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Original Research Article

FUNCTIONAL OUTCOMES OF PROXIMAL HUMERUS FRACTURE USING PHILOS

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Abstract: *Proximal humeral fractures are among the most common upper extremity fractures, particularly in adults, and their management remains a challenge. The Proximal Humerus Internal Locking System (PHILOS) plate fixation is widely used for these fractures, offering stability and enabling early mobilization. However, functional outcomes and potential complications require thorough evaluation to ensure optimal patient care.* ***Objective:*** *To assess the functional outcomes of Proximal Humerus Internal Locking System (PHILOS) plate fixation in patients with proximal humeral fractures.* ***Methods:*** *This prospective observational study was carried out at the orthopaedic department from July 2023 to July 2024. Participants included patients aged 20 years and older with proximal humeral fractures. All patients underwent PHILOS plate fixation performed by experienced orthopaedic surgeons. Functional outcomes were assessed using the Constant-Murley score at 6 months postoperatively, with outcomes categorized as Excellent, Good, Fair, or Poor. Complications, including avascular necrosis, implant-related issues, subacromial impingement, malunion, and nonunion, were recorded.* ***Results:*** *Mean age was 42.98 ± 14.40 years. Functional outcomes were classified as Excellent in 32% of cases, Good in 44%, Fair in 14%, and Poor in 10%. Complications included avascular necrosis in 12%, implant-related complications in 8%, subacromial impingement in 4%, and malunion in 10%.* ***Conclusion:*** *PHILOS plate fixation for proximal humeral fractures provides favourable functional outcomes and minimum complications.*

Keywords: Proximal Humeral Fractures, Philos Plate, Functional Outcome, Complications, Constant-Murley Score, Dash Score

Introduction

Proximal humerus fractures represent 5-6% of all fractures in adults (1). Proximal humerus fractures typically exhibit a bimodal distribution when analyzed by age along with energy level. This bimodal pattern is prevalent, and it is essential for clinicians to identify the distinction between high-energy incidents (such as motor vehicle accidents in younger patients) and low-energy events (like ground-level falls in elderly patients) across different demographics and fracture types (2-5).

Proximal humerus internal locking system plate fixation plates, designed for the proximal humerus, are locking plates that are pre-contoured to match the anatomy of the proximal humerus, thus referred to as anatomically contoured locking plates. These implants exhibit greater flexibility in comparison to traditional plates (6-9).

In conventional plates, as screws are tightened, the plate is snugly fitted against the bone, which increases the chances of disrupting periosteal blood flow. In a contemporary locking plate system, the screw head secures itself within the plate, ensuring that blood flow through the periosteal vessels is preserved, making it an optimal choice for osteoporotic bone. The orientation of the screws in these plates enhances pull-out strength compared to non-locking plates (10). Anatomical reduction and rigid bone fixation facilitate early mobilisation and rehabilitation (11, 12).

Investigating the functional outcomes after PHILOS plate fixation in individuals with proximal humeral fractures is crucial, especially given the rising occurrence of these injuries, notably in the elderly demographic. This fixation technique provides reliable fracture management, facilitating early mobilisation and possibly improving the recovery of shoulder function. This study systematically evaluates functional outcomes to provide evidence regarding the effectiveness of this surgical intervention. Moreover, comprehending the relationship between surgical methods and patient characteristics can inform clinical choices, enhance rehabilitation strategies, and ultimately elevate the quality of life for individuals recuperating from proximal humeral fractures.

Methodology

This prospective observational study was carried out at the orthopaedic unit from July 2023 to July 2024 at Hayatabad Medical Complex, Peshawar, with prior approval from the hospital. Eligible patients included individuals aged 20 years and older who were presented with proximal humeral fractures classified as two-part, three-part, or four-part fractures according to Neer's classification. Exclusion criteria were open fractures, pathological fractures (e.g., metastatic bone disease), patients with significant neurovascular injury, and those who had undergone previous surgery on the affected shoulder. A total of 50 participants were recruited through consecutive sampling.

Data were collected on demographic variables (age, gender), fracture characteristics, and mechanism of injury (categorized as high-energy trauma, low-energy trauma, and sports-related trauma). The primary outcomes were functional assessments and complication rates following PHILOS plate fixation. Functional outcomes were measured using the Constant-Murley score Scores were

recorded as Excellent, Good, Fair, or Poor, as per established cut-off ranges.

