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SHORT COMMUNICATION

FUNCTIONAL RECOVERY AFTER CONCOMITANT FRACTURES OF BOTH HIP AND UPPER LIMB IN ELDERLY PEOPLE

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Objective: **To investigate functional recovery after concomitant fractures of both hip and upper limb in elderly people.**
Design: **Survey study.**
Setting: **Rehabilitation hospital in Italy.**
Participants: **586 consecutive in-patients with hip fracture.**
Main outcome measures: **Functional recovery was evaluated by using Barthel index score.**
Results: **4.1% of patients (i.e. 24/586) suffered from a concomitant fracture of an upper limb, involving proximal humerus ($n = 8$) or distal radius ($n = 16$). After adjustment for 9 prognostic factors, a significant reduction in the Barthel index score on admission but not on discharge was found in the patients with an upper limb fracture. The length of stay was not significantly associated with the presence of the concomitant upper limb fracture.**
Conclusions: **In a sample of hip-fractured patients, neither the functional recovery at the end of a course of rehabilitation nor the length of stay were influenced by the presence of a concomitant fracture involving an upper limb.**

Key words: hip fractures, shoulder fractures, radial fractures, Barthel index, rehabilitation.

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INTRODUCTION

Osteoporosis is a condition of low bone mass and microarchitectural disruption that results in fractures with minimal trauma (1). The most severe osteoporosis complication is hip fracture, which is associated with a significant increase in mortality ranging from 10% to 30% (2). At the upper limb, the osteoporotic fractures involve distal radius and proximal humerus (3). The vast majority of fragility fractures involving hip (4) or upper limb (5, 6) result from a fall from standing height or less. Functional recovery after hip fractures is often poor, despite successful surgical repair (7), however little is known about functional recovery in patients with multiple fragility fractures caused by a single fall (8). Our aim was to investigate both functional recovery and length of stay after concomitant fractures of both hip and upper limb.

SUBJECTS AND METHODS

A total of 655 patients admitted consecutively between January 1996 and January 2002 to our Division of Physical Medicine and Rehabilitation because of recent hip fracture were evaluated in this retrospective study using clinical records. A total of 31 of the 655 patients were excluded because their hip fracture was caused by either major trauma or cancer affecting the bone. All of the 624 remaining patients suffered from fractures that were either spontaneous or caused by minimal trauma (trauma equal to or less than a fall from a standing position). A total of 38 of these 624 patients were excluded because they died or were transferred to other hospitals. One of these 38 suffered from a concomitant fracture of an upper limb. The final study sample included 586 patients. Twenty-four of the 586 patients suffered from a concomitant fracture of an upper limb involving the distal radius ($n = 16$) or the proximal humerus ($n = 8$).

The functional evaluation both on admission to rehabilitation and at the time of discharge from the hospital was performed by a skilled physiatrist using the Barthel index (original version unchanged).

Stepwise linear multiple regression analysis was performed including 9 prognostic factors together with the presence of concomitant fractures at the upper limb as independent variables: age, sex, fracture type (cervical or trochanteric), surgical procedure (arthroplasty or internal fixation), cognitive impairment (Mini Mental State Examination <24/30), pressure sores (pressure ulcers involving a break in the skin), neurological impairment (impairment found at clinical examination due to neurological diseases, mainly Parkinson's disease or stroke), infections (all the infections needing antibiotic treatment during the length of stay) and number of concomitant diseases (all the prevalent diseases judged clinically relevant during the length of stay). Prior to perform regression analysis, the dependent variables (i.e. the Barthel index score and the length of stay) were checked for normality. As the data were non-normally distributed, area transformations were performed, using the formula (r–1/2)/w, where w is the number of observations and r is the rank. Successful normalization was obtained. The residuals were normally distributed in all the linear regression models. Colinearity diagnostics showed that the percentage of variance in each predictor that could not be accounted for by the other predictors was always greater than 85% (no redundant predictors were found).

The statistical package used was SPSS, version 10, 1998 (SPSS, Inc., Chicago, IL, USA).

