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The relation between gain in cognition during rehabilitation on functional outcome among hip fracture adult patients with and without pre-hip fracture dementia

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ABSTRACT

The purpose of the present study was focused on the relationship between change in cognition and the functional outcome during rehabilitation in demented and non-demented adult hip fracture patients. We studied seventy consecutive adult patients with hip fracture admitted to our rehabilitation wards. Functional outcome was assessed by the Functional Independence Measure (FIM). The gain in cognition during the rehabilitation process was measured by the difference in Mini Mental State Examination scores at admission and discharge. Data was analyzed by *t*-test, chi square-test and linear regression. Patients without dementia presented and discharged from the rehabilitation ward with statistically significant higher total, motor, and gain functional independence measure scores compared to patients with dementia. In a multiple regression analyses, gain in Mini Mental State scores examination were not independently associated with higher total and motor functional independence measure scores at discharge (beta = 0.086, *p* = 0.194; beta = 0.077, *p* = 0.309, respectively). Our findings suggest that there is no association between functional outcome and cognitive gain at the end of the rehabilitation process among adult hip fracture patients with and without dementia. However hip fracture adult patients with dementia should not be deprived of a post-acute rehabilitation.

1. Introduction

Hip fractures are common in aging societies with an age-standardized incidence of more than 150/100,000 per year in developed countries (Kanis et al., 2012). The total number of these fractures is expected to increase considerably because of the demographic changes expected over coming decades. Hip fractures are associated with functional decline, high morbidity rates, and premature death (Leibson, Tosteson, Gabriel, Ransom, & Melton, 2002; Marks, 2010). Consequently, hip fractures have been identified as one of the most serious healthcare problems affecting the adults (Brauer, Coca-Perraillon, Cutler, & Rosen, 2009; Marks, 2010). Several studies have assessed predictors of functional recovery in patients following hip fracture surgery and rehabilitation. They found that many factors, including age (Koval, Skovron, Aharonoff, Meadows, & Zuckerman, 1995), gender (Lieberman et al., 1996), health status (Lefavre et al., 2009), fracture

type and procedures (Haentjens et al., 2007), post-operative pain (Morrison et al., 2003), anemia (Carson et al., 1996), cognitive impairment and dementia (Young, Xiong, & Pruzek, 2011), pre-fracture functional status (Parker & Palmer, 1995), postoperative immobilization (Siu et al., 2006), and functional status at discharge (Haentjens et al., 2007), affect the short and long-term prognosis. Cognitive impairment is an independent risk factor for a poorer outcome after hip fracture (Soderqvist, Miedel, Ponsler, & Tidermark, 2006). Behavioral and cognitive impairment can affect an individual's ability to participate effectively in rehabilitation thereby impacting its effectiveness (McGilton et al., 2007). However studies have also demonstrated that older people with mild to moderate cognitive impairment or dementia are capable of gaining functional improvement during inpatient rehabilitation (Mitchell, Harvey, Brodaty, Draper, & Close, 2016; Seitz et al., 2016).

Sometimes cognitive status may change for the better during the

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rehabilitation process. Adam et al in a study of ninety adult patients with a first time unilateral hip fracture over the age of 60 years, found significant advances in cognition from baseline to six weeks post discharge (Adam, Godlwana, & Maleka, 2016).

The aim of the present retrospective study was to investigate the possible interrelation between cognitive gain during rehabilitation process and functional outcomes among hip fracture adult patients.

We hypothesize that a larger cognitive gain will be accompanied by a better functional outcome at the end of the rehabilitation process regardless of the previous cognitive state of the patient. Such data would assist in identifying patients in need of a more intensive and/or an extended cognitive intervention.

2. Patients and methods

2.1. Setting

This is a retrospective chart survey comprising admissions during 2015. The analysis included patients, with a primary diagnosis of hip fracture, admitted to the geriatric rehabilitation ward of a university-affiliated referral hospital, from orthopedic departments of a neighboring general hospital following internal hip fixation operations. The standard rehabilitation course is based on an interdisciplinary rehabilitation team approach. Staff members meet twice a week to evaluate the status of each patient. A treatment plan is established and monitored with the purpose of coordinating and integrating the various aspects of the staff activities (medical, nursing, physical and occupational therapy and social work). These patients usually undergo a 6 h per week of physical and occupational therapy. The study was approved by the local Institutional Review Board.

2.2. Participants

The sample consisted of 70 consecutive patients following recent hip fracture operation (ICD-9-CM Diagnosis Code 821.00).

We included patients age ≥ 64 years (range, 64–97 years; mean: 83.89 ± 6.76) with pertrochanteric (extracapsular) or subcapital (intracapsular) hip fracture.

