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Functional outcome and survival after hip fracture in elderly: a prospective study of 106 consecutive patients

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Abstract Hip fracture is one of the most common, costly, and devastating injuries suffered by elderly. We prospectively analysed the recovery of hip fracture patients in an area of 92 500 inhabitants comprising six municipalities (A-F). Ambulation, functional capacity and survival of 106 consecutive hip fracture patients whose mean age was 79 years (SD=10) were followed for one year. Functional capacity was measured at two weeks, four months and twelve months postoperatively. Locomotor ability was evaluated pre- and postoperatively. Life table method was used in survival analysis. There was a significant decrease in the mean functional capacity of the patients at twelve months compared to the situation prior to the fracture (p=0.001). Prior to the fracture, 59% of the patients were moving without any assistive devices, but one year after fracture only 19% were able to do this. Similarly, not one of the patients was confined to bed before the fracture, but 11% of those who were alive after one year had become bed-ridden (p<0.001). Overall mortality rate was 32%. Age <80 years (OR=7.3; 95% CI, 2.3–23.1), residence in municipalities A and B (OR=4.2; 95% CI, 1.4–12.4) and ASA classes 1–3 (OR=5.2; 95% CI, 1.8–15.4) were positive factors for one-year survival. Patients from municipalities A and B (49% of all patients) whose post-acute care was given in the same rehabilitation department of one hospital recovered best. The locomotor ability of the patients decreased significantly in the first postoperative year. It seems that the centralisation of post-acute rehabilitation improves the functional outcome of these patients.

Key words Functional outcome • Hip fracture • Mortality • Survival

Introduction

Hip fracture is one of the most common, costly, and devastating injuries suffered by elderly. More than 4% of patients with a hip fracture die during hospitalization [1] and around 30% die within one year [2]. Many patients lose the ability to live independently; up to 20% of these patients require permanent institutional care [3]. Despite significant improvements in both surgery and rehabilitation in recent decades, hip fracture remains a much feared injury for patients and their carers [2]. In a prospective study, we evaluated the recovery of these patients during the first postoperative year in southeastern Finland.

Patients and methods

From 1 January 1999 to 31 January 2000, we prospectively registered all consecutive patients with hip fracture at the Kuusankoski Regional Hospital. This hospital is responsible for all hip fractures in an area of 92 500 inhabitants in six municipalities: Kouvola (A), Valkeala (B), Kuusankoski (C), Elimäki (D), Iitti (E), and Jaala (F). The post-acute care in the patients from municipalities A and B took place in one health centre hospital, whereas the patients from the other municipalities were treated in their own health centre hospitals.

Fracture type, operative method and complications were recorded by an orthopaedic surgeon (P.L.). The operability was evaluated according to the classification of the American Society of Anesthesiologists (ASA) [4]. Most of the data collection was performed by dedicated nurses trained for this work. They prospectively compiled the questionnaire with data concerning the patients' backgrounds: age, gender, place of residence (home or institution), form of living (alone or with someone), day of admission, operation and discharge, and place of discharge. Home as a form of residence included the actual home, a residential service home for elderly as well as any other unit of residence provided by social care. By institution, we mean a municipal nursing home or a health centre hospital.

The pre- and post-fracture locomotor abilities of the patients were evaluated and recorded. The patients' functional capacities and their places of residence were studied preoperatively and recorded postoperatively at two weeks, at four months and at twelve months. The functional capacity was studied with nine variables: moving in bed, turning over in bed, sitting up in bed, transferring to chair, standing up, walking, dressing-undressing, using the toilet and washing up, and eating (Figs. 1–3). These tasks were assessed using a three-step level: 1. level = managing independently or guided by the nursing staff; 2. level = managing with the assistance of the nursing staff; 3. level = not managing at all [5].

