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Original Research Article

Predictors of 1-Year Mortality in Patients with Hip Fractures: A Comprehensive Analysis

Amit Virabhai Patel[1], Munir Yogesh Kumar Upadhyay[2]

[1]Senior Resident, Department of Orthopaedic, GMERS Medical College and Civil Hospital, Himmatnagar, Gujarat, India

[2]Assistant Professor, Department of Orthopaedic, GMERS Medical College and Civil Hospital, Himmatnagar, Gujarat, India

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Corresponding author: Dr. Munir Yogesh Kumar Upadhyay

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Abstract

Introduction: Proximal femoral fractures are a significant contributor to morbidity and mortality in the elderly population. Despite the substantial burden of osteoporosis, the majority of existing literature originates from Western countries. Therefore, we conducted this study to identify risk factors for early mortality in hip fractures within Indian population.

Materials and Methods: A total of 227 patients were included. The primary outcome assessed was mortality in elderly patients undergoing operative treatment, and secondary outcome measures examined predictors of mortality within this age group, specifically age, gender, Charlson Comorbidity Index, Injury Severity Score, preoperative ASA grading, duration between injury and surgery, and the length of hospital stay. We performed regression modelling to evaluate the impact of various variables on the time of mortality.

Results: The average age of the patients was 70.25 years. The mean Charlson Comorbidity Score was 1.75. The average time from injury to the operation was 34.75 hours, and the mean length of hospital stay was 5 days. Mortality one year after surgery stood at 18.50%. Univariate and multivariate regression analyses revealed that variables significantly associated with mortality included Age, Charlson Index, Charlson Index Category, time between Injury and operation (in hours), Length of hospital stay, and preoperative ASA grade.

Conclusion: Our findings underscore the importance of implementing a dedicated hip fracture protocol in resource-poor settings. Early and aggressive management to optimize patients for surgery and expedite surgical intervention lead to a swift return to pre-fracture health status and a reduction in early mortality.

Keywords: Proximal Femoral Fractures, Hip Fractures, Osteoporosis, Injury Severity Score, Humans.

Introduction

Hip fractures have long been a historical source of health problems and fatalities within the elderly demographic. With the advancements in medical care facilities, there has been a significant surge in the elderly population, consequently leading to a higher incidence of hip fractures among this age group. Proximal femoral fractures represent a prominent contributor to the overall morbidity and mortality in elderly patients, with reported mortality rates of 11-23% within 6 months and 22-29% within 1 year. In 1990, the occurrence of hip fractures in Asia stood at 26 %, a figure that was projected to rise to 37% by 2025 and a staggering 45% by 2050. It is estimated that one in every three women and one in twelve men will experience a hip fracture in their lifetime.

The first year following a hip fracture is particularly critical, with a mortality rate of 10% within one month and 30% within one years. The relative risk of mortality in the elderly population increases by 4% each year [1-6]. The time elapsed between the injury and the surgical operation is a pivotal factor, as it is the only modifiable element that can potentially prevent early mortality. Surgical delay has been linked to prolonged hospital stays and an elevated risk of postoperative complications [7-10]. However, the precise connection between surgical delay and mortality remains somewhat unclear. A meta-analysis has revealed that a delay of more than forty-eight hours in surgery increases the risk of mortality [11], while no adverse effects of a short surgical delay (less than forty-eight hours) have been identified thus far [7].

Despite the substantial burden of osteoporosis, there is a noticeable deficiency in data concerning the epidemiology, risk factors, and outcomes of fragility hip fractures within the Indian population.

Since the majority of existing literature originates from Western countries, we conducted this study to investigate risk factors associated with early mortality in hip fractures within the Indian subcontinent and to draw comparisons with the published literature.

Materials and Methods

In this retrospective study, data were collected from patients aged 65 years or older who underwent surgical treatment for proximal femur fractures (including femur neck and/or intertrochanteric fractures). Patients with non-operative treatment, those unfit for surgery, and those with pathological fractures were excluded from the study.

A total of 254 patients underwent surgery during the specified period, but 27 patients were lost to follow-up. One-year follow-up data were available for the remaining 227 patients. All patients were admitted through the emergency department and managed according to the ATLS (Advanced Trauma Life Support) protocol, with initial radiological investigations. The collected demographic and epidemiological data included age, gender, mode of injury, time of injury, associated injuries, and co-morbidities. The Charlson Co-morbidity Index (CCI) was used to assess the impact of associated co-morbidities on patient survival rate, and the Injury Severity Score (ISS) was used to evaluate the overall severity of trauma. To categorize Charlson scores, they were grouped into four previously established indices: 0 points (None), 1-2 points (Low), 3-4 points (Moderate), and ≥5 points (High). Interdepartmental consultations were sought as needed to optimize patients perioperatively. Data regarding the time between injury and surgery, duration of surgery, method of fixation, and length of hospital stay were also recorded.

