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Gender differences influence the outcome of geriatric rehabilitation following hip fracture

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ABSTRACT

Hip fracture represents the most dramatic expression of the disease, in terms of morbidity, medical cost and mortality. The incidence of hip fracture increases substantially with age. The purpose of this study was to evaluate the association between gender and geriatric rehabilitation outcome after traumatic hip fracture. Ninety-nine community-dwelling elderly patients (older than 65 years), 64 women and 35 men, who were admitted to geriatric rehabilitation after operated hip fracture were studied. We assessed the patients' clinical and demographic data, preoperative risk (ASA), type of fracture and orthopedic repair, pain intensity (VAS), cognitive (MMSE), mood (Zung IDS), and functional status (FIM) on admission and at the end of geriatric rehabilitation. Men had higher mean number of comorbid conditions at the time of the fracture. Men recovered more from depressed mood in comparison with women during the rehabilitation. Significant improvement in FIM motor subscore on discharge was found in both groups. The FIM motor subscore gain was higher in men (24.47) in comparison with women (19.22, $p = 0.036$). Those differences were demonstrated in mean subscores of transfers ($p = 0.004$), and locomotion ($p = 0.019$). Women were more functionally dependent in locomotion, transfers and sphincter control. There were no differences between the groups by duration on rehabilitation stay. Recovery after hip fracture depends in large part on the pre-fracture health and functional ability of the patient. Gender differences in functional recovery may affect therapeutic and rehabilitative decision making. Functional recovery after traumatic hip fracture was better in men in comparison with women.

1. Introduction

Throughout the world, population structure is changing dramatically, and the aging of society is a demographic fact. The total number of hip fractures worldwide will increase from 1.26 million in 1990 to 2.6 million by the year 2025 and to 4.5 million by the year 2050 (Gullberg et al., 1997). The aging of the population has important public health implications regarding the economic and social costs of functional limitation and chronic condition (Guralnik et al., 1996).

Hip fracture represents the most dramatic expression of the disease, in terms of morbidity, medical cost and mortality (Schurch et al., 1996). It is second leading cause of hospitalization for elderly people (Wilkins, 1999). The incidence of hip fracture increases substantially with age, rising from 22.5 and 23.9 per 100,000 populations at age 50 to 630.2 and 1289.3 per 100,000 populations by age 80, for men and women, respectively (Brainsky et al., 1997). In the United States, up to 25% of patients who experience a hip fracture loss of pre-fracture ability to perform activities of daily living (ADL), and may be transferred to a nursing home (National Osteoporosis Foundation, 2003). The 5-year survival rate is only 41% (Johnell et al., 2004a), with an estimated 740,000 deaths (Johnell and Kanis, 2004b) worldwide. The 85% of hip fractures occur in individuals aged 65 and older (Hip fracture outcomes in people age 50 and over-background paper OTA-BP-H-120, 1994; Koval and Zuckerman, 1998), and the incidence of hip fractures seems to be increasing as the population ages (Severson et al., 1994).

One important measure of age-related disability is a person's ability to perform ADL. Limitations in the ability to perform ADL

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tasks are significant predictors of use of nursing homes (Mor et al., 1994), use of hospital and of physician services (Chan et al., 1999), less use of primary and preventive care (Keller and Potter, 1994) and mortality (Jacobsen et al., 1990).

Osteoporosis has so far been considered a predominantly women's disease and only one of three to five hip fractures occurs in men (Koval et al., 1995; Trombetti et al., 2002). Previous studies that have examined gender differences in functional recovery have reported either no difference (Magaziner et al., 1990; Koval et al., 1998; Di Monaco et al., 2002; Lieberman and Lieberman, 2004), a disadvantage for women (Rozenman et al., 1996; Felsenthal et al., 1998; Friedman et al., 1988; Hall et al., 2000), or for men (Mossey et al., 1989, 1990). It is possible that these reports reflect the greater likelihood of mortality in men, which would presumably eliminate the sickest men, leaving a relatively higher functioning group.

