Early revision after hemiarthroplasty and osteosynthesis of cervical hip fracture

Short-term function decreased, mortality unchanged in 102 patients

Jaakko Sipilä, Pekka Hyvönen, Juha Partanen, Jukka Ristiniemi and Pekka Jalovaara

Department of Orthopaedic Surgery, University of Oulu, P.O. Box 5000, FI-90014 Oulu, Finland
Correspondence PJ: pekka.jalovaara@oulu.fi
Submitted 03-03-01. Accepted 03-12-18

Background There is no consensus on whether osteosynthesis or hemiarthroplasty is preferable in the treatment of cervical hip fractures. Osteosynthesis is associated with more reoperations than hemiarthroplasty but there is little information available on the consequences of these reoperations.

Patients and methods We studied the effect on mortality, hospital stay and functional outcome of revision performed within 4 months of primary surgery with hemiarthroplasty or osteosynthesis for cervical hip fracture. 50 (6%) of 792 patients treated with uncemented Austin-Moore hemiarthroplasty and 52 (13%) of 411 patients with osteosynthesis (86 with two hook pins and 325 with three cannulated screws) had had revision surgery. Control groups matched for age, sex, residential status, walking ability at fracture, type of primary operation and fracture type consisted of patients who had not had a reoperation.

Results Reoperation impaired walking ability and was associated with increased use of walking aids at 4 months in the hemiarthroplasty group and the osteosynthesis group as compared to controls, but did not have any statistically significant effect on residential status. In the hemiarthroplasty group, 4-month mortality was 12% among the reoperated patients and 18% among the controls, while mortality at 1 year was 24% in both groups. The corresponding figures in the osteosynthesis group and controls were 6% and 6% at 4 months, respectively, and 17% and 13% at 1 year.

Interpretation To some extent, reoperation impairs early functional outcome after cervical hip fracture treated by either osteosynthesis or hemiarthroplasty, but does not increase mortality to any significant degree. ■

Osteosynthesis and hemiarthroplasty are the most common treatments for hip fracture (Jalovaara et al. 1992, Lu-Yao et al. 1994). However, they are both associated with complications that require reoperation. Osteosynthesis can be complicated by wound infection, failure of fixation, non-union and avascular necrosis of the femoral head. Hemiarthroplasty can be complicated by wound infection, dislocation and loosening of the prosthesis (Söreide et al. 1979, Sikorski and Barrington 1981, Broos et al. 1987, Rodriguez et al. 1987, Skinner et al. 1989, Keating et al. 1993, Lu-Yao et al. 1994). The rates of reoperation vary from 5% to 24% among patients with arthroplasty, and from 19% to 36% among patients with osteosynthesis (Söreide et al. 1979, Söreide and Lillestöl 1980, Sikorski and Barrington 1981, Broos et al. 1987, Rodriguez et al. 1987, Skinner et al. 1989, Johansson et al. 2000, Palmer et al. 2000, Ravikumar and Marsh 2000). There is a very limited amount of information available on the consequences of reoperation due to these complications (Keating et al. 1993, Palmer et al. 2000).

Using a matched-pair study, we investigated the effect on functional capacity, mortality and hospital stay of early reoperation for cervical hip fracture after hemiarthroplasty or osteosynthesis.

Patients and methods

All hip fractures were registered prospectively at the University Hospital, Oulu, between 1989 and 1999. Standard forms (Jalovaara et al. 1992,

Copyright © Taylor & Francis *2004. ISSN 0001–6470. Printed in Sweden – all rights reserved.*

Table 1. Prefracture characteristics of the study and control groups

	Hemiarthroplasty		Osteosynthesis	
	Reoperated	Controls	Reoperated	Controls
Sex				
Males (%)	6 (12)	6 (12)	13 (25)	13 (25)
Females (%)	44 (88)	44 (88)	39 (75)	39 (75)
Age at operation (years)				
Mean (range)	81 (65–98)	81 (66–97)	72 (52–91)	71 (52–88)
SD	7	7	9	9
Fracture type				
Undisplaced (%)	6 (12)	6 (12)	20 (38)	20 (38)
Displaced (%)	44 (88)	44 (88)	32 (62)	32 (62)
Primary operation				
Hemiarthroplasty (%)	50 (100)	50 (100)		
Three screws			36 (69)	36 (69)
Two nails			16 (31)	16 (31)

Berglund-Rödén et al. 1994) were filled in prospectively with data concerning the patient's background, hospital stay and quality of life, including information concerning the place of residence and locomotor ability. Follow-up lasted for 4 months, and the same functional parameters as recorded preoperatively were noted on a special form. Mortality was recorded at 4 months and at 1 year after the primary operation. Reoperations and the reasons for them were recorded on separate forms until the end of 2000.

