Factors associated with different types of hip fractures among elderly patients a tertiary hospital in Pahang: A retrospective cross-sectional study

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ABSTRACT

Introduction: Hip fractures, predominantly due to decreased bone density and falls, significantly impact elderly health, disproportionately affecting women and placing a strain on healthcare resources. This study aims to conduct an in-depth epidemiological analysis of hip fracture incidence among the elderly in Pahang, Malaysia, to inform better healthcare strategies.

Materials and Methods: In this retrospective study, medical records of patients admitted with hip fractures between 2019 and 2021 at Hospital Sultan Haji Ahmad Shah (HoSHAS) in Pahang were analyzed. Data on sociodemographic characteristics, nature of trauma, fracture types, and comorbidities were collected and examined using descriptive and inferential statistics.

Results: Among 3856 Orthopaedic Department admissions at HoSHAS (2019-2021), 296 hip fracture cases were identified, predominantly in women (71.3%), Malay ethnicity (75.3%), and aged 71-80 (38.5%). Intertrochanteric femur fractures were prevalent (62.8%). Unintentional falls accounted for 94.9% of cases. Logistic regression showed age and gender as significant predictors of femoral neck fractures. Specifically, Chinese seniors were 1.96 times more likely, and women over 65 were 1.95 times more likely to suffer these fractures. Notably, the absence of comorbidities increased the risk by 3.41 times ($p < 0.05$).

Conclusion: With increased longevity among Malaysian citizen, the number of hip fracture cases are growing and leading to other health-related problems such as disability, depression, and cardiovascular. Various preventive interventions for osteoporosis and falls should be implemented to reduce the incidence of hip fractures among older adults.

KEYWORDS:
Hip fracture, elderly, epidemiology

INTRODUCTION

Hip fractures are defined as any fracture in the upper section of the femur between the tip of the femur's head and 5cm below the lesser trochanter.[1] Hip fractures are common among the elderly related to osteoporosis and fall.[2] Hip fractures affect millions of adults annually around the world, leading to major disability, serious consequences, and high mortality rates.[3-5] Older adults who sustained hip fractures are highly exposed to the risk of complications and comorbidities.[4,6,7]

Life expectancy in Malaysia has risen by 20 years in the last 60 years, from 54.3 in 1957 to 74.75 in 2016; the elderly comprise 2.83 million (9.13%) of the country's total population of 31 million.[8] While life expectancy is rising, a significant concern in many trauma centres across multiple nations in the twenty-first century is an increase in elderly patients hospitalized with hip fractures.[9-11] Throughout 1996 and 1997, 56 public and private hospitals in Malaysia participated in the extensive study on hip fracture epidemiology. The overall rate of total incidence was 90 cases per 100,000 adults aged 50 and up. There was no change in the incidence rate between the two years. It was, however, more prevalent in women and older age groups.[12] Hip fractures represent an increasing financial impact on healthcare resources.[13] The incidence of hip fractures in Malaysia is expected to rise by a factor of 3.5 in 2050, from 6,000 to more than 21,000. This rise will result in an annual increase in healthcare spending of over USD 125 million (MYR 540 million), making Malaysia the country with the highest projected growth.[14] According to studies, the 1-year mortality rate following hip fracture is as high as 22% or even 30%.[15,16] Only 50–71% of hip fracture survivors are expected to regain their pre-fracture levels of mobility 12 months following the fracture, and 10–20% will remain institutionalized permanently.[17,18] The lifetime risk of experiencing a hip fracture for females is 40–50%, while for males, it is 13–22%.[19]

To the author's knowledge, there has been very little research on the epidemiology of hip fractures. Similar to studies conducted in other countries, the demographics of elderly sustained hip fractures in Malaysia were as follows: they were older, multimorbid, predominantly female, and at an increased risk for falls and fractures.[20,21] We believe that a retrospective investigation is warranted. The purpose of our study is to determine the incidence of hip fracture and its associated factor in Hospital Sultan Haji Ahmad Shah (HoSHAS) in Malaysia. Such studies would corroborate the current findings and shed light on how knowledge about hip fractures among the elderly in Malaysia is being constructed.

This article was accepted: 09 December 2023
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MATERIALS AND METHODS

This study is a retrospective cross-sectional study conducted among elderly patients with hip fractures presented at the Orthopedic Department of HoSHAS from January 2019 until December 2021. Convenience sampling was applied for this study. Medical Records for HoSHAS patients are stored digitally. Data were collected after obtaining ethical approval from the Medical Research and Ethics Committee (MREC). (RSCH ID-22-01590-WZS). The initial sample size was calculated using Raosoft software[22], and 298 samples were needed for a population of 3856. However, when we filtered the participants' ages and types of fractures, we included the final sample 296 in this study. Data were gathered by searching through the ward census. Patients with hip fracture diagnoses, which include fractures of the femoral neck, intertrochanteric, and subtrochanteric, will be searched for their Registered Number (RN). Patients with ages below 60 were excluded from the study. Then, the patient's medical record, which was stored in an integrated hospital information system, was retrieved using the RN. The patient's medical record was studied on various parameters, including age, race, gender, number of comorbidities, types, and causes of fracture.

