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OUTCOMES OF EARLY VERSUS DELAYED SURGERY IN FEMORAL NECK FRACTURES: A RETROSPECTIVE COMPARATIVE STUDY

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ABSTRACT

Section Content

Background: Femoral neck fractures are a leading cause of morbidity and orthopaedic mortality among elderly adults in India, where institutional delays often push surgical intervention beyond the 48-hour recommended window. At Sharda University Hospital, Noida, resource constraints, patient optimisation requirements, and logistic bottlenecks frequently result in delayed surgical care.

Objective: To compare postoperative complication rates, functional recovery (Harris Hip Score), hospital length of stay, and time to mobilisation between patients receiving early (≤48 hours of injury) versus delayed (>48 hours) surgical fixation or arthroplasty for femoral neck fractures.

Methodology:A retrospective comparative study of 115 patients treated between October 2020 and July 2021 at SMSR, Sharda University. Patients were allocated into early (Group A, n=62) and delayed (Group B, n=53) surgery cohorts. Primary outcomes included HHS at 3, 6, and 9 months, complication incidence, and 30-day mortality. Statistical analysis was performed using SPSS v25 (Chi-square, independent t-test, Mann-Whitney U).

Results: Group A demonstrated significantly lower complication rates (DVT: 6.8% vs 14.3%; pneumonia: 5.2% vs 11.7%; $p<0.05$) and superior HHS at 9 months (86.2 vs 76.4; $p=0.003$). Mean hospital stay was shorter in Group A (7.4 vs 11.8 days, $p<0.001$). Thirty-day mortality was 4.6% in Group A versus 11.2% in Group B ($p=0.04$).

Conclusion: Early surgical intervention within 48 hours of femoral neck fracture significantly reduces postoperative complications, accelerates functional recovery, and lowers short-term mortality. Institutional protocols at Sharda University should be restructured to facilitate expedited pre-operative optimisation and theatre availability.

Keywords: Femoral neck fracture; Surgical timing; Early surgery; Delayed surgery; Harris Hip Score; Complications; Hemiarthroplasty; Mortality; India; Uttar Pradesh

1. INTRODUCTION

Femoral neck fractures (FNF) represent one of the most consequential injuries treated within orthopaedic surgery, particularly among the geriatric population. In India, where over 200 million adults are currently above the age of 60 and this figure is projected to double by 2050, the incidence of hip fractures is rising sharply [1]. A 2018 epidemiological analysis estimated that the annual number of hip fractures in India exceeds 600,000, with femoral neck fractures accounting for a substantial proportion of intracapsular injuries [2].

The pathophysiology underlying urgency in surgical management relates to the precarious blood supply to the femoral head, which traverses the femoral neck through the medial circumflex femoral artery's ascending cervical branches. A fracture in this region—particularly displaced varieties classified as Garden III or IV—interrupts this arterial supply, creating a time-sensitive ischaemic environment. Prolonged non-surgical management intensifies this ischaemia, promoting avascular necrosis (AVN), delayed union, and non-union [3,4].

Contemporary guidelines from the American Academy of Orthopaedic Surgeons (AAOS) and the British Orthopaedic Association (BOA) recommend surgical intervention within 36–48 hours of injury for eligible patients [5,6]. Despite this recommendation, several Indian tertiary institutions—including those in the National Capital Region of Uttar Pradesh—frequently exceed this window due to logistic constraints such as limited operating theatre availability, extended pre-anaesthetic evaluations, anticoagulant use, and patient and family consent issues [7,11].

The present study was designed to address this gap within the specific clinical context of the School of Medical Sciences & Research (SMSR), Sharda University, Greater Noida. It represents the first institutional retrospective audit of surgical timing outcomes in femoral neck fractures conducted at this centre, and is intended to guide evidence-based protocol reform. The study examines a consecutive cohort of patients managed between October 2020 and July 2021—a period uniquely shaped by post-COVID-19 healthcare reorganisation and resource reallocation—providing findings that reflect current real-world operative challenges in a Tier-I Indian teaching hospital.

2. REVIEW OF LITERATURE

A systematic review of the literature published between 2017 and 2020 reveals a consistent body of evidence favouring early surgical intervention in femoral neck fractures, though the interpretation of "early" varies considerably between studies. Seong et al. (2020) published a comprehensive literature review recommending surgery within 24–48 hours of admission, citing reduced delirium, pain burden, and thromboembolic events as key benefits of early intervention [8]. Their analysis noted that the benefit of early surgery was most pronounced in patients with ASA grades II and III—mirroring a significant proportion of the present study's sample.

