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Original Article

Factors associated with functional rehabilitation outcomes of non-operative treatment for hip fractures: a retrospective study

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Abstract. [Purpose] Limited data are available regarding the outcomes of non-operative treatment for hip fractures. We investigated the factors associated with functional rehabilitation outcomes in patients undergoing non-operative treatment for hip fractures. [Participants and Methods] We investigated 57 patients with hip fractures who underwent non-operative treatment. We retrospectively analyzed medical or rehabilitation outcomes and functional outcomes (assessed using the Functional Independence Measure tool). We examined the association between functional outcomes and other factors and compared the medical and rehabilitation outcomes between mobile and immobile patients at the time of discharge. [Results] Of the 57 patients investigated, 15 (26.3%) were mobile at discharge. We observed a significant association between the Functional Independence Measure subscores (Motor and Cognitive) and serum albumin levels. Serum albumin levels and the Functional Independence Measure subscores (Motor and Cognitive) were significantly higher in mobile than in immobile patients. [Conclusion] We observed that functional outcomes at discharge in patients undergoing non-operative treatment for hip fractures were associated with serum albumin ratios and the Functional Independence Measure-Cognitive score.

Key words: Hip fracture, Non-operative management, Functional outcome

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INTRODUCTION

Hip fractures commonly result from a fall or direct blow to the side of the hip. In a survey of patients with hip fractures in Japan from 2009 to 2014, the total number of new hip fracture patients in 2014 was 91,595, which included 20,278 males and 71,072 females[1)]. Other survey reported that the total incidence of hip fracture increases from the age of 40, and a greater increase is found among patients aged 80–94 years[1, 2)]. Therefore, the number of patients increases annually with an increase in the elderly population.

Operative or non-operative treatments for hip fracture are available[3, 4)]. Most hip fractures require surgical intervention, and surgery is generally performed immediately to minimize complication[2)]. However, non-operative treatment should be considered in patients with severe medical comorbidities that preclude surgical treatment. In fact, the proportion of older patients receiving non-operative treatment was higher[3)]. Therefore, non-operative treatment is predicted to increase as the elderly population increases. However, data on the outcome of non-operative treatment for hip fractures are limited.

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Furthermore, little is known about rehabilitation techniques in non-operative patients. Jain reported that mortality with non-operative treatment was lower with early mobilization compared to bed rest; however, the functional outcome was unclear[5]. In rehabilitation, improvement of the functional outcome in the hospital to the extent possible is important.

This study aimed to examine factors related to the outcome of functional rehabilitation among non-operatively treated hip fracture patients. To determine potential factors of functional outcome after hip fracture, the medical and rehabilitation outcomes of patients who are able to walk (AW group) and those of patients who are not able to walk (NW group) at hospital discharge were compared.

PARTICIPANTS AND METHODS

This study followed a retrospective design and was conducted with the approval of the Matsumoto City Hospital Ethics Committee. All participants were patients with hip fracture admitted to the Matsumoto City Hospital from February 1, 2014, to February 29, 2016. Given the retrospective nature of the study, patients were not required to provide written informed consent to participate.

Patients with a diagnosis of intra-capsular fracture or extra-capsular fracture who had been treated non-operatively were included in the examination. Children (<18 years old), patients who were transferred to another hospital, and patients who were transferred from a different hospital were excluded. For the clinical review, electronic medical records in the Matsumoto City Hospital were examined, and the following data were collected:

Background information: medical record number, duration of hospitalization, body weight and height to determine body mass index (BMI), gender, age, pre-fracture mobility, and pre-fracture residence.

Medical information: fracture type, comorbidity (diabetes, chronic heart failure, chronic kidney disease, and cerebral stroke), and serum albumin. Laboratory data on serum albumin levels were extracted from the patients' medical records.

Rehabilitation information: start dates of ambulation: sitting and transfer from bed to a wheelchair from the date of injury.

Outcome measures: functional independence measure (FIM), post-fracture mobility, and post-fracture residence. FIM scores, based on FIM motor sub-scores (FIM-M) and FIM cognitive sub-scores (FIM-C), were collected. Patient's pre- or post-fracture mobility was categorized as mobile indoors without or with walking aids or immobile (wheel chair or bed-bound). Pre- or post-fracture residence of a patient was categorized as living at own home with or without care-giver or in an institutionalized setting.

