The Journal of Physical Therapy Science

Original Article

Factors affecting the discharge destination of hip fracture patients who live alone and have been admitted to an inpatient rehabilitation unit

HIROYUKI HAYASHI, OTR, PhD[1]*, MIDORI IWAI, OTR[2], HIROKA MATSUOKA, OTR[2],
DAIKI NAKASHIMA, OTR[2], SHUGO NAKAMURA, OTR[2], AYUMI KUBO, RPT[2],
NAOKI TOMIYAMA, OTR, MS[1]

[1] *Faculty of Care and Rehabilitation, Seijoh University: 2-172 Fukinodai, Tokai, Aichi 476-8588, Japan*
[2] *Department of Rehabilitation, Tokai Memorial Hospital, Japan*

Abstract. [Purpose] (1) The aim of this study was to examine relations between clinical and functional assessment and discharge destination and (2) to identify the optimal cutoff point for estimating discharge to home after inpatient rehabilitation. [Subjects] The subjects were 54 hip fracture patients (15 males, 39 females; mean age 81.3 ± 7.4 years) living alone. [Methods] The patients were classified into two groups: those discharged to home and those admitted to an institution. Age, gender, side of fracture, fracture type, number of comorbidities, Functional Independence Measure motor score, and Functional Independence Measure cognitive score were compared between groups. Multiple logistic regression analysis was conducted with discharge to home as the dependent variable and age, gender, side of fracture, fracture type, number of comorbidities, Functional Independence Measure motor score, and Functional Independence Measure cognitive score as independent variables. A receiver operating characteristic curve analysis was used to identify a cutoff point for classification of the patients into the two groups. [Results] Multiple logistic regression analysis showed that the Functional Independence Measure cognitive score was a significant variable affecting the discharge destination. The receiver operating characteristic curve analysis revealed that discharge to home was predicted accurately by a Functional Independence Measure cognitive score of 23.5. [Conclusion] Information from this study is expected to be useful for determining discharge plans and for the setting of treatment goals.
Key words: Cognitive, Patient discharge, Living alone

INTRODUCTION

Hip fracture is an extremely common and severe injury experienced by elderly people[1], and its incidence increases with age. The total number of hip fractures is expected to increase because of aging of the population[2]. It is expected that the number of hip fractures will increase progressively to 2.6 million by 2025 and to 4.5 million by 2050[3]. Hip fractures are also associated with increased risk of hospitalization and institutionalization[4]. Therefore, effective hip fracture rehabilitation strategies must be considered. There is also a need for discharge planning, that is planning and making arrangements for discharge of patients from inpatient rehabilitation unit as soon as possible.

Previous studiy have demonstrated that a discharge Functional Independence Measure (FIM) motor score of 58 provides good discriminatory ability for the classification of hip fracture patients to discern those to be discharged into the community and those to be discharged into institutions[5]. Although a FIM score of 58 is useful for discharge planning decisions for hip

fracture patients, selection of this cutoff point assumes that the patient is part of a close family structure. Factors associated with discharge to home include not only younger age and the ability to perform activities of daily living (ADL) independently but also living with another person[6]. The number and often the percentage of older people living alone is increasing in many countries[7, 8]. Remaining in one's own home is important for elderly people[9]. Older people, even those living alone, prefer to reside in their own home[10].

Reportedly, cognitive function is the most important factor affecting the decision to return to one's own home and for regaining pre-fracture function[11]. Therefore, cognitive status might also be important for hip fracture patients living alone. Nevertheless, it remains unclear which factor and cutoff point are the most useful to screen for discharge to home in patients with hip fracture living alone. After inpatient rehabilitation, even if the patient lives alone at home, some hip fracture patients would be discharged to return home. Therefore, ascertaining the necessary capabilities for discharging a patient to live alone at home is important for rehabilitation goal setting.

The goals of this pilot study were the following: 1) to identify appropriate clinical tests on admission for the discharge destination and 2) to ascertain the cut point functional score that best differentiates patients discharged to home when living alone at home. A cutoff point is expected to be useful for discharge planning. The present study is expected to help to predict the discharge destination of patients living alone.