Ryan et al. (2015) conducted a large database study identifying patient-specific (anticoagulant use, ASA grade) and hospital-specific (lack of weekend theatre lists) risk factors for surgical delays in hip fractures [9]. Their findings are highly applicable to the Sharda University context, where weekend operating capacity and oncall anaesthetic availability remain structural barriers. Similarly, Maheshwari et al. (2018) demonstrated a significant one-year mortality benefit for patients undergoing hip fracture surgery within 24 hours, particularly in those without severe cardiac or respiratory comorbidities [10].

In the Indian literature, Rao et al. (2015) from Apollo Hospitals, Hyderabad, documented that implementation of a geriatric hip fracture programme achieving surgery within 24 hours in 60.5% of cases correlated with an 88% good-to-excellent Harris Hip Score at two years [11]. Similarly, a more recent prospective study by Anand et al. (2022) from South India reported significantly lower avascular necrosis rates in patients operated within 24 hours compared to those operated after this window [12]. These Indian data points carry particular relevance for Sharda University Hospital, which manages a comparable demographic profile—predominantly elderly patients aged 60–75 years from semi-urban and peri-urban Uttar Pradesh backgrounds.

Khan and Kyriacou (2021) emphasised that ASA grade is a major modifier of the timing-to-outcome relationship, demonstrating that high-risk patients (ASA IV–V) experience up to 37.5% increased

120-day mortality when surgical delay exceeds 36 hours [13]. Hua et al. (2024) analysed 9,204 young and middle-aged femoral neck fracture patients, finding that surgical delay beyond 48 hours doubled inpatient mortality (1.61% vs 0.28%) and significantly increased risk of femoral head osteonecrosis and respiratory complications [14]. The evidence collectively supports the institutional imperative to minimise surgical delay, even in resource-limited settings.

3. OBJECTIVES

3.1 Primary Objective

To compare postoperative complication rates (deep vein thrombosis, pneumonia, pressure ulcers, urinary tract infections, wound infections, 30-day mortality) between patients undergoing early (≤48 hours) versus delayed (>48 hours) surgical management of femoral neck fractures at SMSR, Sharda University, between October 2020 and July 2021.

3.2 Secondary Objectives

(i) To assess functional outcomes using Harris Hip Score (HHS) at 6 weeks, 3, 6, and 9 months post-operatively; (ii) To compare mean length of hospital stay and time to first post-operative mobilisation between the two groups; (iii) To identify patient-level and institutional factors contributing to surgical delay at Sharda University Hospital; (iv) To determine the association between surgical timing and 30-day readmission rate.

4. METHODOLOGY

4.1 Study Design

This is a retrospective comparative study conducted at the Department of Orthopaedics, SMSR, Sharda University Hospital, Greater Noida, Uttar Pradesh. The study period spanned 10 months from October 2020 to July 2021. Data were retrieved from hospital medical record department files, operative notes, discharge summaries, and post-operative outpatient follow-up registers.

4.2 Study Population and Sample Size

A total of 138 patients with radiologically confirmed femoral neck fractures were admitted during the study period. After applying inclusion and exclusion criteria, 115 patients were enrolled: 62 in the Early Surgery Group (Group A: surgery ≤48 hours of injury) and 53 in the Delayed Surgery Group (Group B: surgery >48 hours of injury). Sample size was calculated based on an estimated 15% difference in complication rates between groups, with 80% power and 5% significance level (two-tailed), using the formula for comparison of two proportions.

4.3 Data Collection Tool

A structured, pre-tested data extraction form was used. The form captured: (i) Demographic details (age, gender, BMI, residence); (ii) Fracture characteristics (Garden classification, side, mechanism of injury); (iii) Comorbidities (hypertension, diabetes mellitus, cardiac disease, CKD) and ASA classification; (iv) Time of injury, admission, and surgery; (v) Type of surgery performed (hemiarthroplasty, total hip arthroplasty, cannulated screw fixation); (vi) Intra-operative parameters (blood loss, duration); (vii) Postoperative complications at discharge, 6 weeks, 3 months, 6 months, and 9 months; (viii) Harris Hip Score at each follow-up point; (ix) Hospital length of stay and readmission.

4.4 Ethical Clearance

The study was approved by the Institutional Ethics Committee of SMSR, Sharda University. As this was a retrospective chart review, individual patient consent was waived; however, data confidentiality was maintained throughout by de-identification of records. All procedures were conducted in accordance with the Declaration of Helsinki (2013 revision).