All patients underwent PHILOS plate fixation performed by experienced orthopaedic surgeons using a standardized approach. The surgical procedure involved a deltopectoral approach with fixation achieved through the PHILOS plate system. The plate and screw configuration, use of additional bone grafting, and any intraoperative complications were documented. Postoperatively patients were assessed for functional outcomes and complications on six months follow up.

SPSS 24 was deployed for the analysis of data, mean and SD along with frequencies and percentages were used to present the data in tables and figures.

Results

The study included 50 participants with an age range of 20 to 70 years, yielding a mean age of 42.98 ± 14.40 years. Gender distribution showed that 34 participants (68.0%) were male, while 16 (32.0%) were female (Figure 1). Mechanism of injury was categorized as follows: 22 participants (44.0%) sustained high-energy trauma, 24 (48.0%) sustained low-energy trauma, and 4 (8.0%) experienced sports-related trauma (Table 1). Fracture types were recorded with 34 participants (68.0%) having two-part fractures, 12 (24.0%) with three-part fractures, and 4 (8.0%) with four-part fractures (Table 2). Functional outcomes were assessed, with 16 participants (32.0%) achieving excellent results, 22 (44.0%) good, 7 (14.0%) fair, and 5 (10.0%) poor outcomes (Table 3). Complications were observed as follows: avascular necrosis in 6 participants (12.0%), implant-related complications in 4 (8.0%), subacromial impingement in 2 (4.0%), malunion in 5 (10.0%), and no complications in 33 participants (66.0%) (Table 4).

Table 1 Mechanism of injury

Mechanism of injury	Frequency	Percent
High energy trauma	22	44.0
Low energy trauma	24	48.0
Sport-related trauma	4	8.0
Total	50	100.0

Table 2 Type of fracture

Type of fracture	Frequency	Percent
Two-part fracture	34	68.0
Three-part fracture	12	24.0
Four-part fracture	4	8.0
Total	50	100.0

Table 3 Functional outcome

Functional Outcome	Frequency	Percent
Excellent	16	32.0
Good	22	44.0
Fair	7	14.0
Poor	5	10.0
Total	50	100.0

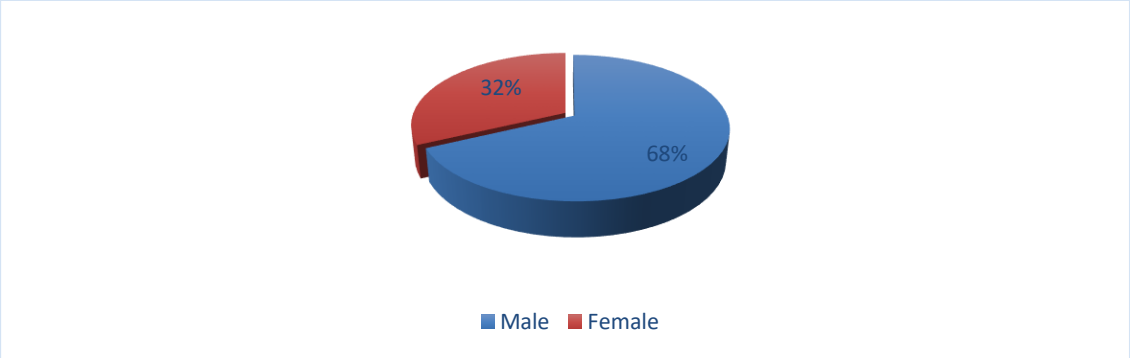

Figure 1 Gender-wise distribution

Table 4 Complications

Complications	Frequency	Percent
Avascular Necrosis	6	12.0
Implant-Related Complications	4	8.0
Subacromial Impingement	2	4.0
Malunion	5	10.0
No complication	33	66.0
Total	50	100.0

Discussion

The mean age of patients was 42.98 ± 14.40 years. This demographic is generally comparable to findings in Sapienza M et al., where the mean age was 66.2 ± 7.1 years, specifically focusing on patients above 55 years with significant osteoporotic tendencies and similar age distribution patterns (13). However, studies focused on younger cohorts, such as that by Foruria AM et al., report a mean age closer to 41 years, which aligns more closely with

the average age observed in the present study and highlights differences in injury mechanisms, often associating higher-energy trauma and sports-related injuries with younger populations (12).

