6. The screw fixation used for the posterior malleolus was not broken in any of the experiments.
7. The main loaded areas of the tibia surface were the 2nd and 3rd quarters.
8. The 1st quarter of the tibia was partially loaded.
9. The main loaded areas of the talus surface were the 2nd and 3rd quarters.

169. Similar pattern of injuries in two patients involved in the same road traffic accident

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A 48- and a 25-year-old female were involved in the same road traffic accident. They were the rear seat passengers in a motor vehicle which was involved in a rear-end collision. On admission to hospital the younger patient complained of pain in her lower neck, diffuse abdominal discomfort, right hip, left thigh and left leg pain. During examination she was fully conscious, neurologically intact, had a decreased range of movement in the cervical spine, right hip and left knee, and there were clinical signs of a fracture in the left femur and lower tibia. Plain radiography revealed C6–C7 subluxation, an undisplaced fracture of the right acetabulum, a fracture of the left femur, an avulsion fracture of the medial intercondylar tubercle left upper tibia and a fracture of the mid shaft of the left tibia. Diagnostic peritoneal lavage was positive for intra-abdominal hemorrhage and a laparotomy followed by splenectomy was performed as a matter of emergency.

The older patient was fully conscious but tetraplegic (neurological level C6) with contusions of the forehead, a painful neck and virtually nil movements of the cervical spine. Further clinical examination revealed an obvious left thigh, left leg and left forearm deformity. The radiological examination showed a C6 burst fracture-dislocation, a fracture of the right acetabulum, a fracture of the left radius and ulna, a fracture of the left femur and a fracture of the left tibia and fibula. Again, splenectomy was performed in this patient shortly after her admission.

As regards the orthopedic operations for both patients, they were deferred until their general condition became stable.

Hip fracture

170. Walking ability is better after osteosynthesis than after hemiarthroplasty in femoral neck fractures

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Introduction: Femoral neck fractures can be primarily treated with osteosynthesis or arthroplasty. Both methods have well known early and long term complications. A 50% five year survival makes long time functional capacity following different procedures important in the difficult choice of method.

Patients: In the Lund Department of Orthopedic Surgery, 1,066 consecutive patients were primarily treated by osteosynthesis. 124 survivors with a mean follow-up of 7.7 years were available as potential matched controls.

At the Oulu Department of Surgery 401 consecutive patients over 65 years of age were treated with an uncemented Austin Moore hemiarthroplasty through a postero-lateral incision. A few patients older than 65 had been treated with osteosynthesis and a few patients younger than 65 had hemiarthroplasty on special indications. Of 75 patients without revision surgery for complications, 33 (5 men and 28 women) with a mean follow-up of 6.6 years were available for the investigation.

In the hemiarthroplasty group, 5 men, 69 (64–75) years old at follow-up, and 28 women, 81 (63–99) years old, were matched with 5 men, 68 (62–74) years old, and 28 women, 81 (62–98) years old, with osteosynthesis.

Method: All patients were sent a questionnaire concerning social circumstances and walking capacity. The Swedish version of the Nottingham Health Profile (NHP) was mailed to the Swedish group and a Finnish translation to the Finnish group. Matching was considering age and sex as well as living alone and heart disease.

Results: In the osteosynthesis group 7/33 and in the hemiarthroplasty group 14/33 patients were confined to wheel chair, rollator or other person's assistance when walking outdoors (p=0.02), 14/30 patients in the osteosynthesis group could walk at least a block as compared to 3/33 in the hemiarthroplasty group (p=0.002). No difference was found in the patients' opinion on pain at rest and pain on walking. In the osteosynthesis group 12/32 considered their walking ability unchanged compared to prefracture, only 5/32 in the hemiarthroplasty group (p=0.05).

According to the NHP the osteosynthesis group had better physical mobility than the hemiarthroplasty group (p=0.01). The scores for social isolation (p=0.005) and motion (p=0.001) were also better while the difference in other aspects was not significant.

Conclusion: In a long term follow-up (4–12 years) this study indicates that walking capacity is better following a

femoral neck fracture osteosynthesis than after primary hemiarthroplasty. This aspect of femoral neck fracture treatment should be further investigated in randomized studies considering functional capacity, not only in short but also in long time follow-up, since reduced walking capacity is a threat to the social independence of the aged.

