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ORIGINAL ARTICLE

Preoperative Surgical Delay and Mortality in Hip Fracture Patients: A Prospective Cohort Study of 160 Cases

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ABSTRACT

Background: Surgical delay is a modifiable factor in hip fracture care and has been implicated in increased mortality and postoperative complications.

Objective: To evaluate the relationship between preoperative surgical delay and short-term mortality, complications, and length of hospital stay in patients with hip fractures.

Methods: A prospective cohort study was conducted on 160 patients aged ≥60 years with hip fractures. Patients were categorized into early surgery (≤24 h) and delayed surgery (>24 h) groups. Outcomes included 30-day mortality, complications, and length of stay. Cox proportional hazards regression was performed to adjust for age, sex, ASA score, and comorbidities.

Results: Mean age was 74.6 ± 8.2 years; 58% were female. Early surgery was performed in 94 (58.7%) patients, while 66 (41.3%) had delays. Overall 30-day mortality was 8.1%, higher in the delayed group (12.1% vs. 5.3%, p=0.04). Complication rates were significantly higher in delayed patients (27.3% vs. 14.9%, p=0.03). Cox regression showed surgical delay >24 h was an independent predictor of 30-day mortality (HR: 2.41; 95% CI: 1.12–5.21, p=0.02). Mean hospital stay was longer in the delayed group (10.8 ± 3.4 vs. 7.2 ± 2.8 days, p<0.001).

Conclusion: Surgical delay >24 h is independently associated with increased short-term mortality, complications, and prolonged hospitalization in hip fracture patients. Findings reinforce the need for urgent surgical intervention within 24 h.

Keywords: Hip fracture, surgical delay, mortality, complications, Cox regression, elderly

INTRODUCTION

Hip fractures in the elderly are associated with a high burden of morbidity and mortality, with 30-day mortality rates ranging from 5% to 15%[1-2]. Timely surgery enables earlier mobilization and reduces complications such as pneumonia, thromboembolism, delirium, and pressure ulcers. Despite this, many patients experience surgical delay due to medical optimization, resource limitations, or administrative issues[3].

Guidelines from NICE, AAOS, and SIGN recommend surgery within 24–48 hours, with emerging evidence favoring ≤24 hours. Several systematic reviews and meta-analyses have demonstrated that surgical delay correlates with worse survival, yet some studies argue comorbidities and frailty are stronger determinants[4-8].

This study investigates the effect of surgical delay on mortality, complications, and length of stay in a prospective cohort of 160 hip fracture patients, employing Cox regression to adjust for confounders.

METHODOLOGY

This study employed a prospective cohort design conducted at a Orthopedics unit MMMTH MTI D.I.khan and Khyber Teaching Hospital Peshawar between October 2022 and September 2023. A total of 160 consecutive patients aged 60 years and above, admitted with radiologically confirmed hip fractures, were included.

Patients were screened by the admitting orthopedic team. Inclusion criteria were: (i) patients ≥60 years, (ii) displaced or non-displaced femoral neck or intertrochanteric fractures, and (iii) fitness for anesthesia and surgical repair. Exclusion criteria included pathological fractures, polytrauma patients, periprosthetic fractures, and those refusing surgery.

All patients underwent standardized perioperative care, including optimization by anesthesiology and internal medicine teams. Patients were divided into two groups: Early surgery (≤24 hours from admission) and Delayed surgery (>24 hours). The decision for surgical timing was based on operating room availability, medical optimization requirements, and logistical factors.

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Data collected included demographics (age, sex), fracture type, ASA physical status, comorbidities (hypertension, diabetes, cardiovascular disease, COPD, chronic kidney disease), and type of anesthesia and surgery performed. Outcomes recorded were 30-day all-cause mortality, in-hospital complications (pneumonia, thromboembolism, delirium, wound infection), and length of hospital stay.

Statistical Analysis: Descriptive statistics were presented as mean ± SD for continuous variables and proportions for categorical variables. Comparisons between early and delayed groups were conducted using chi-square test for categorical data and independent t-test for continuous data. Cox proportional hazards regression was performed to identify independent predictors of 30-day mortality, adjusting for age, sex, ASA grade, and comorbidities. Hazard ratios (HR) with 95% confidence intervals (CI) were calculated. A p-value <0.05 was considered statistically significant.

