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Preinjury Factors that Influence the Outcome of Patients with Hip Fracture

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Abstract

Background: The question of whether patients with hip fracture can be discharged home or require hospital transfer for additional rehabilitation is critical. The same clinical pathway is not suitable for all patients. However, there are no clear indices for establishing the appropriate clinical pathway. To address this, we examined preinjury factors, including the Barthel index (BI), and performed logistic regression analysis to identify factors affecting the outcome (direct home discharge or hospital transfer) of patients with hip fracture.

Materials and methods: Patients with hip fracture who underwent surgery at Yokohama City University hospital were consecutively enrolled, and clinical data were retrospectively reviewed. Intergroup (direct home discharge or hospital transfer) comparison was performed using Student's t test (continuous variables) and Fisher's exact test (categorical variables). Factors affecting outcome were determined by logistic regression analysis. Receiver operating characteristic (ROC) curve analysis was used to identify the cut-off level, sensitivity, and specificity of the identified factors.

Results: The preinjury BI scores for patients discharged home directly were significantly higher ($p<0.01$) and age was significantly lower ($p<0.05$) than for those transferred to another hospital. The american society of anesthesiologists physical status (ASA-PS) for patients discharged home was significantly ($p<0.05$) less than that for transferred patients. Logistic regression analysis revealed that preinjury BI scores and older age affected outcome whereas the ASA-PS did not. ROC curve analysis revealed that patients with preinjury BI <85 and aged >79 were difficult to discharge directly home and were more likely to be transferred to another hospital (95.6% sensitivity and 62.9% specificity).

Conclusions: Low preinjury BI scores (<85) and higher age (>79) indicate a requirement for a co-operative pathway between regional hospitals that ensures a smooth hospital transfer.

Keywords: Hip fractures; Preinjury factors; Barthel index; Clinical pathway

Introduction

The incidence of hip fracture is increasing year-on-year due to the aging population and coincident osteoporosis [1]; as such, hip fractures have become a major socioeconomic problem. There were an estimated 148,100 new hip fractures patients in Japan [2]. As the population continues to age, and if the incidence of fracture does not change, we will be faced with 250,000 patients per year by 2020 and 300,000 by 2030. Many patients with hip fracture have severe comorbidities, particularly those admitted to a University hospital. Thus, patients with hip fractures necessarily stay in hospital for a long time and frequently require transfer to another satellite hospital. In addition, the inability to walk at the time of hospital discharge is an independent predictor of mortality [3]; thus walking prior to home discharge is crucial. The decision to initiate hospital transfer or aim for direct home discharge is critical from the standpoint of clinical management, co-operation with regional hospitals, and medical expenses. However, it is often difficult to judge at the time of admission.

Not all patients require hospital transfer for rehabilitation. From an economic point-of-view, it is desirable that patients are discharged directly home. The clinical pathway plays an important role in achieving smooth discharge; however, it is not easy to apply the same clinical pathway to all patients. The final goal, i.e., direct home discharge or hospital transfer, is important from the viewpoint of the chosen clinical pathway. The question is whether factors such as preoperative performance of activities of daily living and age affect the final outcome.

To examine this question, we investigated preinjury factors, including the Barthel index (BI), and performed logistic regression analysis to identify factors that affect the outcome (home discharge or transfer) of patients with hip fracture.

Methods

Patients

The study enrolled 65 consecutive patients (65 hips) who underwent surgery for hip fracture at our University hospital from January 2011 through December 2015. The study was approved by the our institutional review board, and informed consent was obtained from all patients. Clinical data were retrospectively reviewed. The mean age of

the 65 patients (26 male and 39 female) at the time of surgery was 77.2 years (52–96). The type of fracture was as follows: 41 femoral neck fractures and 24 intertrochanteric fractures. Femoral neck fractures were treated by hemiarthroplasty with a cementless stem (SL-Plus, Smith and Nephew, Memphis, TN, USA; 31 cases) or a sliding hip screw (Asnis, Stryker Orthopedics, Mahwah, NJ, USA; ten cases). Trochanteric fractures were fixed with an intramedullary nail (Gamma 3, Stryker Orthopedics, Mahwah, NJ, USA; 24 cases). The decision whether to transfer to another hospital was determined by the attending orthopedic surgeon, who considered the walking status of the patient and the ability of the family to care for the patient at home. Fifteen patients were discharged home directly while 50 were transferred to other satellite hospitals. All data from the orthopedic surgeon were collected prospectively as part of ongoing quality improvement efforts.