RESULTS

Twenty-two of the 24 patients with concomitant fractures of hip and upper limb suffered from ipsilateral fractures. None of the 24 patients had undergone surgery for the fractures of the upper limb that were treated conservatively with immobilization. All

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Table I. *Characteristics of the 2 groups of patients (given as mean ± SD where not otherwise stated)*

Variable	Group 1: fractures of both hip and upper limb ($n = 24$)	Group 2: hip fracture only ($n = 562$)
Age (years)	79.7 ± 10.6	79.9 ± 8.5
Sex: women/men (%)	96/4	87/13
Hip-fracture type: trochanteric/cervical (%)	63/37	57/43
Surgical procedure type: arthroplasty/internal fixation (%)	50/50	51/49
Cognitive impairment (%)	21	30
Pressure sores (%)	26	30
Neurological diseases (%)	8	13
Infections (%)	29	45
Concomitant diseases (*n*)	2.5 ± 1.2	2.3 ± 1.3
Barthel index score on admission	39.1 ± 15.6	44.7 ± 20.0
(Median; interquartile range)	40.0; 23.75	45.0; 30.0
Barthel index score on discharge	75.6 ± 20.0	75.6 ± 23.1
(Median; interquartile range)	82.5; 28.75	80.0; 30.0
Length of stay (days)	38.1 ± 11.0	39.0 ± 13.1
(Median; interquartile range)	39.0; 14.0	38.0; 11.0

of them had their upper limb immobilized on admission, but not on discharge, as the immobilization period ended during the course of rehabilitation. Table I summarizes the distribution of the 9 prognostic factors studied, the Barthel index and the length of stay in the patients with and without the concomitant fractures of the upper limb. Multiple regression showed that several factors were significantly associated with functional recovery, accounting for 23% of the variance in the Barthel index score on admission and 27% of the variance in the Barthel index score on discharge. The presence of the concomitant fracture of an upper limb was significantly associated with the Barthel index on admission, but not on discharge (Table II). Four factors were significantly associated with length of stay, accounting for only 6% of its variance ($R^2 = 0.061$; $F = 7.55$; $p < 0.001$): infections, trochanteric fracture, neurological impairment and absence of cognitive impairment. A concomitant fracture of an upper limb was not significantly associated with length of stay.

DISCUSSION

Twenty-four of 586 patients with hip fractures (i.e. 4.1%) were affected by concomitant upper limb fractures. After adjustment for 9 confounding variables, the presence of an upper limb fracture was independently associated with the functional index before but not after rehabilitation. Thus, the negative role exerted by the concomitant upper limb fracture on functional performance was transient: it was found on admission when the upper limb was immobilized, but not on discharge, after the end of the immobilization period. The length of stay was not significantly influenced by the upper limb fracture.

Multiple regression showed that 6 other factors were negatively associated with the functional score: cognitive impairment, age, pressure sores, neurological impairment infections and male sex. Four factors were positively associated with length of stay: infections, trochanteric fracture, absence of cognitive impairment and neurological impairment. In the literature the role of all the variables listed above has already been reported (9–12).

The main limitation of our study is the lack of information about the possible selection criteria used by the orthopaedic surgeons who sent the patients to the rehabilitation hospital. Our patients came from many orthopaedic wards and no common selection rule was established. However, in our city almost all hip-fractured patients are sent to the rehabilitation hospitals. Another limitation of the study is the lack of information about other factors such as economic and social, which might have

Table II. *Multiple regression analysis model. The dependent variable was the Barthel index (after normalization by area tranformation). Among the independent variables only those significantly associated with the Barthel index are listed in the table. Male sex and presence of cognitive impairment, pressure sores, neurological impairment, infections and upper limb fractures were conventionally attributed a value of 1 (female sex and the absence of the conditions listed above were attributed a value of 0).*

A) Dependent variable = Barthel index on admission. $R^2 = 0.235$; $F = 24.04$ ($p < 0.001$)

	Beta	*p*
Cognitive impairment	−0.250	<0.001
Age	−0.205	<0.001
Pressure sores	−0.147	<0.001
Neurological impairment	−0.148	<0.001
Infections	−0.119	0.002
Upper limb fractures	−0.087	0.020
Sex	−0.077	0.041

B) Dependent variable = Barthel index on discharge. $R^2 = 0.271$; $F = 40.98$ ($p < 0.001$).

	Beta	*p*
Cognitive impairment	−0.285	<0.001
Age	−0.261	<0.001
Neurological impairment	−0.181	<0.001
Pressure sores	−0.135	0.001
Infections	−0.078	0.041

been relevant. Moreover, the patients had a long stay in the rehabilitation ward: uncertainty exists about the generalizability of our results to other rehabilitation units that have substantially shorter lengths of stay.

In conclusion, our data show that in a sample of hip-fractured patients, neither the functional recovery at the end of a course of rehabilitation nor the length of stay were influenced by the presence of a concomitant fracture involving an upper limb.

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