International Orthopaedics (SICOT) (2004) 28:28–31
DOI 10.1007/s00264-003-0517-y

ORIGINAL PAPER

Juha Partanen · Pekka Jalovaara

Functional comparison between uncemented Austin-Moore hemiarthroplasty and osteosynthesis with three screws in displaced femoral neck fractures—a matched-pair study of 168 patients

Accepted: 11 September 2003 / Published online: 29 October 2003

Abstract There is no consensus as to whether osteosynthesis (OS) or hemiarthroplasty (HA) should be used as the primary treatment of displaced femoral-neck fracture. In a prospective matched-pair study, we compared 84 patients treated with OS with three screws and 84 patients treated with uncemented Austin-Moore HA focusing on functional parameters, reoperations and mortality. At 4 months after the fracture, functional recovery was not significantly different between the study groups. However, OS patients tended to have slightly better functional ability than HA patients, as more of them were able to walk out of doors (45.2% versus 39.2%), more were able to walk without walking aids (23.7% versus 16.7%), and more returned to live in their own homes (80%versus 72.9%). OS patients used slightly but not significantly less painkillers and had less hip pain than HA patients. OS patients had had 15.4% more reoperations by 4 months and 14.2% more by 1 year compared to the HA group. The 4-month and 1-year mortality rates of the study groups were of the same order. Functional recovery was slightly better after OS with three screws than after uncemented HA, although no significant differences were seen in a sample of this size. On the other hand, OS was associated with a higher reoperation rate.

Résumé Il n'y a aucun consensus sur le traitement initial de la fracture déplacée du col fémoral entre ostéosynthèse (OS) ou hémiarthroplastie (HA). Dans une étude prospective appariée avec focalisation sur les paramètres fonctionnels, les réinterventions et la mortalité, nous avons comparé 84 malades traités par OS avec trois vis et 84 malades traités par HA de type Austin Moore non cimentée. Quatre mois après la fracture, la récupération fonctionnelle n'était pas significativement différente entre les deux groupes de l'étude. Cependant, les malades OS avaient tendance à avoir une meilleure fonction que les malades HA, avec une meilleure possibilité de marche à l'extérieur (45,2% contre 39,2%), de marche sans aide (23,7% contre 16,7%), et plus de retour à domicile (80% contre 7,9%). Les malades OS utilisaient, mais de façon non significative, moins d'antalgiques que les malades HA et avaient moins de douleurs de hanche. Les malades OS avaient 15,4% de plus de ré-opérations à 4 mois et 14,2% dans l'année, comparés au groupe HA. Le taux de mortalité à quatre mois et à un an était du même ordre dans les deux groupes. La récupération fonctionnelle est légèrement meilleure après OS avec trois vis qu'après HA non cimenté, bien qu'aucune différence significative n'ait été relevée dans cet échantillon. En revanche, OS est associé à un taux supérieur de réinterventions.

J. Partanen · P. Jalovaara (✉)
Department of Orthopaedic and Trauma Surgery,
University Hospital of Oulu,
PO Box 22, 90221 Kajaanintie 50, Finland
e-mail: pekka.jalovaara@oulu.fi
Tel.: +358-8-3152011
Fax: +358-8-31555318

Introduction

There are a number of controversies concerning the methods of treating displaced fractures of the femoral neck, and the principal issue of disagreement at present is whether to reduce the fracture and use internal fixation or to perform a total or partial hip replacement arthroplasty [4, 13, 18, 19, 20, 21]. Most comparative studies on this topic deal with such aspects as mortality, reoperation rate, bone healing, complications, and cost [4, 8, 13, 18, 19, 20, 21, 22, 23]. The functional outcome has received less attention [7, 15, 24]. Nevertheless, it is essential to know how well the patients regain their preinjury level of function and independence [12], and functional outcome is also a good indicator of the effectiveness of treatment with regard to socioeconomic aspects [24].

The aim of this study was to compare osteosynthesis (OS) with three hip screws and hemiarthroplasty (HA) as the treatment for displaced femoral-neck fractures using functional parameters, reoperations, and mortality as outcome parameters in a matched-pair analysis.