The observed survival rates after hip fracture were compared with the survival rates based upon sex- and age-adjusted life-tables for the whole population in Finland. The calculations of the survival rates are based on the individual life expectancies of the target population for the target year (reference population). The relative survival of the Finnish reference population would be 1.00. If the survival curve of the group remains below the survival of the reference population there is excess mortality in the group (Fig. 4) [6, 7]. The survival rates were analysed in one-month periods during the first post-fracture year according to the patients' municipalities of residence.

The statistical analyses were performed using the *t* test, the paired *t* test, the chi-squared test, Wilcoxon's rank test, and logistic regression analysis.

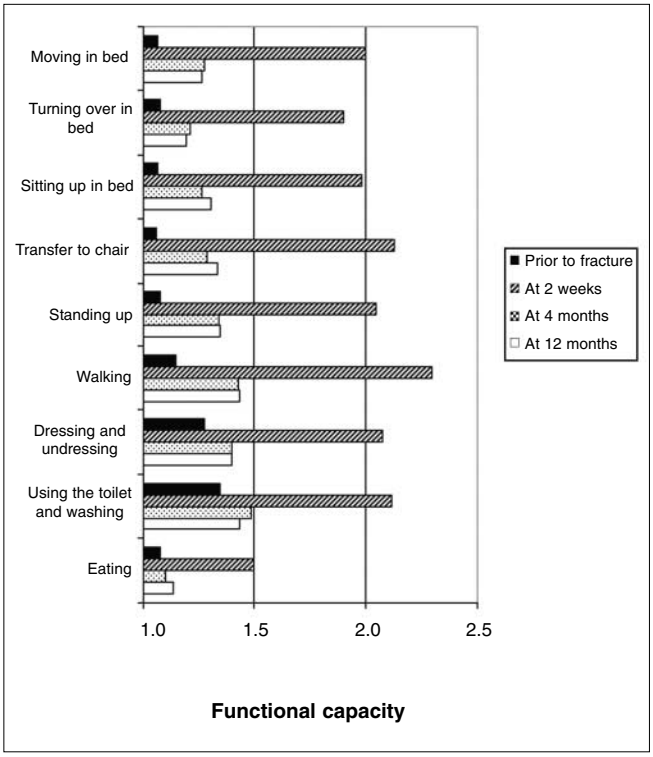

Fig. 1 Mean functional capacity of 106 elderly patients prior to hip fracture and at 2 weeks (n=104), 4 months (n=80) and 12 months (n=72)

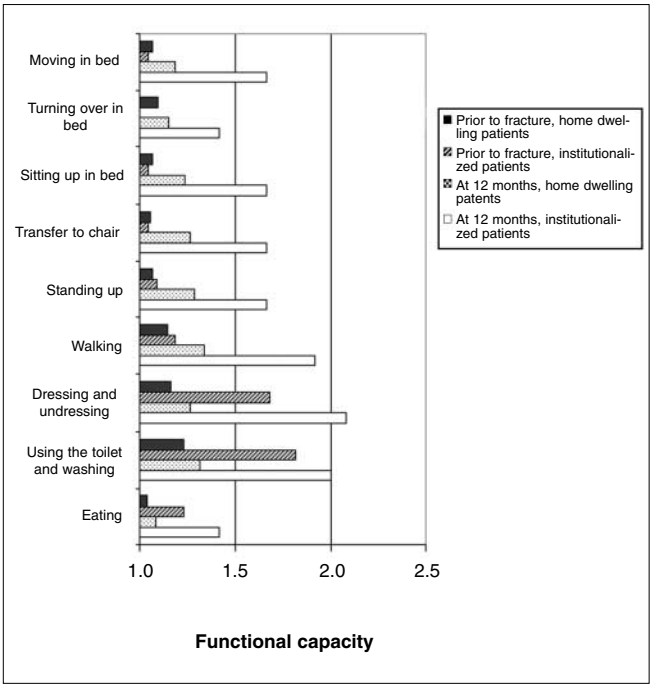

Fig. 2 Mean functional capacity before injury (n=106) and 12 months later (n=72), by place of residence