Deep vein thrombosis (DVT) prophylaxis was provided to all patients, with in-hospital administration of low-molecular-weight heparin and aspirin upon discharge. Patients were advised for partial weight-bearing after surgery, except for those with spinal and lower limb fractures. Follow-up assessments were conducted with X-rays at 1, 3, 6 months, and 1 year, respectively. The primary objective of this study was to assess the mortality in elderly patients undergoing operative treatment for proximal femoral fractures. Secondary outcome measures involved examining predictors of mortality in this age group with respect to age, gender, Charlson comorbidity index, injury severity score, pre-operative ASA grading, injury-surgery duration, and length of hospital stay. Data on mortality were collected by communication with patients or their family members via telephone.

Statistical analysis involved the use of MS Excel for data storage and SPSS v213 (IBM Corp.) for data analysis. Group comparisons for continuous data utilized independent sample 't' tests for two-group comparisons, while non-normally distributed data were analyzed using appropriate non-parametric tests like the Wilcoxon Test. Categorical data comparisons were conducted using the Chi-squared test, and Fisher's exact test was employed when expected frequencies were <5 for >25% of the cells in the contingency table. Cox proportional regression hazards regression modeling was carried out to assess the impact of various variables on the time of mortality, with statistical significance defined as $p<0.05$

Results

All data was gathered from a total of 227 patients who met the study's inclusion criteria and presented during the designated study period. This data is summarized in Table 1.

Table 1: Summary of all variables

Parameter	**Mean ± SD**	
Age (Years)	70.25 ± 8.30	
Age (Years)	n	%
≤75	130	57.27
>75	97	42.73
Gender		
Female	138	60.79
Male	89	39.21
Diagnosis/Type of Fracture		
Intertrochanteric	154	67.84
Neck of Femur	72	31.72
Neck + Shaft of Femur	1	0.44
Laterality		
Left	116	51.10
Right	111	48.90
Mode of Injury		
Fall from Standing Height	170	74.89
Road Traffic Accident	37	16.30

Fall From 12 Feet Height	20	8.81
Management		
Proximal Femoral Nailing	155	68.28
Bipolar Hemiarthroplasty	68	29.96
Dynamic Hip Screw	4	1.76
Charlson Index	1.75 ± 1.45	
Charlson Index Category		
0-1	111	48.90
2-3	85	37.44
≥4	31	13.66
ISS Score	9.30 ± 0.45	
ASA Grade		
I	110	48.46
II	63	27.75
III	42	18.50
IV	12	5.29
Injury to Operation Time (Hours)	34.75 ± 18.95	
Injury to Operation Time		
≤24 Hours	82	36.12
24-48 Hours	107	47.14
>48 Hours	38	16.74
Length of Hospital Stay (Days)	5.00 ± 1.40	
Length of Hospital Stay		
≤4 Days	129	56.83
>4 Days	98	43.17
Mortality (Present)	42	18.50
Time to Mortality	305.75 ± 117.20	

In a comprehensive analysis involving multiple variables, it was observed that Age, Charlson Index, Charlson Index Category, Injury to operation time (Hours), Length of hospital stay, and pre-operative ASA grade were all significantly associated with mortality. The statistical significance for each of these factors was found to be below the 0.05 threshold, as detailed in Table 2.

Table 2: Association between Variables and Mortality

Parameter	Present (n=42)	Absent (n=185)	P Value
Age (Years)	75.25 ± 9.50	70.80 ± 6.90	<0.05
Age (Years)			
≤75	21	109	<0.05
>75	21	76	
Gender			
Female	28	110	0.296
Male	14	75	
Diagnosis/Type of Fracture			
Intertrochanteric	28	126	0.85
Neck of Femur	14	58	
Neck + Shaft of Femur	0	1	
Laterality			
Left	26	90	0.16
Right	16	95	
Mode of Injury			
Fall from Standing Height	35	135	0.15
Road Traffic Accident	7	30	
Fall From 12 Feet Height	0	20	
Method of Fixation			
Proximal Femoral Nailing	28	127	0.58
Bipolar Hemiarthroplasty	13	55	
Dynamic Hip Screw	1	3	
Charlson Index	2.65 ± 1.60	1.60 ± 1.45	<0.05

Charlson Index Category			
0-1	8	103	<0.05
2-3	17	68	
≥4	17	14	
ISS Score	9.20 ± 0.30	9.10 ± 0.40	0.23
ASA Grade			
I	8	102	<0.05
II	12	51	
III	16	26	
IV	6	6	
Injury to Operation Time (Hours)	49.80 ± 27.00	32.90 ± 14.70	<0.05
Injury to Operation Time			
≤24 Hours	12	70	<0.05
24-48 Hours	10	97	
>48 Hours	20	18	
Length of Hospital Stay (Days)	49.80 ± 27.00	32.90 ± 14.70	<0.05
Length of Hospital Stay			
≤4 Days	13	116	<0.05
>4 Days	29	69	

Table 3 presents the Cox Proportional Hazard Regression coefficients and a Kaplan-Meier Survival plot, which depict the relationships between Age, Charlson Index category, Injury to Operation time, Length of Hospital stay, and ASA Grade in terms of their impact on patient outcomes.