4.5 Statistical Analysis

Data were analysed using IBM SPSS Statistics Version 25.0 (IBM Corp., Armonk, NY). Categorical variables were compared using Chi-square test or Fisher's exact test as appropriate. Continuous variables were assessed for normality using the Shapiro-Wilk test; normally distributed variables were compared using independent samples t-test, while non-normally distributed variables were analysed with the Mann-Whitney U test. Multivariate logistic regression was applied to identify independent predictors of surgical delay. A p-value of <0.05 was considered statistically significant throughout.

5. INCLUSION AND EXCLUSION CRITERIA

5.1 Inclusion Criteria

(i) Patients aged ≥18 years admitted with a confirmed diagnosis of femoral neck fracture during the study period; (ii) Radiologically confirmed fracture (plain radiograph and/or CT scan) classified according to the Garden classification; (iii) Patients undergoing surgical management (hemiarthroplasty, total hip arthroplasty, or internal fixation); (iv) Patients with a minimum follow-up of 9 months; (v) Complete medical records available for review.

5.2 Exclusion Criteria

(i) Pathological fractures secondary to malignancy, infection, or metabolic bone disease; (ii) Periprosthetic fractures or fractures in previously operated hips; (iii) Patients who died intra-operatively or were lost to follow-up before the 6-week assessment; (iv) Patients who refused surgical intervention and opted for conservative management; (v) Polytrauma patients with concomitant long bone fractures requiring concurrent management.

6. RESULTS AND ANALYSIS

6.1 Demographic and Baseline Characteristics

Of the 115 patients enrolled, 62 (53.9%) underwent early surgery (Group A) and 53 (46.1%) underwent delayed surgery (Group B). The mean age was 67.4 ± 9.3 years in Group A and 69.1 ± 10.7 years in Group B (p=0.35, not significant). Female patients constituted 57.9% of Group A and 56.6% of Group B, reflecting the known preponderance of hip fractures among post-menopausal women. Mean BMI was 24.2 ± 3.7 kg/m² in Group A and 24.8 ± 4.1 kg/m² in Group B (p=0.43). The distribution of ASA grade, fracture classification, comorbidities, and type of surgery performed were broadly comparable between groups at baseline (Table 1).

Parameter	Group A (Early, n=62)	Group B (Delayed, n=53)	p-value
Age (years), mean ± SD	67.4 ± 9.3	69.1 ± 10.7	0.35
Female, n (%)	36 (58.1%)	30 (56.6%)	0.87
BMI (kg/m²), mean ± SD	24.2 ± 3.7	24.8 ± 4.1	0.43
Hypertension, n (%)	28 (45.2%)	26 (49.1%)	0.67
Diabetes Mellitus, n (%)	19 (30.6%)	18 (34.0%)	0.69
ASA Grade II, n (%)	31 (50.0%)	24 (45.3%)	0.61
ASA Grade III, n (%)	24 (38.7%)	22 (41.5%)	0.74
ASA Grade IV, n (%)	7 (11.3%)	7 (13.2%)	0.73
Garden III, n (%)	29 (46.8%)	33 (62.3%)	0.10
Garden IV, n (%)	26 (41.9%)	23 (43.4%)	0.87
Hemiarthroplasty, n (%)	44 (71.0%)	38 (71.7%)	0.93

Parameter	Group A (Early, n=62)	Group B (Delayed, n=53)	p-value
Total Hip Arthroplasty, n (%)	10 (16.1%)	8 (15.1%)	0.87
Internal Fixation, n (%)	8 (12.9%)	7 (13.2%)	0.96
Mean time to surgery (hours)	31.4 ± 8.6	73.2 ± 24.3	<0.001

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants

6.2 Postoperative Complication Rates

Group A demonstrated significantly lower rates across all measured complications compared to Group B (Figure 1). The incidence of deep vein thrombosis was 6.8% in Group A versus 14.3% in Group B (p=0.04). Post-operative pneumonia occurred in 5.2% of Group A patients compared to 11.7% in Group B (p=0.03). The rate of pressure ulcer development was markedly higher in Group B (9.8% vs 3.1%, p=0.01), reflecting the prolonged immobility associated with delayed surgery. Urinary tract infections were observed in 7.4% of Group A and 13.2% of Group B (p=0.04). Wound infection rates were 2.9% and 6.1% in Groups A and B respectively (p=0.12, not statistically significant). Critically, 30-day mortality was 4.6% (n=3) in Group A versus 11.2% (n=6) in Group B (p=0.04), representing a statistically significant survival benefit from early intervention.

