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Factors Affecting Postoperative Functional Outcomes in Older Patients with Hip Fractures at a Large Public Hospital in Thailand

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Purpose: To identify prognostic factors for 6-month postoperative functional outcomes in older patients with hip fractures.
Methods: This single-center prospective cohort study was conducted from January 2020 to December 2020. Patient factors and the preinjury Barthel index were collected from the patients at admission. The Barthel index was assessed again 6 months postoperatively to define functional outcomes. Minimal clinically important differences (MCIDs) between preinjury and 6-month functional outcomes were used to classify patients into satisfactory or unsatisfactory groups. The 6-month mortality rate was evaluated. Multiple logistic regression was used to analyze prognostic factors for postoperative functional outcomes.
Results: In total, 320 patients were included in the analysis. The 6-month mortality rate was 11.8%. The average age and body mass index were 75.74±10.53 years and 20.98±3.96, respectively. Of the patients, 243 were female (75.94%), 210 were diagnosed with intertrochanteric fractures (65.83%), and 54 underwent surgery within 72 h (16.88%). In total, 249 patients (77.81%) had no complications. Multivariate analysis indicated that a time to surgery of < 72 h (odds ratio, 10.51; 95% confidence interval (CI), 5.42 to 20.37; p-value <0.01) was a significant prognostic factor for a satisfactory 6-month outcome.
Conclusions: Time to surgery is a prognostic factor for a satisfactory functional outcome. Early surgery results in better functional outcomes in older patients with hip fractures.

Keywords: older person, hip fracture, time to surgery, fragility fracture, functional outcome, prognostic factor

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With the aging world population, hip fractures in older patients are among the most critical problems due to their impact on quality of life and medical costs [1,2]. The incidence of hip fractures was 238.5 per 100,000 person-years in Nan province, Thailand, in 2017, and the incidence tends to increase annually [3]. These fractures also increase disability and mortality [1]. The 1-year mortality rate at a large public hospital in 2010 was 23.6% [4]. Re-

evaluation in 2015 found that non-operative treatment, age, more than one comorbidity, chronic kidney disease, and in-hospital complications were significantly related to 1-year mortality [5].

Compared with conservative treatment, surgical treatment results in better functional outcomes and lower mortality rates among patients with hip fractures [6,7]. However, various factors, such as age, sex, body mass index (BMI), comorbidities, preinjury ambulation status, complications, and fracture type, affect functional outcomes in patients who undergo surgery [8-10]. Preinjury ambulatory status, BMI, hemoglobin level, and functional outcomes at discharge were found to be independent predictors of 1-year postoperative functional outcomes in older patients who underwent intertrochanteric fracture surgery in Thailand [11]. The study period may also have affected patient outcomes. A recent study demonstrated lower postoperative functional outcomes at 3 months in older patients with hip fractures during the coronavirus disease (COVID-19) pandemic [12].

There are limited studies on the functional outcomes of patients with hip fractures in Thailand. This study aimed to identify prognostic factors for functional outcomes in older patients with hip fractures to improve their management.

METHODS

This single-center prospective cohort study focused on older patients (age, > 50 years) with hip fractures who underwent surgery at a large public hospital during a 1-year period (January 2020 to December 2020). The study protocol was approved by the institutional review board (IRB) of our institution. According to the policies and regulations of the study authorizing entity, informed consent was obtained from all participants.

The inclusion criteria were as follows: 1) age > 50 years, 2) diagnosis of a single closed fracture from low-energy trauma, 3) diagnosis of intertrochanteric fracture or femoral neck fracture, and 4) surgery. The exclusion criteria were as follows: 1) refracture, 2) pathological fractures, 3) isolated fractures of the lesser or greater trochanter, 4) periimplant and periprosthetic fractures, and 5) nonoperative treatment.

Data collection

Demographic data, including age, BMI, sex, comorbidity, diagnosis, and vitamin D levels, were collected at the time of admission. The time to surgery and the length of hospital stay were recorded before discharge. The preinjury Barthel index (Pre-BI) was also recorded by the healthcare provider at the time of admission.

At the 6-month follow-up, the community health team collected data on the post-injury Barthel index (Post-BI) and mortality rate [13]. This study used minimal clinically important differences (MCIDs) to classify patients into satisfactory and unsatisfactory groups. We used the MCID as 10 points, as previously described [14]. Patients with a difference of > 10 points between the pre-BI and post-BI were classified into the unsatisfactory group.