Rehabilitation improves functional outcomes (Keith et al., 1987; Petrella et al., 2000). The Functional Independence Measure (FIM; Keith et al., 1987; Petrella et al., 2000) is the most widely used standardized functional outcome measure in medical rehabilitation. Advantages of using the FIM as compared to other generalized disability scales include the capability to compare functional outcomes by diagnosis, as well as by facility and internationally with the large FIM database maintained by central coordinating centers (Petrella et al., 2000). The FIM is also subject to continuous review and refinement to maintain standards and relevance. In addition, clinicians in subscribing centers undergo training courses and accreditation examinations in order to maintain competency.

This study was designed to evaluate the gender differences in geriatric rehabilitation after traumatic hip fracture, by using the FIM as the primary outcome measure.

2. Patients and methods

2.1. Design and setting

During the period of January 2001 to December 2002, we prospectively recruited consecutive post hip fracture operated elderly patients, who were admitted for geriatric rehabilitation treatment in Schiff Warburg Geriatric Medical, on Netanya, Israel.

2.2. Subjects

The study included all patients aged 65 years and older admitted to geriatric rehabilitation after operated hip fracture during the study period. Exclusion criteria included functionally dependent patients at the time of the fracture ($n = 66$), severe cognitive decline and uncommunicative patients ($n = 25$); disease involving the contralateral hip, or fracture of the ipsilateral lower extremity that precluded unrestricted weight bearing ($n = 12$), and patients who were admitted to acute care units ($n = 18$).

2.3. Assessment of patients

On admission, data was collected including: gender, age, social status, chronic medical conditions, pre-fracture functional status, place of falls, and type of fracture, type of operation, pain perception, physical, functional, and cognitive examination on admission. Comparisons of functional and cognitive status as well as pain perception were performed on admission and on the end of the study. Comorbidity included list of 12 chronic conditions (cardiovascular disease: hypertension, ischemic heart disease, congestive heart disease, atrial fibrillation, previous myocardial infarction; pulmonary disease: bronchial asthma, chronic bronchitis or emphysema; diabetes mellitus, renal failure, anemia, thyroid gland dysfunction, osteoarthritis, Parkinson's disease, gastric, liver diseases, previous stroke and fracture).

The health of the patient was also evaluated at hospital admission using the American Society of Anesthesiologists (ASA; Owens et al., 1978) rating of operative risk: (I) normal and healthy; (II) mild systemic disease; (III) severe systemic disease without incapacitation; (IV) severe incapacitating systemic disease with constant threat to life; (V) moribund. No patient had an ASA rating of V. The patients were categorized into those with low operative risk (I and II) and high risk (III and IV).

Support was evaluated by determining the living conditions as living alone or with at least one other person. Place of falls was defined as in and out of home.

2.4. Cognitive assessment

Cognitive status was assessed by the Mini Mental State Examination (MMSE; Folstein et al., 1975). The MMSE is a general purpose cognitive screening test that consists of 11 items. Scores on the MMSE ranges from 0 to 30 with the lower scores indicating more cognitive dysfunction. An MMSE score of 23 or less indicated cognitive impairment.

The mood status was assessed by the Short Zung Interviewer-assisted Depression Rating Scale (Zung IDS; Tucker et al., 1987). The Short Zung IDS has been derived from the 20-question Zung Self-rating Depression Scale (Zung SDS) for use in the elderly. The Short Zung IDS has proved to be a useful brief screening test for depression in the elderly and should be of value in measuring changes in mood (Tucker et al., 1987). The Short Zung IDS index of 70% and more was considered as depressed mood.

2.5. Assessment of functional status

Functional gain was assessed by the Functional Independence measure (FIM; Keith et al., 1987) at baseline (up to 72 h on admission [AFIM]) and at the end of geriatric rehabilitation (two days before discharge [DFIM]). AFIM was evaluated between the third and fifth day and discharge FIM 3 days before discharge.

The FIM consists of 13 questions relating to motor (FIM-M) and 5 to cognitive functioning (FIM-C). The FIM is rated on a seven-point ordinal scale from 7, indicating total independence, to 1, indicating total dependence. The highest total score that a person can achieve is 126 points. 7 points indicate complete independence, 6 points indicate modified independence through use of a device such as a cane or walker, 5 points indicate visual or verbal supervision, 4 points indicate that the individual can complete 75% of the task with some human assistance, 3 points indicate that the individual can complete 50–75% of the task, 2 indicate that the individual can complete 25–50% of the task, and 1 point indicates that the individual can complete less than 25% of the task or needs two-person assistance.

