FUNCTIONAL ABILITY AFTER HIP FRACTURE AMONG PATIENTS HOME-DWELLING AT THE TIME OF FRACTURE

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SUMMARY

The aim of the study was to assess the change in function and residential status four months after hip fracture in patients over 50 years of age and living independently at home at the time of fracture. All consecutive hip fracture patients treated at Oulu University Hospital during 1989–1999 were followed up. Data collection was done on standardized hip fracture forms, which were filled in at admission and at four months postoperatively. The forms included demographic data, place of residence, locomotor ability, use of walking aids, data on the fracture and its treatment, hospital stay, place of discharge and pain.

At four months, 16.0% of the men and 14.3 % of the women were permanently institutionalized. Preoperatively, 81.1 % of the patients had been able to walk out of doors either alone or accompanied, while at 4 months, less than half of the patients (149 men, 391 women) were able to do so. Two thirds of the hip fracture patients had been able to walk without walking aids before the fracture, the corresponding proportion being one fifth at four months after the fracture. Cumulative mortality at 4 months was 9.9%, being higher among the male (15.5%, n=53) than the female patients (7.9%, n=75).

The original study population was also divided into two subgroups operated at different period of time (1989–92 and 1993–99), the functional results seemed to improve with time. Hip fracture leads to the institutionalization of every seventh patient able to live at home at the time of fracture and impairs markedly one's functional capacity. To restore the pre-fracture status as well as possible and to reduce the burden of the consequences of hip fracture, it might be beneficial to evaluate and improve the existing rehabilitation system.

Key words: follow-up study, home-dwelling elderly, mortality, institutional care, hip fracture, locomotor ability

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INTRODUCTION

Hip fracture is one of the most resource-consuming incidents among older people. Hip fracture patients occupy 11–13% of all surgical beds in Finland (1). As the population is aging, it has been estimated that the incidence of hip fractures will increase fast (2). Globally, the number of hip fractures was approximately 1.66 million in 1990, and the rate is expected to reach 6.26 million by 2050 (2). The aim of the treatment is to restore the patient's functional ability to the pre-fracture level. According to previous studies, however, a considerable number of hip fracture patients seem to become permanently institutionalized (3, 4, 5).

The aim of this study was to assess the changes in the short term functional ability and residential status after hip fracture among patients home-dwelling at the time of fracture.

METHODS

This follow-up study was conducted on a series of hip fracture (pathological fractures excluded) patients over 50 years of age treated in Oulu University Hospital in 1989–1996. The total number of patients was 1,878, of whom 1,292 had been living independently at their own homes at the time of fracture. Infor-

mation was collected on standardized hip fracture forms (6, 7). These forms were prospectively filled in both at admission by a study nurse and at four months postoperatively by the patients themselves, their relatives, friends or the nursing staff of the institutions they were cared in. The four-month form was completed by the study nurse over telephone if necessary.

The forms filled in at admission included demographic data, data concerning the patient's background, i.e. place of residence, locomotor ability, use of walking aids and data on fracture and its treatment.

Locomotor ability and use of walking aids were classified into 5 categories as shown in Table 2. Type of fracture was classified as described earlier (6) (Table 1).

57.0% (n=735) of the fractures were cervical and 43.0% (n=553) trochanteric (Table 1). The majority of cervical fractures (52.8%) were treated with Austin-Moore prosthesis (Table 1). Gamma nailing was the most common (65.9%) fixation method for trochanteric fractures (Table 1).

The 4-month questionnaires recorded hospital stay, place of discharge and pain. Queries concerning function and residential status were the same as presented at admission. Reoperations were recorded on a special form. Information on deaths during the follow-up period was obtained regularly from the official death certificates.