SUBJECTS AND METHODS

We conducted a pilot cross-sectional study of hip fracture patients who were discharged between September 2009 and September 2014 from a 199-bed hospital located in Aichi, Japan. In all, 706 hip fracture patients were admitted to the inpatient rehabilitation unit. The inclusion criteria were as follows 1) 65 years old or older; 2) living alone in their own home before fracture, and 3) no change in family structure on hospital discharge. Three patients with missing data were excluded. Ultimately, 54 hip fracture patients (15 males, 39 females; mean age 81.3 ± 7.4 yr) who met the criteria were included in the study. All patients hospitalized received standard physical therapy (i.e., walking, climbing stairs, balance, muscle strength, and range of motion) and occupational therapy (i.e., basic ADL, instrumental ADL, and environment advice). Physical and occupational therapy were administered approximately 1.5 hr/day, 6–7 days per week. Patients were classified into those discharged to home (home group) and those admitted to an institution (institution group).

The study protocol, which met the standards of the Declaration of Helsinki, was approved by the research ethics committee of Seijoh University and Tokai Memorial Hospital. This study was retrospective. Therefore, written informed consent was not required for the use of patient data.

Data were collected from medical records: age, gender, fracture type (intercapsular fracture or extracapsular fracture), right/left side of fracture, and comorbidities. Because Alffram[11] found greater numbers of left hip fractures, data on the side of fracture were collected. The recorded comorbidities were cardiovascular disease, stroke, respiratory disease, diabetes, rheumatoid disease, Parkinson's disease, and malignant disorder. The number of comorbidities was dichotomized into either 0–1 or > 1[12]. Moreover, at the time of admission to the inpatient rehabilitation unit, patients were evaluated for their FIM level of functioning. The FIM has two unidimensional subscales: the motor subscale, consisting of 13 items related to self-care, transfers, and locomotion, and the cognitive subscale, consisting of 5 items related to comprehension, expression, and memory[13]. Each item is assigned a rating of 1–7, where 1 denotes the necessity for total assistance and 7 denotes complete independence. The FIM has been demonstrated to have good reliability, validity, and responsiveness[14]. Patients were assessed on the day of admission to the inpatient rehabilitation unit or on the next day.

Data were collected and analyzed using software (IBM SPSS Statistics for Windows, Version 22, IBM Japan Ltd., Tokyo, Japan). Independent t-tests were used to examine differences in age, admission FIM motor scores, and FIM cognitive scores of patients discharged to home and those admitted to an institution. χ^2 tests and Fisher exact tests were applied for intergroup comparison of gender, right/left side of fracture, fracture type, and comorbidity number. A stepwise multiple logistic regression analysis was used to identify significant predictors of discharge to home after rehabilitation. A multiple logistic regression analysis was conducted, with discharge to home as the dependent variable and age, gender, FIM motor score, FIM cognitive score, side of fracture, fracture type, and comorbidity number as independent variables. For the significant predictor of the discharge destination after rehabilitation identified in the stepwise logistic regression analysis, receiver operating characteristic (ROC) curves were used. Then the area under the curve (AUC) was computed to evaluate discriminative ability. The Youden index was used to calculate a cutoff point for the larger AUC. AUC values of 0.9 and above, 0.7–0.9, and < 0.7 indicate high accuracy, good accuracy, and low accuracy, respectively[15]. Statistical significance was inferred for $p < 0.05$.

RESULTS

Characteristics and functional levels of the patients are presented in Table 1. Thirty-seven patients were classified into the home group (69%), and 17 were classified into the institution group (31%). The respective mean ages (standard deviation) of the home group and institution group were 79.3 (7.2) and 85.1 (6.5) years. The mean age of the home group was lower (p = 0.006). The FIM cognitive scores on admission were significantly different between groups (home group, 29.2; institution group, 21.4, p = 0.001).The same was true for the FIM motor scores (home group, 62.1; institution group, 45.2, p < 0.001).

Table 1. Characteristics of the patients discharged to home and admitted to institutions

Variable	Home group (n = 37)	Institution group (n =17)
Age mean (SD), yr	79.3 (7.2)	85.1 (6.5) *
Gender (female), %	73	71
Side of fracture (right), %	46	47
Type of fracture (extracapsular fracture), %	54	41
Comorbidity (> 1), %	22	35
FIM motor score mean (SD)	62.1 (13.8)	45.2 (18.5) *
FIM cognitive score mean (SD)	29.2 (4.8)	21.4 (8.2) *

Values are means (standard deviation) or percentages. p values were calculated using a t-test or χ^2 test.
*$p < 0.05$

Table 2. Results of multivariate logistic analysis to investigate independent factors in patients discharged to home

	Coefficient (B)	Standard error	Wald	p	Odds ratio	95% confidence interval
Age	−0.099	0.056	3.076	0.079	0.906	0.812–1.012
Gender	−0.783	1.089	0.517	0.472	0.457	0.054–3.863
Side of fracture	−0.093	0.780	0.014	0.905	0.911	0.198–4.200
Fracture type	0.947	0.842	1.265	0.261	2.578	0.495–13.423
Comorbidities	0.399	0.927	0.185	0.667	1.490	0.242–9.163
FIM motor	0.051	0.028	3.295	0.070	1.052	0.996–1.111
FIM cognitive	0.170	0.078	4.784	0.029	1.185	1.018–1.379

No differences were found in other characteristics between groups.