The total maximal score of FIM-M is 91 points. It is subdivided into: (i) Self-care: eating, grooming, bathing, dressing of upper and lower body, toileting (maximal score of 42 points). (ii) Sphincter control: bladder and bowel management (maximal score of 14 points). (iii) Transfers: in and out of bed, toilet, and tub/shower (maximal score of 21 points). (iv) Locomotion: walking and stair climbing (maximal score of 14 points).

A subclass to three different functional levels was done. FIM 7 or 6 points was addressed as independence. FIM of 4–5 was defined as needing assistance and FIM of 3 or less was defined as dependence.

The following parameters derived from the FIM-M were used to judge the geriatric rehabilitation outcome: The FIM gain is the difference between DFIM and AFIM scores and measures functional improvement. The FIM efficiency is the FIM gain divided by the length of stay (LOS), and measures the rate of functional improvement (Petrella et al., 2000).

2.6. Type of fracture and operative repair

Radiographically fractures were classified as (i) non-displaced or impacted femoral neck; (ii) displaced femoral neck; (iii) stable intertrochanteric; or (iv) unstable intertrochanteric. Stability of intertrochanteric fractures was based on the integrity of the medial cortex, according to the recommendations of the Orthopedic Trauma Association (1996). All patients were treated operatively. For patients with non-displaced or impacted femoral neck fractures, the operative treatment consisted of percutaneous placement of three or four cannulated cancellous screws. Patients with displaced femoral neck fractures were treated with cemented or cementless hemiarthroplasty or total arthroplasty. Patients with intertrochanteric fractures had their fractures stabilized with close or open reduction and internal fixation using a sliding hip screw device. For all patients, physical therapy was begun with weight bearing as tolerated as soon as the patient was medically stable.

2.7. Statistical analysis

Data were expressed as mean ± S.D., percentages or numbers. In comparisons between two groups Student's *t*-test was used for ratio data, Mann–Whitney *U*-test for ordinal data and Pearson's χ^2-test for nominal data. Multiple regression analyses were performed. The dependent values in regression models were FIM-M on discharge. We performed multiple linear regression analyses to identify independent clinical variables associated with the discharge total FIM-M. The independent variables chosen were based on prior literature review as well as a consensus among the authors. This included age, gender, LOS, social and demographics, comorbid diseases, type of fracture and operative repair. The variables were then entered simultaneously into the linear regression models. The adjusted R^2 was calculated for these models to assess whether they were good predictors of the FIM-M.

The SPSS version 11.5 software (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Unless otherwise indicated, statistical analyses performed were parametric when groups were compared and a $p < 0.05$ was considered statistically significant.

3. Results

3.1. General characteristics

Ninety-nine community-dwelling elderly patients met the inclusion criteria of this study, and 65% were women. The mean age of the sample was 77.39 years (range, 65–92). At the time of fracture a large percentage of men were married in comparison with women, and they had more family support (Table 1).

Men had higher mean number of comorbid conditions at the time of the fracture, with an average of 3.3 per-patients compared with 2.9 per-patients for women ($p > 0.05$). No statistical difference was noted for a specific medical condition between men and women except for CHF ($\chi^2 = 3.93$, $p = 0.047$). Men were also sicker than women according to the ASA classification of preoperative risk (2.4 vs. 2.1, respectively, $p > 0.05$).

The overall women/men ratio of fracture incidence was 2.77 for femoral neck fractures and 1.27 for trochanteric fractures. In 53% (52/99) of the patients, fracture were inside the home; 61% (39/64) in women and 37% (13/35; $\chi^2 = 5.14$, $p = 0.023$) in men.

The patients were operated on 2.4 days (range 1–9) after admission to orthopedic department; (2.19 days in women and on 2.8 days [$p < 0.001$] in men). Fifty-six percent (36/54) of women and 23% (9/35; $\chi^2 = 8.51$, $p = 0.004$) of men were operated on first day of admission to orthopedic ward, 27% (17/64) and 58 (21/35; $\chi^2 = 10.7$, $p = 0.001$) of the patients, respectively, were operated on third day and thereafter. The mean length of stay in orthopedic ward was 7.61 (range 3–14) days; 7.67 days in women and 7.49 ($p > 0.05$) in men.