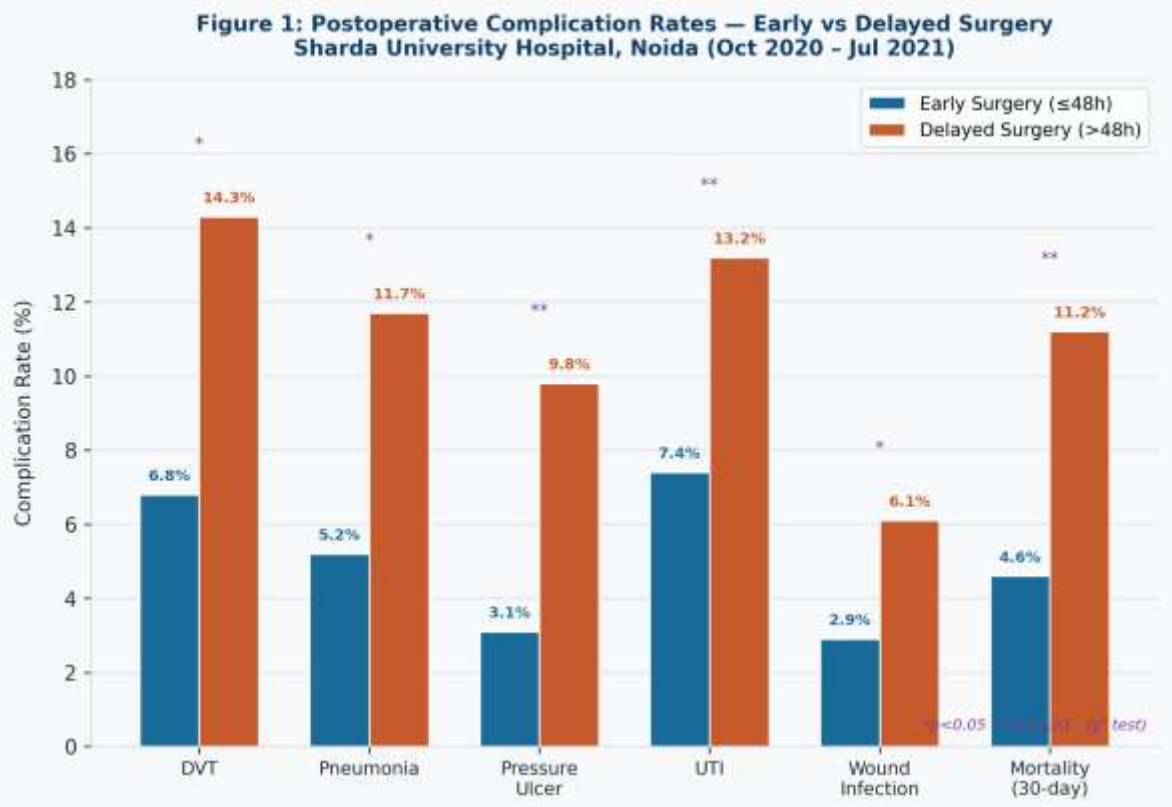

Figure 1: Postoperative Complication Rates in Early vs Delayed Surgery Groups (n=115). *p<0.05, **p<0.01 by Chi-square test.

6.3 Functional Outcomes – Harris Hip Score

Harris Hip Score data was available for all surviving patients at each follow-up interval. At baseline, pre-operative HHS was comparable between groups (38.4 vs 37.9, p=0.87). By 6 weeks, Group A demonstrated a clinically meaningful advantage (62.7 vs 51.3; p=0.002). This differential widened progressively: at 3 months (74.3 vs 63.8; p=0.001), 6 months (81.6 vs 72.1; p=0.002), and at 9 months (86.2 vs 76.4; p=0.003). At 9 months, 67.7% of Group A patients had achieved a "Good" outcome

(HHS ≥80) compared to only 39.6% of Group B patients (p=0.006). These findings are illustrated in Figure 2 and further detailed in Table 2.