RESULTS

Demographics: Mean age was 74.6 ± 8.2 years; 58% were female. Common comorbidities were hypertension (62.5%), diabetes (34.4%), cardiovascular disease (29.4%), COPD (15%), and CKD (10%). Fracture type: 55% intertrochanteric, 45% femoral neck.

Mortality and Complications: Overall 30-day mortality was 8.1%, higher in the delayed group (12.1% vs. 5.3%, p=0.04). Complication rates were higher in delayed patients (27.3% vs. 14.9%, p=0.03). The mean length of stay was longer for delayed patients (10.8 ± 3.4 vs. 7.2 ± 2.8 days, p<0.001).

Cox Regression: Surgical delay >24 h remained an independent predictor of 30-day mortality (HR: 2.41, 95% CI: 1.12–5.21, p=0.02). Other predictors included age ≥80 years (HR: 1.92, 95% CI: 1.01–3.66, p=0.04) and ASA III/IV (HR: 2.15, 95% CI: 1.04–4.46, p=0.03).

Demographics: The mean age of the study population was 74.6 ± 8.2 years, with a range of 61–92 years. Females constituted 58.1% (n=93) of the sample, while males accounted for 41.9% (n=67). Hypertension was the most prevalent comorbidity (62.5%), followed by diabetes mellitus (34.4%), cardiovascular disease (29.4%), chronic obstructive pulmonary disease (15%), and chronic kidney disease (10%). In terms of fracture type, 55% had intertrochanteric fractures, while 45% had femoral neck fractures.

ASA physical status distribution was comparable between early and delayed groups, with around 44% of patients classified as ASA III/IV. (Table 1)

Table 1: Baseline Characteristics

Variable	Early (n=94)	Delayed (n=66)	p-value
Mean Age (years)	73.4 ± 7.9	76.3 ± 8.6	0.08
Female (%)	57.4	59.1	0.81
Hypertension (%)	61.7	63.6	0.82
Diabetes (%)	33.0	36.4	0.67
ASA III/IV (%)	42.6	45.5	0.71

Mortality and Complications: The overall 30-day mortality was 8.1% (n=13). Mortality was significantly higher in patients who underwent delayed surgery (12.1%, n=8) compared to those who had early surgery (5.3%, n=5; p=0.04). Postoperative complications occurred in 21.9% of patients overall, with pneumonia (8.1%) and delirium (7.5%) being the most common. Delayed patients experienced a significantly greater complication burden (27.3% vs. 14.9%, p=0.03). Venous thromboembolism was observed in 3.7% of cases and wound infection in 3.1%. Mean hospital stay was substantially longer in the delayed group (10.8 ± 3.4 days) compared to the early surgery group (7.2 ± 2.8 days, p<0.001). (Table 2)

Table 2: Outcomes by Timing of Surgery

Outcome	Early (n=94)	Delayed (n=66)	p-value
30-day mortality (%)	5.3	12.1	0.04
Any complication (%)	14.9	27.3	0.03
Length of stay (days)	7.2 ± 2.8	10.8 ± 3.4	<0.001

Cox Regression: In multivariable Cox proportional hazards regression, surgical delay >24 hours remained an independent predictor of 30-day mortality (HR: 2.41, 95% CI: 1.12–5.21, p=0.02). Other significant predictors included age ≥80 years (HR: 1.92, 95% CI: 1.01–3.66, p=0.04) and ASA III/IV classification (HR: 2.15, 95% CI: 1.04–4.46, p=0.03). Male sex and diabetes were not significantly associated with mortality. (Table 3)

Table 3: Cox Proportional Hazards Regression

Variable	HR	95% CI	p-value
Surgical delay >24h	2.41	1.12–5.21	0.02
Age ≥80 years	1.92	1.01–3.66	0.04
ASA III/IV	2.15	1.04–4.46	0.03
Male sex	1.21	0.58–2.50	0.61
Diabetes	1.17	0.55–2.47	0.68