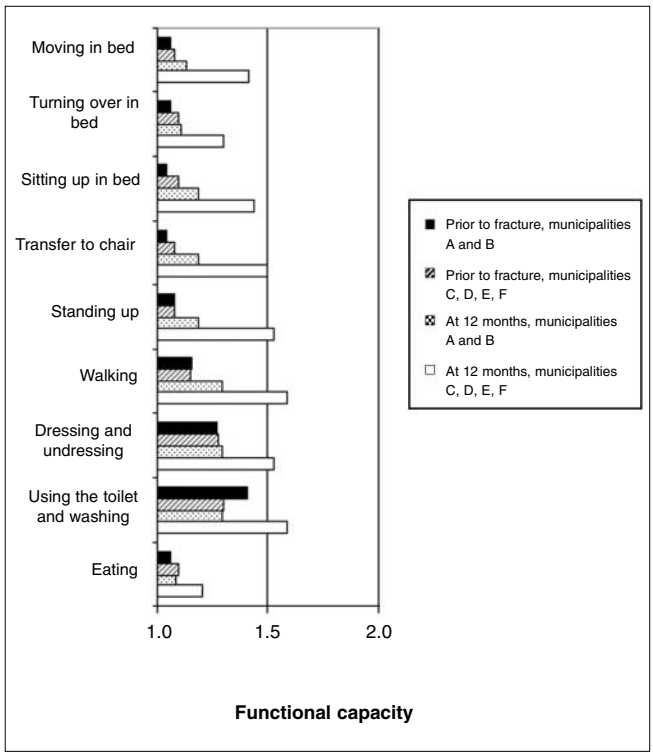

Fig. 3 Mean functional capacity prior to fracture and 12 months later, according to the municipality of residence

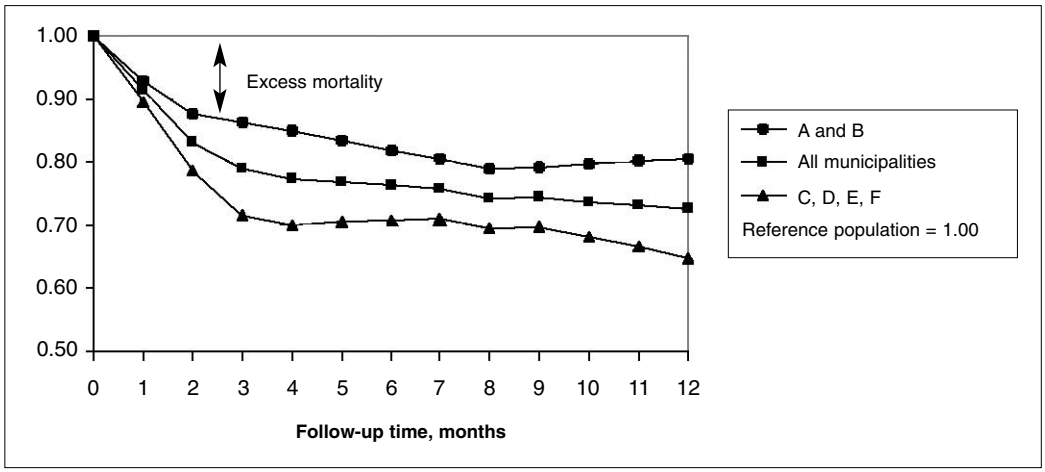

Fig. 4 Relative survival of the patients according to the municipality of residence

Results

A total of 106 patients with hip fracture were treated at the Kuusankoski Regional Hospital. Of these patients, 74 (69.8%) were women with a mean age of 80.8 years (SD=8.9 years). The mean age of the 32 male patients was 74.1 years (SD=12.2 years). Over half 41 (55%) of the women and one-fifth 7 (22%) of the men were living alone when the fracture occurred, and 84 (79%) of all patients were still living at home at the time of the injury. The ASA level of operability was judged to be 1–2 in 34 patients (32%), 3–4 in 71 cases (67%) and 5 in 1 case. A total of 52 patients (49 %) were residents of the municipalities A and B. There were no differences in age, sex, place of residence, locomotor ability or ASA class among patients residing in the different municipalities.

