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SHORT COMMUNICATION

Activities of daily living after hip fracture: profile and rate of recovery during 2 years of follow-up

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Abstract
Summary In this study 509 hip fracture patients were followed-up during 24 months measuring their recuperation in activities of daily living. The different activities measured had both different profile and probability of recovery.
Introduction Recovery of pre-fracture functional level is a goal of hip fracture treatment. The objective of this study was to measure recovery of previous functional level for ambulation and for the activities of daily living during the 24 months after osteoporotic hip fracture.
Methods This is a longitudinal prospective study of the patients admitted to the orthopaedics department of a university hospital for hip fracture and followed up by a geriatrician during three years (2003–2005). Demographic, clinical, functional and treatment data were collected during hospitalisation. Telephone follow-up was made at 3, 6, 12 and 24 months. Data were analysed by survival analysis applying the Kaplan–Meier estimator.
Results Five hundred and nine patients were included. The mean age was 84.5 (SD 6.3) years. The activities with lower probability of recovery to the previous level at 24 months were climbing stairs, chair/bed transfers, ambulation, dressing, bathing and use of toilet (between 67.5% and 76% recovery). The activities with higher probability of recovery were grooming, feeding and bladder and bowel control (between 86.3% and 95.4%). Recovery of previous performance level for ambulation, chair/bed transfers, use of toilet, feeding, grooming and bladder control occurred primarily during the first 6 months, whereas recovery of bathing, dressing and climbing stairs occurred mainly in the first 12 months after the fracture.
Conclusions The activities with lower likelihood of recovery were ambulation, chair/bed transfers, climbing stairs, use of toilet, bathing and dressing. Time of recovery varied by activity; bathing, dressing and climbing stairs were the activities with the longest recovery time.

Keywords Activities of daily living · Elderly · Functional recovery · Hip fracture · Longitudinal change

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Introduction

Hip fracture is a health problem that increases in incidence after 60 years of age, following an exponential pattern up to age 84 [1]. It is important not only because of its high frequency [2], but also due to its associated mortality (25% reduction in life expectancy [3]), its morbidity (patients have 4.2 times more immobility and 2.6 times more functional dependence than the elderly without hip fracture [4]) and its high economic and social cost [5].

In addition to the classical goals of hip fracture surgery—reduction of the fracture, prevention of avascular necrosis and reduced mortality—other, more ambitious objectives are now sought, such as returning patients to their pre-fracture functional level as quickly as possible and enabling them to return to their previous social setting. This requires that

patients recover their ability to walk and to carry out the rest of the activities of daily living (ADLs). Many experts now consider that achieving the pre-fracture health and functional level should be included among the objectives of hip fracture treatment [6]. By monitoring the achievement of these objectives, it is possible to evaluate the effectiveness and quality of health care provided to patients [7].

Ambulation and other necessary activities of daily living are important in recovery of previous functional status after hip fracture; however, the levels and profiles of recovery are not well known. Many studies have analysed the rate of functional recovery after hip fracture [8–13], but only a few of them have measured specific ADLs other than ambulation [8, 10, 12], and fewer yet have studied the patterns of recovery of different ADLs over a period of 24 months [10]. No studies in the literature we have consulted have studied the evolution of ten ADLs in conjunction over a period of years.

The objective of this study was to measure recovery to the previous level of performance for ten ADLs (ambulation, chair/bed transfers, use of toilet, climbing stairs, dressing, feeding, bathing, grooming and bladder and bowel control) during the 24 months after an osteoporotic hip fracture. This knowledge can help us to recognise the functions for which improved therapeutic measures are needed to allow these patients' recovery.

Patients and methods

Study setting

The study was carried out in a 1,300-bed university hospital, which at the time of the study, had 126 orthopaedic beds. The type of collaboration between the orthopaedics and geriatrics departments has been described elsewhere [14, 15].

Patients and methods

This was a prospective longitudinal study of 660 consecutive patients over 64 years of age admitted for a proximal femur fracture of probable osteoporotic aetiology from January 1, 2003 to December 31, 2005. They were treated in the acute phase by a team that included orthopaedic surgeons and geriatricians.

The inclusion criteria were: (1) having sustained a fall from their own standing height in the 72 h before admission resulting in hip fracture; (2) ability to walk before the fracture (either independently or aided by another person) (non-ambulatory patients were omitted); (3) absence of a terminal disease as well as of any other serious condition that would impede rehabilitation (advanced cancer, advanced chronic renal failure in a haemodialysis programme, severe uncontrolled psychiatric disturbance prior to admission, polytrauma, subarachnoid haemorrhage); (4) surgery for the hip fracture; (5) absence of serious post-surgical orthopaedic complications that would require additional surgery; (6) alive at hospital discharge; (7) consent for study inclusion.