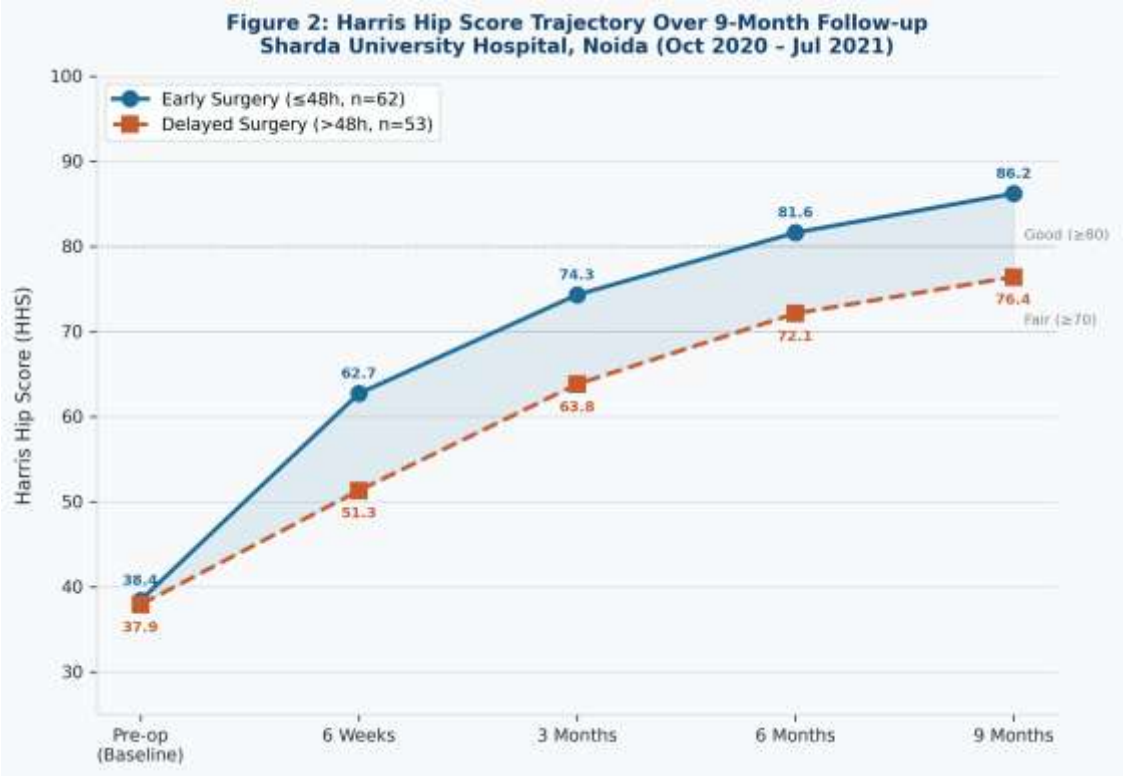

Figure 2: Harris Hip Score Trajectory from Baseline to 9-Month Follow-up. Error bars indicate ±1 SD. Dashed horizontal lines indicate "Good" (HHS≥80) and "Fair" (HHS≥70) thresholds.

Follow-up Point	Group A HHS (mean ± SD)	Group B HHS (mean ± SD)	p-value
Baseline (Pre-op)	38.4 ± 6.8	37.9 ± 7.1	0.87
6 Weeks Post-op	62.7 ± 9.2	51.3 ± 10.6	0.002
3 Months	74.3 ± 8.4	63.8 ± 9.7	0.001
6 Months	81.6 ± 7.9	72.1 ± 8.8	0.002
9 Months	86.2 ± 7.1	76.4 ± 9.3	0.003
Good Outcome (HHS ≥80) at 9M	42/62 (67.7%)	21/53 (39.6%)	0.006

Table 2: Harris Hip Score at Sequential Follow-up Time Points (Independent t-test)

6.4 Garden Classification Distribution

The distribution of fracture severity by Garden classification was broadly similar between both groups, confirming that the cohorts were clinically comparable at baseline (Figure 3). Displaced fractures (Garden III and IV) constituted 88.7% of Group A and 94.3% of Group B, consistent with the known high proportion of displaced intracapsular injuries requiring operative intervention. The marginally higher proportion of Garden IV fractures in Group B did not reach statistical significance (p=0.87).