Table 1
General characteristics of studied patients on admission to geriatric rehabilitation. (mean ± S.D. or *n*/%).

	Women	Men
Age	76.53 ± 6.67	78.97 ± 6.81
BMI	25.32 ± 1.98	23.52 ± 1.29
Marital status		
Married*	20 (31)	21 (60)
Single/divorced†	30 (47)	8 (23)
Widowed	14 (22)	6 (17)
Family assistance‡	19 (30)	18 (51)
Comorbidity§	2.94 ± 1.49	3.34 ± 2.11
Medical history		
Ischemic heart disease	43 (67)	25 (71)
Hypertension	27 (42)	17 (49)
Chronic obstructive pulmonary disease‖	23 (36)	16 (46)
Congestive heart disease	8 (13)	10 (29)
Diabetes mellitus	11 (17)	6 (17)
Cerebrovascular accident	6 (9)	3 (9)
Hospitalized in past 6 months	5 (8)	4 (11)
ASA class	2.09 ± 1.03	2.43 ± 1.07
I–II	46 (72)	22 (63)
III–IV	18 (28)	13 (37)
Type of operation		
Nailing	17 (27)	8 (23)
PCCP	24 (37)	17 (49)
Arthroplasty	23 (36)	10 (29)
FIM (Total)	70.95 ± 17.49	69.43 ± 20.17
Motor	43.34 ± 12.14	41.57 ± 16.00
Locomotion	3.72 ± 1.69	3.34 ± 1.73
Self-care	17.97 ± 9.46	17.94 ± 9.40
Sphincter control	8.31 ± 2.64	7.86 ± 3.07
Transfers	13.34 ± 3.51	12.43 ± 3.91
Cognitive functioning	27.61 ± 7.70	27.86 ± 6.16
Type of fracture		
Garden I–II	15 (23)	7 (20)
Garden III–IV	21 (33)	6 (17)
Extracapsular stable¶	16 (25)	16 (46)
Extracapsular unstable	12 (19)	6 (17)
Zung IDS	62.52 ± 13.11	57.23 ± 15.08
MMSE	23.41 ± 5.73	23.23 ± 4.17
VAS#	7.77 ± 1.29	7.03 ± 1.92

* $p < 0.01$, $\chi^2 = 7.71$.
† $p < 0.05$, $\chi^2 = 5.52$.
‡ $p < 0.05$, $\chi^2 = 4.57$.
§ $p < 0.01$.
‖ $p < 0.05$, $\chi^2 = 3.93$.
¶ $p < 0.05$, $\chi^2 = 4.44$.
\# $p < 0.05$.

3.2. Functional outcomes and subgroup analyses

The mean total AFIM score was 70.51 and the mean total DFIM score was 92.98. This gain in FIM scores is highly significant ($p < 0.001$). There was also highly significant gains in motor, but not in cognitive FIM scores (Table 2). The mean FIM gain was 22.47 and the FIM efficiency was 0.56 points/day. In both groups were significant FIM gains and FIM efficiency, and there is an inverse relationship between lower total AFIM scores and better FIM gains and FIM efficiency. The FIM-M gain was higher in men (24.47) than in women (19.22, $p = 0.036$). Those differences were demonstrated in mean subscores of locomotion ($p = 0.019$), and of transfers ($p = 0.004$). Unlike than there were no significant gender differences by mean FIM-M subscores, higher number of women were more functionally dependent than men in locomotion, transfers and sphincter control (Table 3).

The mean duration of geriatric rehabilitation stay was 49.53 days; 50.72 days (range 10–152) in women and 47.34 (range 22–93,

Table 2
Improvement in FIM scores following rehabilitation, (mean ± S.D.).