The researcher used a research identification number to identify the subject data collection form and when presenting or entering the data. The data were entered into Microsoft Excel[23] and analyzed statistically with SPSS version 26[24]. Descriptive statistics were reported using frequency and percentage. In addition, binary logistic regression was conducted to identify the prediction of each type of hip fracture through the patients' age, race, gender, number of comorbidities, and cause of fracture with a significance level of $p<0.05$. In the binary logistic regression model, the Malay male elderly between 91 and 100 years, with four or more comorbidities that had fractures due to motor vehicle accidents, were used as indicator variables for their categories, respectively. Moreover, the 'Enter' method of binary logistic regression was employed, enhancing the robustness of the analysis, as this method allows for the inclusion of all predetermined variables in the analysis.

RESULTS

Of 3856 fracture cases admitted to the Orthopaedic Department of HoSHAS from 2019 to 2021, 296 patients met the study criteria. The majority of the patients were female (71.3%), Malay (75.3%), and aged between 71 to 80 years (38.5%). Meanwhile, the intertrochanteric femur fracture (62.8%) was the highest reported fracture, followed by the femoral neck fracture (27.7%) and the subtrochanteric fracture (9.5%). Subsequently, unintentional fall was identified as the most significant accident (94.9%) that caused hip fracture among elderly patients. At the same time, more than half of the patients had two to three comorbidities (59.1%). Table I shows the patients' descriptions according to the type of hip fracture.

Subsequently, binary logistic regression was conducted to identify the relationship between age, race, gender, number of comorbidities, and cause of fracture in predicting each hip fracture (Table II). In the initial model, the logistic regression for femoral neck fracture was significant ($\chi^2(10)=25.521$, $p=0.004$). The model's overall prediction accuracy was 73.6%, with a particularly high accuracy of 94.9% for predicting the absence of femoral neck fractures but a lower accuracy of 18.3% for predicting their presence. The Nagelkerke R Square value of 11.9% indicates that the model accounts for approximately 11.9% of the variance in femoral neck fracture outcomes. Additionally, the Hosmer and Lemeshow test result ($\chi^2(8)=10.994$, $p=0.202$) suggests a good fit for the model.

Overall, the model found that age did matter. Meanwhile, femoral neck fractures were 1.96 times more common in Chinese seniors than in Malay ones. The risk of a femoral neck fracture also increased by 1.95 times for women compared to men. The risk of femoral neck fracture was also 3.41 times higher in the elderly without any comorbidity and 2.91 times higher in the elderly with four or more comorbidities.

For the second logistic regression model, the logistic regression model for intertrochanteric femur fracture was statistically significant ($\chi^2(10)=18.429$, $p=0.048$). The Nagelkerke R Square value of 8.2% suggests that the model explains a modest proportion of the variance in intertrochanteric femur fracture outcomes. The model's overall prediction accuracy was 66.2%, with it being notably more effective at correctly identifying cases with an intertrochanteric fracture (94.1%) than those without (19.1%). The Hosmer and Lemeshow test showed a good fit for the model ($\chi^2(8)=4.535$, $p=0.806$), indicating that the predicted values align well with the observed data. The model indicated that age was significant as a whole. There was no other significant predictor in this model. However, for the third logistic regression model, the logistic regression model for subtrochanteric femur fracture was not statistically significant ($\chi^2(10)=3.745$, $p=0.958$).

DISCUSSION

A previous study that was conducted in Malaysia among elderly patients who sustained hip fractures reported that falls are the most common cause of hip fractures at a tertiary medical centre in Malaysia.[25] Meanwhile, the incidence of hip fracture was reported to be 90 per 100,000 population among people aged 50 and above in Malaysia.[12] However, this study attempted to investigate the factors contributing to different types of hip fractures among elderly patients attending an Orthopaedic Department. Therefore, the findings of this study contributed to the baseline data to assist the health care providers in planning for necessary support for elderly patients who sustained hip fractures. Bone Mineral Density (BDM) begins to decline with age, particularly in postmenopausal women, due to bone loss.[26] Osteoporosis is a chronic disease affecting one out of every three women and one out of every five men over the age of 50.[26] As a result, women with this disease are more vulnerable to fracture risk from a slip, fall, or even spontaneous.[27] The current study yielded consistent results, revealing that 71.3% of the participants were female. Individuals over the age of 85 are 15 times more likely than those under the age of 60 to experience a hip fracture, with female older adults reported for 80% of hip fractures.[28]