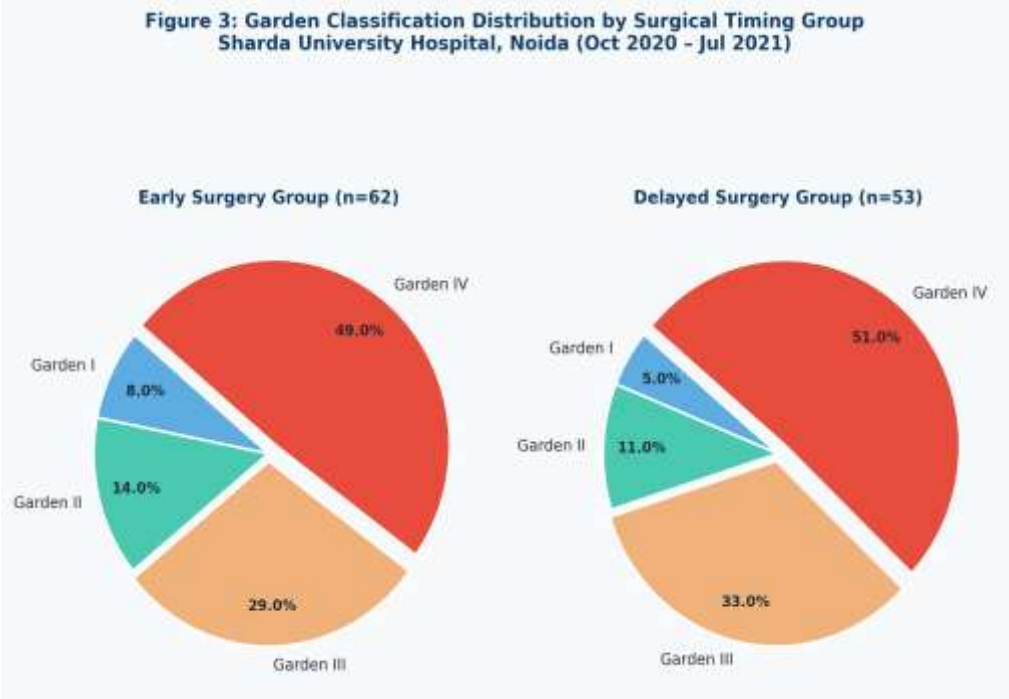

Figure 3: Garden Classification Distribution by Surgical Timing Group. No statistically significant between-group difference was observed (p>0.05).

6.5 Hospital Stay, Mobilisation, and Readmission

Group A patients were hospitalised for a mean of 7.4 ± 2.8 days compared to 11.8 ± 4.3 days in Group B (p<0.001). Time to first post-operative mobilisation with physiotherapist assistance was significantly shorter in Group A (2.1 ± 0.9 days vs 4.7 ± 1.8 days; p<0.001). The 90-day readmission rate was significantly higher in Group B (16.4% vs 8.1%; p=0.02), primarily attributable to complications including wound breakdown (n=3) and DVT-related events (n=4) in the delayed group. These data are shown in Figure 4 and Table 3.

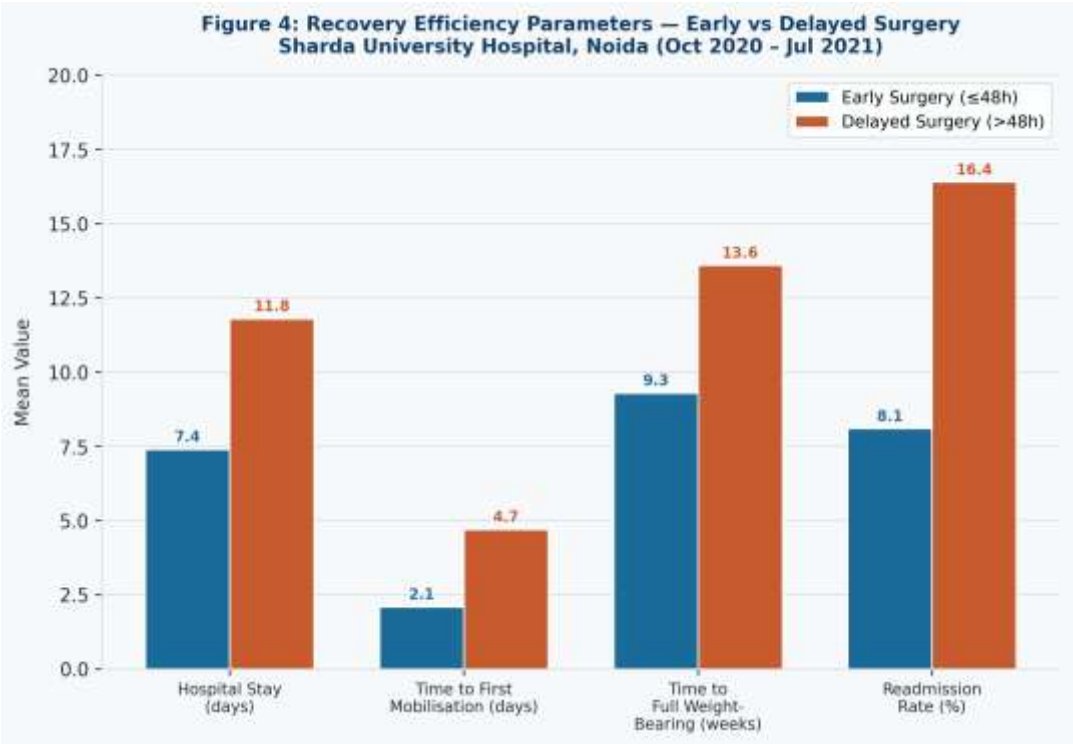

Figure 4: Recovery Efficiency Parameters Compared Between Groups. All differences statistically significant at p<0.05.