	Men	Women	Total
Gender (%), (n)	26.5 (343)	73.5 (949)	
Age (years)			
Median	75	79	78
Mean	73	78	77
Range	51–97	51–98	51–98
SD	10.64	8.76	9.48
Living alone (%), (No. of observations)			
Before fracture	31.0 (106)	46.0 (435)	42.0 (541)
At 4 months	21.4 (53)	33.1 (253)	30.2 (306)
Marital status (%), (No. of observations)			
Not married	15.6 (51)	11.0 (94)	12.2 (145)
Married	60.6 (198)	29.8 (255)	38.3 (453)
Divorced	5.8 (19)	3.9 (33)	4.4 (52)
Widow/er	18.0 (59)	55.4 (475)	45.1 (534)
Side of fracture (%), (n)			
Left	49.9 (171)	51.1 (485)	50.8 (656)
Right	50.1 (172)	48.9 (464)	49.3 (636)
Type of fracture (%), (No. of observations)			
Undisplaced cervical	13.8 (47)	11.4 (108)	12.0 (155)
Displaced cervical	43.5 (148)	45.6 (432)	45.0 (580)
Basocervical	2.4 (8)	1.9 (18)	2.0 (26)
Trochanteric two-fragment	15.0 (51)	14.5 (137)	14.6 (188)
Trochanteric multi-fragment	18.8 (64)	22.3 (211)	21.4 (275)
Subtrochanteric	6.5 (22)	4.4 (42)	5.0 (64)
Primary operation methods (%), (No. of observations)			
Cervical fractures			
Austin-Moore hemiarthroplasty	25.4 (87)	32.9 (313)	31.0 (400)
Osteosynthesis	28.7 (98)	20.5 (195)	22.7 (293)
Total arthroplasty	3.5 (12)	4.2 (40)	4.0 (52)
Trochanteric fractures			
Gamma nail	27.8 (95)	29.0 (275)	28.7 (370)
Dynamic hip screw	12.0 (41)	12.7 (120)	12.5 (161)
Girdlestone	0.3 (1)		0.1 (1)
Not operated	2.0 (7)	0.5 (5)	0.9 (12)

The ethical committee of Oulu University Hospital approved the study protocol, and informed consent was obtained from the patients.

We also divided the original group of 1,292 patients into two subgroups based on time when the operation was done. The first group included those who were operated between the years 1989–1992 (n=511), (89–92 group) and the second included the patients operated between the 1993–1999 year (n=781), (93–99 group). The subgroup analyses were done similarly as the analyses for the total study population and they were compared with one another. The mean age of the patients in the subgroups was quite the same, 76 (range 51–98) years in the former group and 77 (range 51–97) years in the latter group.

Statistical methods: The results in terms of the binary and categorical variables were presented as cross-tabulations and percentages. The χ^2-test was used to test the significance of difference between the study groups; p-values less or equal to 0.05 were considered to be statistically significant. SPSS 11.5 for Windows was used in the statistical calculations.

Table 2. Patients' walking ability and use of walking aids before the hip fracture and 4 months postoperatively

	Before fracture			At 4 months		
	Men	Women	Total	Men	Women	Total
Walking ability (%), (No. of observations)						
Walked alone out of doors	78.9 (270)	70.4 (666)	72.7 (936)	48.2 (135)	33.3 (288)	37.0 (423)
Walked out of doors only if accompanied	4.7 (16)	9.7 (92)	8.4 (108)	5.0 (14)	11.9 (103)	10.2 (117)
Walked alone indoors but not out of doors	12.0 (41)	16.1 (152)	15.0 (193)	25.4 (71)	34.1 (295)	32.0 (366)
Walked indoors only if accompanied	2.0 (7)	3.1 (29)	2.8 (36)	9.6 (27)	14.1 (122)	13.0 (149)
Unable to walk	2.3 (8)	0.7 (7)	1.2 (15)	11.8 (33)	6.5 (56)	7.8 (89)
Use of walking aids (%), (No. of observations)						
Able to walk without aids	63.7 (218)	64.0 (603)	63.9 (821)	22.1 (62)	17.6 (152)	18.7 (214)
Needed						
– One aid	21.1 (72)	18.2 (171)	18.9 (243)	23.8 (67)	20.0 (173)	21.0 (240)
– Two aids	4.1 (14)	2.2 (21)	2.7 (35)	11.7 (33)	8.9 (77)	9.6 (110)
– Frame	7.6 (26)	14.6 (138)	12.8 (164)	30.6 (86)	46.0 (397)	42.2 (483)
– Wheelchair/bed-bound	3.5 (12)	1.0 (9)	1.6 (21)	11.7 (33)	7.4 (64)	8.5 (97)