The fractures were classified as undisplaced cervical (Garden classification 1–2) or displaced cervical (Garden 3–4). This study concerns only cervical fractures (Figure and Table 1), which amounted to 1355 (301 undisplaced and 1054 displaced). 792 were treated by hemiarthroplasty (mean age 80) and 411 by osteosynthesis with three screws (n = 325) or with two nails (n = 86) (mean age 72).

170 patients had had reoperations or closed reduction; 74 of them had been treated primarily with hemiarthroplasty and 75 with osteosynthesis. 17 patients had had closed reduction of a dislocation of the prosthesis, and 7 patients with hemiarthroplasty and 23 patients with osteosynthesis had been reoperated more than 4 months after the primary operation, and were excluded from the analysis. Thus, the study groups consisted of all 102 patients who had had a reoperation within 4 months of the primary surgery. 50 of the patients had had hemiarthroplasty (Austin-Moore, Howmedica, Benois Girard, France) as the primary operation (referred to below as the Hemiarthroplasty group). 52 patients were primarily treated by osteosynthesis,16 with two LIH hook pins (PSAB, Sweden) and 36 with three screws (Ulleval Screws, Howmedica, Benois Girard, France) (referred to below as the Osteosynthesis group). The types of primary reoperations and the reasons for them are given in Tables 2 and 3.

Table 2. Type of reoperation

	Hemiarthroplasty	Osteosynthesis
Removal of osteosynthesis for loss of position of implants	–	7
Hemiarthroplasty	7	16
Total hip arthroplasty	11	12
Re-osteosynthesis	–	13
Osteosynthesis for periprosthetic fracture	14	–
Girdlestone	11	2
Drainage of hematoma or infection	4	2
Open reduction of dislocation	3	–
Total	50	52

The control groups were made up by matching the reoperated patients with non-reoperated ones for gender, age (± 2 years), type of fracture, primary operation, walking ability before the fracture and residential status at the time of the fracture (Table 1). Antibiotic prophylaxis was used in 88% of the reoperated hemiarthroplasty patients and in 86% of the corresponding controls, and in 58% and 56% of the osteosynthesis group and controls, respectively. Anti-thrombotic prophylaxis was used in 100% of the reoperated and in 96% of

Table 3. Reason for reoperation

	Hemiarthroplasty	Osteosynthesis
Fracture displacement	–	25
Loss of position of osteosynthesis material without fracture displacement (cut out)	–	7
Additional fracture around the implant	18	10
Nonunion	–	3
Local pain or tenderness at operation site, or prominent implant-related discomfort with healed fracture	–	5
Dislocation of arthroplasty	11	–
Loosening of the prosthesis	11	–
Wound infection	9	–
Wound hematoma	1	2
Total	50	52

the control hemiarthroplasty patients, and in 81% and 87% of the osteosynthesis group and controls, respectively. Mean body mass index was 23 in both reoperated patients (SD 3) and in the controls (SD 4) of the hemiarthroplasty group, and 25 (SD 4) in both osteosynthesis patients and controls, respectively. The mean primary operation time was 60 (SD 20) min in the reoperated hemiarthroplasty patients and 60 (SD 27) min in the corresponding controls, and 42 (SD 12) min and 48 (SD 18) in the osteosynthesis group of patients and their controls, respectively. There were no significant differences in these parameters between the reoperated groups and their controls.

The Wilcoxon rank sum test, the chi-square test and the Mann-Whitney U-test were used in the statistical analysis. A p-value of < 0.05 was considered significant.

Results

Reoperations after hemiarthroplasty

The mean age of the 50 patients (44 women) who had had an open reoperation within 4 months (reoperation rate: 6%) was 81 (65–98) years (Table 1). Three of them had had 2 reoperations, one 3 reoperations, one 4 reoperations and one 5 reoperations. The mean period between the primary operation and the reoperation was 55 (1–121) days.

There was no significant difference in residential status at 4 months between the hemiarthroplasty group and their controls. Walking ability was better in the control group (Table 4). Only 4 of the reoperated patients were able to walk freely out of doors, as compared to 10 of the controls. The reoperated patients also used more walking aids (Table 4).