Clinical parameters

Clinical parameters analyzed included age, gender, body mass index (BMI), the preinjury BI, the duration from admission to operation, the length of hospital stay, preoperative American society of anesthesiologists physical status (ASA-PS), dementia, and surgical modality. Information regarding pre-fracture mobility status was obtained from the patients themselves. Where patients had a diagnosis of dementia, information was obtained from a family member.

Statistical analyses

All statistical analyses were performed using SPSS 22.0 software. Data were expressed as the mean ± standard deviation. Intergroup comparison was performed using Student's t test for continuous variables and Fisher's exact test for categorical variables. Factors affecting outcome were identified by logistic regression analysis. A p value <0.05 was considered significant. Receiver operating characteristic (ROC) curve analysis was used to calculate the cut-off level and the sensitivity and specificity of the affecting factors.

Results

The characteristics for the 65 patients are shown in Table 1.

Age (years)	77.2 ± 8.1
Gender, male/female	26/39
BMI (kg/m2)	20.3 ± 3.3
Preinjury Barthel index score	79.8 ± 16.2
Duration from admission to operation (days)	4.1 ± 2.3
Length of hospital stay (days)	20.4 ± 14.2
ASA-PS, III or above (%)	31
Dementia (%)	15
Surgical modality, hemiarthroplasty (%)	48

Table 1: Characteristics of the 65 patients, P values are expressed as the mean ± SD, ASA-PS : american society of anesthesiologists physical status, BMI : body mass index.

Table 2 shows the difference in clinical parameters between the direct home discharge group and the hospital transfer group. The preinjury BI scores for patients discharged home directly were significantly higher ($p<0.01$) and age was significantly lower ($p<0.05$) than for patients transferred to another hospital. Table 3 shows the results of statistical analysis of the effects of gender, surgical procedure, ASA-PS, and dementia (Fisher's exact test). The ASA-PS for patients discharged home directly was significantly lower than that for patients transferred to another hospital ($p<0.05$).

	Direct discharge home n=15	Hospital transfer n=50	P value
Age (years)	72.4	79.0	<0.05
BMI (kg/m2)	20.8	20.1	N.S.
Preinjury BI	93.2	75.6	<0.01
Length of hospital stay (days)	21.6	20.0	N.S.
Duration from admission to operation (days)	4.2	4.0	N.S.

Table 2: Patients discharged home directly or transferred to another hospital, Data analyzed using Student's t test, N.S., not significant.

	Direct discharge home n=15 (n, %)	Hospital transfer n=50 (n, %)	P value
Male/Female	5 (33.3)/10 (66.7)	21 (42.0)/29 (58.0)	N.S.
Hemiarthroplasty	9 (60.0)	22 (44.0)	N.S.
Dementia	1 (6.7)	8 (12.3)	N.S.
ASA-PS (III or above)	1 (6.7)	18 (36.0)	<0.05

Table 3: Significance of gender, surgical procedure, dementia, and ASA-PS (Fisher's exact test).

Table 4 shows the results of logistic regression analysis to identify factors affecting outcome. The preinjury BI score and age had a significant effect on outcome, but the ASA-PS did not. When the preinjury BI score was low and age was high, the probability of direct discharge home decreased significantly. Logistic regression analysis did not identify dementia as a factor that affected outcome in this study. In addition, there was no clear correlation between the preinjury BI and age.

	Hazard ratio	95% Confidence interval	P value
Age (years)	1.14	1.021–1.282	<0.05
Preinjury BI	0.892	0.823–0.968	<0.01
ASA-PS	8.06	0.698–93.131	N.S.

Table 4: Logistic regression analysis to identify factors affecting direct discharge home.

ROC curve analysis revealed that the cut-off level for the preinjury BI score was 82.5. Patients with a score of 85 or above could be discharged home directly (85.7% sensitivity and 69.8% specificity). The

cut-off level for age was 78.5. Those aged 79 or above were more likely to be transferred to another hospital (72.1% sensitivity and 78.6% specificity). Patients with a preinjury BI <85 and aged >79 were difficult to discharge home and so were transferred to another hospital (95.6% sensitivity and 62.9% specificity).

Discussion

Here, we examined preinjury factors and performed logistic regression analysis to identify factors affecting the outcome (home discharge or transfer to another hospital) of patients with hip fracture. Logistic regression analysis identified age and the preinjury BI score as significant factors. Furthermore, ROC curve analysis revealed that a low preinjury BI score (<85) and older age (>77) were both risk factors for hospital transfer. Such patients will require a coordinated care pathway to ensure a smooth hospital transfer.