Table 3. Place of discharge from the primary hospital and place of residence at 4 months

	Men %	Women %	Total %
Place of discharge (%), (No. of observations)			
Own home	19.9 (68)	10.9 (103)	13.3 (171)
Full-service unit with meals, home for the elderly	0.6 (2)	1.0 (9)	0.9 (11)
Geriatric department or other department for chronic care	56.3 (192)	65.6 (621)	63.1 (813)
Acute hospital	13.2 (45)	12.9 (122)	13.0 (167)
Other	5.0 (17)	7.9 (75)	7.1 (92)
Not admitted, taken care of in another department	1.5 (5)	1.1 (10)	1.2 (15)
Unknown	3.5 (12)	0.7 (7)	1.5 (19)
At 4 months			
Residential status (%), (No. of observations)			
Own home	75.2 (212)	78.0 (675)	77.3 (887)
Full-service unit with meals, home for the elderly	6.8 (19)	5.2 (45)	5.6 (64)
Geriatric department or other department for chronic care	16.0 (45)	14.3 (124)	14.7 (169)
Acute hospital	1.1 (3)	1.4 (12)	1.3 (15)
Other	1.1 (3)	1.0 (9)	1.0 (12)

RESULTS

Background data: Of the 1,292 patients, 26.5% were men (n=343) and 73.5% women (n=949). The median age was 75 years for men (range 51–97) and 79 years for women (range 51–98). Forty-two percent of the patients were living alone at the time of fracture (31.0% of the men and 46.0% of the women), the corresponding percentage among the surviving patients at 4 months postoperatively being 30.2 % (21.4% of men and 33.1% of women) (Table 1).

Within 120 days after the primary operation, 124 patients had been reoperated (only the first reoperation was recorded), and the results of this subgroup will be presented elsewhere.

Discharge: More of the men (19.9%, n=68) than of the women (10.9%, n=103) were discharged to their own homes from the primary hospital (Table 3). Almost two thirds of the patients (63.1%, n=813) were primarily discharged to geriatric departments or other departments for chronic care. 22.2 % of the patients (n=285) were discharged to other institutions or residential

Table 4. Length of hospital stay, pain at 4 months and rate of mortality in the primary hospital and at 4 month

	Men	Women	Total
Hospital stay (days)			
Mean	7.6	7.4	7.5
Median	6	6	6
Range	1–78	1–47	1–78
Pain at 4 months (%), (No of observations)			
Yes, quite a lot	13.2 (37)	11.0 (94)	11.6 (131)
Yes, a little	61.4 (172)	55.9 (476)	57.3 (648)
No, not at all	25.4 (71)	33.0 (281)	31.1 (352)
Died in hospital after operation (%), (n)	4.1 (14)	0.9 (9)	1.8 (23)
Died during 4 months postoperatively (%), (n)	15.5 (53)	7.9 (75)	9.9 (128)

homes for the elderly. The place of discharge was unknown for 19 patients.

Residential status: Four months after the operation, 75.2% (n=212) of the men and 78.0% (n=675) of the women were living at their own homes. 6.8% (n=19) of the men and 5.2% (n=45) of the women were living independently or semi-independently in various homes for older people. 16.0% (n=45) of the men and 14.3 % (n=124) of the women had become permanently institutionalized by four months (Table 3). More than one fifth of the patients who had been living at home at the time of fracture have changed their place of residence; 65% of them have become permanently institutionalized, 25% have moved into homes for the elderly and 10% were in acute hospitals or non-defined places (Table 3).

Locomotor ability: Preoperatively, more than 80 percent of the patients (286 men, 758 women) had been able to walk out of doors either alone or accompanied. Their walking ability was remarkably impaired by the hip fracture; at 4 months, less than half of the patients (149 men, 391 women) were able to walk out of doors (Table 2).

Two thirds of the hip fracture patients had been able to walk without walking aids before the fracture, whereas the corresponding proportion was less than one fifth four months after the fracture (Table 2).

Pain: At the end of the follow-up, approximately two thirds (n=779) of the patients felt pain in the operated hip (Table 4).