The 4-month mortality was 12% in the reoperated group and 18% in the corresponding controls ($p = 0.4$). The mortality rate at one year was 24% in both groups. The mean total hospital stay within 4 months of the primary surgery was 15 (3–36) days among the reoperated patients and 7 (2–49) days among the controls, the difference being significant ($p < 0.001$).

Reoperations after osteosynthesis

52 patients (39 women) had required one or more open reoperations within 4 months, and these had a mean age of 72 (52–91) years with a reoperation rate of 13%. Six patients had had 2 reoperations, three 3 reoperations, one 4 reoperations and one 5 reoperations. The mean period between the primary operation and the first reoperation was 64 (1–131) days.

There were no significant differences in residential status between the reoperated patients and the corresponding controls at 4 months after the primary operation. The control group had better walking ability and used fewer walking aids. Of the reoperated patients, 18 were able to walk freely out of doors, 9 of them without aids. The corresponding figures among the controls were 26 and 18, respectively (Table 5).

4-month mortality was 6% in both the reoperated patients and the controls. At 1 year after the primary operation, the corresponding rates were 17% and 13% ($p = 0.6$), respectively. The mean total hospital stay within 4 months of primary surgery was 17 (4–69) days among the reoperated patients and 8 (2–64) days among the controls ($p < 0.001$).

Discussion

Previous findings indicate that most of the recovery of function after hip fracture surgery occurs by 4–6 months. Hannan et al. (2001) observed some additional recovery in all functional domains at the

Table 4. Residential status and walking functions at fracture, and four months after hemiarthroplasty

	Controls		Reoperated		P-values (contr vs. reop prefracture)	P-values (contr vs. reop 4 months)
	Prefracture	At 4 months	Prefracture	At 4 months		
Residential status						
Own home	27 (54)	17 (34)	26 (52)	12 (24)	0.7	0.9
Convalescent home		2 (4)	2 (4)			
Full-service unit with meals, home for the elderly	19 (38)	9 (18)	17 (34)	7 (14)		
Geriatric department, rehabilitation clinic	1 (2)	11 (22)	3 (6)	19 (38)		
Acute hospital	1 (2)	1 (2)	2 (4)	4 (8)		
Other	2 (4)	1 (2)		2 (4)		
Dead		9 (18)		6 (12)		
Total	50 (100)	50 (100)	50 (100)	50 (100)		
Walking ability					1.0	< 0.001
Walked alone out of doors	31 (62)	10 (20)	30 (60)	4 (8)		
Walked out of doors only if accompanied	3 (6)	7 (14)	3 (6)	3 (6)		
Walked alone indoors but not out of doors	13 (26)	9 (18)	13 (26)	11 (22)		
Walked indoors only if accompanied	1 (2)	12 (24)	1 (2)	10 (20)		
Unable to walk	2 (4)	3 (6)	2 (4)	14 (28)		
Missing data			1 (2)	2 (4)		
Dead		9 (18)		6 (12)		
Total	50 (100)	50 (100)	50 (100)	50 (100)		
Walking aids					1.0	0.03
Could walk without aids	31 (62)	3 (6)	27 (54)	1 (2)		
One aid	8 (16)	8 (16)	10 (20)	2 (4)		
Two aids		1 (2)	2 (4)	4 (8)		
Frame	9 (18)	24 (48)	7 (14)	18 (36)		
Wheelchair/bedbound	2 (4)	5 (10)	2 (4)	16 (32)		
Missing data			2 (4)	3 (6)		
Dead		9 (18)		6 (12)		
Total	50 (100)	50 (100)	50 (100)	50 (100)		

population level between 6 and 12 months, which did not necessarily reflect the subjective experience of recovery in individual cases. Ceder et al. (1980) aimed to define and test the early indicators of prognosis with regard to the rehabilitation of patients with hip fracture. They also found that between 4 months and 12 months after the fracture, there was no remarkable increase in the proportion of patients living in their own homes and managing the basic ADL or household functions. Borgquist et al. (1990) concluded that ADL, walking ability and household activities remained at the level already achieved by 4 months after fracture during the 10-year period that they prospectively followed up patients admitted from their own homes. It is thus evident that early recovery is important for hip fracture patients, and it is important to know how the process of recovery is disturbed by revisions. Consequently, we chose 4 months as the follow-up period. The effect of late revisions is difficult to evaluate and requires a different study design.

