentation and/or resorption of the epiphysis; Group 2: *Suspected* necrosis, i.e, flattening of the epiphysis similar to the reparative end stage of Legg-Calvé-Perthes disease; Group 3: *"Normal"*, i.e., hips with a spherical epiphysis and no signs of necrosis, but possibly with other findings typical of JCA. The *epiphysis index* and the *caput index* were calculated. The presence of a "sagging rope" sign in the femoral neck was recorded as was the extension deficit of the hip at the time of the examination.

Results: Ten hips in 6 children aged 3 (1–6) years at onset of the disease had obvious necrosis of the epiphysis. Twenty hips in 13 children aged 4 (2–11) years had suspected necrosis, whereas 42 hips in 23 children aged 7 (2–13) years had no sings of necrosis. The *epiphysis index* and the *caput index* correlated well with the radiographic signs of necrosis, as did extension deficit and the presence of a "sagging rope" sign indicating a previous period of growth arrest. The incidence of obvious signs of necrosis in children with JCA and hip involvement was 14 percent, including suspected signs the incidence was 42 percent.

Discussion: The radiographic features of ischemic necrosis in our study were very similar to those of "idiopathic" Legg-Calvé-Perthes disease in its various stages and correlated well with the age of the child at the onset of JCA. In the late stage, a "sagging rope" sign strongly indicates a previous period of ischemia with subsequent avascular damage to the epiphysis and growth plate. Both are supplied by intracapsular vessels vulnerable to an increase in intracapsular pressure caused by synovitis. This may well explain the ischemic necrosis so far solely attributed to systemic treatment with corticosteroids.

Hereditary sensory neuropathy with anhidrosis — 3 cases in southeast Sweden

Bengt Brodd[1] and Lars Sjöstrand[2]

Departments of Orthopedics, Central Hospital[1] S-391 85

Kalmar, and Central Hospital[2] S-371 85 Karlskrona, Sweden

Type 4 hereditary sensory neuropathy (HSN) according to Dyck and Ohta is a rare condition; to date, 14 cases have been described. It is characterized by generalized congenital analgesia, with resulting gross malformation of the extremities, multiple fractures, and often self-inflicted injuries, anhidrosis, and mental retardation.

The peripheral nerves reveal with electron microscopy an extreme paucity of unmyelinated fibers and a reduction of myelinated fibers of small caliber.

Of 3 children with bizarre malformations, osteomyelitis, and increasingly demanding orthopedic efforts, 2 died of hyperpyrexia during benign infections due to unidentified loss of sweat function. One boy is still alive with progressive osteomyelitis, Charcot joints, and he requires advanced bracing.

Varia

Three-dimensional computer graphics of musculoskeletal anatomy

Wolfgang Rauschning[1,2], John Prothero[2] and John Sundsten[2]

Department of Orthopedics[1], Uppsala University, Uppsala, Sweden, and Department of Biological Structure[2], University of Washington, Seattle, WA, USA

Refinements and innovations in orthopedic surgical procedures, as well as in computerized diagnostic imaging (CT, MRI), in recent years have entailed the necessity for a thorough understanding of functional and topographic relationships in complex anatomic regions of the spine and appendicular skeleton. Conventional dissection destroys these relationships. The mental transformation of two-dimensional radiographs and scans into three-dimensionality is exceedingly difficult for surgeons and imaging experts.

To obtain accurate sectional-anatomic image materials, the Uppsala cryoplaning technique is used to section injected, carefully positioned specimens that are frozen under controlled conditions and sectioned without previous decalcification. Registration images are obtained by macrophotography of the specimen surface, together with a metric scale and an array of fideucial reference marks in and around the specimens. Images taken at submillimeter intervals are projected onto a drawing table on which anatomic structures and contours are identified, outlined, and numbered. These outlines, together with the annotations, are traced on a digitizing tablet and stored in the memory of a computer graphic workstation. Computer graphics postprocessing includes stacking of the images, using the fideucial marks for reference, assignment of specific colors to different anatomic structures, and selection of separate illumination source and shading for every structure with individual azimuth settings.

These electronic anatomic models can be displayed with solid surface or increasingly transparent grain or wire frame structures and with real time rotation in optional planes. Electronic dissection and even surgical simulations may be accomplished. The digitized format also renders itself to accurate morphometric analysis of distances, area, volumes, and directional trajectories and precise data acquisition for the creation of finite element models, as well as for diagnostic imaging reference.