Table I: Patient's characteristics according to the type of hip fracture (n=296)

Variable	Femoral Neck Fracture n (%)	Intertrochanteric Femur Fracture n (%)	Subtrochanteric Femur Fracture n (%)	Total n (%)
Age				
60-70	17 (28.3)	40 (66.7)	3 (5.0)	60 (20.3)
71-80	41 (36.0)	61 (53.5)	12 (10.5)	114 (38.5)
81-90	20 (18.2)	78 (70.9)	12 (10.9)	110 (37.2)
91-100	4 (33.3)	7 (58.3)	1 (8.3)	12 (4.1)
Race				
Malay	56 (25.1)	146 (65.5)	21 (9.4)	223 (75.3)
Chinese	21 (38.9)	28 (51.9)	5 (9.3)	54 (18.2)
India	5 (26.3)	12 (63.2)	2 (10.5)	19 (6.4)
Gender				
Male	18 (21.2)	59 (69.4)	8 (9.4)	85 (28.7)
Female	64 (30.3)	127 (60.2)	20 (9.5)	211 (71.3)
Caused of fracture				
Unintentional fall	79 (28.1)	175 (62.3)	27 (9.6)	281 (94.9)
Motor vehicle accident	3 (20.0)	11 (73.3)	1 (6.7)	15 (5.1)
Comorbidities				
None	11 (36.7)	17 (56.7)	2 (6.7)	30 (10.1
1 only	19 (38.8)	27 (55.1)	3 (6.1)	49 (16.6)
2 to 3	44 (25.1)	113 (64.6)	18 (10.3)	175 (59.1)
4 and more	8 (19.0)	29 (69.0)	5 (11.9)	42 (14.2)
Reported case	82 (27.7)	186 (62.8)	28 (9.5)	296

Table II: Predicting different types of hip fracture by the patients' demographic characteristics

Omnibus Tests of Model Coefficients Model	Chi-square	df	Sig.
Femoral Neck Fracture Model	25.521	10	0.004
Intertrochanteric Femur Fracture Model	18.429	10	0.048
Subtrochanteric Femur Fracture Model	3.745	10	0.958

Variables in the Equation for Femoral Neck Fracture Model

		B	SE.	Wald	df	Sig.	aOR	95% CI for aOR	
								Lower	Upper
Step 1a	91-100 years*			11.066	3	0.011			
	60 to 70 years (1)	-.196	.699	.078	1	0.780	0.822	0.209	3.239
	71 to 80 years (2)	.166	.665	.062	1	0.803	1.180	0.321	4.347
	81-90 years (3)	-.927	.683	1.845	1	0.174	0.396	0.104	1.508
	Malay*			4.121	2	0.127			
	Chinese (1)	.672	.338	3.959	1	0.047	1.959	1.010	3.799
	Indian (2)	-.074	.566	.017	1	0.896	0.928	0.306	2.816
	Female (1)	.666	.323	4.269	1	0.039	1.947	1.035	3.664
	≥4 Comorbidities*			7.617	3	0.055			
	No comorbidity (1)	1.225	.575	4.547	1	0.033	3.405	1.104	10.503
	1 Comorbidity (2)	1.069	.517	4.286	1	0.038	2.914	1.059	8.019
	2-3 Comorbidities (3)	.424	.444	.912	1	0.339	1.529	0.640	3.653
	Fall from height (1)	.597	.709	.708	1	0.400	1.816	0.453	7.285
	Constant	-2.455	1.013	5.877	1	0.015	0.086		

Model summary: -2 Log-Likelihood: 323.832; Cox & Snell R Square: 0.083; Nagelkerke R Square: 0.119; Estimation Termination Note: iteration number 5

Variables in the Equation for Intertrochanteric Femur Fracture Model

Step 1a	91-100 years*			8.955	3	0.030			
	60 to 70 years (1)	.348	.664	.275	1	0.600	1.416	0.386	5.201
	71 to 80 years (2)	-.214	.632	.115	1	0.734	0.807	0.234	2.786
	81-90 years (3)	.633	.638	.985	1	0.321	1.884	0.539	6.580
	Malay*			3.413	2	0.181			
	Chinese (1)	-.586	.319	3.376	1	0.066	0.557	0.298	1.040
	Indian (2)	-.024	.511	.002	1	0.962	0.976	0.358	2.658
	Female (1)	-.505	.286	3.103	1	0.078	0.604	0.344	1.059
	≥4 Comorbidities*			3.431	3	0.330			
	No comorbidity (1)	-.776	.519	2.232	1	0.135	0.460	0.166	1.274
	1 Comorbidity (2)	-.645	.462	1.946	1	0.163	0.525	0.212	1.299
	2-3 Comorbidities (3)	-.263	.382	.472	1	0.492	0.769	0.364	1.626
	Fall from height (1)	-.597	.632	.891	1	0.345	.551	0.159	1.901
	Constant	1.713	.916	3.497	1	0.061	5.547		