Revisions seemed to impair walking ability after hemiarthroplasty. Similar findings have been reported earlier by Keating et al. (1993) and Palmer et al. (2000), although these authors did not consider function adequately, which prevents proper comparison. We did not make any long-term checks, and it is therefore not known if this lowered level of function persisted.

Reoperations after hemiarthroplasty did not appear to increase mortality. This is in disagreement with the study of Palmer et al. (2000) reporting 25% mortality at 1 year in reoperated patients and 11% in patients without revision. A higher 1-year mortality rate after revisions of hemiarthroplasty, 36%, was also reported by Keating et al. (1993).

Table 5. Residential status and walking functions at fracture, and 4 months after osteosynthesis

	Controls		Reoperated		P-values (contr vs. reop prefracture)	P-values (contr vs. reop 4 months)
	Prefracture	At 4 months	Prefracture	At 4 months		
Residential status						
Own home	45 (87)	39 (75)	41 (79)	33 (63)	0.4	0.2
Convalescent home			1 (2)			
Full-service unit with meals, home for the elderly	5 (10)	6 (12)	7 (13)	3 (6)		
Geriatric department, rehabilitation clinic	2 (4)	4 (8)	2 (4)	12 (23)		
Acute hospital			1 (2)	1 (2)		
Dead		3 (6)		3 (6)		
Missing data						
Total	52 (100)	52 (100)	52 (100)	52 (100)		
Walking ability					1.0	0.02
Walked alone out of doors	42 (81)	26 (50)	41 (79)	18 (35)		
Walked out of doors only if accompanied	2 (4)	7 (13)	4 (8)	4 (8)		
Walked alone indoors but not out of doors	8 (15)	7 (13)	7 (13)	12 (23)		
Walked indoors only if accompanied		7 (13)		8 (15)		
Unable to walk		2 (4)		7 (13)		
Dead		3 (6)		3 (6)		
Total	52 (100)	52 (100)	52 (100)	52 (100)		
Walking aids					1.0	0.006
Could walk without aids	39 (75)	18 (35)	43 (83)	9 (17)		
One aid	7 (13)	9 (17)	3 (6)	8 (15)		
Two aids	2 (4)	6 (12)		5 (10)		
Frame	4 (8)	12 (23)	5 (10)	18 (35)		
Wheelchair/bedbound		4 (8)	1 (2)	9 (17)		
Dead		3 (6)		3 (6)		
Total	52 (100)	52 (100)	52 (100)	52 (100)		

Revisions also impaired the patients' walking functions at short-term follow-up after osteosynthesis. We have found no other report for comparison. However, our findings seem to be in line with the study of Palmer et al. (2000), who reported a downgrade in destination and in the level of independency after revision surgery following osteosynthesis.

Reoperations after osteosynthesis may have the effect of increasing mortality slightly (not statistically significant). This is in line with the report by Söreide and Lillestöl (1980) who compared reoperated patients with nonoperated age- and sex-matched controls. Contrary results have also been published. Palmer et al. (2000) observed lower mortality rates at 1 year after the primary operation in reoperated patients than in patients who had not been reoperated. This difference may be explained by the fact that these authors did not match their controls.

Osteosynthesis involved a higher reoperation rate than arthroplasty. Recent studies have supported this finding (Davison et al. 2001, Parker et al. 2002, Rogmark et al. 2002). However, the failure after osteosynthesis can be effectively treated by revision to an arthroplasty. The rate of reoperation after osteosynthesis ranges from 19% to 36% and that after arthroplasty from 5% to 24% (Söreide et al. 1979, Söreide and Lillestöl 1980, Sikorski and Barrington 1981, Broos et al. 1987, Rodriguez et al. 1987, Skinner et al. 1989, Johansson et al. 2000, Ravikumar and Marsh 2000, Palmer et al. 2000).

In conclusion, early reoperation after hip fracture increases length of hospital stay and impairs walking functions in the short term, but has no effect on residential status or mortality.

We thank Mrs Eila Haapakoski for technical assistance and Mr. Hannu Vähänikkilä for statistical analysis.

The study was financially supported by the Oulu University Hospital Project Fund.

No competing interests declared.

Berglund-Rödén M, Swiersta B A, Wingstrand H, Thorngren K-G. Prospective comparison of hip fracture treatment. 856 cases followed for 4 months in The Netherlands and Sweden. Acta Orthop Scand 1994; 65 (3): 287-94.