A new device to control the heat generation during orthopedic cutting

Sören Toksvig Larsen, Anders Lindstrand and Leif Ryd

Department of Orthopedics, University Hospital, S-221 85 Lund, Sweden

Introduction: Bone-cutting procedures, as tested during knee arthroplasty, give rise to significant temperatures. This heat generation and subsequent bone death may be one factor responsible for the lack of bony ingrowth into porous prostheses, as shown by histologic and stereophotogrammetric studies.

Alterations in saw blade design do not appear to control the temperature elevation, and usual cooling was unsatisfactory. Further development was done to control the temperature generation.

Method: A new saw blade with water cooling was made and tested by laboratory cutting with usual hospital equipment. The saw blade was built from two standard oscillating saw blades adapted to each other with canals inside (four-roof system), so that the cooling agent was led to the saw teeth to cool the bone in the cutting area and to clear the chips from the kerf. The saw blade was driven by a standard air-powered machine, and connected to an arthroscopy pump with a water flow of 80 ml/min.

Thermocouples were inserted in the saw blade. The laboratory tests were done on ox bone with standard hospital equipment. Comparison with other saw blade designs and other attempts to cool the cutting process with ordinary saw blade and cooling with water applied by a syringe manually and by a pump (600 ml/min) was done.

Results: The laboratory tests showed that the temperature development during the orthopedic cutting processes could be controlled. The heat generation was in practice negligible with the new saw blade at a maximum temperature between 25 and 29 °C. For comparison, the maximum temperature when using standard saw blades ranged from 82 °C to 184 °C.

Conclusions: With the cooled saw blade, the heat generation during bone cutting could be fully controlled in a practical way using ordinary orthopedic equipment. This may be a realistic way to control the temperature elevation during bone-cutting procedures.

Optimizing tourniquet design for orthopedic surgery in bloodless field

B. L. Rydevik[1], A. G. Crenshaw[2], A. R. Hargens[2], R. A. Pedowitz[2], D. H. Gershuni[2] and S. R. Garfin[2]

Department of Orthopedics[1], University of Gothenburg, Sahlgren Hospital, Gothenburg, Sweden, and Division of Orthopedics and Rehabilitation[2], University of California, San Diego, CA, USA

Introduction: Tourniquets are commonly used in orthopedic surgery, but there is still controversy concerning critical pressures and duration, as well as optimal cuff design. The aims of this study were a) to determine the pressure distribution beneath relatively wide tourniquets applied to legs of varying circumference and b) to determine the relationship between cuff width and shape and the cuff pressure needed to eliminate blood flow in the legs of normal subjects.

Methods: Longitudinal and radial tissue fluid pressure (TFP) distributions were determined beneath and adjacent to wide (12 and 18 cm) pneumatic tourniquet cuffs placed on intact human cadaveric arms (n 6) and legs (n 6), respectively. TFP was measured simultaneously at four depths with slit catheters connected to pressure transducers and a recording system. In volunteers (n 12) with thigh circumferences ranging from 31 to 65 cm, the cuff pressure required to eliminate the pulses detectable by a Doppler device was determined for cuffs with widths of 4.5, 8, 12, and 18 cm.

Results: The tissue fluid pressures showed broad maxima under the center of the cuffs, and generally there were no differences at the various depths studied. Limb circumference was not a determining factor in the transmission of pressure to deeper tissues. In the volunteers, the cuff pressure required to eliminate blood flow significantly decreased as cuff width increased. Thigh circumference was only a determining factor in the pressure required to eliminate blood flow while using the smaller cuffs, but not while using the 18-cm cuff on the leg. Curved cuffs transmitted the pressure slightly more effectively than straight cuffs.

Conclusion: Wide cuffs, especially if slightly curved, transmit a greater percentage of the applied tourniquet pressure to deeper tissues in the leg, thereby requiring lower cuff pressures for blood flow elimination than narrow cuffs. Wide cuffs might therefore be less harmful to the underlying nerve and muscle tissue to obtain a bloodless field.

Fractures in rheumatoid arthritis: A diagnostic and therapeutic problem

Håkan Brattström

Department of Orthopedics, University Hospital, S-221 85 Lund, Sweden

Fractures in patients with RA give specific problems in diagnostics and therapy. Some examples from the Departments of Rheumatology and Orthopedics in Lund and from the office of patients insurance in the Ministry of Health are given.

