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Unlocking the Influence of Age and Fracture Side on Recovery in Unstable Proximal Femoral Fractures: Insights from a Tertiary Care Hospital in a Developing Country

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ABSTRACT

Objective: The aim of our research is to identify the clinical and demographic characteristics that affect the functional results in patients with proximal femur fractures who are treated with dynamic condylar screws.

Method: A descriptive cross-sectional survey conducted from September 2019 to March 2022, enrolled 115 patients aged 20-60 years with unstable proximal femoral fractures managed with dynamic condylar screws. The data was collected 12 weeks following the surgery to assess the factors influencing the Harris Hip Score. The data on clinical, demographic, and surgical detail was collected and analyzed employing the SPSS version 22, using the Shapiro-Wilk test.

Results: The study revealed significant functional improvement associated with the age group 41-60 years, additionally, patients with left-sided fracture showed statistically significant functional outcomes in comparison to patients with right-sided fractures. No significant association of HHS score was found in relation to clinical, surgical, socioeconomic or occupational factors on postoperative outcomes. The findings highlight a complex interplay of demographic factors following the fracture management for unstable PFF.

Conclusion: The uni-variant results yield higher age and left-sided fracture associated with higher functional outcomes following an unstable proximal femur fracture managed with dynamic condylar screws. The statistical results showed no significant association of clinical factors influencing the functional status. The unique demographic finding needs further larger multi-variant research to establish the clinical and demographic factors influencing the functional outcomes following the dynamic condylar screw in patients with proximal femur fracture.

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Introduction

Femur fracture of proximal location constitute a significant clinical and socioeconomic burden in the field of orthopedics [1]. The complexity and clinical burden of the PFF enhance the interest of the surgeons in the development of improvement in fracture management. The primary management goal is stable fixation allowing early mobilization [2,3]. The variation in the anatomical details of the PFFs contributes to a specific feature of the fracture in relation to fracture pattern and clinical outcome [4]. The literature evidence the correlation of substantial morbidity and mortality with unstable PFFs, however, association with coexisting

comorbidities such as diabetes, hypertension, and cardiac and renal conditions can further contribute to poor prognosis of the fracture [4].

The literature indicates that unstable proximal femoral fractures (PFFs), such as Arbeitsgemeinschaft für Osteosynthesefragen (AO) type A2 or A3 fractures, fractures with a broken lateral wall of the greater trochanter, reverse oblique fractures, subtrochanteric fractures, and comminuted proximal femoral fractures, present a significant clinical challenge. However, the use of dynamic hip screws (DHS) in the management of unstable PFFs has been shown

to result in significantly better clinical and radiological outcomes [5,6]. The unremarkable outcomes of DHS in intertrochanteric fractures regarded it as the implant of choice. However, other surgical correction types of orthopaedic implants, including proximal femoral nail anti-rotation (PFNA), reconstruction nails (Recon nail), Russel Taylor Nail, Gamma Nail, and DHS with Trochanteric Stabilising Plate (DHS with TSP), have been developed and presented.

However, PFNA and Gamma Nails have been employed less occasionally considering the higher cost and surgeons' acquaintance with their application.

Dynamic Condylar Screws (DCS) are considered a superior option in the management of unstable PFF which exerts vertical forces on weight bearing [10,11]. Orthopaedic surgeons have difficulties in dealing with malunion and non-union due to compression, tensile, and torsional forces, as well as reduced blood supply in the subtrochanteric area [11]. The subtrochanteric fracture results in more blood loss compared to fractures of the femoral neck or intertrochanteric femur [12]. Fixing unstable proximal femoral fractures with Dynamic Compression Screw (DCS) results in rapid fracture healing and early return of patient mobility [13,14]. Kakar et colleagues discovered that the functional result, as measured by the Harris hip score (HHS), was outstanding in 46.9% of the patients, good in 39.4%, fair in 8.1%, and bad in 5.4% of the patients treated with DCS [15].

The optimal management of proximal femoral fractures remains a challenge for the orthopedic surgeon. Early anatomical reduction and surgical fixation remain the best options to reduce the risk of complications like non-union and avascular necrosis for the management of the fractured neck of the femur. Despite the frequent employment of DHS, our literature search showed a limitation in the data available regarding the relation of clinical and demographic factors influencing functional outcomes. The objective of our study is to determine the factors influencing the HHS score in the patients managed with DCS following surgical correction. We believe the results from our study would potentially offer new information to clinicians that can influence clinical management and improve quality of life and patient outcomes in Pakistan.