The multiple logistic regression analysis identified the FIM cognitive score (odds ratio, 1.185; 95% confidence interval (CI), 1.018–1.379, p = 0.029) as the factor determining the discharge destination (Table 2). Therefore, the FIM cognitive score was eliminated from the ROC analysis.

The AUC for the FIM cognitive score was 0.787 (95% CI: 0.639–0.935). The cutoff point calculated for the FIM cognitive score, based on the Youden index, was 23.5 (specificity, 0.919; sensitivity, 0.647).

DISCUSSION

The present study revealed 1) that the FIM cognitive score on admission is a significant predictor of discharge to home and 2) that the cutoff point is 23.5 for patients with a hip fracture living alone in the community.

Absence of a partner is a risk factor for patients discharged to their own home[16, 17]. Living alone is usually associated with an inability to return home after a person experiences hip fracture[18]. These results can be regarded as clinically significant for hip fracture patients. However, after inpatient rehabilitation, some hip fracture patients are discharged to return home, even if they live alone. In recent years, because the number of elderly people living alone has tended to increase, factors predicting which hip fracture patients living alone can be discharged to home are important when considering discharge.

Age, FIM motor score, and FIM cognitive score were significantly different between the home group and institution group. The results of the present study demonstrated that older patients are discharged less frequently to their own homes. Chin et al.[19] and Deakin et al.[20] reported that older people are discharged to their own homes less often. The results of the present study also suggest that increasing age is a risk factor affecting the discharge of hip fracture patients to their homes when the patients are living alone. Moreover, Takeda et al.[21] reported that the FIM motor score enables determination of whether hip fracture patients should be discharged to their own home. However, in this study, logistic regression analysis revealed that the FIM cognitive score was a significant predictor of discharge to home. Wang et al.[5] reported that the FIM motor rating demonstrated good discriminatory ability for classifying the discharge setting and that a FIM motor rating of 58 at discharge might be an important threshold for increased likelihood of discharge to the community. However, the subjects of their study were certainly not all living alone. In contrast, all patients examined in the present study were living alone. The AUC of the FIM cognitive scores showed a high discriminative value (0.787), which suggests that the FIM cognitive score shows good discriminative capability to predict the discharge destination of hip fracture patients living alone in a community. The optimal cutoff point for the FIM cognitive scores was calculated to be 23.5 based on the Youden index for hip fracture

patients living alone: such patients in a community would be expected to show a FIM cognitive score of 24 on admission, or higher. A patient living with family members might be discharged to return home by raising his/her independent motor function status to the greatest degree possible. A cognitive deficit decreases the probability of a person living at home[22]. Moreover, MacNeill et al.[23] reported both physical function and cognitive status as predictors of returning to one's own home for patients living alone. Therefore, cognitive status such as that included in the FIM cognitive score might be a factor that is necessary to consider for hip fracture patients living alone.

This study has some limitations. First, factors we did not investigate, such as economic status, social support, home and surrounding environment, severity of comorbidities, and pre-fracture status, might be associated with the discharge destination. Second, the limited sample size might have provided insufficient capability to examine multiple outcomes and interactions among predictors. Not only the FIM cognitive score but also the FIM motor score and other factors might affect the discharge destination. Therefore, a large cohort study must be conducted to ascertain the factors and cutoff point scores that best differentiate patients discharged to their own residences.

In conclusion, the FIM cognitive score on admission showed good discriminative ability to predict the discharge destination for hip fracture patients living alone. The ROC curves and Youden index for patients discharged to home and those admitted to institutions showed good accuracy, as indicated by good AUC values. A FIM cognitive score of 24 on admission was shown to be useful for classifying patients discharged to home and those admitted to institutions. The information gained from this study is expected to be useful for determining discharge plans and for the setting of treatment goals. However, a larger study must be conducted to ascertain the factors and cutoff point scores that best differentiate patients discharged to home.