The "soft parts" of a patient with RA are *not* muscles, capsules, or ligaments, *but* the osteoporotic bone and the sick cartilage.

The diagnosis may easily be missed because 1) there is often no dramatic trauma; 2) the patient is used to pain; 3) the family and the staff are used to complaints about pain; 4) the patient usually takes some sort of analgetic.

Problems in therapy: the patients have a tendency to develop joint stiffness if immobilized in a plaster cast, but the bone may be too osteoporotic for adequate internal fixation.

Conclusions: 1) Handle patients with RA very carefully, especially when under anesthesia; 2) a "new" pain must be thoroughly examined, and radiography and/or scintigraphy considered; 3) improvise treatment.

Myonecrosis and traumatically induced heterotopic bone formation in rabbits

L. Ahrengart[1], U. Lindgren[1], F. P. Reinholt[2] and D. Fisher[3]

Departments of Orthopedics[1] and Pathology[2], Karolinska Institute, Huddinge University Hospital, Stockholm Sweden, and Department of Radiology[3], Clinical Science Center, University of Wisconsin, Madison, WI, USA

Heterotopic bone formation can be produced experimentally by manipulations of otherwise immobilized knees in rabbits. We have studied this process by MRI and histology.

Materials and methods: One hind leg of New Zealand White male rabbits was immobilized by means of a splint with the knee in extension. Every other day, the knee was passively mobilized. Three animals were immobilized withut manipulations. MRI studies were done at different times; and, at the termination of the experiment, sections of the thighs were studied by histology.

Results: The MRI and histology revealed a progressive muscle necrosis limited to m. vastus intermedius. Necrosis was noted already after 4 days and increased gradually, subsequently fibrosis and bone formation occurred. After 3 weeks heterotopic bone was seen on radiographs as a cloudy calcification within the quadriceps muscle. At 30 days the bone had usually fused with the femur. Similar muscle changes, but without bone formation, were seen within the group that was immobilized only.

Conclusions: Immobilization of the knee joint in rabbits causes serious metabolic and structural muscle changes. If passive, repetitive manipulations are added, heterotopic bone develops. This process is limited to m. vastus intermedius, which according to a preliminary study consists mainly of type 1 fibers as opposed to most other thigh muscles. Manipulation of the damaged muscle leads to hemorrhage, which may be important in the initiation of heterotopic bone formation.

Survival time after operative treatment of malignant metastases of the long bones

Anders Sjödin and Claes Olerud

Department of Orthopedics, University Hospital, S-751 85 Uppsala, Sweden

Recent advances in the treatment of malignant diseases have increased the survival time. More patients live longer with metastases, and consequently symptomatic metastases and pathologic fractures of long bones compromise an increasing orthopedic problem. The aims of this study were to analyze the outcome in terms of survival time and complications in patients treated for these conditions.

From 1983, through 1987, 64 patients with 81 metastases of the long bones were treated at our department. Of these we have been able to evaluate 72 operations, 22 in the humerus and 50 in the femur. The primary tumors were breast in 24, myeloma in 20, kidney in 10, prostate in 5, lung in 2, and miscellaneous or unknown in 11 cases. The mean patient age was 65 (35–91) years.

In most cases the patients were treated with reduction and internal fixation in combination with bone cement. Radiation was routinely used if the tumor was considered sensitive. The series was evaluated by examining the charts and the outcome was registered. Life table analysis was applied to the data.

In the series, no direct mortality and only a few complications were noticed. The majority of the patients became pain-free and could be discharged to their homes. A high mortality was seen within the first months. However, 50 percent survived 4 months, 25 percent survived 1.5 years, and 10 percent lived more than 4 years after the operation.

An aggressive attitude to pathologic fractures and symptomatic metastases in the long bones is rewarding.

First years experiences with the bone bank at Huddinge

Claes Nilsson, Göran Sjödin and Gudmund Blomgren

Department of Orthopedics, Huddinge University Hospital, S-141 86 Huddinge, Sweden

Since the beginning of 1987, the bone bank at Huddinge University Hospital has been in clinical use. Living donors have been used.