171. Hastings bipolar hemiarthroplasty in femoral neck fractures

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In 1984–1990, we treated 332 patients with 340 femoral neck fractures with Charnley-Hastings hemiarthroplasty: 296 women and 37 men, median age 80 (40–95) years. 107 prostheses (31%) were inserted primarily because of severely dislocated or old fracture, or failed reduction whereas 233 prostheses were inserted median 3 (0–60) months after the injury because of early mechanical failure (160), nonunion (30), or late segmental collapse (43). There were no differences between the primary and secondary replacements regarding morbidity, mortality or prosthesis failure. 37 patients (10.9%) died within 3 months of the operation. Nine patients were lost for follow-up. The major postoperative complications were: early wound infection in 10 (2.9%), dislocation of the prosthesis in 16 (4.7%), fracture of femoral shaft in 9 (2.6%), loosening with reoperation in 6, and late hematogenous infection in 2. The reoperations were: open reduction of dislocation in 12, debridement in 4, change of femoral component in 4, conversion to Charnley total hip in 5, plate osteosynthesis in 6, and conversion to Girdlestone hip in 2. Nonsurvival of the prosthesis was defined as dislocation of prosthesis, fracture, removal of part or whole prosthesis, loosening with pain, or protrusion. The survival rates were after 3 years 88% (119 hips) and after six years 82% (12 hips).

172. Intracapsular pressure and femoral head bone circulation in femoral neck fractures

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An increase in the intracapsular pressure caused by hemarthrosis has been pointed out as an inducing factor of posttraumatic avascular necrosis following femoral neck fractures. Aspiration of intracapsular hematoma has been said to produce an increase in femoral blood flow measured by intra-osseous pressure, shielding femoral head bone from necrosis. We study the variations in intracapsular pressure after changes in hip position, hip traction and aspiration of hemarthros. Furthermore, the influence of all these factors on the development of femoral head necrosis was analyzed.

Patients and methods: A consecutive series of 34 patients with femoral neck fractures (11 Garden I–II and 23 Garden III–IV) was included in a prospective study. Under anesthesia and before internal fixation, intracapsular pressure was recorded with the hip in different positions. Pressure was measured before and after aspiration of the hemarthrosis. Prior to surgery (mean 3 days after trauma), ^{99m}Tc-MDP scintimetry was performed in order to evaluate bone blood flow in the femoral head. Results from scintimetry were evaluated with the head-to-head ratio as described by Strömqvist (1983). Patients were followed during 3 years for detection of avascular necrosis.

Results: Before aspiration, the mean intracapsular pressure in the physiological position (20°–30° hip flexion, 10°–20° abduction and 30°–45° medial rotation) was 44.4 mmHg. Pressure was maximal (mean value 124.8 mmHg) with the hip in extension, adduction and inward rotation, surpassing the blood systolic pressure in some cases. When a 3 kg traction was applied to the extremity in physiological position, the mean intracapsular pressure decreased to 28.1 mmHg. After aspiration, the mean pressure in this position was 37.4 mmHg. Again, in this position, intracapsular pressure had no correlation with the amount aspirated or the duration of the hemarthrosis. Segmental collapse of the femoral head due to avascular necrosis was detected in 6 cases. In the preoperative scintimetry, all these patients disclosed a head-to-head ratio lower than 0.80, showing a decrease in bone blood flow on the fractured side. In only one of these cases, intracapsular pressure was greater than 80 mmHg, a value indicating a risk for tamponade effect. There was no significant correlation between intracapsular pressure and ^{99m}Tc-MDP scintimetry ratio, although a trend was observed—increasing intraarticular pressure corresponded to decreasing bone isotope uptake. Blood flow measured indirectly by scintimetry was not significantly related to the amount of hemarthrosis aspirated.

Conclusion: Aspiration of hemarthrosis does not induce a significant decrease in intracapsular hip pressure. Traction of the extremity in physiologic position is more effective in preventing bone flow tamponade of the femoral head. In our series, most of the patients who developed femoral head necrosis had intracapsular pressure below their diastolic blood pressure. This fact may indicate that vascular damage related to the fracture could be the cause of bone necrosis instead of reduction of blood supply due to tamponade.

Reference

Strömqvist B. Femoral head vitality after intracapsular hip fracture. Acta Orthop Scand 1983; Suppl. 200: 1–71.

173. Hip fractures prevented by external hip protectors. A randomized nursing home study

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Aim of the study: Most hip fractures seem to be related to a direct trauma to hip. We studied the effect of external hip protectors to prevent hip fractures in a nursing home.

Methods and patients: During the period February to December 1991 (11 months) 665 nursing home residents were randomized to receive external hip protectors. The treatment group comprised 167 women and 80 men, while the control group comprised 277 women and 141 men. A prospective fall registration was performed in selected departments of the treatment and control groups. Results given with 95% confidence limits.