We observed a range of fracture types at various levels (Table 1): cervical (n=61), basocervical (n=4), trochanteric (n=35) and subtronchanteric (n=6). Hip fracture was treated surgically in 105 of 106 patients (Table 2). The average delay from hospital admission to operation was 1.5 days (SD=1.9 days): 20 patients (19%) were operated on the day of admission while 54 (51%) were operated on the following day; operation was delayed in the remaining 32 patients due to

Table 1 Type of hip fracture in 106 elderly patients

Fracture	Patients, n (%)
Cervical	
Garden I-II	12 (11)
Garden III-IV	49 (46)
Basocervical[a]	4 (4)
Trochanteric[a]	
2 fragments	18 (17)
≥ 3 fragments	17 (16)
Subtrochanteric[a]	6 (6)

[a] All these fractures are trochanteric fractures

Table 2 Operative methods in 106 patients with hip fracture

Operation	Patients, n (%)
Thompson hemiprosthesis	56 (53)
Total arthroplasty	1 (1)
Sliding nail	41 (39)
Screws	3 (3)
Gamma nail	4 (4)
No operation	1 (1)

their medical conditions. The mean hospitalisation time in acute care was 8.8 days (SD=4.7 days; range, 2–23 days).

Post-acute care was provided by health centre hospitals for 84 patients (79%), while 14 patients (13%) were discharged home after acute care, 3 patients (3%) to other institutions and 5 patients (5%) died during the acute care. After four months, of the survivors, 53/80 (66%) were living at home, while after one year correspondingly, 54/72 (75%) were home-dwelling. Of the 84 subjects who were home-dwelling before the injury, 11 (13%) stayed in permanent institutional care. Two patients were reoperated during the first year, and six patients suffered from a superficial wound infection.

Ambulatory and functional capacities

Prior to the fracture, 63 patients (59%) were moving without any assistive device, but one year after fracture only 14 (19%) were able to do this (Table 3). Similarly, not one of the patients was confined to bed before the fracture, but 8 (11%) of those who were alive after one year had become bed-ridden (Wx = 5.42; $p<0.001$).

Table 3 Locomotor ability of the patients prior to hip fracture and 12 months postoperatively. Values are number (percentage) of patients

Locomotor ability	Prior to fracture (n=106)	At 12 months (n=72)[a]
No assistive device	63 (59)	14 (19)
With cane	18 (17)	14 (19)
With two canes	3 (3)	8 (11)
With rollator	20 (19)	23 (32)
With wheelchair	2 (2)	5 (7)
Non-ambulatory	0 (0)	8 (11)

[a] 34 patients died during the 1-year follow-up

Table 4 Total functional capacity (sum of 9 individual variables) of the patients during the 12-month follow-up

	Functional capacity, mean (SD)	*t*	*p*
Prior to fracture (n=106)	10.2 (2.3)	–	–
Survivors at 2 weeks (n=104)			
Prior to fracture	10.2 (2.4)		
At 2 weeks	18.0 (5.3)	-15.734	<0.001
Survivors at 4 months (n=80)			
At 2 weeks	16.8 (4.9)		
At 4 months	11.8 (4.4)	9.324	<0.001
Survivors at 12 months (n=72)			
Prior to fracture	9.8 (1.9)	-3.391[a]	0.001[a]
At 4 months	11.1 (3.6)	-1.847[a]	0.069[a]
At 12 months	11.8 (5.2)	–	–

[a] Compared to 12-month values

The functional capacity of the patients did not resume the level they had had prior to the fracture (Fig. 1). As regards the total functional capacity of the patients who survived the whole follow-up year (Table 4), their average capacity (11.8) was significantly lower (p=0.001) than before the fracture (9.8).