Patients scheduled for hip replacements, osteotomies, or scoliosis corrections were asked to donate excised skeletal material. During the first year, a total of 58 transplants have been collected, the majority being femoral heads. Fourteen transplants were discarded following positive serology for hepatitis or positive bacterial cultures; the most frequent bacterium was *Staphylococcus epidermidis*. Twenty allografts were used in 18 patients. Two patients received two allografts. Four patients were transplanted in another hospital. The allografts were needed in revision hip arthroplasties, femoral fractures, bone cysts, spinal fusions, osteotomies, and arthrodeses. Clinical and radiographic follow-up show no signs of bone resorptions or infections.

Prediction of the risk of fracture in women

S. A. V. Eriksson and J. U. Lindgren

Department of Orthopedics, Karolinska Institute, Huddinge University Hospital, S-141 86 Huddinge, Sweden

Thirty-six women who had only soft-tissue injuries after a simple fall were compared with 36 age-matched women who sustained a fracture from the same type of trauma. We measured the bone mineral content in the proximal femur with dual photon absorptiometry (Lunar Radiation) and in the radius with single photon absorptiometry. Women between 45 and 70 years of age who sustained a fracture had significantly lower bone density in the proximal femur, and fractured women also had significantly lower grip strength of the hand, In women over 70 years of age, we found no difference in bone density and hand strength between fractured and non-fractured individuals, but the group with fractures had significantly higher body weights than the nonfractured group. A low bone density and a low muscle strength are associated with fracture below the age of 70, but not in higher age groups.

Verapamil treatment increases bone turnover in man

G. Sjödén, M. Rosenqvist, E. Kriegholm and I. Björkheim

Departments of Orthopedics, Internal Medicine, and Clinical Chemistry, Huddinge University Hospital, S-141 86 Huddinge, Sweden

Introduction: Verapamil is a calcium channel blocker widely used for treating hypertension, angina pectoris, or cardiac arrythmias. In rats, verapamil inhibited the intestinal absorption of calcium (1). However, there were no such effects on human calcium absorption (2). To establish if the skeleton was affected by verapamil, this study was undertaken.

Patients: Seventeen patients (14 males and 3 females, mean age 56 [41–75] years) with hypertension (WHO grade I–II) or angina pectoris were included in the study.

Methods: Serum and single urine specimens were obtained from the patients after overnight fasting. The patients were then given verapamil (Isoptin®, Knoll AG) at a dose of 80–120 mg three times daily. After 2 months' treatment, fasting blood and urine specimens were again obtained. Two-tailed paired *t*-tests were performed and statistical significance was set at $P < 0.05$.

Results: Following verapamil treatment, there was an increase in ALP levels (2.72 μkat/L±1.04 vs. 3.20 ±1.23; P = 0.01) and skeletal ALP isoenzymes became evident. The serum levels of $1,25(OH)_2D_3$ were unaffected by verapamil (16.7 ng/L±4.3 vs. 17.8 ±8.0; NS). There was no significant increase in serum iPTH (1.00 μg/L±0.80 vs. 1.16 ±0.57) or any change in the serum calcium concentration (2.42 mmol/L ±0.10 vs. 2.39 ±0.12; NS) or of the excretion of calcium in urine (Ca/creatinine ratio 0.31 ±0.19 vs 0.31 ±0.25).

Conclusion: Verapamil, at doses recommended for clinical use, increases serum ALP; and skeletal ALP isoenzymes

become present. The development of a secondary hyperparathyroidism following verapamil treatment cannot be excluded. Verapamil treatment affects the skeleton probably by increasing bone turnover. Whether or not verapamil induces osteopenia in humans will need further investigations.

References

Sjödén, G. et al. *Calc Tiss Int* 1985;35, Suppl A32.
Sjödén, G. et al. *Br J Clin Pharm* 1987;24:367–371.

The prediction of fractures in women and men using forearm bone densitometry

O. Johnell, P. Gärdsell and B. E. Nilsson

Department of Orthopedics, Malmö General Hospital, Malmö, Sweden

See abstract in Proceedings of the Scandinavian Orthopedic Association, 44th Assembly, Århus, Denmark, June 8–11, 1988, *Acta Ortop Scand* 1988;59 Supplement 227.

The predictive value of fracture, disease, and radiographic examination for fragility fractures in women and men

P. Gärdsell, O. Johnell and B. E. Nilsson

Department of Orthopedics, Malmö General Hospital, Malmö, Sweden

See abstract in Proceedings of the Scandinavian Orthopedic Association, 44th Assembly, Århus, Denmark, June 8–11, 1988, *Acta Ortop Scand* 1988;59 Supplement 227.