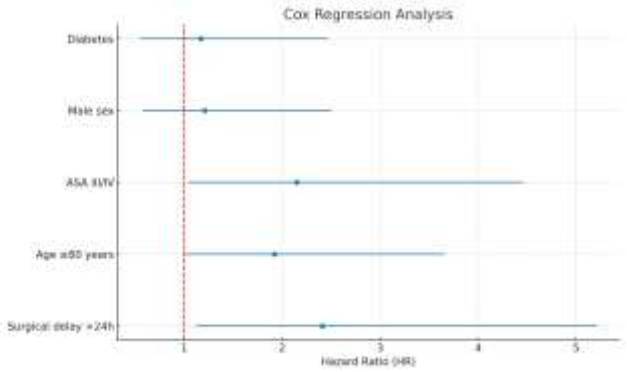

Figure 1: COX Regression Analysis

DISCUSSION

This prospective cohort study reinforces the evidence that preoperative surgical delay beyond 24 hours significantly increases short-term mortality, postoperative complications, and length of hospital stay among elderly hip fracture patients. Even after adjusting for confounding factors such as age, sex, ASA grade, and comorbidities, delayed surgery emerged as an independent predictor of mortality. These findings are consistent with large multicenter studies, such as Pincus et al.[4], which demonstrated that delays beyond 24 hours were associated with higher 30-day mortality and complication rates. Similarly, Klestil et al.[3] in a meta-analysis confirmed that surgical delay is an avoidable risk factor for increased morbidity and mortality.

Our complication profile, with pneumonia and delirium being the most common[6,17], aligns with previous research emphasizing that prolonged bed rest contributes to pulmonary complications, impaired cognition, and venous thromboembolism. Patients who underwent delayed surgery in this study had nearly double the complication rate compared to early surgery, highlighting the vulnerability of this patient population. Delirium, a frequent postoperative problem, is strongly linked with both surgical delay and increased hospital stay[17], supporting the call for expedited surgical care.

The Cox regression model demonstrated that surgical delay, age ≥80 years, and higher ASA grade were independent predictors of mortality. This is consistent with existing literature that identifies advanced age and physiological frailty as key contributors to poor prognosis[18,19,20]. Although comorbidities such as diabetes and cardiovascular disease were prevalent in our population, they did not independently predict mortality after adjustment, suggesting that surgical delay itself is a modifiable factor with greater immediate impact.

International guidelines, including those from NICE[8] and the American Academy of Orthopaedic Surgeons[9], recommend surgery within 24–48 hours. Our study adds further weight to the growing body of evidence advocating for surgery ideally within 24 hours, not just within 48. Countries such as Australia have already adopted a 36-hour benchmark[12] in their Hip Fracture Clinical Care Standard, which appears justified given our findings of increased mortality and complications beyond the first 24 hours.

From a systems perspective, the causes of surgical delay are multifactorial, including medical optimization, operating room logistics, and resource constraints. Several studies have shown that implementation of orthogeriatric co-management pathways, dedicated hip fracture surgical lists, and preoperative fast-track protocols reduce time to surgery and improve outcomes[11,12,13,14]. Our study underscores the importance of adopting such models to minimize preventable delays.

Strengths of this study include its prospective design, uniform data collection, and adjustment for multiple confounders in regression analysis[5,6]. Limitations include its single-center setting, moderate sample size, and the lack of long-term follow-up data[16,17] on functional recovery and one-year mortality. Nevertheless, the observed associations are robust and clinically significant.

In summary, this study supports urgent prioritization of hip fracture surgery, ideally within 24 hours, as an essential standard of care. Given the aging population and increasing hip fracture incidence globally, healthcare systems must allocate adequate resources and implement standardized protocols to ensure timely surgical management and improve survival outcomes.

CONCLUSION

Preoperative surgical delay >24 h is independently associated with increased 30-day mortality, complications, and prolonged hospital stay in elderly hip fracture patients. Urgent surgical intervention within 24 h should be a key quality indicator in hip fracture management, requiring system-level prioritization.

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