Results: The number of hip fractures in the intervention group with hip protectors and control group was respectively 8 and 31, while the number of other nonhip fractures was 15 and 27. The relative risk of hip fractures among women in the intervention group was 0.46 (0.14–0.79) and 0.29 (0–0.84) among men. The estimated annual incidence of falls was 1580 per 1000 persons. The percentage of residents who experienced at least one fall during the study period was 82% and 70% for respectively women and men. The percentage of repetititve fallers was 29% and 21% for respectively women and men. 19% of the 154 registered falls had an impact directly on the hip. The risk of hip fracture in case of a direct trauma to the hip was 53%. Six out of the 10 patients who were registered with a fall and a hip fracture had a direct trauma to the hip, while 4 nursing home residents were not able to describe the trauma.

Conclusion: The external hip protectors were found effective to prevent hip fractures associated with an direct trauma to the hip. The study also confirmed the hypothesis that a direct trauma to the hip is essential in hip fractures.

174. Nonoperative treatment of impacted femoral neck fractures—a preliminary report of a prospective study

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Material: A prospective study of functional treatment of impacted femoral neck fractures was started in January 1991. Patients with radiologically impacted fractures (Raaymakers and Marti 1991) who were able to lift the knee from the bed were included. Fractures with the proximal fragment retroverted more than 30 degrees were excluded from the study and treated as displaced fractures. We present results from 25 patients, 22 women and 3 men. Their mean age was 76 (56–92). The patients were mobilized the day after injury if possible and instructed partial weight bearing (i.e. 15–20 kg). Radiographs were taken every 2nd week during 6 weeks, or when the patient noticed increased pain. At admission, all proximal fragments were tilted in valgus (0°–30°, median 8°) and retroversion (0°–26°, median 6°). The size of the femoral heads measured as the distance from the center to the fracture line was median 13 (6–25) mm. 11 fractures were Pauwel's type 1 (inclination of the fracture line 0°–30°) and 14 fractures type 2 (30°–60°). During the observation period, secondary instability and displacement occurred in 13 of 25 patients, these were treated with hemiarthroplasty. A stepwise logistic regression analysis did not point out any significant risk factor in the material.

Discussion: The failure rate in the present study was disappointingly high. Further investigation hopefully reveals risk factors and helps in defining criteria for conservative treatment.

References

Raaymakers and Marti. J Bone Jt Surg 1991; 73B: 950.

175. Femoral head and neck fractures —absorbable implants in the fixation —an experimental and clinical study

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Introduction: The use of absorbable rods in the fixation of experimental femoral neck osteotomies has been described (1). An experimental femoral neck osteotomy in sheep may provide a fitting model to test the possibilities to treat upper femoral fractures with this new method based on the absorbable fixation. After earlier and own experimental studies we could start the clinical use of absorbable fixation devices in the treatment of upper femoral fractures.

Experimental material and methods: 13 osteotomies were fixed with 2 absorbable self-reinforced poly-L-lactide (SR-PLLA) lag-screws and 6 osteotomies with standard metallic cancellous bone screws. Domitor® and Ketalar® anesthesia were used. Prophylactic antibiotic (Procapen®) and antiflogistic (Reumuzol®) drug were used for three days. After lateral exposure the femoral neck was exposed and osteotomy performed with oscillating saw. The reduction was performed with clamps. After drilling with 3.2 drill the special tapping device was used and the screw inserted with special screwdriver. The radiographical analysis was done after three weeks.

Clinical materials and methods: The implant used in the clinical study was a screw made of poly-L-lactide handled by a special self-reinforcing technique, 6.3 mm in outer diameter and 79 to 110 mm long. Four femoral neck fractures were fixed with three screws—two Garden I fractures, one Garden II and one Garden IV. For the four femoral head fractures the SR-PLLA screws 3.2 mm in inner diameter and with additional absorbable 2.0 mm rods of SR-PGA or SR-PLLA were used. The patients were examined after 3, 6 and 12 weeks and 6 and 12 months postoperatively.

Experimental results: There was one failure and one insignificant displacement in the sheep treated with absorbable (n=13) and metallic screws (n=6). Callus formation was similar in both groups.

Clinical results: In femoral head fractures the early healing was uneventful, but later one has been reoperated because of aseptic necrosis. Three patients maintain their previous activities. The first patient, who had a significant post-operative myositis ossificans was reoperated later on. Three of four femoral neck fractures have healed uneventfully. The patient with a Garden IV fracture redislocated 3 weeks postoperatively and was treated with total arthroplasty. The patients are followed for on an average 12 (1–29) months.

Discussion and conclusion: After experimental studies and the early clinical experience we conclude that certain femoral neck and head fractures can be treated with absorbable screws and rods only.

References

1. Rokkanen P, Vasenius J, Laitinen O, Pohjonen T, Törmälä P, Vainionpää S. Healing of subcapital femoral osteotomy after fixation with absorbable self-reinforced ultra-high strength poly-L-lactic acid (SR-PLLA) pins. Abstract. EORS November 11–12, 1991, Paris, France.