	Women	Men	*p*
Primary FIM outcome measures			
Admission total FIM	70.95 ± 17.49	69.72 ± 19.96	>0.05
Discharge total FIM	91.50 ± 23.50	95.61 ± 18.03	>0.05
p	<0.001	<0.001	
FIM subscores			
Admission FIM motor	43.34 ± 12.14	41.72 ± 15.80	>0.05
Discharge FIM motor	62.56 ± 18.34	66.19 ± 14.92	>0.05
p	<0.001	<0.001	
Admission FIM cognitive	27.61 ± 7.70	28.00 ± 6.13	>0.05
Discharge FIM cognitive	28.94 ± 7.58	29.42 ± 4.67	>0.05
p	>0.05	>0.05	
Derivative FIM scores			
FIM gain			
Total FIM	20.55 ± 14.11	25.89 ± 11.82	>0.05
FIM Motor subscores	19.22 ± 13.19	24.47 ± 9.35	0.036
FIM efficiency			
Total FIM	0.52 ± 0.62	0.61 ± 0.30	0.022
FIM motor subscores	0.49 ± 0.59	0.58 ± 0.29	0.011

Table 3
Functional outcome on discharge (*n*/%).

	Dependent	Assistance	Independent
Locomotion			
Women	18 (28)	34 (53)	12 (19)
Men	6 (27)	15 (43)	14 (40)
p	>0.05	>0.05	0.022*
Self care			
Women	11 (17)	36 (56)	17 (27)
Men	6 (17)	18 (51)	11 (31)
p	>0.05	>0.05	>0.05
Sphincter control			
Women	15 (23)	45 (70)	6 (4)
Men	7 (20)	17 (49)	11 (31)
p	>0.05	0.033†	0.005‡
Transfers			
Women	17 (27)	32 (50)	15 (23)
Men	6 (17)	14 (40)	15 (43)
p	>0.05	>0.05	0.044§
FIM motor subscores			
Women	9 (14)	40 (63)	15 (23)
Men	6 (17)	15 (43)	14 (40)
p	>0.05	>0.05	>0.05

* $\chi^2 = 5.28$.
† $\chi^2 = 4.57$.
‡ $\chi^2 = 7.74$.
§ $\chi^2 = 4.04$.

$p > 0.05$) days in men. A multivariate regression analysis showed that predictors of functional outcome (FIM-M) were different between women and men. Only VAS score on admission and arthroplasty were common in both groups, but with them different impaction on DFIM-M (Table 4). There were gender differences in factors that influenced on DFIM-M. The factors with the highest impact on the DFIM-M among women were extracapsular unstable facture ($\beta = 37.98$) and arthroplasty ($\beta = 8.39$), beside than in men VAS on admission ($\beta = 6.35$) and complication rate ($\beta = 5.52$). Family support among men was predominant positive factor ($\beta = 25.96$).

On discharge 15% (15/99) of patients were functional dependent: 14% (9/64) in women and 17% (6/35, $p > 0.05$) in men (Table 3).

3.3. Pain, cognition and mood

On admission women suffered more from pain in comparison with men (Table 1), and those differences increased significantly on discharge (3.91 vs. 3.26, $p = 0.007$). Pain (VAS) on admission negatively correlated with AFIM-M and DFIM-M in both groups ($r = -0.543$, $p < 0.001$ in women and $r = -0.631$, $p < 0.001$ in men). VAS positively correlated with Zung IDS on admission ($r = 0.452$, $p < 0.001$ in women and $r = 0.592$, $p < 0.001$ in men), and those correlations decreased on discharge in both groups ($r = 0.465$, $p < 0.001$ and $r = 0.394$, $p = 0.019$, respectively). Negative correlation between VAS and cognition on admission as well as on discharge presented only among women patients ($r = -0.321$, $p = 0.009$ and $r = -0.296$, $p = 0.017$, respectively).

On admission to the geriatric rehabilitation 23% (15/64) of women and 45% (23/35) of men were cognitively depressed (MMSE of 23 or less; mean 18.2 and 17.6, respectively), and on discharge 30% (19/64; mean MMSE score of 18.5) and 20% (9/35; mean MMSE score of 19.07; $p > 0.05$ for both), respectively, with mean score of 18.5 and 19.07. Cognitive depressed patients on discharge had lower FIM-M scores (47.94 and 51.00, respectively for women and men), in comparison with cognitively intact patients (60.17, $p = 0.03$, and 70.57, $p = 0.048$, respectively). Correlation between Zung IDS and MMSE was found only on discharge among women ($r = -0.417$, $p < 0.001$).