Materials and methods

During the years 1989–1999, all hip fractures treated in Oulu University Hospital were prospectively registered on specific hip-fracture follow-up forms [1, 11, 14]. Place of living, walking ability, use of walking aids and activities of daily living (ADL) functions (ability to dress and undress) were recorded at fracture (Table 1). Femoral-neck fractures were classified according to Garden classification [6]. There were 1,356 patients with cervical femoral-neck fractures, of which 301 were nondisplaced and 1,055 were displaced. Of those with displaced fractures (Garden III–IV), 161 patients underwent OS with three hip screws and 711 uncemented Austin-Moore HA. Follow-up was continued for 4 months by recording the reoperation rate, mortality, and the same functional parameters as recorded preoperatively. Mortality and reoperation rate were also recorded at 1 year after the fracture.

The patients treated with OS were cross-matched with the patients treated with Austin-Moore HA for age, gender, place of living at fracture, walking ability at fracture, and fracture type (Table 1). Cross-matching was performed by a statistician, and 84 pairs with displaced femoral-neck fractures were found.

HA was performed via a posterior approach using an uncemented Austin Moore prosthesis (Howmedica, Benois Girard, France), and OS was performed through a lateral incision after closed reduction and fixation was made with three cannulated screws (Ulleval Screws, Howmedica, Benoist Girard, France).

Data processing and statistical analyses were performed using the SPSS statistical software (SPSS Inc., 1998, 9.0 standard version for Windows, Chicago, IL, USA) by a statistician. All statistical analyses were performed by a statistician, as described by Breslow and Day [3] for matched-pair studies by mutually comparing the pair members using McNemar's test for dichotomous variables and the marginal homogeneity test for multiple categorical variables. $P<0.05$ was considered significant. Sample power test (power=0.80, alpha=0.05) was used to find the number of pairs reaching the level of difference in the analyzed parameters.

Results

Although there were no significant differences between the study groups, there was a clear tendency in several outcome parameters to show that the OS patients managed better than the HA patients (Table 2). More of them were able to live at their own home, to walk out of doors, to walk without walking aids, to walk as well as before the fracture, had less pain and used less painkillers, and had better ADL function than OS patients (Table 2).

Significantly more OS patients than HA patients had been reoperated by 4 months and 1 year (at 4 months 19.0% versus 3.6%, at 1 year 20.2% versus 6.0%; $p=0.004$ and $p=0.012$, respectively) (Table 2).

Mortality was of the same magnitude among both HA and OS patients (at 4 months 7.1% and 9.5%, at 1 year 16.7 and 14.3%, respectively) (Table 2).

Discussion

Our study was a prospective matched-pair study comparing HA and OS, the two main treatment modalities in displaced femoral-neck fracture, by focusing on functional recovery, reoperation rate, and mortality. The functional outcome was assessed at 4 months, by which time ADL, walking ability, and household activities have been shown to have reached a constant level [2]. By this time, about 80% of patients who had been admitted from their own homes had returned there [2]. On the other hand, a considerable number of reoperations are done after 4 months, and the patients were therefore followed up for 1 year [5, 16].

Table 1 Cross-matched data and background factors of patients with femoral-neck fracture treated with hemiarthroplasty (HA) and osteosynthesis (OS) with three screws

Operation type	HA (%)	OS (%)
Number of patients	84	84
Mean age in years (range)	75 (63–92)	75 (62–92)
Male	29	29
Mean age (range)	75 (63–87)	74 (62–86)
Female	55	55
Mean age (range)	75 (62–86)	75 (63–92)
Residential status at fracture		
Own home	70 (83)	70 (83)
Convalescent home or full-service unit with meals	12 (14)	12 (14)
Geriatric department, rehabilitation, or long-term care	2 (3)	2 (3)
Walking capacity		
Walked alone or accompanied out of doors	64 (76)	64 (76)
Walked alone indoors but not out of doors	17 (20)	17 (20)
Walked indoors only accompanied	3 (4)	3 (4)
Unable to walk, able to sit	0	0
Use of walking aids		
Without aids	49 (59)	59 (70)
One stick	17 (20)	13 (16)
Two sticks	2 (2)	1 (1)
Rollator/walking frame	16 (19)	11 (13)
Wheelchair	0	0
Activities of daily living functions		
Yes	65 (77)	68 (81)
No	19 (23)	16 (19)

Table 2 Outcome data 4 months after fracture in hemiarthroplasty (HA) and osteosynthesis (OS) patients