Method

Study Design

The descriptive cross-sectional survey was conducted from 21st September 2019 to 21st March 2020 in the Department of Orthopedics, at Jinnah Post-graduate Medical Center (JPMC), Karachi, Pakistan. A total of 115 patients were enrolled following the written consent of the included patients. The study was conducted following the approval of the Institutional Ethical Review Committee.

Participants

115 patients aged 20-60 years presented with unstable PFFs within 72 hours of fracture were included in the study. Patients were only included if their baseline American Society of Anesthesiologists (ASA) score was less than or equivalent to 2. The patients with open fractures, infected fractures, a history of inflammatory arthritis, a history of corticosteroid use in the past five days, a history of osteoporosis or osteomalacia, malignancy, patients with a history of stroke, asthma, renal impairment, chronic pulmonary disease, acute myocardial infarction, and congestive cardiac failure were excluded.

Data Collection

The baseline clinical and demographic characteristics including age, gender, affected side, mechanism of injury, type of fracture, comorbidities, smoking history, socioeconomic status, duration of surgery, and functional outcomes using HHS were assessed using a Google Form and imported on an Excel sheet. Patients were followed every second week, and the endpoint functional outcomes were compared with the quantitative and qualitative variables during the 12th week of the surgery.

Surgical Procedure

All the included patients were operated by experienced orthopedic surgeons with a minimum of 10 years of experience. All patients had the posterolateral approach. The surgical procedure was carried out utilising a fracture table and image intensifier to align the fractured bones. A 4- or 6-hole DCS (dynamic compression screw) and lag screws of suitable size were used for fixation.

Following surgery, all patients were kept in the orthopaedic department for a duration of 2 days before being released. They were provided appropriate oral antibiotics, analgesics, and calcium supplements. The patients were ambulated promptly using crutches, with the damaged side permitting just toe-touch to the ground for the first six weeks, followed by full-weight bearing. Patients were monitored every two weeks and in the 12th week to evaluate the functional results using the HHS. The purpose was to identify the elements that influenced the improvement in functionality.

Statistical Analysis

The sample size was calculated employing the World Health Organization (WHO) software for statistical analysis (16), considering the prevalence fair HHS 8.1%, margin of error of 5%, and confidence interval of 95% [15].

All the collected data was analyzed on the Statistical Package for Social Sciences (SPSS) Version 22. The mean and standard deviation (SD) were calculated for the quantitative variables like age and duration of surgery. The normality of the data was assessed using the Shapiro-Wilk test. The mean and SD were reported for the normally distributed while the median (IQR) was reported for the non-normality distributed quantitative variables. Frequencies and percentages were calculated for the qualitative variables like gender, side of limb fracture, mechanism of injury, type of fracture, diabetes mellitus type II, hypertension, smoking status, family monthly income status, occupational status, and functional outcome (excellent/good/fair/poor). The effect modifiers were controlled through stratification of age, gender, side of limb fracture, mechanism of injury, type of fracture, diabetes mellitus type II, hypertension, smoking status, family monthly income status, occupational status, and duration of surgery to see the effect of these on the outcome variables. Post-stratification chi-square test/Fischer test was applied taking a p-value of ≤ 0.05 as statistically significant.

Results

A total of 115 patients were followed for 12 weeks. The mean age of the patients was 48.21 ± 10.24 years. The majority of patients had left-sided PFFs. Road traffic accident (RTA) was the most common cause of PFFs in the included patients, followed by ground-level falls and falls from a height majority of patients (83%) had Type A3 fractures, and only 32% of patients had Type A2 fractures. The mean duration of the surgery was 2.14 ± 1.89 hours. The baseline HHS score revealed an excellent score in 66.1% of patients,

good in 11.3%, fair in 18.3%, and poor HHS score in 4.3% of the patients. Table 1. presents a conclusive summary of the baseline demographic and clinical characteristics.

Table 1: Baseline demographic and clinical characteristics

Variable	Frequency (Percentage)
Gender	
Male	63 (54.8%)
Female	52 (45.2%)
Age Group	
20-40 years	39 (33.9%)
41-60 years	76 (66.1%)
Duration of Surgery	
≤ 1.5 hours	40 (34.8%)
> 1.5 hours	75 (65.2%)
Side of Limb Fracture	
Right	40 (34.8%)
Left	75 (65.2%)
Mechanism of Injury	
Fall from Height	18 (15.7%)
Road Traffic Accident	78 (67.8%)
Ground Level Fall	19 (16.5%)
Type of Fracture	
Type A2	32 (27.8%)
Type A3	83 (72.2%)
Functional Outcome	
Excellent	76 (66.1%)
Good	13 (11.3%)
Fair	21 (18.3%)
Poor	5 (4.3%)
Comorbidities	
Diabetics Mellitus Type II	20 (17.4%)
Hypertensive	40 (34.8%)
Smoking Status	
Smokers	42 (36.5%)
Family Monthly Income	
≤ 50000	54 (47%)
> 50000	61 (53%)
Occupational Status	
Employed	94 (81.7%)
Unemployed	21 (18.3%)