176. Multicentric randomized study on screw osteosynthesis of femoral neck fractures

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During 1991 we included 321 women and 83 men, mean age 77 years (SD 10) years into a randomized study where a femoral neck fracture was fixed with 3 Ullevaal hips screws —a new hip screw system—or an alternative method: 2 Olmed screws in Oslo, Stavanger and Huddinge, 2 Tronzo screws in Akershus, and 3 Mecron screws in Helsinki. Minimum follow-up time was 3 months.

Table 1. 3-month results of osteosynthesis

	N	Reoperated patients
Ullevaal	181	14
Olmed	132	10
Tronzo	47	2
Mecron	13	0

Table 2. Comparison of the bone problems in the two largest groups

Screw	Hospital	N	Normal healing	Bone problems
Ullevaal	Ullevaal	26	23	3 (12%)
Olmed	Ullevaal	33	16	17 (51%)
Ullevaal	Other	149	116	33 (22%)
Olmed	Other	98	71	27 (28%)

The results concerning reoperation rates were similar (Table 1). When the two largest groups, Ullevaal and Olmed screws were compared (Table 2), healing problems, such as lost reduction, backing out of screws, and perforation of the femoral head, were least frequent with Ullevaal screw in Ullevaal Hospital where the method was developed.

Our preliminary conclusion is that several hip screw systems using 2 or 3 screws give similar results in a short term study.

177. Factors influencing healing after internal fixation of intracapsular femoral neck fractures

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Introduction: Internal fixation of displaced femoral neck fractures leads to early failure (nonunion) in 15–40% of all cases. These cases can be selected for primary arthroplasty, if we are able to predict nonunion by the presence of specific factors.

Purpose: To assess the prognostic significance of a number of factors with possible influence on the healing (after internal fixation) of femoral neck fractures.

Patients and methods: Since January 1987 all cases of hip fracture in Århus County has been registered in a prospective multicenter investigation. The following variables are registered for each patient: the date of birth, gender, the date and hour of fracture, the date and hour of admittance, prefracture social setting, prefracture walking ability, fracture type, date and hour of surgery, treatment, date of discharge, postfracture social setting and the date of death.

All patients entered into the above mentioned registry with a femoral neck fracture (Garden type 1–4) treated with

internal fixation and followed (roentgenographically) for at least one year after surgery (or until failure) had their radiographs reviewed (N = 254). Preoperative radiographic variables recorded were Garden type, posterior angulation, Singh's index. Postoperative radiographic variables registered were reduction quality (angulation, displacement), osteosynthesis method, distance from joint line to osteosynthesis material, the number of screws in each head sector, parallelity of screws and calcar support for the screws. Besides the radiographic variables the following independent variables were entered into the model: Age, gender, the delay from admission to operation, living alone versus not living alone, status as a nursing home patient, home-assistance versus no home-assistance and prefracture walking ability. The complications registered were nonunion and collapse of the femoral head. A backward stepwise (p-entry = 0.05) logistic regression model was used for statistical analysis (Software: SPSS), dependent variable nonunion.

Results: Displaced fracture versus nondisplaced fracture had a risk ratio of 2.71 for nonunion (p = 0.03, SE 0.47), postoperative varus angulation versus no angulation had a risk ratio of 4.15 for nonunion (p = 0.005), postoperative displacement exceeding or equal to 5 mm in any direction versus a displacement of less than 5 mm had a risk ratio of 3.56 (p = 0.001, SE = 0.39) and placement of at least half of the screws in the upper lateral head sector versus placement of less than half of the screws in the upper lateral sector had a risk ratio of 3.98 (p = 0.02, SE = 0.60). None of the other factors mentioned above had significant prognostic influence on the dependent variable nonunion.

Discussion and conclusion: The most important prognostic factor was the quality of reduction followed by the position of the internal fixation material and the Garden type. The type of internal fixation device (sliding screw versus multiple screws) had no significant effect on the occurrence of nonunion. Comparative studies of one internal fixation device versus another do not always evaluate the quality of reduction—an important source of bias. Failure to achieve adequate reduction must be considered a strong argument in favour of proceeding with primary hip arthroplasty (hemi- or total hip arthroplasty).

178. Subtrochanteric femoral fractures—a review of 106 surgically treated patients

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The treatment of unstable subtrochanteric fractures is still controversial, reflected by the great number of devices, from ordinary sliding screws to different types of endoprosthesis, designed to solve this problem. The risk of complications in surgically treated subtrochanteric fractures is higher than in other types of femoral fractures. The aim of the internal fixation is to achieve anatomic reduction and stability of the fracture.