Operation type	HA	Percent	OS	Percent	*P* value	Statistical test	N of the sample power test
Residential status					0.427	Wilcoxon signed ranks test	550 pairs
Own home	51	60.7	56	66.7			
Convalescent home or full-service unit with meals	15	17.9	3	3.6			
Geriatric department, rehabilitation clinic or long-term care	10	11.9	14	16.7			
Acute hospital	1	1.2	3	3.6			
Unknown	4	4.8	7	8.3			
Walking ability					0.171	Wilcoxon signed ranks test	550 pairs
Walked alone out of doors or accompanied	34	39.2	39	45.2			
Walked alone indoors but not out of doors	23	27.4	24	28.6			
Walked indoors only accompanied	11	13.1	9	10.7			
Unable to walk, able to sit	9	10.7	5	6.0			
Walks					0.462	McNemar	400 pairs
As good as before	36	42.9	39	46.5			
Worse because of the hip	41	48.8	37	44.0			
Use of walking aids					0.559	Wilcoxon signed ranks test	400 pairs
Without aids	14	16.7	18	23.7			
One stick	14	16.7	15	17.9			
Two sticks	7	8.3	6	7.1			
Rollator/walking frame	31	36.9	31	36.9			
Wheelchair	11	13.1	6	7.1			
Activities of daily living functions					0.327	McNemar	350 pairs
Yes	39	46.4	47	56.0			
No	37	44.0	29	34.5			
Pain in involved hip					0.648	McNemar	
Yes	59	70.2	54	64.3			
No	17	20.2	20	23.8			
Use of painkillers because of the involved hip					0.327	McNemar	250 pairs
Yes	29	34.5	20	23.8			
No	31	36.9	41	48.8			

Slightly more OS patients had returned home by 4 months compared to HA patients. The power analysis showed that the difference would have reached the level of significance if the number of pairs had been 550. The percentage of OS patients (80%) who returned to live in their own homes was in line with the report of Borqvist et al. [2], while only 73 % of HA patients had returned to their own homes by 4 months.

Walking ability has been reported in only a few studies comparing HA and OS, and the results have been contradictory. Broos et al. [4] reported that HA patients had less pain and better functional status at 1-year follow-up than did OS patients. In a prospective randomized comparison between total hip replacement, HA, and OS by Skinner et al. [20], the patients with total hip replacement had the least pain and best mobility at 1 year, while HA was worst in these respects, findings that are in accordance with our results. In the study by Young et al. [24], patients who had HA tended to show better short-term functional recovery, although the overall physical activities of daily living (PADL) and the instrumental activities of daily living (IADL) at 1 year were not different between the OS and HA groups. Our results are in accordance with this study.

Use of walking aids at 4 months was slightly but not significantly more common among HA patients than OS patients. This is in agreement with the report of Söreide et al. [21], who found no significant differences in the use of walking aids at 1 year.

Slightly more of our HA patients (about 10%) used painkillers because of the involved hip and had more hip pain, which is in agreement with the study of Skinner et al. [20]. These facts may, in part, explain the slight differences in functional recovery between OS and HA patients in our study.

Reoperation rates at 4 months and 1 year were significantly higher in OS patients than in HA patients. This is in line with the metaanalysis by Lu-Yao et al. [13] where the rates of second operation ranged within 20–36% at 2 years after internal fixation and within 6–18% after HA, while our rates at 1 year were 20.2% and 6.0%, respectively.

Mortality has been reported to be lower in OS patients than in HA patients in most studies [1, 4, 9, 10, 17, 18]. On the other hand, some prospective trials [19, 20, 21] have revealed no difference in mortality following internal fixation or HA. Our findings of no significant differences in mortality are in line with the latter.

In conclusion, patients treated with OS with three cannulated screws tended to have a slightly better short-term functional outcome but a higher reoperation rate. The differences in function did not reach the level of significance in the group size studied here. Functional recovery should be considered in outcome studies on hip

fractures in the elderly and in selecting of the method of treatment.

Acknowledgements We thank Eila Haapakoski for her persistence and honest work with the data collection and Hannu Vähänikkilä for help with the statistical analysis.