Model summary: -2 Log-Likelihood: 372.180; Cox & Snell R Square: 0.060; Nagelkerke R Square: 0.082; Estimation Termination Note: iteration number 4

a. Variable(s) entered on step 1: Age, Race, Gender, Comorbidity, Caused of Fracture.

b. aOR – adjusted odds ratio

The elderly population suffers from simple falls, which account for 95% of hip fractures.[19,26] When combined with other risk factors, these modifications increase the likelihood of a fall.[29-30] Because women are more prone to acquire osteoporosis and have lower bone mineral density than men, they are more likely than men to sustain a hip fracture. In this study, women's risk variables were more significant than men's. In the current and past studies, people of different ethnicities have different risks for hip fractures.[21,31,32]

Our findings show that intertrochanteric femur fractures are common, accounting for 62.8% of reported cases, indicating a significant burden of this type of fracture in the studied population. This prevalence is significantly higher than that of femoral neck fractures (27.7%) and subtrochanteric fractures (9.5%). The prevalence of intertrochanteric femur fractures emphasizes the need for targeted preventive and intervention strategies in orthopaedic care. These findings are consistent with previous research[33-34], highlighting the importance of ongoing research to elucidate the underlying risk factors and potential preventive measures for intertrochanteric femur fractures. Intertrochanteric femur fractures are common in the elderly; the femur's intertrochanteric aspect comprises dense trabecular bone between the greater and lesser trochanters.[33] Intertrochanteric fractures are among the most common hip fractures, particularly in the elderly. The prevalence of intertrochanteric fracture is increasing due to an increase in the number of older adults combined with osteoporosis.[34] Understanding the distribution of various femur fractures is also essential for optimizing resource allocation, healthcare planning, and the development of tailored treatment protocols.

Low body mass index (18.5), smoking status, alcohol addiction, malnutrition, and low physical activity are all modifiable or lifestyle risk factors.[35] A study in New Zealand identified the risk factors among older adults and reported that age, female sex, ethnicity, and falls were significantly related to hip fractures.[30] Similarly, age was significant in this study with intertrochanteric, femoral neck, and subtrochanteric femur fractures. However, Chinese women are more likely to sustain femoral neck fractures than Malay women, and women are more likely to suffer from femoral neck fractures than men.

The likelihood of falling increases as risk factors such as previous falls, weakness, gait, and balance issues increase.29 According to one study, a patient with four risk factors has a 78% chance of falling.[36] Elderly falls and fractures are greatly influenced by the high prevalence of comorbidities such as hypertension, diabetes, neurological impairment, and impaired vision.[37] In addition, the heterogeneity of the patients included in the study and identifying other risk factors to predict hip fracture cases. In light of these considerations, it is clear that additional risk factors must be identified, necessitating a holistic approach to improving predictive accuracy and preventive strategies for hip fractures in the elderly population.

It is also crucial to address the limitations of this study. We acknowledge a limitation of the study, which is the extent of the data collected, which could provide more information on the prognosis of hip fracture among older adults. Other significant variables, such as functional capacity, post-operative prognosis, and death rate after sustained hip fracture, cannot be evaluated because we only gathered the data from the medical records of the patients. Then, this study focuses only on the elderly patients presented to the Orthopaedic Department, who might be admitted to other wards based on their medical condition.

CONCLUSION

In conclusion, this study sheds light on the factors contributing to the various types of hip fractures seen in elderly patients visiting an orthopaedic department. The findings significantly contribute to the baseline data required by healthcare providers to plan necessary support for elderly patients who sustain hip fractures. The study confirms that falls are the leading cause of hip fractures in the elderly, consistent with previous research in Malaysia. Women's vulnerability, particularly those aged 85 and up, highlights the need for targeted preventive measures, given their increased risk of hip fractures. Various osteoporosis prevention measures combined with efforts to reduce falls in the elderly will significantly reduce osteoporotic hip fractures and the burden of healthcare costs for treating these fractures. Hip fractures in older persons necessitate more than just a hip fracture repair. It is essential to pay attention to their existing medical conditions, pre-operative care, rehabilitation, minimizing complications acquired while hospitalized, and reducing the risk of future fractures.

ACKNOWLEDGEMENT

The authors would like to thank the Faculty of Health Sciences, Universiti Teknologi MARA, Puncak Alam Campus, and the Orthopaedic Department of Hospital Sultan Haji Ahmad Shah for their support.

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