We report a study consisting of 106 subtrochanteric fractures operated in our department from 1980 to 1990. Patients with pathologic fractures of fractures below an endoprosthesis were excluded from the study. There were altogether 62 women and 44 men; the mean age was 57 years, ranging from 20 to 95 years.

We used the ASIF-fracture classification, since it proved simple and useful identifying the fracture pattern and the degree of comminution. It also served as a guide to treatment.

The reduction and internal fixation of the fracture was done on the traction table controlled by two-plane fluoroscopy with image intensifer. The ASIF 95° condylar plate was used in 25, the ASIF 130° intertrochanteric plate in 15, the dynamic condylar screw (DCS) in 46, a gliding screw device in 26 and an intramedullary locking device in 8 cases. Autogenous bone transplant was added in 68 patients.

At the end of the follow-up period (mean 4.6 years) the results were rated as good in 73%, fair in 18% and poor in 9%. The ASIF 95° condylar plate and the dynamic condylar screw (DCS) was significantly (p<0.01) more suitable than the gliding screw device. Bone grafting should routinely be carried out in all elderly patients and in all comminuted fractures.

The failures in our study were caused either by poor primary reduction, inadequate internal fixation, loss of medial cortical support, or by too early weight bearing. Fracture instability was seen as an early loosening of fixation, delayed union or nonunion, infection or as late fatigue fractures of the implant. In general, surgical treatment of subtrochanteric fractures is challenging but rewarding.

179. Gamma nail versus DHS in the treatment of trochanteric and subtrochanteric fractures

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A prospective randomized multicenter study of 299 cases was carried out May 1989–January 1991. There were 224 women and 75 men. The mean age was 81 for women and 73 for men. The trochanteric fractures were classified according to Evans: 108 cases were Evans types 1 and 2 and 165 Evans types 3, 4 and 5. The 26 subtrochanteric fractures were classified according to Seinsheimer.

There were no difference between the two groups in mean operating time, operative blood loss, wound drainage or postoperative hemoglobin level. Twenty-four patients died during the first six months in the DHS group and 22 in the gamma group. There was one deep infection in the DHS group and two with gamma nailing. The compression screws cut out from the femoral head in six cases in the DHS group and in 10 cases in the gamma group. Eight patients suffered a femoral shaft fracture peroperatively or during the first three postoperative months.

In the 3- and 6-months review there were no differences between the two groups in walking capacity or accommodation. Immediate weight bearing was allowed for all patients in the gamma group. Significantly more patients in the gamma group had pain in the trochanter region. The telescoping capacity was significantly less with the gamma nail and there was a significantly higher tendency of varus angulation. There was a non significant tendency of better healing in the gamma group. In the DHS group six patients had to be reoperated on—in the gamma group 12. In the DHS group there were 12 secondary admissions—in the gamma group 31.

We concluded that the gamma nail allowed immediate weight-bearing and provided a safe fracture healing in a good position but that it required considerable surgical expertice.

180. Factors predicting failures of internal fixation in trochanteric hip fractures—a multivariate analysis comparing Ender pins and a dynamic hip screw

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So far, few prospective randomized studies have compared the outcome of femoral trochanteric fractures treated with flexible fixation according to Ender versus the sliding compression hip screw. In these reports, the identification of factors influencing or predicting failure has not been evaluated by multivariate analysis. This investigation addresses this issue in a prospective, comparative study of patients with intertrochanteric fractures of the femur randomly treated with either Ender pins or a dynamic hip screw.

Patients and methods: During a 3-year period, 149 patients over 50 years of age with a trochanteric fracture of the femur were included in a trial. There were 103 women with a mean age of 79 years and 46 men with an age average of 72 years. The random allocation disclosed 90 patients treated with DHS and 59 with Ender pins. The operations were performed by 12 surgeons, 7 of whom had completed their orthopedic training and were considered as experienced. The remaining 5 were in their residence program and regarded as nonexperienced. During follow-up, radiographic assessments were performed 2 weeks, 6 weeks, 3 months, and 6 months after surgery. Of the 149 patients involved in the study, 113 patients could finally be evaluated. The DHS was applied to 70 patients and Ender pins to 43. The groups were matched regarding age, sex, type of fracture and experience of the surgeon. Factors predicting failure or complication, stability of the fracture, quality of reduction, position of device, experience of the surgeon and osteoporosis, were noted.