The gender distribution in this study revealed 68.0% male and 32.0% female participants. This distribution contrasts with some studies like that by Geiger AV et al., where female representation was higher (71.4%) among those treated for proximal humerus fractures due to the predominance of osteoporotic fractures in postmenopausal women (14). Similarly, Foruria et al. report a greater prevalence of proximal humerus fractures in elderly women due to bone fragility and lower-energy falls (12). The predominance of male participants in this study might suggest a higher incidence of traumatic, high-energy injury mechanisms rather than age-related bone density issues. The mechanism of injury also underscores a notable difference. High-energy trauma was responsible for 44.0% of fractures, while 48.0% were caused by low-energy trauma, and sports-related trauma accounted for 8.0%. Laux CJ et al. observed a similar trend of high-energy trauma associated with younger, more active populations, yet their study also recognized low-energy falls as common causes in older adults, reflecting a bimodal age distribution typical of proximal humerus fractures (15).

Regarding fracture type, this study's most common type was the two-part fracture, representing 68.0% of cases, with three-part fractures at 24.0% and four-part fractures at 8.0%. These findings align with research showing two-part fractures as the most prevalent, especially in the elderly, as noted in Norouzi M et al., who found a predominance of two-part fractures followed by three-part fractures in younger populations subjected to high-energy trauma (16). Similarly, Jacob TT et al. reported that approximately half of their study population exhibited two-part fractures, commonly treated with PHILOS plates to maintain stability in proximal humerus fractures (17). The observed distribution of fracture types in this study corresponds with other research findings, emphasizing the practicality of using locking plates, particularly for simpler fracture patterns, while more complex three- and four-part fractures require increased surgical complexity and carry higher risks.

In terms of functional outcomes, 32.0% of participants in this study achieved an "excellent" outcome, 44.0% "good," 14.0% "fair," and 10.0% "poor." These results are generally consistent with studies by Norouzi M et al., who reported that 72.9% of patients had minimal functional limitations post-treatment, indicating that PHILOS plate fixation yields favourable functional results in most cases, especially for less severe fractures (16). Additionally, Jacob TT et al. documented similar outcomes, with approximately 31% of patients reporting good results, underscoring that PHILOS plate fixation can improve functional outcomes across various patient demographics, particularly those with a two-part fracture (17). However, Geiger EV et al. highlighted that while outcomes are generally positive, older patients or those with more complex fractures are more likely to experience moderate to poor outcomes due to factors like reduced range of motion and postoperative complications (14). Thus, the current study's outcomes align with broader findings on functional recovery but indicate that younger patients, especially those sustaining two-part fractures, have a higher likelihood of achieving favourable outcomes.

The study found that complications were primarily avascular necrosis (12.0%), implant-related issues (8.0%), subacromial impingement (4.0%), and malunion (10.0%), while 66.0% of patients experienced no complications. These rates are in line with Foruria AM et al., who observed complications like screw back-out, joint penetration, and plate loosening in similar studies on PHILOS plate application in osteoporotic fractures, showing a 15-20% complication rate depending on patient age and fracture complexity.[12] The occurrence of subacromial impingement in this study at 4.0% is consistent with findings by Geiger EV et al., who identified impingement primarily due to superior plate positioning as a prominent complication.[14] Sapienza M et al. also noted that more complex fractures, such as three- or four-part fractures, have a higher risk of malunion or nonunion, with about 10% of cases experiencing healing issues, aligning with the findings here where malunion represented 10.0% of complications.[13] Notably, this study's rate of implant-related complications at 8.0% is lower than those seen in elderly populations, where bone fragility can compromise fixation stability, as discussed in studies by Laux CJ et al. and Mariadoss A et al (15-18).

Conclusion

PHILOS plate fixation in patients with proximal humeral fractures demonstrated positive functional outcomes, with 32% achieving excellent outcomes and 44% good outcomes with minimum complications rate.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-BMCP-339/22)

Consent for publication
Approved

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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

SHAFI UL HAQ
Drafting article, Study Design, Conception of Study, Data Analysis, and final approval of the manuscript.
MUHAMMAD SAEED
Development of Research Methodology, Review of manuscript.
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Coordination of collaborative efforts.

MAJID HUSSAIN (Postgraduate)
Literature review

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