Demographic (age, sex, previous living situation) and clinical (type of fracture, medical history and surgical risk according to American Society of Anesthesiologist classification (ASA) [16]) data were collected during hospital admission. Previous and discharge functional level were assessed by applying the Barthel Index [17], which evaluates ten ADLs: ambulation, chair/bed transfers, use of toilet, climbing stairs, dressing, feeding, bathing, grooming and bladder and bowel control. Cognitive function was evaluated by applying Pfeiffer's questionnaire [18] and the Red Cross Mental Impairment Scale [19, 20] which allow assessment of the current and the previous cognitive state of the patient. Length of hospital stay and discharge destination were also registered. After surgery, patients began early physical therapy on the same orthopaedic floor, and those who so required were sent to a geriatric rehabilitation unit after discharge. Patients were followed up by telephone at 3, 6, 12 and 24 months, at which time functional status was assessed by applying the Barthel Index. Previous studies have shown the reliability and validity of information elicited by applying the Barthel Index in telephone interviews [21, 22]. All study patients, or their relatives if they had cognitive impairment, consented to the use of their data for research. At each follow-up call, subjects were asked about their wish to continue taking part in the study or not, before asking the follow-up questions.

Statistical analysis

Continuous data are presented as means and standard deviations and categorical data as frequencies and percentages. Qualitative data were compared with Fisher's Exact Test. The probability of recovery was calculated by survival analysis applying the Kaplan–Meier estimator. The log–rank test was used to compare differences between men and women. For each of the ten activities measured, patients were considered to have recovered the previous level of performance if they received the same score on the items established in the Barthel Index [17] for that ADL. The data were analysed using the statistical programme SPSS/PC 11.

Results

Of the 660 patients evaluated, 151 were excluded based on the criteria shown in Table 1. Five hundred and nine

Table 1 Criteria for exclusion of patients from study of functional recovery after hip fracture

Criteria	No. of patients
At hospital admission	
Severe previous functional impairment (inability to walk)	26
Polytrauma: various fractures, subarachnoid haemorrhage	23
Pathologic fracture, advanced cancer, renal failure in haemodialysis, gangrene	17
Fall from more than standing height or major trauma	9
Severe, uncontrolled psychiatric impairment	5
Fracture of more than 72 h evolution	4
During hospital admission	
No surgical intervention	25
Death in hospital during acute phase	21
Additional surgery required for fracture during acute phase	5
Other causes	
Refusal to participate in the study	16
Total	151

patients were included and followed up. Patients identified but excluded from the study were less frequently women (65.2% vs. 81.3%; $p<0.001$) but were not significantly different with regard to any other variables analysed.

Study patients were elderly, with a mean age of 84.5 years (SD 6.3); 219 patients (43%) were older than 85. The mean number of medical conditions was 4.9 (SD 2.4). Almost half (47.2%) had high surgical risk (ASA III–IV). Previous mental score on the Red Cross Scale was 1.1 (SD 1.2). Over two thirds (69%) lived in their own home before admission. With respect to type of fracture, 208 were intracapsular (40.9%), 265 intertrochanteric (52.1%) and 36 (7.1%) subtrochanteric. Before the fracture, all 509 patients (100%) were independent or required minimal help for walking, 501 (98%) for chair/bed transfers, 487 (96%) for feeding, 450 (88%) for use of the toilet, 410 (81%) for dressing, and 376 (74%) for climb stairs. Four hundred and nine patients (80%) were independent for grooming and 163 (32%) for bathing. Bowel incontinence was absent or occasional in 440 patients (86%), and bladder incontinence was absent or occasional in 323 patients (63%).

Most patients 410 (80.5%) returned to their previous home or nursing home after discharge; 84 (16.5%) were referred to a geriatric rehabilitation unit, and 15 (2.9%) were referred to long-stay wards. Mean acute hospital stay was 16.4 days (SD 5.1), and mean length of stay of patients referred to a geriatric rehabilitation unit was 25.13 days (SD 11.6). During the follow-up period, 70 patients (14%) had died at 3 months, 27 (5%) more at 6 months, 31 (6%) more at 12 months, and 47 (9%) more at 24 months.

Table 2 shows the probability of recovering the previous level of performance of the ADLs at 3, 6, 12 and 24 months after hip fracture in the total study population. As the table shows, by the end of 24 months follow-up, the study cohort had not completely recovered all ten ADLs analysed. Use of stairs, transfers, ambulation, dressing, bathing and use of the toilet were the activities with lower probabilities of

Table 2 Probability of recovering previous functional performance level in ambulation, chair/bed transfers, feeding, use of toilet, dressing, grooming, climbing stairs, bathing, bladder and bowel control at hospital discharge and at 3, 6 12 and 24 months in a cohort of elders undergoing surgery for osteoporotic hip fracture

	Grooming (%)	Feeding (%)	Bowel control (%)	Bladder control (%)	Use of toilet (%)	Bathing (%)	Dressing (%)	Ambulation (%)	Transfers (%)	Stairs (%)
Discharge	41.6	47.98	61.8	57.5	4.6	0	7.2	6.9	2.8	0
3 months	80.1	79.17	82.3	75.6	58.4	27.5	48.5	59.4	47.9	31.8
6 months	89.4	84.4	87.1	79.2	68.8	50.9	62	70	60.6	49.8
12 months	92.1	86.3	87.9	81.9	73.8	67.8	71.6	73	65.6	60.3
24 months	95.4	90.7	89.2	86.3	76	75.9	75.5	73.6	69.7	67.5

Probability shown in percentage, calculated by survival analysis applying the Kaplan–Meier estimator

Activities are ordered by level of patient recovery at 24 months

recovery in the first 24 months. Grooming, feeding, and bladder and bowel control had higher probabilities of recovery.