Patients who are able to walk at discharge are defined as those with FIM levels measured while walking, not those measured while on a wheelchair: 5 (supervision), 6 (modified independence), or 7 (complete independence).

Statistical analysis was performed using SPSS 22.0 J for Windows (SPSS Inc., Chicago, IL, USA). Values were presented as means ± standard deviations and medians (interquartile ranges). Participants were categorized as patients who are able to walk without or with walking aids indoors (AW group) or patients who are not able to walk (NW group). Independent t-test or Mann-Whitney U test was used to compare background information outcomes, medical or rehabilitation outcomes, and functional outcomes. Spearman's rank correlation coefficient was used to investigate the relationships between functional outcome (FIM-M) and background information outcomes, medical or rehabilitation outcomes. Multiple regression analysis was performed with FIM-M scores as the dependent valuable and age, serum albumin rations as the independent valuable. Values of $p<0.05$ were considered statistically significant.

RESULTS

For over a 2 year period, 196 patients with hip fracture were admitted to the Matsumoto City Hospital. Of all patients, regardless of the exclusion criteria, 32% were treated non-operatively, but only 57 patients met the inclusion criteria. Table 1 summarizes the characteristics of the participants. The mean age was 87.4 ± 8.5 years. Forty-eight participants (84.2%) were females. Twenty-one participants (36.8%) had intra-capsular fracture, and the rest (63.2%) had extra-capsular fracture.

Of all participants, 15 (26.3%) were able to walk at discharge. The age (mean ± SD) between the AW and NW group was comparable (87.4 ± 7.8 vs. 87.6 ± 8.8, respectively) (Table 1). No difference in comorbidity rate or rehabilitation process such as sitting and transfer start was found between both groups ($p>0.05$). The serum albumin was significantly higher in the AW group than in the NW group ($p=0.013$). FIM-M and FIM-C sub-scores were significantly higher in the AW group than in the NW group ($p<0.01$ and $p<0.01$). There was a higher rate of being discharge to one's home in the AW group than in the NW group (73.3% vs. 35.7%, $p<0.01$).

The significant relationships between FIM-M and age, serum albumin, or FIM-C were as follows: age, $r=-0.329$ ($p=0.013$); serum albumin, $r=0.332$ ($p=0.015$); FIM-C, $r=0.620$ ($p=0.001$). No significant relationships between FIM-M and comorbidities were found ($r=0.023$–0.235, $p>0.05$). The relationships between FIM-M and the progress of the rehabilitation were as follows: sitting start dates, $r=0.108$ ($p=0.429$); transfer start dates, $r=0.226$ ($p=0.094$). No significant relationship between age and serum albumin, $r=-0.23$ ($p=0.09$) was found. Multiple regression analysis revealed that FIM-M scores was significantly independently associated with serum albumin ($\beta=0.24$, $p=0.04$), with FIM-C ($\beta=0.53$, $p<0.01$), and not significantly associated with age ($\beta=-0.18$, $p=0.09$).

Table 1. Demographic, clinical, functional, nutritional characteristics and patient outcomes in the AW and NW groups

	All	AW group	NW group	p value[b]
Age (years)[a]	87.5 ± 8.5	87.4 ± 7.8	87.6 ± 8.8	0.98
BMI (kg/m^2)[a]	19.5 ± 3.7	18.5 ± 3.1	19.8 ± 3.9	0.37
Albumin (g/dL)[a]	3.4 ± 0.5	3.7 ± 0.5	3.3 ± 0.5	0.01
Comorbidities [n(%)]				
DM	11 (19.3%)	3 (20.0%)	8 (19.0%)	0.60
CKD	7 (12.3%)	2 (13.3%)	5 (11.9%)	0.60
CVA	14 (24.6%)	5 (33.3%)	9 (21.4%)	0.28
CHF	22 (38.6%)	6 (40.0%)	16 (38.1%)	0.90
FIM[a]				
Motor sub-scores	37.8 ± 21.0	65.5 ± 8.7	28.6 ± 14.7	<0.01
Cognitive sub-scores	19.4 ± 8.9	24.8 ± 8.4	17.6 ± 8.5	<0.01
Duration of hospitalization (days)[a]	66.4 ± 25.6	68.9 ± 21.2	65.5 ± 27.3	0.66
Rehabilitation progression (days)[a]				
Sitting start days	9.6 ± 7.8	10.8 ± 8.9	9.1 ± 7.5	0.29
Wheelchair start days	12.6 ± 9.5	15.1 ± 10.2	11.9 ± 9.2	0.22
Standing start days	16.8 ± 12.2	19.9 ± 11.8	15.6 ± 12.3	0.73
Mobility (n) independently mobile/mobile with walking aids/wheel chair				
Pre-fracture	11/37/9	5/10/0	6/27/9	0.07
Post-fracture	1/14/42	1/14/0	0/0/42	<0.01
Discharge residence (n)				
Home	38/19	12/3	26/16	0.20
Other	26/31	11/4	15/27	<0.01