REFERENCES

1) Beloosesky Y, Weiss A, Manasian M, et al.: Handgrip strength of the elderly after hip fracture repair correlates with functional outcome. Disabil Rehabil, 2010, 32: 367–373. [Medline] [CrossRef]

2) Lönnroos E, Kautiainen H, Karppi P, et al.: Increased incidence of hip fractures. A population based-study in Finland. Bone, 2006, 39: 623–627. [Medline] [CrossRef]

3) Gullberg B, Johnell O, Kanis JA: World-wide projections for hip fracture. Osteoporos Int, 1997, 7: 407–413. [Medline] [CrossRef]

4) Braithwaite RS, Col NF, Wong JB: Estimating hip fracture morbidity, mortality and costs. J Am Geriatr Soc, 2003, 51: 364–370. [Medline] [CrossRef]

5) Wang CY, Graham JE, Karmarkar AM, et al.: FIM motor scores for classifying community discharge after inpatient rehabilitation for hip fracture. PM R, 2014, 6: 493–497. [Medline] [CrossRef]

6) Auron-Gomez M, Michota F: Medical management of hip fracture. Clin Geriatr Med, 2008, 24: 701–719, ix. [Medline] [CrossRef]

7) Chandler J, Williams M, Maconachie M, et al.: Living alone: its place in household formation and change. Sociol Res Online, 2004, 9: 3. http://www.socresonline.org.uk/9/3/chandler.html (Accessed Jan. 5, 2015) [CrossRef]

8) Powell JL: Global projections of populational ageing. Int Lett Soc Humanist Sci, 2014, 26: 106–118. [CrossRef]

9) Hammer RM: The lived experience of being at home. A phenomenological investigation. J Gerontol Nurs, 1999, 25: 10–18. [Medline] [CrossRef]

10) Lee YM, Holm K: Family relationships and depression among elderly Korean immigrants. ISRN Nurs 2011, 2011 doi: 10.5402/2011/429249.

11) Alffram PA: An epidemiologic study of cervical and trochanteric fractures of the femur in an urban population analysis of 1,664 cases with special reference to etiologic factors. Acta Orthop Scand Suppl, 1964, 65: 65, 1–109. [Medline]

12) Samuelsson B, Hedström MI, Ponzer S, et al.: Gender differences and cognitive aspects on functional outcome after hip fracture—a 2 years' follow-up of 2,134 patients. Age Ageing, 2009, 38: 686–692. [Medline] [CrossRef]

13) Sakurai H, Tsujimura T, Sugiura Y, et al.: Determinants of return to home after stroke: an analysis based on FIM scores. J Phys Ther Sci, 2011, 23: 283–287. [CrossRef]

14) Cohen ME, Marino RJ: The tools of disability outcomes research functional status measures. Arch Phys Med Rehabil, 2000, 81: S21–S29. [Medline] [CrossRef]

15) Swets JA: Measuring the accuracy of diagnostic systems. Science, 1988, 240: 1285–1293. [Medline] [CrossRef]

16) Vochteloo AJ, van Vliet-Koppert ST, Maier AB, et al.: Risk factors for failure to return to the pre-fracture place of residence after hip fracture: a prospective longitudinal study of 444 patients. Arch Orthop Trauma Surg, 2012, 132: 823–830. [Medline] [CrossRef]

17) Hershkovitz A, Kalandariov Z, Hermush V, et al.: Factors affecting short-term rehabilitation outcomes of disabled elderly patients with proximal hip fracture. Arch Phys Med Rehabil, 2007, 88: 916–921. [Medline] [CrossRef]

18) Boockvar KS, Litke A, Penrod JD, et al.: Patient relocation in the 6 months after hip fracture: risk factors for fragmented care. J Am Geriatr Soc, 2004, 52: 1826–1831. [Medline] [CrossRef]

19) Chin R, Ng B, Cheung LP: Factors predicting rehabilitation outcomes of elderly patients with hip fracture. Hong Kong Med J, 2008, 14: 209–215. [Medline]

20) Deakin DE, Wenn RT, Moran CG: Factors influencing discharge location following hip fracture. Injury, 2008, 39: 213–218. [Medline] [CrossRef]

21) Takeda H, Kamogawa J, Sakayama K, et al.: Evaluation of clinical prognosis and activities of daily living using functional independence measure in patients with hip fractures. J Orthop Sci, 2006, 11: 584–591. [Medline] [CrossRef]

22) von Bonsdorff M, Rantanen T, Laukkanen P, et al.: Mobility limitations and cognitive deficits as predictors of institutionalization among community-dwelling older people. Gerontology, 2006, 52: 359–365. [Medline] [CrossRef]

23) MacNeill SE, Lichtenberg PA: Home alone: the role of cognition in return to independent living. Arch Phys Med Rehabil, 1997, 78: 755–758. [Medline] [CrossRef]