Japan is the most aged society in the world; therefore, the increasing incidence of hip fracture is a serious issue [1], as it is in other countries [4-9]. Even after appropriate surgery and rehabilitation, not all patients can return to daily activity levels that are the same as those preinjury [10,11]. The ultimate goal of treatment is that patients return home with the same level of activity they showed prior to admission. Hence, co-operation with regional satellite hospitals is very important if we are to achieve full rehabilitation of patients who cannot be discharged home directly.

Several recent studies report the utility of care pathways for ensuring smooth and successful rehabilitation; such studies include total hip arthroplasty [12], total knee arthroplasty [13], and hip fracture [14]. For elderly patients with hip fracture in particular, comprehensive geriatric intervention undertaken by a geriatrician, a rehabilitation specialist, and a social worker reduces the rates of in-hospital mortality and medical complications [15]. It is important to evaluate the medical and psychosocial problems and the functional capability of the patient, and to share this information within the multidisciplinary team. In particular, the implementation of a defined clinical pathway for patients with hip fracture reduces the length of hospital stay, time to surgery, and in-hospital complication rate, with no negative impact on associated clinical and functional outcomes [14,16]. Thus, an appropriate clinical pathway will contribute reduced medical expenses. However, many patients cannot complete a prescribed clinical pathway [14] due to delayed recovery. To avoid this, the pathway must be changed in accordance with a patient's activity level. The results presented herein suggest that age and the preoperative BI score are the important factors that dictate the decision to discharge a patient home directly or to transfer them to another hospital for ongoing rehabilitation.

Several studies examined factors that affect functional outcome and mortality; such factors include age, preinjury walking ability, comorbidities, cognitive function, gender, the surgical modality, the fracture type, the duration from injury to operation, postoperative delirium, pressure ulcers, and nutritional status [3,11,17-20]. These studies report that older age or walking disability prior to injury are risk factors for mortality and functional deterioration, meaning that a patient cannot be discharged home [11,17,18]. Age greater than 85 years is a risk factor for a less satisfactory functional outcome and a low chance of home discharge after hip fracture [8,11]. However, Doshi et al. report that age is not a factor that determines functional recovery [21]. Thus, the influence of age is unclear. Here, we found that patients aged over 79 years were much more likely to require hospital transfer for further rehabilitation.

As well as age, we found that the preinjury functional activity level was an important factor related to postoperative activity. The BI is recognized as a good indicator of activity in aged patients [22]. A BI score <60 at admission is associated with surgical delay and in-hospital mortality [16]; several studies report a cut-off value of 85 for functional recovery [23,24]. Thus, accurate evaluation of the preinjury BI may help to predict functional recovery post-surgery. The results presented herein suggest that 85 is a reasonable cut-off point for predicting direct discharge home. In addition, combining the BI and patient age has even better predictive ability.

We found no significant relationship between dementia and outcome. Previous studies report that low cognitive function is a factor that negatively affects rehabilitation status or functional outcome after hip fracture in elderly patients [25,26]. Other studies show that patients with impaired cognition had lower functional ability at discharge and that fewer were discharged to their own homes [11,26]. Another factor affecting mortality and complication rates in patients with hip fracture is delayed surgery [16,27]. Although the duration from injury to operation was not a factor that affected outcome in the present study, it may be important with respect to a clinically adequate pathway.

One of the limitations of this study is that the characteristics of our study population (those admitted to a University hospital) may not be applicable to all hospital patients. This may have affected the results. For example, some cases could not be discharged home directly due to general complications (e.g., younger patients with a high preinjury BI). Another limitation is that there were no clear criteria for determining whether a patient was discharged home or transferred to another hospital. In reality, the decision was influenced slightly by environmental factors, such as whether the family could care for a patient at home. For example, two patients who could walk with a cane were transferred to another hospital for this reason. A multicenter study that enrolls more cases is desirable; however, the results presented herein provide a picture of the situation at a large University hospital.

Conclusion

The present study examined preinjury factors and performed logistic regression analysis to identify those that affected patient outcome after hip fracture. Logistic regression analysis identified the preinjury BI and age as significant factors. Patients with low preinjury BI scores (<85) and older age (>79) will more likely require transfer to a regional hospital via a fully co-operative care pathway.

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