There were no significant differences between the functional capacity of men and women two weeks or four months after fracture. However, after one year, women

needed more assistance than men in moving in bed (p=0.005), in turning over (p=0.029) and in sitting up (p=0.010) (data not shown). The functional capacity of the patients in institutional care decreased more than that of home-dwellers (Fig. 2).

Survival

During the l-year follow-up, 34 patients (32%) died. Of these, 8 (24%) had been living at home before the injury and 3 (9%) had already been in institutional care. Mortality during acute care was 5% (5 patients). The one-year mortality rate was 31% among those who were operated within two days from admission and 36% among those operated later (not significant). Death occurred during the first month in 35% of the cases (12 patients), in the second to the fourth months in 41% of the cases (14 patients) and between 5 and 12 months in 24% (8 patients). The mortality in women was higher than in men (34% vs. 28%) but this difference was not significant. Among the 61 patients with femoral neck fractures, 16 (26%) died, while 18 of 45 patients (40%) with a trochanteric fracture died. The mean age of the patients who died was higher than that of those who survived the follow-up year (t=3.758; df=104; p<0.001). Age (under 80 years), municipality of residence (A and B), and ASA class (1–3) had a significant positive correlation with survival rate during the follow-up year (Table 5).

Table 5 Factors connected to one-year survival after hip fracture in 105[a] elderly patients

Factor	Patients, n	OR	(95% CI)
Place of residence			
Home	83	1.3	(0.4–4.3)
Institution	22	1.0	
Gender			
Male	32	0.8	(0.3–2.4)
Female	73	1.0	
Age			
<80 years	54	7.3	(2.3–23.1)
≥80 years	51	1.0	
ASA class			
1–3	71	5.2	(1.8–15.4)
4–5	34	1.0	
Municipality of residence			
A, B	52	4.2	(1.4–12.4)
C, D, E, F	53	1.0	
Fracture type			
Cervical	60	2.5	(0.9–6.9)
Trochanteric	45	1.0	

[a] Patient treated conservatively (n=1) excluded

Patients from municipalities A and B, whose post-acute care was given in the same rehabilitation department, recovered better than those from the other municipalities (Fig. 3).

At two months, the excess mortality rate compared to the reference population for patients from municipalities A and B was 12% as opposed to 21% for patients from municipalities C, D, E and F (Fig. 4). At six months, the corresponding figures were 18% and 29%, and at one-year they were 19% and 35%, respectively. In terms of the whole study population, the excess mortality rate was 24% after six months and 27% after one year.

Discussion

Many factors influence the recovery after hip fractures: pre-fracture health, mental and functional status including muscle power of the good limb [8, 9], type of surgery, fracture type, surgical complications, in-hospital self-efficacy beliefs, depressive symptoms, number of medications [10], hip pain [11], urinary incontinence [12], and chronic diseases [13].

The treatment and rehabilitation of patients with a hip fracture is an example of multidisciplinary team work. In Finland, the acute care of patients with a hip fracture, i.e. pre-operative care, operation, and the starting of immediate postoperative rehabilitation, is the duty of acute-care hospitals, whereas primary health care has the main responsibility for post-acute rehabilitation in health centre hospitals, involving general practitioners, hospital and community nurses, physiotherapists, social workers and the patients' families. The main aim of this multidisciplinary discharge management is to restore the functional capacity of these patients to the same level they had prior to the fracture. Another aim is that the patients who come from their own homes, residential service homes or homes for elderly should be able to return to the same place.

It is generally accepted that operations for the treatment of hip fractures in elderly should be performed as soon as possible (within 24 hours) after the patient has been admitted to the hospital [2]. Grimes et al. [14] retrospectively studied 8383 patients aged 60 years or older who were hospitalized less than 48 hours after fracture, and found no association between time to surgery (<24 hours vs. 24–48 hours) and short- or long-term mortality after adjusting for active medical problems. In an earlier study, however, an operation delay of more than two cal-

endar days after admission was an important predictor of mortality within one year for elderly patients who had a hip fracture and who were cognitively intact, able to walk and living at home before the fracture [15]. In the present study, 74 (70%) of 106 patients were operated within two days after admission. The main reason for the delay in the remaining patients was their medical conditions.