The presence of ischemic heart disease (manifested as stable or unstable coronary syndrome), previous stroke, diabetes mellitus, hypertension, hyperlipidemia, was established by medical history, and a complete physical examination under taken.

The presence of dementia was documented from the hospitalization or community medical records of the patients when positive for dementia (ICD-9-CM code 294.1). Twenty two (31.4%) patients had dementia.

By using the Confusion Assessment Method (CAM) (Inouye et al., 1990), no one of the patients whom were participated in our study, were diagnosed suffering from delirium.

2.3. Functional management

To assess functional outcome each patient was evaluated twice (upon admission and discharge) for level of functioning by the FIM instrument (Linacre, Heinemann, Wright, Granger, & Hamilton, 1994). This tool is widely used to rate patients' performances on 13 motor and 5 cognitive domains. Total FIM scores range between a minimum of 18 for a totally dependent patient and a maximum of 126 for independent patients. Motor FIM is particularly sensitive in the detection of functional improvement and score ranges between a minimum of 13 (dependent) and a maximum of 91 (independent) (Dodds, Martin, Stolov, & Deyo, 1993). FIM scores were recorded by certified physiotherapists and geriatric nurses familiar with this scoring system.

2.4. Cognition management

During the first week after admission to the rehabilitation ward and a few days prior to discharge, each patient's cognitive status was evaluated by the MMSE (Folstein, Folstein, & McHugh, 1975). The change in the MMSE score (MMSE-gain) was calculated according to the difference between discharge and admission MMSE scores. Scores of each patient were adjusted for age and education (Crum, Anthony, Bassett, & Folstein, 1993).

None of the patients included in the study, was diagnosed as suffering from delirium at admission or discharge from our department. The cognitive evaluations were performed by our experienced ward occupational therapist.

2.5. Data analysis

Comparisons between patients with and without dementia, were performed by *t*-tests for continuous variables and χ^2 -tests was used for categorical variables. Multiple regression analyses were performed to study the association between the gain in MMSE during hospitalization and various comorbidities (age, gender, ischemic heart disease, arterial hypertension, diabetes mellitus, hyperlipidemia, dementia and previous stroke) as predictors of total and motor FIM at discharge. A $P < .05$ was considered as statistically significant. Statistical analysis was performed using SPSS, version 21 (IBM Inc.).

3. Results

We had data on 70 consecutive patients (age range 64–97) admitted to our rehabilitation ward. The demographic and clinical characteristics of these patients are presented in Table 1.

The average age was 83.89 ± 6.76 and most (65.7%) were women. Twenty two patients (31.4%) were diagnosed as suffering from dementia before hospitalization. There was a significant difference between patients with ($n = 22$) and without dementia ($n = 48$) by age, length of stay, hypertension, hyperlipidemia, ischemic heart disease, MMSE scores at admission and MMSE scores at discharge, respectively. However, there was no significant difference between the two groups of patients by gender, previous stroke, diabetes mellitus and MMSE gain, respectively. As seen in Table 2, the functional outcome of patients without dementia was significantly better than patients with dementia, as measured by total, motor and gain FIM scores at admission and discharge. Higher rate of patients without dementia (47.9%) had positive gain of MMSE scores at the end of the rehabilitation period compared to patients with dementia (22.7%) but the difference in gain

Table 1

Clinical and cognitive characteristics of patients by dementia status at admission, mean \pm S.D.

Variable	All	No-Dementia	Dementia	<i>p</i> [*]
Number	70	48	22	
Age, years	83.89 ± 6.76	82.58 ± 6.9	86.73 ± 5.55	0.016
Female gender	46 (65.7)	34 (70.8)	12 (54.5)	0.183
Length of stay, days	42.44 ± 15.95	45.1 ± 17.4	36.64 ± 10.32	0.038
Diabetes mellitus	19 (27.10)	15 (31.3)	4 (18.2)	0.254
Hypertension	53 (75.7)	41 (85.4)	12 (54.5)	0.005
Hyperlipidemia	28 (40)	24 (50)	4 (18.2)	0.012
Ischemic heart disease	41 (58.6)	32 (66.7)	9 (40.9)	0.042
Previous stroke	13 (18.6)	8 (16.7)	5 (22.7)	0.545
MMSE-admission	17.06 ± 8.41	21.54 ± 4.22	7.27 ± 6.8	< 0.001
MMSE-discharge	17.89 ± 8.79	22.56 ± 4.27	7.68 ± 7.36	< 0.001
MMSE-change	0.82 ± 2.61	1.02 ± 2.99	0.41 ± 1.44	0.37

* *p* calculated using χ^2 -test for categorical variables and Student's *t*-test for comparisons for continuous variables.

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