[a]: Data are expressed as the mean ± standard deviation. [b]: AW group vs. NW group.
AW: able to walk group; CHF: congestive heart failure; CKD: chronic kidney disease; CVA: cerebrovascular accident; DM: diabetes mellitus; FIM: functional independence measure; NW: not able to walk group.

DISCUSSION

The proportion of patients who were treated non-operatively in this study was higher than that reported in a previous study[1]. The most commonly expressed reason was that the average age of participants was higher than that in the other study and the participants have various comorbidities.

In this study, the functional rehabilitation outcome such as FIM in the AW group was higher than that in the NW group. This indicated that acquisition of walking was conductive to the improvement of the activity of daily living (ADL). Furthermore, the return rate to one's home in the AW group was higher than that in the NW group, and the acquisition of walking and improvement of ADL may be affective to the return rate to one's home.

This study showed that the functional outcomes on hospital discharge were associated with serum albumin levels and FIM-C. In previous studies, serum albumin levels have been related to the nutritional status assessed by the Mini Nutritional Assessment Short-Form (MNA-SF)[6, 7], and serum albumin has been considered as an indicator of a person's nutrition status[6–8]. In a previous study, serum albumin ratios at admission were shown to significantly affect walking function recovery in the operative hip fracture patients[8]. Malnourished patients were functionally more dependent and more likely to reside in an institutionalized setting. The reason for this belief was that surgical stress in addition to preoperative fasting may increase catabolism, and undernutrition has a bad influence on performance of ADL and recovery of functional mobility than not undernutrition[9, 10]. Similar to the operative patients in the previous study, a significant relationship between the serum albumin rations and functional outcome in non-operative patients was obtained in the present study. Walking ability was associated with lower limb muscle strength[11]. Possibly, undernutrition is speculated related to lower walking ability because undernutrition could lead to lower skeletal muscle protein synthesis ability and has a bad influence on the improvement of muscle strength. However, in this study, muscle strength of the participants was not evaluated; further study is needed to verify the hypothesis. Another study demonstrated a progressive reduction of serum albumin levels with aging[12]. However, our result showed no significant relationship between age and serum albumin level.

Our study also revealed that a FIM-C score was associated with FIM-M score at discharge from hospital. Since a cognitive impairment adversely affects the rehabilitation progress, it may result in poor functional recovery. Our results are congruent with what has been reported by Okamoto et al.[8] and Inoue et al.[9]

The relationships between FIM and the progress of the rehabilitation were not significant. The previous reference about non-operative treatment of hip fracture indicated that by 6 weeks most patients could be lifted into a wheelchair; however, this reason remains unclear[13]. The study on rehabilitation techniques for non-operative treatment of hip fracture will be needed in the future.

Functional status on hospital discharge is one of the most important goals for hip fracture patients. The present results suggest that nutrition status and cognitive score are factors affecting functional status during rehabilitation for hip fracture.

However, the causal association between nutrition status and functional outcome remained unclear because of the retrospective design of this study. Therefore, a prospective study with more hip fracture patients that investigate the causal association between the nutrition status and the recovery of functional outcome for non-operative hip fracture patients will be needed in the future. Furthermore, about nutrition status in the present study, only serum albumin was investigated, and therefore other nutrition status will be investigated in a future study.

Funding and Conflict of interest

None.

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