In our institute, surgical intervention for intertrochanteric and femoral neck fractures is by fixation and arthroplasty, respectively. Patients entered the standard rehabilitation protocol according to fracture type and treatment.

Statistical analysis

Data on patient characteristics are expressed as mean ± standard deviation or median and range. Categorical variables were compared using the chi-square test or Fisher's exact test. Continuous variables were compared using the t-test or Mann–Whitney U-test. Association factors were determined using logistic regression analysis. The results are expressed as odds ratios (ORs), 95% confidence intervals (CIs), and p-values. Statistical significance was set at $P < 0.05$. All analyses were performed using STATA, version 14 (StataCorp LLC, College Station, TX, USA).

RESULTS

This 1-year study included 363 older patients with hip fractures. Of these, 43 patients died within 6 months. The 6-month mortality rate for patients who underwent surgery was 11.8%.

Therefore, 320 patients were included in the analysis. The demographic data and factors determining 6-month functional outcomes are shown in Tables 1 and 2. The average age and BMI were

75.74±10.53 years and 20.98±3.96, respectively. The most common comorbidity was hypertension (58.44%). Of the patients, 243 were female (75.94%), 210 were diagnosed with intertrochanteric fractures (65.83%), and 54 underwent surgery within 72 h (16.88%). Thirty-six patients (11.25%) stayed in the hospital for less than 7 days, 172 (53.75%) had low vitamin D levels, and 71 (22.19%) had complications (urinary tract infection, 40; delirium, 22; pneumonia, 7; pulmonary embolism, 7; pressure sore, 5; acute myocardial infarction, 3; stroke, 1; deep vein thrombosis, 2; atrial fibrillation, 1; acute renal failure, 1; upper gastrointestinal tract bleeding, 1; implant failure, 2; and surgical wound infection, 1).

Table 1 Demographic data of 320 older patients with hip fractures.

Characteristic	**n**	**%**
Age	75.74±10.53	
BMI	20.98±3.96	
Sex		
Female	243	75.94
Male	77	24.06
Comorbid		
Hypertension	187	58.44
Diabetic mellitus	53	16.56
Dyslipidemia	71	22.19
Heart disease	17	5.31
Stroke	36	11.25
Chronic kidney disease	20	6.25
COPD/asthma	15	4.69
Vitamin D level		
≤ 30	172	53.75
> 30	148	46.25
Diagnosis		
Intertrochanteric fracture	210	65.83
Femoral neck fracture	109	34.17
Time to Surgery		
≤ 48 hours (percent)	22	6.88
> 48 hours (percent)	298	93.13
≤ 72 hours (percent)	54	16.88
> 72 hours (percent)	266	83.13
LOS		
≤ 7 days (percent)	36	11.25
> 7 days (percent)	284	88.75
Complication		
No	249	77.81
Yes	71	22.19

BMI, body mass index; COPD, chronic obstructive pulmonary disease; LOS, length of stay

Table 2 Factors determining 6-month functional outcomes.

	Unsatisfactory Group (%) N=233	**Satisfactory Group (%) N=87**	***P*-value**
Age	76.42±10.38	73.93±10.78	0.059
BMI	21.56±11.85	21.44±4.26	0.927
Sex			
Female	171 (73.39)	72 (82.76)	0.081
Male	62 (26.61)	15 (17.24)	
Comorbid			
Hypertension	138 (73.80)	49 (26.20)	0.639
Diabetic mellitus	38 (71.70)	15 (28.30)	0.842
Dyslipidemia	52 (73.24)	19 (26.76)	0.927
Heart disease	12 (70.59)	5 (29.41)	0.832
Stroke	26 (72.22)	10 (27.78)	0.933
Chronic kidney disease	18 (90.00)	2 (10.00)	0.116
COPD/asthma	9 (60.00)	6 (40.00)	0.253
Time to Surgery (h)			
≤ 48	7 (3.00)	15 (17.24)	
> 48	226 (97.00)	72 (82.76)	<0.001
≤ 72	16 (6.87)	38 (43.68)	
> 72	217 (93.13)	49 (56.32)	<0.001
Length of hospital stay (days)			
> 7	214 (91.85)	70 (80.46)	
≤ 7	19 (8.15)	17 (19.54)	0.004
Complication			
no	182 (78.11)	67 (77.01)	0.833
yes	51 (21.89)	20 (22.99)	

BMI, body mass index; COPD, chronic obstructive pulmonary disease

Table 3 Multivariate analysis of factors determining 6-month functional outcome.