Results: At 6-month follow-up, 18 fractures (3 stable and 15 unstable) operated on with Ender pins failed in healing or healed with complications. In the DHS group, similar cases were found in 23 fractures, 5 stable and 18 unstable. A statistically significant difference between the two fixation methods was detected only in unstable fractures ($p<0.05$). By univariate analysis, there were some factors related to a failed or complicated healing. In the Ender group, these factors were found to be an unstable fracture type ($p=0.02$) and a nonsatisfactory reduction of the fracture ($p=0.01$). In the DHS group, the closest correlation was found with nonsatisfactory reduction ($p=0.0001$), and less strong correlation with unexperienced surgeon ($p=0.01$) and unstable fracture type ($p=0.02$). Applying multivariate analysis, 4 factors were associated with radiographic healing complications in cases treated with DHS: unexperienced surgeon ($p=0.0005$), nonsatisfactory reduction ($p=0.003$), unstable fracture ($p=0.03$) and abnormal osteoporosis index ($p=0.03$). In the Ender group, the only factor with independent correlation with the failed or complicated healing was instability of the fracture ($p=0.01$). Sex, age (<75 years or >75 years) and position of device had no correlation with the healing of fracture in any of the two groups, Ender or DHS.

Conclusions: Our findings indicate that, to ensure satisfactory outcome, strict adherence to proper operative technique and experienced hands are more essential when using a DHS than the Ender procedure for fixation of trochanteric fractures of the femur.

181. Health care consumption after hip fracture

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Introduction: During the last decade, advances in orthopedic technology (1) have allowed elderly hip fracture patients a rapid mobilization and a shortened stay in acute hospitals. But what happens after discharge?

Patients and methods: Data on all patients in the Stockholm county operated on for acute hip fracture during the last consecutive years were gathered from the official health statistics. We calculated: mean length of hospitalization in the acute hospital, length of stay in nursing homes

and rehabilitation hospitals, and the total number of hospital days up to one year after the accident, irrespective of diagnosis.

Results: Throughout the observation period there was a constant decrease in the mean hospital stay in acute hospitals. This trend is, however, less apparent in the total hospital stay, i.e. the number of hospital days in acute and rehabilitation hospital—there was no significant change in the total number of hospital days (all diagnoses included), one year after the fracture.

Discussion: Our results indicate that it would be beneficial for this group of patients if an economic incentive for an efficient rehabilitation were created. The prospective payment system for diagnose related groups—which is now being implemented in the Scandinavian countries—have been reported to worsen the outcome for patients with hip fractures (2). In order to further improve the results after hip fractures in the elderly a continuous cost-benefit appraisal for the total rehabilitation resourses is urgently needed.

References

1. Thorngren KG. Optimal treatment for hip fractures. Acta Orthop Scand 1991; 62 (Suppl. 241): 31-4.
2. Fitzgerald JF, Moore PS, Dittus RS. The care of elderly patients with hip fracture. Changes since implementation of the prospective payment system. N Engl J Med 1988; 319: 1392–7.

182. Prospective comparison of hip fracture treatment in Holland (Rotterdam), and Sweden (Sundsvall and Lund)

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Within a prospective multicenter study hip fracture patients were in 1989–1990 registered in Rotterdam (Holland) as well as in Sundsvall and in Lund (Sweden). For femoral neck fractures hemiarthroplasty was the predominating operation method in Rotterdam (n=169), whereas osteosynthesis was used in Sundsvall (screws n=135) and Lund (hook pins n=149). The patients operated with these methods had very similar background parameters with a mean age of 79-80 years and living alone of 46-57%. About 80% came from independent living and 30% had home help. The mortality within the first 10 days (30 days) of hospital stay was 2% (7%) in Rotterdam, 1% (2%) in Sundsvall and 0% (0%) in Lund.

The mean (and median) stay at the operating department was 32 (20) days in Rotterdam, 16 (12) days in Sundsvall and 17 (10) days in Lund. In Rotterdam 68% were discharged to independent living, in Sundsvall 72% and in Lund 53%. Before and up to 4 months after operation the capacity for activities of daily living (ADL) and walking ability was very similar in all hospitals.

For trochanteric fractures screw-plate was the predominating method in Rotterdam (n=146) and Lund (n=78) whereas Ender nails were used in Sundsvall (n=117). When patients operated with these methods were compared, the background parameters were, again, similar. Mortality within the first 10 days (30 days) of hospital stay was 1% (4%) in Rotterdam, 3% (9%) in Sundsvall and 6% (8%) in Lund.

The mean (and median) stay at the orthopedic department was 39 (29) days in Rotterdam, 24 (15) days in Sundsvall and 19 (11) days in Lund. Discharge to independent living was 44% in Rotterdam, 57% in Sundsvall and 39% in Lund. The ADL activity and walking ability did not differ much.

183. Years of potential life lost (YPLL) after hip fracture among postmenopausal women

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Introduction: Years of potential life lost (YPLL) per death is calculated by taking the difference between the midpoint of the age range and the remaining life expectancy at that age from a lifetable (life expectancy method) (Center for Disease Control 1986). YPLL can assist in the performance of three basic public health functions: the establishment of research and resource priorities, the surveillance of temporal trends in mortality and the evaluation of the effectiveness of program intervention.