The rate of recovery over time varied for the different ADLs. Recovery of ambulation, use of the toilet, transfers, feeding and grooming occurred primarily during the first 6 months, with little probability of recovery in the following 18 months. In contrast, the probability of recovery of bathing, climbing stairs and dressing extended throughout the first 12 months, with little probability of recovery in the following 12 months. With regard to recovery of previous level of continence, the highest probability was in the first 6 months after hip fracture.

With respect to sex, there were no statistically significant differences in the probability of recovery of the ADLs except in the case of grooming (p=0.04), which was higher in men.

Discussion

This study provides a detailed and panoramic view of the rate of functional recovery during the first 24 months after hip fracture. The level of patients' recovery of the ADLs was far from complete.

Overall, the functional performance of these elderly patients was good prior to hip fracture. All study patients were able to walk alone (90.6%) or with minimal assistance from another person (9.4%). With regard to the ADLs, over 95% were independent or required minimal help for transfers and feeding, and over 80% for use of the toilet, dressing and grooming. Moreover, all patients underwent surgery and initiated early rehabilitation on the same orthopaedic ward. From the time of hospital admission until discharge, they were followed by a geriatrician who managed their comorbidity. Finally, those patients whose recovery required more intensive functional treatment were provided this opportunity in a geriatric rehabilitation unit.

Three findings should be highlighted: first, that functional recovery was not achieved in all the ADLs even 24 months after the fracture, although this was not the same for all patients; second, not all the ADLs were recovered in the same proportion; and third, there were differences in the recovery time required for each activity analysed.

Overall, it can be said that the highest rate of ADL recovery occurred in the first 12 months, and that important functional loss persisted after 24 months. In other studies with 12 months follow-up, it was also found that the functional level of patients with hip fracture improved during the first 6 months [11], with higher recovery at 1 year [8, 12]. It has also been seen that improvement continues up to 24 months for those functions involving the lower extremities [10], which is consistent with our results.

In our study, the rate of recovery at 2 years varied depending on the activity measured. Activities such as transfers, ambulation, climbing stairs, use of the toilet, bathing and dressing had a poorer probability of recovery, ranging from 67% to 76%. In contrast, the probability was higher for activities like continence, feeding and grooming, ranging from 86% to 95%. Similar to our study, other authors have found important functional loss at 3 months after hip fracture for bathing (40%) and dressing (25%) in elderly persons with good mental function [23], loss of 37%, 23% and 21% for bathing, dressing and grooming, respectively, at 1 year [24], and loss of 28% for ambulation at 24 months after hip fracture [9]. Other studies, even those using stricter selection criteria, have reported somewhat smaller proportions of functional disability than we found for activities such as transfers (22%) and feeding (6%) at 24 months [25].

With regard to the different recovery profiles, we found that ambulation, use of the toilet, transfers, feeding, grooming and continence were recovered mainly during the first 6 months, with a less than 10% probability of achieving additional recovery in the following 18 months. On the other hand, the probability of recovering bathing, climbing stairs and dressing occurred mainly in the first 12 months and also had a less than 10% probability of improvement in the remaining 12 months. The ability to climb stairs, which requires better ambulation, took longer to recover than ambulation itself. Bathing is a complex activity, and as such would be expected to take a long time to recover. However, it is surprising that the probability of recovering the ability to dress oneself is more prolonged, exceeding that of grooming and feeding.

The failure to recover previous functional status found in our work and in other studies, both for activities that affect the upper extremities and those affecting the lower extremities, suggests that what is considered good treatment for patients with hip fracture (surgery, early physical therapy, medical follow-up) is in fact insufficient. It is difficult to accept that in the 21st century, we are unable to improve the probability of functional recovery in patients with hip fracture.

The factors that can affect recovery are multiple and varied (demographic, clinical, functional, cognitive and affective, social and treatment-related) [26]. Furthermore, it is possible that management of other factors such as a quick normalisation of vitamin D deficiency [27, 28], better knowledge of the influence of comorbidity, early introduction of occupational therapy in the post-operative period, or evaluation of possible adaptations in the home [29, 30] may result in improved outcomes in the future. Likewise, there may be a subgroup of patients for whom an increased length and intensity of rehabilitative treatment will improve function [31], since the population that suffers hip fracture is a highly heterogeneous group.

Hip fracture is a complex process for which the intrinsic mechanisms of recovery in each patient are not fully known. Therefore, the therapeutic measures available to these patients are currently insufficient.

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Conflicts of interest None.

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