References

1. Berglund-Rödén M, Swierstra BA, Wingstrand H, Thorngren KG (1994) Prospective comparison of hip fracture treatment. 856 cases followed for 4 months in The Netherlands and Sweden. Acta Orthop Scand 65:287–294
2. Borgquist L, Ceder L, Thorngren KG (1990) Function and social status 10 years after hip fracture. Prospective follow-up of 103 patients. Acta Orthop Scand 61:404–410
3. Breslow NE, Day NE (1980) The analysis of case-control studies. Statistical methods in cancer research, vol 1. IARC, Lyons
4. Broos PL, Stappaerts KH, Luiten EJ, Gruwez JA (1987) Endoprosthesis. The best way to treat unstable intracapsular hip fractures in elderly patients. Unfallchirurg 90:347–350
5. Eiskjaer S, Ostgard SE, Jakobsen BW, Jensen J, Lucht U (1992) Years of potential life lost after hip fracture among postmenopausal women. Acta Orthop Scand 63:293–296
6. Garden RS (1964) Stability and union in subcapital fractures of the femur. J Bone Joint Surg [Br] 46:630–647
7. Heikkinen T, Wingstrand H, Partanen J, Thorngren KG, Jalovaara P (2002) Hemiarthroplasty or osteosynthesis in cervical hip fractures: matched-pair analysis in 892 patients. Arch Orthop Trauma Surg 122:143–147
8. Hui AC, Anderson GH, Choudhry R, Boyle J, Gregg PJ (1994) Internal fixation or hemiarthroplasty for undisplaced fractures of the femoral neck in octogenarians. J Bone Joint Surg [Br] 76:891–894
9. Hunter GA (1969) A comparison of the use of internal fixation and prosthetic replacement for fresh fractures of the neck of the femur. Br J Surg 56:229–232
10. Hunter GA (1974) A further comparison of the use of internal fixation and prosthetic replacement for fresh fractures of the neck of the femur. Br J Surg 61:382–384
11. Jalovaara P, Berglund-Rödén M, Wingstrand H, Thorngren KG (1992) Treatment of hip fracture in Finland and Sweden. Prospective comparison of 788 cases in three hospitals. Acta Orthop Scand 63:531–535
12. Koval KJ, Zuckerman JD (1994) Functional recovery after fracture of the hip. J Bone Joint Surg [Am] 76:751–758
13. Lu-Yao GL, Keller RB, Littenberg B, Wennberg JE (1994) Outcomes after displaced fractures of the femoral neck. A meta-analysis of one hundred and six published reports. J Bone Joint Surg [Am] 76:15–25
14. Parker MJ, Currie CT, Mountain JA, Thorngren KG (1998) Standardised Audit for Hip Fractures in Europe (SAHFE). Hip Int 8:10–15
15. Partanen J, Saarenpaa I, Heikkinen T, Wingstrand H, Thorngren KG, Jalovaara P (2002) Functional outcome after displaced femoral neck fractures treated with osteosynthesis or hemiarthroplasty: a matched-pair study of 714 patients. Acta Orthop Scand 73:496–501
16. Pitto RP (1994) The mortality and social prognosis of hip fractures. A prospective multifactorial study. Int Orthop 18:109–113
17. Raine GE (1973) A comparison of internal fixation and prosthetic replacement for recent displaced subcapital fractures of the neck of the femur. Injury 5:25–30
18. Rodriguez J, Herrara A, Canales V, Serrano S (1987) Epidemiologic factors, morbidity and mortality after femoral neck fractures in the elderly. A comparative study: internal fixation vs. hemiarthroplasty. Acta Orthop Belg 53:472–479
19. Sikorski JM, Barrington R (1981) Internal fixation versus hemiarthroplasty for the displaced subcapital fracture of the femur. A prospective randomised study. J Bone Joint Surg [Br] 63:357–361
20. Skinner P, Riley D, Ellery J, Beaumont A, Coumine R, Shafighian B (1989) Displaced subcapital fractures of the femur: a prospective randomized comparison of internal fixation, hemiarthroplasty and total hip replacement. Injury 20:291–293
21. Söreide O, Mölster A, Raugstad TS (1979) Internal fixation versus primary prosthetic replacement in acute femoral neck fractures: a prospective, randomized clinical study. Br J Surg 66:56–60
22. Söreide O, Alho A, Rietti D (1980) Internal fixation versus endoprosthesis in the treatment of femoral neck fractures in the elderly. A prospective analysis of the comparative costs and the consumption of hospital resources. Acta Orthop Scand 51:827–831
23. van Vugt AB, Oosterwijk WM, Goris RJ (1993) Osteosynthesis versus endoprosthesis in the treatment of unstable intracapsular hip fractures in the elderly. A randomised clinical trial. Arch Orthop Trauma Surg 113:39–45
24. Young Y, German P, Brant L, Kenzora J, Magaziner J (1996) The predictors of surgical procedure and the effects on functional recovery in elderly with subcapital fractures. J Gerontol A Biol Sci Med Sci 51:M158-M164