Borgquist L, Ceder L, Thorngren K G. Function and social status 10 years after hip fracture. Prospective follow-up of 103 patients. Acta Orthop Scand 1990; 61 (5): 404-10.

Broos P L, Stappaerts K H, Luiten E J, Gruwez J A. Endoprosthesis. The best way to treat unstable intracapsular hip fractures in elderly patients. Unfallchirurg 1987; 90: 347-50.

Ceder L, Thorngren K G, Wallden B. Prognostic indicators and early home rehabilitation in elderly patients with hip fractures. Clin Orthop 1980; (152): 173-84.

Davison J N S, Calder S J, Anderson G H, Ward G, Jagger C, Harper W M, Gregg P J. Treatment for displaced intracapsular fracture of the proximal femur. A prospective, randomised trial in patients aged 65 to 79 years. J Bone Joint Surg (Br) 2001; 83: 206-12.

Hannan E L, Magaziner J, Wang J J, Eastwood E A, Silberzweig S B, Gilbert M, Morrison R S, McLaughlin M A, Orosz G M, Siu A L. Mortality and locomotion 6 months after hospitalization for hip fracture: Risk factors and risk-adjusted hospital outcomes. JAMA 2001; 285 (21): 2736-42.

Jalovaara P, Berglund-Rödén M, Wingstrand H, Thorngren K-G. Treatment of hip fracture in Finland and Sweden: Prospective comparison of 788 cases in three hospitals. Acta Orthop Scand 1992; 63 (5): 531-5.

Johansson T, Jacobsson S A, Ivarsson I, Knutsson A, Wahlstrom O. Internal fixation versus total hip arthroplasty in the treatment of displaced femoral neck fractures: a prospective randomized study of 100 hips. Acta Orthop Scand 2000; 71 (6): 597-602.

Keating J F, Robinson C M, Court-Brown C M, McQueen M M, Christie J. The effect of complications after hip fracture on rehabilitation. J Bone Joint Surg (Br) 1993; 75: 976.

Lu-Yao G, Keller R, Littenberg B, Wennberg J. Outcomes after displaced fractures of the femoral neck: A meta-analysis of one hundred and six published reports. J Bone Joint Surg (Br) 1994; 76 (1): 15-25.

Palmer S J, Parker M J, Hollingworth W. The cost and implications of reoperation after surgery for fracture of the hip. J Bone Joint Surg (Br) 2000; 82 (6): 864-6.

Parker M J, Khan R J, Crawford J, Pryor G A. Hemiarthroplasty versus internal fixation for displaced intracapsular hip fractures in the elderly. A randomised trial of 455 patients. J Bone Joint Surg (Br) 2002; 84: 1150-5.

Ravikumar K J, Marsh G. Internal fixation versus hemiarthroplasty versus total hip arthroplasty for displaced subcapital fractures of femur-13 year results of a prospective randomised study. Injury 2000; 31 (10): 793-7.

Rodriguez J, Herrara A, Canales V, Serrano S. Epidemiologic factors, morbidity and mortality after femoral neck fractures in the elderly. A comparative study: internal fixation vs. hemiarthroplasty. Acta Orthop Belg 1987; 53: 472-9.

Rogmark C, Carlsson A, Johnell O, Sernbo I. A prospective randomised trial of internal fixation versus arthroplasty for displaced fractures of the neck of the femur. Functional outcome for 450 patients at two years. J Bone Joint Surg (Br) 2002; 84:183-8.

Sikorski J M, Barrington R. Internal fixation versus hemiarthroplasty for the displaced subcapital fracture of the femur. A prospective randomised study. J Bone Joint Surg (Br) 1981; 63 (3): 357-61.

Skinner P, Riley D, Ellery J, Beaumont A, Coumine R, Shafighian B. Displaced subcapital fractures of the femur: a prospective randomized comparison of internal fixation, hemiarthroplasty and total hip replacement. Injury 1989; 20 (5): 291-3.

Söreide O, Lillestöl J. Mortality patterns following internal fixation for acute femoral neck fractures in the elderly with special emphasis on potential excess mortality following reoperations. Age Ageing 1980; 9: 59-63.

Söreide O, Mölster A, Raugstad T S. Internal fixation versus primary prosthetic replacement in acute femoral neck fractures: a prospective, randomized clinical study. Br J Surg 1979; 66: 56-60.