The statistical analysis revealed the functional outcomes assessment of the included cohort across the various demographic and clinical characteristics. Age was found to significantly influence the functional outcomes, the results showed patients aged between 41-60 years demonstrate a higher proportion of excellent and good HHS scores compared to patients aged 20-40 years ($p=0.03$). The gender does not exhibit any significant difference in the functional outcomes ($p=0.73$). However, we found that left-sided limb fractures showed significant functional outcomes in comparison to right-sided PFFs ($p=0.01$). Similarly, no significant difference in functional outcome was found based on the mechanism of injury ($p=0.19$), and duration of the surgery ($p=0.83$). The clinical correlation with diabetes ($p=0.70$) and hypertension ($p=0.60$) does not have any impact on the HHS score. The demographic factors including smoking ($p=0.23$), occupational status ($p=0.90$), and economic status ($p=0.82$) do not have any impact on the function outcomes assessed by HHS. The findings express a complex interplay of various factors for determining a post-surgical functional outcome in PFFs.

Table 2: The statistical results illustrate the univariant correlation of Function outcomes assessed with Harris Hip Score (HHS) with the demographic and clinical characteristics

Variable	Subgroup	Functional Outcomes (HHS)				Total (n=115)	P-Value
		Excellent	Good	Fair	Poor		
Age	20-40 years	20 (51.3%)	05 (12.8%)	10 (25.6%)	04 (10.3%)	39	0.03*
	41-60 years	56 (73.7%)	08 (10.5%)	11 (14.5%)	01 (1.3%)	76	
Gender	Male	42 (66.7%)	06 (9.5%)	13 (20.6%)	02 (3.2%)	63	0.73
	Female	34 (65.4%)	07 (13.5%)	08 (15.4%)	03 (5.8%)	52	
Duration of Surgery	≤1.5 hours	25 (62.5%)	04 (10%)	09 (22.5%)	02 (5%)	40	0.83
	>1.5 hours	51 (68%)	09 (12%)	12 (16%)	03 (4%)	75	
Side of Limb Fracture	Right	18 (45%)	06 (15%)	14 (35%)	02 (5%)	40	0.01*
	Left	58 (77.3%)	07 (9.3%)	07 (9.3%)	03 (4%)	75	
Mechanism of Injury	Fall from Height	13 (72.2%)	02 (11.1%)	01 (5.6%)	02 (11.1%)	18	0.19
	Road traffic Accident	50 (64.1%)	09 (11.5%)	18 (23.1%)	01 (1.3%)	78	
	Ground Level Fall	13 (68.4%)	02 (10.5%)	02 (10.5%)	02 (10.5%)	19	
Type of Fracture	A2	25 (78.1%)	02 (6.2%)	04 (12.5%)	01 (3.1%)	32	0.40
	A3	51 (61.4%)	11 (13.3%)	17 (20.5%)	04 (4.8%)	83	
Diabetes Mellitus Type II	Yes	13 (65%)	03 (15%)	04 (20%)	00 (0%)	20	0.70
	No	63 (66.3%)	10 (10.5%)	17 (17.9%)	05 (5.3%)	95	
Hypertension	Yes	27 (67.5%)	04 (10%)	06 (15%)	03 (7.5%)	40	0.60
	No	49 (65.3%)	09 (12%)	15 (20%)	02 (2.7%)	75	
Smoking Status	Yes	30 (71.4%)	06 (14.3%)	06 (14.3%)	00 (0%)	42	0.23
	No	46 (63%)	07 (9.6%)	15 (20.5%)	05 (6.8%)	73	
Family Monthly Income	≤ 50000 Rupees	38 (70.4%)	05 (9.3%)	09 (16.7%)	02 (3.7%)	54	0.82
	> 50000 Rupees	38 (62.3%)	08 (13.1%)	12 (19.7%)	03 (4.9%)	61	
Occupational Status	Employed	63 (67%)	11 (11.7%)	16 (17%)	04 (4.3%)	94	0.90
	Unemployed	13 (61.9%)	02 (9.5%)	05 (23.8%)	01 (4.8%)	21	

Discussion

We present the assessment of evidence from the data recorded from 115 patients with unstable PFF managed with DCS to determine the factors influencing the functional outcome in low socioeconomic patients. The results showed that patients aged 41-60 years showed significant clinical improvement in comparison to patients aged 20-40 years. The side of the limb also impacts the functional outcomes; we reported significant clinical improvement in patients with fractured left leg than in patients with fractured right leg. However, there is no effect of clinical, surgical, socioeconomic, and occupational factors.