Purpose: To quantify and compare YPLL after fracture of the hip among postmenopausal women with YPLL after ischemic heart disease, cerebrovascular disease, breast cancer and cancer of the uterus.

Material and methods: From January 1987 and onwards all cases of hip fracture in èrhus County have been registered in a prospective multicenter investigation. Until December 1990, 2,273 postmenopausal women with first hip fractures were registered. Only 643 of these sustained a hip fracture in 1988. Life tables were constructed for different age groups. These life tables were compared to the life tables for the standard population in èrhus county and the excess mortality in each age group was calculated. The number of deaths caused solely by hip fracture was calculated by multiplying the number of hip fractures in the year 1988 (separately for each age group) with the excess mortality in that particular age group. The YPLL rate per 1000 persons was calculated according to the life expectancy method (Center for disease control 1986). The YPLL rate was adjusted to the age distribution of the female Danish population in 1988 according to the direct method.

This rate was compared to the YPLL rates for other selected conditions calculated on the basis of official vital statistics.

Results: The excess mortality was 9.8% (50–69 years), 15.4% (70–79 years), 19.7% (80–89 years) and 14.1% (> 90 years). The YPLL rates (per 1000 persons) were as follows: Hip fracture 9.2, ischemic heart disease 73.1, cerebrovascular disease 28.8, breast cancer 19.6 and cancer of the uterus 6.7.

Discussion and conclusion: Death represents the most serious consequence of a hip fracture. With increasing age specific incidences of hip fracture YPLL rates will also increase. Hip fracture mortality data should be continuously monitored to detect any changes. The concept of YPLL offers an effective instrument to achieve this.

References

Center for Disease Control. MMWR 1986; 35 (Suppl. 2S): 1–11.

184. Body fat distribution and hip fractures

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Background: Low body weight is a major risk factor for hip fractures, besides, women with osteoporosis seem to have a more android body habitus. No studies have described the body fat distribution in patients with hip fractures.

Methods: In a cross-sectional study we measured anthropometric variables including thickness of adipose tissue covering the hip and abdomen in women (n=41) and men (n=20) with hip fractures and in controls (F/M=17/9).

Results: Women with hip fractures had a mean body mass index (BMI) of 22.9 kg/m^2 compared with 25.1 kg/m^2 in controls ($p<0.05$). The thickness of adipose tissue covering the hip was on an average 3.0 cm compared with 3.6 cm in the controls ($p<0.05$). In contrast no difference was found in thickness of abdominal adipose tissue (patients; 2.5 cm and controls; 2.6 cm). Both men with hip fractures (BMI=24.7 kg/m^2) and controls (BMI=25.5 kg/m^2) had a mean layer of 2.2 cm adipose tissue covering the hip. The waist-hip circumference ratio (WHR) was found to be significantly related to BMI adjusted for age and smoking habits only in women with hip fractures and in men. In control women no association between WHR and BMI was found ($p=0.57$). Smoking was more prevalent in the fracture groups, and smoking tended to be related to an increased deposition of fat centrally as reflected by a closer relationship between WHR and BMI in the fracture groups as compared to controls.

Conclusion: The diminished fat padding of the hip, which is related to low body weight and android body habitus, increases the risk of hip fractures probably due to a reduced local energy absorptive capacity. In addition, the hormonal profile related to android body habitus may also modify the strength of bone. The fat pattern is determined by genetic factors and age, and can be modified by smoking and hormones.

185. Swedish multicenter hip fracture study

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A multicenter study of hip fractures in the elderly has been introduced in Sweden to compare different methods of surgery, mobilization and rehabiliation. Data concerning the hospital stay are, prospectively, registered on printed forms by the operating department. There is also a patient inquiry, which gives follow-up functional parameters at four months after the operation. Data are reported on data disks through a special program for personal computers. The project now covers more than half of the Swedish hospitals.

To exemplify, total data are given from fully participating hospitals in 1988 (n=3,956), 1989 (n=4,396), 1990 (n=4,762) and 1991 (n=3,204). The background parameters were very stable over the years. Three fourths (72–73%) were women. Mean age at fracture was 78, 78, 79 and 79 years. Half of the patients (47–52%) were living alone. One fourth (22–24%) had home help before fracture and then on average 6–8 hours per week. Three fourths (73–74%) managed ADL before fracture. Mean hospital time decreased during the period: 19 days in 1988, 18 days in 1989, 17 days in 1990 and 15 days in 1991. The median hospital time decreased: 14, 13, 13 and 12 days. The mean time from fracture to operation was 1 day.