Mortality: Hospital mortality was 1.8% (23 patients, 14 men, 9 women) (Table 4). Cumulative mortality at 4 months was 9.9% (n=128), being higher among the male (15.5%, n=53) than the female patients (7.9%, n=75) (Table 4). The mortality of the patients with trochanteric hip fracture (11.2 %) was higher than that of the patients with a cervical fracture (8.8%).

The effect of operational progress on functional results: When comparing the subgroups (89–92 group and 93–99 group), we found differences in the following items. The mortality during the hospital stay was smaller among the 93–99 group (1.5% vs.

2.2 %) and it was mostly because the male hospital mortality had decreased (5.3 % vs. 3.3 %). The total mortality at 4 months did not change though the mortality among the men had decreased from 18.2 % to 13.7 %.

The operation results seemed to improve with time when comparing the need of walking aids between the subgroups. In the 89–92 group, the proportion of patients not needing any walking aids before the fracture was 66.4 % whereas the same proportion in the 93–99 group was 62.3 %. At four months the figures were 16.1 % in the former group and 20.4 % in the latter group. The proportion of patients using frame had increased both pre- and postoperatively.

In the 89–92 group, 59.8 % of the male patients were living at their own homes, at 4 months the figure being 65.7 % in the 93–99 group.

As to the feeling of pain, one fourth of the 89–92 group and one third of the 93–99 group felt no pain. 10.3 % of the men in the former group felt pain quite a lot, as the figure was 15.0 % in the latter group. The proportion of female patients feeling pain quite a lot decreased from 13.7 % to 9.3 % with time.

DISCUSSION

The present study, which included a total of 1,292 home-dwelling hip fracture patients, was conducted during ten consecutive years in Oulu University Hospital, which serves the population of the City of Oulu with its 115,000 inhabitants and the surrounding region, the primary catchment area consisting of 43 municipalities with a total population of 365,000. In addition, there are three district hospitals in the catchment area, but they only treat less than 10% of all the hip fracture patients of the area. Our population represents the average hip fracture population over 50 years of age in Finland, where the living conditions and treatment modalities are rather similar to most parts of Europe, suggesting that the results obtained in this population are comparable to most other European countries.

We used standardized hip fracture forms for data collection. These forms have also been used in some earlier studies (6, 7). Many of the earlier studies on hip fracture treatment have used fracture healing, complications and reoperation rates as outcome measures (8). Our forms, however, focused on functional parame-

ters, which better reflect the outcome of treatment with regard to the quality of life and socio-economical aspects. Consequently, any direct comparison of our results with those of some previous studies is difficult. In addition, some other factors, such as age distribution, length of follow-up and functional outcome measures vary in different studies.

The follow-up period here was restricted to four months, because previous studies have shown that the functional ability of hip fracture patients usually remains at the level achieved within 4 months (4).

The primary hospital stay of hip fracture patients depends on several factors, e.g. the patient's age and general health, the type of fracture and operation and, remarkably, the rehabilitation resources and procedures (9, 10). The mean primary hospitalization time in our study was only 7.5 days, which is clearly shorter than in the previous studies, which have reported hospitalization periods varying within 16–27 days (3, 11, 12, 13). In these studies, however, the proportion of patients discharged home from the primary hospital has been higher, 56%–76%, as compared to 13% in this study. The main reason for our short primary hospitalization is the dense network of small health care center hospitals run by municipalities, which are mainly responsible for the rehabilitation of hip fracture patients and which are able to admit the patient very soon after the operation. We also have some municipal rehabilitation units and some private rehabilitation clinics. Our policy has so far been to discharge hip fracture patients from the orthopedic department to health care center hospitals or rehabilitation units as soon as the patient's general medical condition allows it. This is also the main reason for the low number of discharges directly to home from the primary hospital. A higher proportion of the men than the women were discharged home after the operation in our study, too. This could be explained at least partly by the female patients' higher age compared to the men and the fact that elderly women live alone more often than men and thus may not have enough help at home immediately after the early postoperative phase. Indeed, previous studies have shown that living with someone facilitates recovery and the return home compared to those living alone (4, 12).