The literature evident numerous clinical evidence reporting the factors associated with osteoporosis and mortality in patients with unstable PFF [17-19]. Canbeyli et al. reported significant mortality in patients with ASA grade 4, advanced age, male sex, general anesthesia, and additionally, patients undergoing hemiarthroplasty in intertrochanteric fractures are at higher risk of

mortality [20]. Similar to Canbeyli et al., Kumar et al. presented a systematic review and meta-analysis demonstrating a lower mortality rate and a statistically higher HHS score in AO A2 and A3 intertrochanteric fracture managed with proximal femur nails in comparison to hemiarthroplasty [21]. Despite the large and strong evidence supporting nails in AO A2 and A3 PFFs, the evidence for predicting clinical and demographic factors affecting the outcome is scanty. Therefore, delving into the methodology of our study, the study provides a comprehensive design to assess the factors influencing the functional outcomes.

Zhu et al. reported that DHS with positive buttress reduction showed statistically significant functional outcomes assessed with HHS in young patients in comparison to elderly patients due to superior mechanical support, however, the results were also influenced by the shorter surgical time, less radiation exposure, and higher baseline HHS [22]. Our results showed superior functional outcomes in elderly patients in comparison to young patients.

Similarly, the side of the limb fracture emerges as a significant demographic factor determining better functional outcomes. Patients with left-sided fractures showed significant clinical improvement, however, not neglecting the potential confounding bias and unmeasured variables that can influence such as surgical techniques, therefore, the considerable rigorous statistical analysis might produce the limitation of result confidence for age and fracture side. Mohan et al. reported the difference of side in the outcomes for DHS. They reported that a clockwise insertion in the right-sided fracture results in the extended position at the hip joint with apposition or flexed position, on the contrary, the left-sided fracture results in hip flexion and extension of the fracture site leading to instability, therefore, concluding that the torsion at the fracture site possess significant problem in unstable PFFs [22]. However, our results have identified a correlation between functional outcome and fracture side, we acknowledge the use of unmeasured confounding variables and anatomical considerations, and we underscore the need for further research to better understand the need for more research to identify the demographic factors influencing the functional outcomes.

The absence of a significant association between clinical factors might be considered to be partially attributed to relatively homogenous health status in the included population. The patients were only included if they had an AO 2 or 3 score, which limits the variation in health status across the included demographic and clinical factors and, therefore, might result in minimizing the potential impact of the included factors on the postoperative factors [24]. Swaroop et al., reported the results of their prospective study to determine the factors affecting the outcomes of unstable intertrochanteric fracture following the proximal femoral nail anti-rotation 2 implants in Indian populations. Despite employing a different surgical method, Swaroop et al. reported a similar set of factors influencing the functional outcomes assessed with HHS [24]. They reported a nonsignificant correlation of the modified HHS score with the type of fracture and ASA score similar to our results.

Despite the consistent results of a study regarding the clinical factors correlating with the HHS. Our demographic results identify a unique set of associated factors inconsistent with the previous literature, therefore, we believe further research is mandatory to highlight an enhanced understanding of the postoperative outcomes in Pakistan. We include potential confounding factors, limited generalizability considering sample size and setting, selection bias, and reliance on HHS as a potential limitation of our study. The study restriction to an ASA score less than or equivalent to 2 may introduce selection bias considering the severe comorbidities associated with a higher ASA score. additionally, the unicentric study character may not be generalizable to the local population with distinct demographic factors.

Conclusion

The univariant results yield higher age and left-sided fracture associated with higher functional outcomes following an unstable proximal femur fracture managed with dynamic condylar screws. The statistical results showed no significant association of clinical factors influencing the functional status. The unique demographic finding needs further larger multivariant research to establish the clinical and demographic factors influencing the functional outcomes following the dynamic condylar screw in patients with proximal femur fracture.

Authorship Declaration

We confirm that this manuscript is an original work and has not

been submitted, published, or under consideration for publication elsewhere.

Ethical Approval

IRB taken from institute.

Conflict of Interest

We declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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Declarations

Ethics Approval and Consent to Participate

Jinnah postgraduate Medical Centre/ Orthopedic department unit 1, Institute approved IRB.
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Consent for Publication

The consent to publish the patient's data was taken from patients.

Competing Interests

The authors declare that they have no competing interests.

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All the authors approved the final draft and stand accountable for validity of data.

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