In 1988 (values for 1991 in parenthesis) there were among these hospitals 9% (10%) operations with von Bahr screws and 10% (18%) with other screws. Hook-pins were used in 31% (24%). There were 31% (38%) operations with sliding screw- plate and 9% (1%) Ender nailing. During the time in hospital 3% (2%) reoperations were performed and the average mortality was 6% (4%).

Before fracture 65% (64%) of the patients were living in own home and 19% (19%) in old peoples' homes. The remainder lived in nursing homes or geriatric hospitals. Direct discharge from the orthopedic department to origin was 50% (53%). Of the patients originally coming from own home three fourths had returned there at 4 months after the fracture. The special graph showing daily changes in habitat for all patients showed a stabilized pattern at around 45 days after the fracture. Then most patients had returned to their original habitat.

186. Swedish experience of the first 209 randomized patients with gamma nail vs. screw-plate

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A prospective randomized multicenter study is currently performed in Scandinavia. In Sweden an analysis of the first 209 cases has been carried out. All fractures were operated with the original 20 cm gamma nail or with a standard compression hip screw device (Richards' Classic or Synthes' DHS). There were 105 gamma nails and 104 screw plates performed. Pertrochanteric (n=190) and subtrochanteric (n=19) fractures were equally distributed between the two groups.

No difference was found in preoperative background parameters between the two groups (age, sex, type of residence, mobility). Total blood loss (intra- and postoperative) differed slightly. Mean (median) blood loss was for all gamma nails 300 (250) ml and for the CHS group 440 (300) ml ($p<0.01$), whereas in the subtrochanteric subgroup the gammas bled 480 (500) ml, and the CHS 1090 (880) ml ($p<0.05$).

The mean (median) operating time for the pertrochanteric fractures was for the gamma nails (n=96) 68 (65) minutes and for the CHS (n=94) 56 (45) minutes ($p<0.01$). For the subtrochanteric fractures the corresponding times were for the gamma nails (n =9) 70 (70) minutes, and for the CHS (n=10) 109 (107) minutes ($p<0.05$).

There were 16 peroperative difficulties in the gamma group and 10 in the CHS group. In the gamma group, the most common problem during operation was insertion of the distal locking screws. The femoral head screw was repositioned in one case. In the CHS group repositioning of the femoral head screw was done in two cases, one at a reoperation. In the CHS group during operation one fracture extended from per- to subtrochanteric. No peroperative such fracture was encountered in the gamma group. Two CHS cases had excessive bleedings >2.0 L, and another 6 cases >1.0 L while none in the gamma group exceeded this value.

Length of hospital stay was almost identical. Mean (median) hospital stay was 17 (13) days in the gamma group and 16 (14) days in the CHS group. In both groups three fifths of the patients could be sent back to the same habitat as pre-operatively.

One deep infection and 8 superficial were noted in the CHS group. In the gamma group 12 superficial infections were seen. Four thromboses appeared in the gamma group but none in the CHS.

Patients were followed-up 6 months postoperatively. Data were also collected from the Swedish Multicenter Hip Fracture database. We saw no significant differences in fracture healing, walking ability, accomodation or home care need after six months.

At 6 months' follow-up 18 patients were dead in the gamma group and 23 in the CHS group. There were 4 delayed unions and 2 pseudarthroses in the gamma group, and 5 and 2, respectively, in the CHS group. In the gamma group one patient with subtrochanteric fracture had been reoperated with a longer gamma nail. Gliding-screw cut-outs occurred in 3 cases and refractures/dislocations in 2 cases, in each group. One infected CHS had an operative revision. In all, 6 reoperations had to be performed in the gamma group versus 8 in the CHS group.

We concluded that the new gamma nail device for trochanteric fractures appeared in this first analysis to be comparable with the compression hip screw device. It required less operating time and hemorrhage in the subtrochanteric cases.

187. Garden III and IV subcapital fractures treated by open reduction and muscle pedicle bone graft—a new method by A. Renieris

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From February 1980 to December 1989, we treated 49 patients with displaced Garden III and IV subcapital femoral fractures. There were 30 women and 19 men, aged 21–68 years.

Using a Watson Jones approach to the hip, first the muscle pedicle bone graft is prepared and dissected with an osteotome from the anterior edge of the greater trochanter, close to the main attachment of the gluteus minimus. The capsule is then incised with a T incision and the fracture is reduced and fixed using a sliding compression hip screw.

A tunnel is now drilled, starting from the greater trochanter, parallel to the screw on the antero-superior part of the femoral neck. Through this opening, the muscle pedicle bone graft is inserted until it crosses the fracture line.

Postoperatively, ambulation on crutches is permitted during the third week and full weight bearing after three months.

This technique has led to neither infection nor major complications. The union rate was 100% and avascular necrosis developed in 7 patients (14.5%).