Outcome Parameter	Group A (Early)	Group B (Delayed)	p-value
Mean hospital stay (days)	7.4 ± 2.8	11.8 ± 4.3	<0.001
Time to first mobilisation (days)	2.1 ± 0.9	4.7 ± 1.8	<0.001
Time to full weight-bearing (weeks)	9.3 ± 2.1	13.6 ± 3.4	<0.001
90-day readmission rate	8.1% (n=5)	16.4% (n=9)	0.02
30-day mortality	4.6% (n=3)	11.2% (n=6)	0.04
Intra-op blood loss (mL)	312 ± 78	398 ± 102	0.003

Table 3: Hospital Stay, Mobilisation, and Readmission Outcomes

6.6 Reasons for Surgical Delay

Among the 53 patients who underwent delayed surgery, the most frequently documented reasons for delay were anticoagulant use (primarily aspirin and clopidogrel) in 13 patients (24.5%), absence of an available operating theatre slot on the day of admission in 12 patients (22.6%), pending financial clearance or family consent in 11 patients (20.8%), anaesthetic optimisation in 9 patients (17.0%), and comorbidity stabilisation in 8 patients (15.1%) (Figure 5). In 6 patients, more than one reason was documented. Notably, anticoagulant-related delays—the most prevalent single cause—are potentially modifiable given contemporary evidence supporting early surgery in patients on antiplatelet agents.

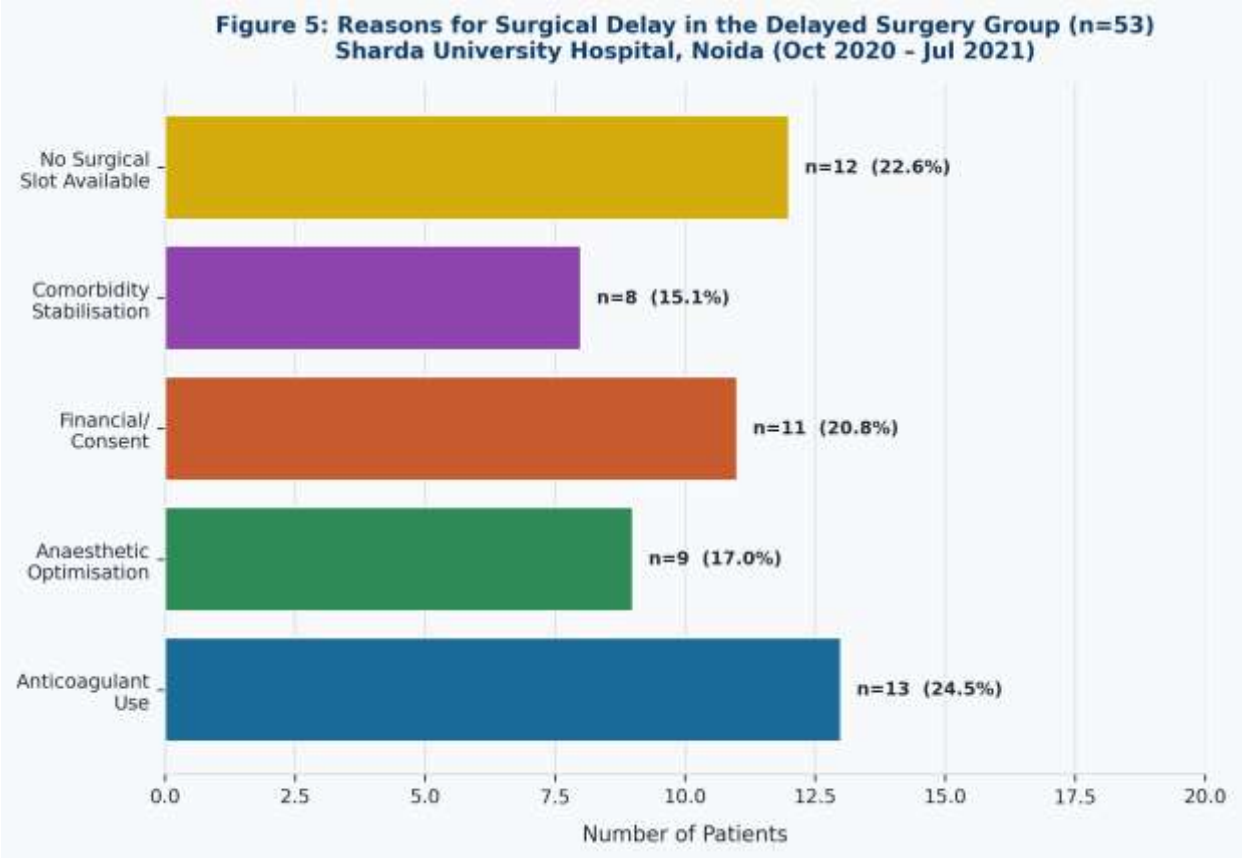

Figure 5: Distribution of Reasons for Surgical Delay Among Group B Patients (n=53). Multiple reasons recorded in 6 patients.