Table 3: Regression Coefficients (Cox Proportional Hazards)

Variable	B	SE	CI	z	p value	HR
Age>75 Years	1.45	0.4	[0.68, 2.14]	3.95	<0.05	3.78
Injury to Operation Time						
24-48 Hours	-0.4	0.5	[-1.27, 0.57]	-0.8	0.42	0.7
>48 Hours	1.68	0.5	[0.74, 2.53]	3.62	<0.05	4.42
Charlson Index						
2-3	0.98	0.5	[0.18, 2.06]	1.91	0.03	2.85
≥4	2.24	0.5	[1.36, 3.42]	4.14	<0.05	10.1
Length of Hospital Stay >4 Days	1.15	0.4	[0.52, 1.85]	3.03	<0.05	3.17
ASA Grade						
II	0.95	0.6	[0.15, 1.98]	1.63	0.052	2.6
III	1.68	0.5	[0.76, 2.68]	3.23	<0.05	5.35
IV	2.47	0.6	[1.37, 3.68]	4.05	<0.05	12.8

Discussion

In the past century, the orthopaedic trauma community primarily focused on developing new methods and implants for hip fracture treatments. However, over the last two decades, there has been a significant increase in research examining mortality in the elderly population following these injuries [12]. In our study, even though only 42.73% of our patients were aged above 75 years, this group accounted for half of the cases with mortality. This finding aligns with Berry et al.'s study, which reported a 30% rise in mortality for every 5 years of advancing age among nursing-home residents aged 65 and older with hip fractures [12]. Several other studies also revealed a similar association between increasing age and adverse outcomes, although the specific incidence varies between studies [13-15]. Elderly individuals often have multiple coexisting medical conditions, making them more susceptible to peri-operative complications. The likelihood of mortality is doubled for patients with a Charlson score of 4 or higher, as suggested by a body of literature that employs the Charlson Comorbidity Index (CCI) to assess risk and predict 1-year mortality [13-17]. Studies like Roche et al.'s investigation of 2448 hip fractures found that having three or more medical comorbidities was linked to higher complication rates and mortality [18]. Bentler et al. studied 495 hip fractures and discovered that patients with three or more comorbid conditions were 65% more likely to die than those with fewer conditions [19]. Similarresults were found in our study, highlighting that this category carries a higher risk of early mortality [13-16].

In our series, 83.26% of the patients received surgery within 48 hours, with 36.12% of them undergoing surgery within 24 hours. Studies have

shown that patients who had surgery within 36 hours of admission experienced shorter hospital stays, fewer pressure ulcers, and a greater likelihood of returning to independent living [20].

Delaying surgery for 2 days or more from admission was associated with a 17% increase in 30-day mortality in an analysis of 18,209 Medicare recipients who underwent surgery for a hip fracture [21]. Although some studies haven't demonstrated a reduction in mortality with surgery within 48 hours of admission, they have reported decreased rates of minor and major complications [21-23]. We believe that once patients are medically optimized, they should undergo surgery promptly to prevent potential complications and potentially improve mortality.

A systematic review and meta-analysis involving 75 studies and 64,316 patients revealed overall mortality rates of 13.3% at 1 month, 15.8% at 3-6 months, 24.5% at 1 year, and 34.5% at 2 years. This analysis identified 12 strong predictors of mortality, including factors such as advanced age, male gender, residence in nursing homes or facilities, poor preoperative walking capacity, and various comorbidities [24]. In our study, the risk of mortality increased with advancing age, higher Charlson index, and ASA grade.

Several studies have established an association between the patient's gender and mortality. Similarly, our findings indicated that men had a higher risk of 1-year mortality compared to women [25]. In a study by Schnell et al., the 1-year mortality of patients treated in a hip fracture program for the elderly was found to be 21.2% [26]. In our series, the overall 1-year mortality was slightly lower at 18.50%. It's worth noting that a comprehensive comanaged geriatric hip fracture program could further reduce this figure [26]. While our study has provided valuable insights, it does have limitations, including its retrospective nature, a relatively small sample size, the absence of a control group, and the fact that it's hospital-based. Therefore, the findings may not be universally applicable to the geriatric population. In conclusion, we recommend that in resource-poor settings, the early and aggressive management of patients to prepare them for surgery, along with timely surgical intervention, can lead to a quicker return to pre-fracture status and a reduction in early mortality.

Conclusion

In settings with limited resources, we propose that the absence of a specialized hip-fracture protocol necessitates early, proactive patient management to prepare them for surgery. This approach aims to expedite surgical intervention as soon as practicable, facilitating a prompt return to the pre-fracture health status and subsequently reducing the risk of early mortality.

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