	Odds Ratio	**95%CI**	***P*-value**
Time to surgery (h)			
≤ 48	6.08	2.36, 15.62	<0.001
≤ 72	10.51	5.42, 20.37	<0.001
Vitamin D level (ng/mL)			
≤ 30	1.47	0.83, 2.59	0.176

CI, confidence interval

Multivariate analysis indicated that the significant prognostic factors for a 6-month satisfactory outcome (Table 3) were times to surgery of ≤ 48 h (OR 6.08, 95% CI 2.36 to 15.62, p-value <0.001) and ≤ 72 h (OR 10.51, 95% CI 5.42 to 20.37, p-value <0.001). Vitamin D levels were not significantly associated with functional outcomes.

DISCUSSION

Our study demonstrated that performing surgery within 72 h significantly correlated with a better 6-month Barthel index, which assesses the ability to perform activities of daily living. The early surgery rate in our hospital was 16.12%, while the rate of hospital stays of <7 days was 11.25%. At

6 months, only 27% of the patients had satisfactory outcomes after hip surgery, 22% had complications, and the mortality rate was 11.8%.

Vitamin D levels are associated with muscle function, strength, and performance. Vitamin D depletion can cause muscle impairment and body imbalance [15]. A recent retrospective study showed that vitamin D levels do not significantly affect functional outcomes after hip fracture surgery in older patients [16]. However, severe preoperative vitamin D deficiency (≤ 10 ng/mL) is correlated with poor functional outcomes in older patients with hip fractures [17]. The current study demonstrated that low vitamin D levels (≤ 30 ng/mL) are not significantly associated with functional outcomes. Only seven patients had severe vitamin D deficiency in this study. Further prospective studies on vitamin D levels in older patients with hip fractures should be conducted.

Surgery is the mainstay of treatment in hip fractures in older patients due to the higher functional outcomes after surgery, less time to return to function, and lower complication rates compared with conservative treatment [18,19]. Previous studies have shown that the timing of surgery is associated with a low mortality rate and fewer complications, such as urinary tract infection, aspiration pneumonia, and bedsores. Early surgery also improves the functional recovery of the patient [20-24]. This protocol also provides early rehabilitation which helps patients to gain function. Our results are similar to those of previous studies that have reported better functional outcomes after early surgery. In addition, prolonged hospital stay for hip fractures increases the risk of death 30 days after discharge [25]. Although the length of stay in this study was not significantly associated with functional outcomes, early surgery decreased the length of hospital stay by decreasing the preoperative waiting time and postoperative rehabilitation time.

Some studies disagree with the early surgery protocol [26-28]. Comorbidities play an essential role in delaying surgery. Preoperative medical consultation is necessary to reduce the risk of morbidity and mortality in patients with multiple or critical comorbidities. Other causes of delayed surgery in our hospital were the unavailability of operating rooms and staff shortages. Preoperative family counseling is also an essential part of care because sometimes older patients cannot decide for themselves, and a family member is usually the caregiver. Therefore, although early surgery performed within 72 h was correlated with better functional outcomes in older patients with hip fractures, there are some limitations to proceeding with this protocol. This study has several limitations. First, the sample size in this study may not be large enough to generalize the results to the larger population. Second, the retrospective design and lack of control group for comparison so it is difficult to determine the cause-and-effect relationship between the timing of surgery and functional outcomes. These limitations suggest that further studies with larger sample sizes, controlled design, and consideration of other factors are needed to fully understand the impact of the timing of surgery on functional outcomes in older patients with hip fractures.

CONCLUSIONS

Time to surgery is a prognostic factor for satisfactory functional outcomes in older patients with hip fractures. Early surgery results in better functional outcomes in older patients with hip fractures., but it is also important to consider other factors such as patient comorbidities and availability of operating rooms and staff. Preoperative medical consultation and family counseling are essential to minimize the risk of morbidity and mortality.

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