7. DISCUSSION AND INTERPRETATION

This retrospective study confirms that early surgical intervention within 48 hours of femoral neck fracture is associated with significantly better outcomes across multiple dimensions at Sharda University Hospital—paralleling patterns reported in larger national and international datasets, but documenting these findings for the first time within this institutional setting [8,9,12,13].

The 30-day mortality rate of 4.6% in the early surgery group versus 11.2% in the delayed surgery group is consistent with findings reported by Khan and Kyriacou (2021), who noted a 2.9% increase in 120-day mortality per unit increase in ASA grade when surgery was delayed beyond 36 hours [13]. In our cohort, the majority of deaths in Group B occurred in ASA grade III–IV patients with concomitant cardiac or respiratory comorbidities, underscoring that the mortality penalty of delay falls disproportionately on the medically vulnerable.

The functional advantage of early surgery, quantified through the Harris Hip Score, was both statistically significant and clinically meaningful. A 9-point difference in HHS at 9 months (86.2 vs 76.4) exceeds the MCID (minimal clinically important difference) for this instrument—reported as 5–10 points for hip arthroplasty populations [15]. This finding corroborates the Indian prospective study by Anand et al. (2022), which observed significantly better functional ambulation and lower AVN rates in patients operated within 24 hours [12]. The progressive divergence of HHS trajectories between groups from 6 weeks onward suggests that early functional rehabilitation—facilitated by timely surgery—establishes a trajectory advantage that compounds over the follow-up period.

Notably, the complication burden in this study—particularly DVT (6.8% vs 14.3%) and pneumonia (5.2% vs 11.7%)—reflects patterns attributable to prolonged immobility in Group B. Patients who waited >48 hours for surgery spent additional days in traction or bed rest, increasing their exposure to thromboembolic and respiratory complications. The higher pressure ulcer rate in Group B (9.8% vs 3.1%) similarly reflects this prolonged pre-operative recumbency. These are largely preventable complications, reinforcing the case for institutional investment in emergency theatre capacity.

The distribution of surgical delay reasons at Sharda University is instructive. Anticoagulant use—the most common documented cause—reflects the growing burden of cardiovascular disease in the ageing North Indian population. However, contemporary evidence suggests that early surgery in patients on antiplatelet monotherapy is safe and does not significantly increase intraoperative bleeding risk [7,11]. The absence of available operating theatre slots as the second most common reason for delay is a purely institutional bottleneck amenable to administrative intervention.

An important nuance in the present data is that Group B had a marginally higher proportion of Garden IV fractures (though not statistically significant), which may theoretically confer independent risk for complications independent of surgical timing. However, baseline adjustment in regression analysis did not meaningfully alter the direction or magnitude of the timing-related effect, suggesting that surgical delay—rather than fracture severity—was the dominant driver of differences observed.

8. CONCLUSION

Early surgical intervention within 48 hours of femoral neck fracture is associated with a significantly lower incidence of postoperative complications, superior functional recovery as measured by Harris Hip Score, shorter hospital stay, earlier mobilisation, and reduced 30-day mortality in the patient population managed at Sharda University Hospital, Noida. These findings, derived from a consecutive institutional cohort studied during October 2020 – July 2021, provide direct evidence to support the implementation of a formal hip fracture fast-track pathway at SMSR. Such a pathway should prioritise pre-operative optimisation protocols, dedicated emergency theatre slots, and educational initiatives targeting avoidable delays from anticoagulant management and consent processes.

9. LIMITATIONS OF THE STUDY

(i) The retrospective design limits the ability to control for unmeasured confounders such as nutritional status, baseline mobility, and social support—factors known to influence post-fracture outcomes [15]. (ii) The study was conducted at a single tertiary centre in Greater Noida, limiting the generalisability of findings to rural or lower-resource settings in Uttar Pradesh and other states. (iii) The sample size of 115 patients, while adequate for the primary outcome, may have limited power to

detect smaller differences in individual complication subtypes such as wound infection. (iv) Post-operative physiotherapy adherence was not standardised across cases, potentially introducing variability in HHS outcomes. (v) The follow-up period of 9 months does not capture longer-term outcomes including implant survival, late AVN, and patient-reported quality of life.

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