The one-year mortality rate after hip fractures is high. In previous Finnish studies, this rate varied between 18% and 28% [7, 16–19]. In the present study, 32% of patients died within one year of the fracture. It is difficult to compare the mortality rates from different studies, especially from different countries, because the background variables differ regarding patient age, gender, health status, walking ability, activities of daily living (ADL), place of residence before injury, post-acute care and residence after rehabilitation. Nowadays, the mean age of hip fracture patients is higher than in the last three decades [7, 16–19]. In the present study, patients who were under 80 years old survived considerably better than those over 80 years. The mortality risk was highest within the first four months following the fracture; this result is similar to that from a recent study from New York, USA [20]. Hip fracture is generally associated with a higher mortality rate in men than in women [15, 21, 22]. However, in the present study there were no significant differences in this respect.

In this study, 79% of the patients were discharged for rehabilitation in local hospitals after the acute hospital treatment. Of these patients, 49% (those from municipalities A and B) were discharged to the same rehabilitation department; the functional outcome in these patients was surprisingly better than that of the other patients. In addition, the survival rate of these patients was four-fold compared to the other patients during the follow-up. Huusko et al. [23] assessed the outcomes of care given to hip fracture patients suffering from dementia and presented similar findings, stating that the centralisation of patient rehabilitation seems to be of benefit. According to Huusko et al. [24], centralising the care of patients with minor or moderate dementia in the geriatric ward was the right solution, because the patients could receive geriatric rehabilitation there and be released significantly sooner. In addition, this solution had a significant role in preventing the patients with moderate dementia from being permanently confined to institutions. Patients who are mentally alert, medically well and mobile postoperatively are most likely to benefit from a supported discharge scheme [25–28] and should be identified by a multidisciplinary team assessment [2]. However, in a recent study from Germany, no significant differences in mortality and morbidity were found in over 64-year-old patients with a hip fracture and a normal mental status between those who were in institutional rehabilitation (orthopaedic or geriatric hospital) after surgery and those who received special rehabilitation [29]. In the present study, our aim was not to compare the recovery rates in different municipalities. However, our results support the centralisation of the post-acute rehabilitation of hip fracture patients to wards specialized in geriatric rehabilitation.

In this study 66% and 75% of the survivors had returned home after 4 months and one year, respectively. In an other prospective study from Sweden and Northern Finland, 71% of patients with a displaced femoral neck fracture treated with hemiarthroplasty and 87% of those treated with osteosynthesis who had been living in their own home at the time of the fracture, had returned to their own home at 4 months [19]. A recent study from The Netherlands evaluated whether the early discharge of hip fracture patients from acute hospital *vs*. conventional management would affect the outcome [30]. At four months in both groups, similar percentages of patients (53%–55%) had returned to their own homes.

Several studies have found that recovery following hip fractures is usually complete within 6 months [31–34]. In our study, functional recovery of the patients was best at four months, and it decreased between four and twelve months but not significantly. After one year, functional outcomes of our patients were generally poor compared to the pre-fracture situation: 69% required some sort of aid for locomotion and 11% were not ambulatory. Before injury, these figures were 41% and 0%, respectively. Permanent institutional care had to be provided for 13% of the patients who had previously been living at home.

Hip fracture is fateful for the patient. For many patients previously fit, it means a loss of prior full mobility. The final outcome is affected by many factors, including the ability in the activities in daily life and the medical condition of the patient prior to the injury, the success of the operation from the technical viewpoint, as well as the professional know-how of the rehabilitation staff in health centre hospitals, and the collaboration between social workers, home-care staff and the patients' families.

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