Living at home is less expensive for society than living in institutions, and rehabilitation aiming to return the patient to his/her preoperative place of residence is therefore the most cost-effective goal of treatment for people with hip fractures. The impact of living at one's own home on the patient's quality of life should not be disregarded, either (15).

In the present study, 85% of the surviving patients had returned back to their own homes or various homes for the elderly presenting independent living, while 15% had been institutionalized within 4 months. This supports the results of some previous reports focusing on patients living at home at the time of fracture, in which the proportion of patients returning home by 4 months has varied from 69% to 79% (3, 4, 5, 11). Borgquist and coworkers reported in three different studies that 75%, 76% and 79% of patients rehabilitated in primary health care had returned to their own homes by 4 months (4, 11, 16). Holmberg and Thorngren found that 69% of the baseline patients were back at home at 4 months, while 20% were in a geriatric hospital and 2% in an acute hospital (5). In the study by Parker and Palmer, 65% of the baseline study population was able to live at home one year after the injury

(17). Ceder et al. (12) reported that, at 4 months from the injury, 81.8% of the surviving patients admitted from their own homes had returned there, while 18 patients out of 99 were living in institutions.

Walking ability usually deteriorates remarkably and the need for walking aids also increases after hip fracture (3, 18, 19). Borgquist and coworkers (3) reported that 92% of the patients coming from their own homes had been able to walk outdoors and 98% indoors at the time of fracture, the corresponding percentages being 82% and 97% at 4 months, respectively. In our study, half of the patients were able to walk outdoors and over 90% indoors at 4 months. In view of the fact that the walking ability at fracture was somewhat worse in our study than in the above-mentioned paper, our results regarding walking ability are rather congruent with the results reported by Borgquist. Comparison with many other studies is difficult because of the wide spectrum of evaluation scales used for the evaluation of ambulation. Koval et al. (18) found in their study that 41% of patients maintained their pre-fracture ambulatory ability and 81% remained ambulatory but needed more assistive devices at one year postoperatively than before the fracture. Clearly worse results on functional ability after hip fracture have also been reported. For example, Marottoli et al. reported that 75% of their hip fracture patients had been able to walk indoors independently at baseline, while 15% were able to do so at 6 months after fracture. Additionally, only 6% of these patients were able to walk half a mile at 6 months, the corresponding pre-fracture figure being 41% (19).

The mortality rate of home-dwelling hip fracture patients at four months has been around 9% in most previous studies, if it has been mentioned (3, 5, 13, 16), with the obvious exception of the study by Ceder et al., were 4 hip fracture patients out of 103 had died during the 4 months after the fracture (12). Our 9.9% mortality agrees well with the former studies.

When comparing the results of the two subgroups it seems that progress in the treatment and rehabilitation of hip fracture patients had taken place. The hospital mortality had decreased from the early 1990's towards the end of the century and the proportion of men living at home at four months had increased in the latter group, which has both important economical and also quality of life effects. It is also noteworthy that a smaller proportion of the patients suffered from pain in the latter group. This finding might reflect as well progress in surgical techniques as in treating pain. Though the proportion of patients using walking frame had increased between the time periods 1989–1992 and 1993–1999, the need of all kinds of walking aids was smaller during the latter time period.

To summarize, our results show that fifteen percent of the patients who had been living at home at fracture have become permanently institutionalized. The patients' functional capacity had also deteriorated markedly: 81% of the patients had been able to walk out of doors before the fracture, while 47% of them were able to do so at 4 months. The need for walking aids have also increased. Given that the population will be aging in the future and the predicted incidence of hip fracture will rise fast, the treatment of hip fractures and their consequences will cause continuously increasing costs and individual hardships in the community. Therefore, any attempts to evaluate and improve the existing rehabilitation systems and their cost-

-effectiveness as well as to develop new ones, especially for people able to live at home at the time of fracture should be encouraged and supported.

In addition, special attention should be attached to the prevention of hip fractures among home-dwelling elderly. Prevention of the institutionalization of home-dwelling hip fracture patients should be the primary goal of rehabilitation because it is rational from both the individual and the economic point of view.

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