During geriatric rehabilitation the number of patients with depressed mood decreased from 23% (15/64) to 20% (13/64) in women and from 23% (8/35) to 11% (4/35) in men. On discharge, patients with decreased mood had lower DFIM-M score (46.77 and 54.25, respectively for women and men) in comparison with patients with intact mood (64.94, $p = 0.007$, and 68.26, $p > 0.05$, respectively for women and men). They had also longer LOS (57.38 days in women and 60.75 days in men, $p > 0.05$), in comparison with patients with intact mood (49.02 and 45.61, respectively). In addition they have higher VAS score (4.77 in women and 3.75 in

Table 4
Predictors for functional outcome (FIM motor) following rehabilitation.

Gender	Variables	$\beta \pm$ S.E.M.	*t*	*p*	Adjusted R^2
Women	VAS on admission	−5.043 ± 1.22	−4.123	<0.001	0.431
	VAS on discharge	−3.887 ± 1.57	−2.478	0.015	
	Zung IDS on discharge	−0.198 ± 0.12	−1.707	0.091	
	Hemiarthroplasty/or total arthroplasty	−8.388 ± 2.62	−3.200	0.002	
	Duration of geriatric rehabilitation stay	0.167 ± 0.07	2.350	0.021	
	Extracapsular unstable fracture	−37.977 ± 16.41	−2.314	0.023	
Men	VAS on admission	−6.350 ± 1.77	−3.586	0.001	0.604
	Family support	25.960 ± 8.43	3.079	0.005	
	Hemiarthroplasty/or total arthroplasty	−0.668 ± 0.20	−3.350	0.002	
	Complication rate	−5.518 ± 2.07	−2.667	0.012	
	Age	−0.877 ± 0.35	−2.479	0.019	

men), in comparison with patients with intact mood (3.69, $p = 0.003$, and 3.19, $p > 0.05$, respectively). Depressed mood on admission and on discharge negatively correlated with DFIM-M.

3.4. Complication

Following geriatric rehabilitation stay serious complication was reported in 32 patients. Men had non-significant trend to higher rate of complication (43% vs. 27%). The rate of specific complication was similar in both groups. The predominant complication was exacerbation of CHF (12%), followed by falls (9%), pneumonia (9%), bedsores (9%), delirium (7%), cardiac rhythm disturbances (4%), deep vein thrombosis (2%), and fracture (1%).

4. Discussion

The major goals of geriatric rehabilitation for older people are independent mobility and self-care. This prospective study analyzed the gender differences in recovery after traumatic hip fracture. We studied 99 community-dwelling elderly patients aged 65 years and older, who on the time of fracture were functionally independent or needed some assistance in performance of ADL.

The study showed that gender differences in elderly patients with traumatic hip fracture are multifactorial. Those differences were present before, on the time of fracture and following geriatric rehabilitation. (1) In comparison with women, male patients were older, presented with higher number of comorbid disease and higher ASA class, a large number of them were married and had family assistance in comparison with women. (2) The predominate type of fracture in women was femoral neck and in men it was trochanteric. (3) On admission to geriatric rehabilitation more male patients were cognitively depressed. (4) Women suffered more from pain and higher number of them presented with depressed mood.

During geriatric rehabilitation significant improvement in FIM-M were reported in both groups. Generally, patients with lower FIM scores on admission had the highest increase in FIM-M on discharge. This ceiling effect was overcome by using the FIM-M for efficacy and efficiency of geriatric rehabilitation. In our study, the motor functional gain was better improved in men than in women in both motor efficacy (24.47 and 19.22, respectively; $p = 0.011$) and efficiency (0.58 and 0.49, respectively; $p = 0.011$) scores.

Multiple regression models showed that from nine variables influenced on DFIM-M only VAS on admission and performing arthroplasty were common in both groups, but with different impaction on function outcome.

Possible explanations to these interesting results are (1) older patients hospitalized for hip fractures do not receive any pain treatment (Feldt et al., 1998) or this treatment was inadequate (Tait and Chibnall, 2002). (2) Previous studies (Resch and Thorngren, 1998; Lenze et al., 2004) found that fracture type did not affect the outcome, but patients that underwent hemiarthroplasty or total arthroplasty in the short period after surgery suffered more from pain in comparison with patients that underwent internal fixation (Parker et al., 2002).

Pain is modifiable factors that negatively influence the functional recovery following rehabilitation (Andersen et al., 1999; Lamb et al., 2000). Pain may lead to poorer functional recovery after hip fracture through psychological and/or physical mechanisms. There is evidence indicating an association between pain and depression (Berkman et al., 1986; Williamson and Schulz, 1992) and between pain and markers of physical ability (Gill et al., 1995; Guralnik et al., 1995; Scudds and Mc Robertson, 1998) among community-dwelling elderly persons. If depressive symptoms or physical ability does serve to mediate the relationship between pain and hip fracture recovery, they must themselves be associated with that recovery. Depressive symptoms relate to poorer functional status after hip fracture (Jette, 1986; Williamson and Schulz, 1992; Lenze et al., 2004), and physical performance measures, such as gait speed, are well-known correlates of functional status (Beekman et al., 1986; Gill et al., 1995; Guralnik et al., 1995). Functional disability encompasses psychological and social recovery as well as physical recovery (Jette, 1986; Jette et al., 1987). The four domains of functional disability are physical, mental, emotional, and social disability.

For persons with pain, psychological factors are potentially important risk factors for disability (Andersen et al., 1999; Lamb et al., 2000). Cross-sectional research has documented an association between depressive symptoms and greater disability in older persons with musculoskeletal pain (Scudds and Mc Robertson, 1998; Lamb et al., 2000). Community-dwelling women have higher prevalence of psychological symptoms such as depressive feeling compared to men (Williamson and Schulz, 1992). The experience of fall-related fracture may have induced depressive symptoms. Lenze et al. (2004) found that depression is predictive of negative outcomes in elderly patients' geriatric rehabilitation from hip fracture.

The increased fracture rate in depressed individuals may reflect a greater number of falls due to use of antidepressants (Mussolino, 2005) or poor lifestyle choices leading to low bone mineral density (BMD) or falling (Whooley et al., 1999). In addition, low BMD could be caused by immune and endocrine disturbances associated with depressive disorders, including hypersecretion of corticotropin-releasing hormone, hypercortisolism, and elevated plasma interleukin-6 levels (Whooley et al., 1999; Cizza et al., 2001). Many depressed elderly have concomitant chronic diseases and our measure of attitude may be another proxy for frailty. Patients who are depressed due to a disability also tend to need longer rehabilitation (Cizza et al., 2001; Mussolino, 2005). Depression impedes recovery processes if a person is not motivated to obtain adequate rehabilitation.

Geriatric rehabilitation efficiency may be improved with shorter LOS, accompanied by higher efficacy scores. Patients with shorter LOS had a relatively better rehabilitative response (better gain and efficiency scores) than those patients who experienced a longer LOS. Increased LOS may have been affected by poor health status, comorbid diseases and complications following geriatric rehabilitation. Greenwald et al. (2001) not find association between gender and LOS, beside those other studies (Wolinsky et al., 1999; Vincent et al., 2006) found that women have had longer LOS than in men. The higher rate of medical complications seen in men (43%) compared to women (27%, $p > 0.05$) in our study did not affect their LOS, accompanied by higher efficacy scores.

In our study, the functionally dependency were found in 15% of patients (14% in women and 17% in men), with rate of long-term institutionalization was 19% (22% and 14%, respectively).

Patient transfer mobility and locomotion at discharge are critical areas of concentration for inpatient geriatric rehabilitation (Zuckerman, 1996) because they are both required for independent living (Craik, 1994; Guralnik et al., 1995, 1996). Poor locomotion skills may be attributed to poor balance (Guralnik et al., 1995; Felsenthal et al., 1998; Petrella et al., 2000) and impaired gait speed (Guralnik et al., 1995; Hall et al., 2000), and both have been related to a diminished quality of life for older survivors of hip fracture (Friedman et al., 1988; Koval et al., 1998). Patient's fear of falling has been associated with limiting his or her functional recovery (Rozenman et al., 1996). These researchers suggested that the patient's fear of experiencing a subsequent fall and possible hip fracture may restrict physical activity, thus contributing to a further loss of function. In our study men were more independent in locomotion and transfers compared to women.

5. Conclusion

Recovery after hip fracture depends in large part on the pre-fracture health and functional ability of the patient. Gender differences in functional recovery may affect therapeutic and rehabilitative decision making. Functional recovery after traumatic hip fracture was better in men in comparison with women.

Conflict of interest statement

None.

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