


Comparison of Functional Outcome of Proximal Humerus Management with K-Wire versus PHILOS Plate

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Disclaimers

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ABSTRACT

Background: Background: Proximal humerus fractures account for approximately 4% of all fractures and 26% of humeral fractures. While conservative treatment is often recommended, surgical management remains debated, particularly with the use of percutaneous pinning and PHILOS plating.

Objective: To compare the functional outcomes of proximal humerus fractures managed with percutaneous pinning versus PHILOS plating using Constant and Murley's score.

Methods: This prospective, randomized controlled trial was conducted at Services Hospital, Lahore, over 18 months. A total of 128 patients were randomized into two groups: Group A (Percutaneous Pinning, n=64) and Group B (PHILOS Plating, n=64). Demographic data were recorded, and functional outcomes were assessed using Constant and Murley's score at the 24th week. Data analysis was performed using SPSS 25, with independent t-tests and chi-square tests applied, considering p<0.05 significant.

Results: The mean Constant and Murley score were 84.58 ± 8.561 in Group A and 86.48 ± 7.622 in Group B (p=0.186). Favorable outcomes were seen in 34.4% (n=44) in Group A and 42.2% (n=54) in Group B (p=0.037).

Conclusion: PHILOS plating proved a higher rate of favorable outcomes compared to percutaneous pinning, suggesting its preferable use for proximal humerus fracture management.

INTRODUCTION

Proximal humerus fractures, especially among the elderly and individuals with osteoporotic bones, are becoming increasingly common as the global population ages. These fractures, which make up approximately 5.03% of all fractures, represent a significant burden, both in terms of morbidity and the strain they place on healthcare systems (1). The mechanism of injury often involves low-impact falls in older individuals or high-velocity trauma in younger patients (2). The anatomical complexity of the proximal humerus, particularly the insertion of muscles like the deltoid and subscapularis, can lead to significant lateral deformity in the event of a fracture. This deformity is further complicated by the internal rotation of the articular segment and lesser tuberosity, often requiring advanced imaging techniques such as CT scans for optimal preoperative planning (3). While MRI is rarely necessary, the CT scan offers critical data for determining whether fixation or reconstruction is appropriate (4).

The treatment of proximal humerus fractures has evolved significantly yet remains a topic of debate within orthopaedic surgery. Conservative treatment, which has a high rate of success for non-displaced and minimally displaced fractures, remains the first line of management in many cases, with more than 80% of these injuries showing excellent union rates (4). However, surgical intervention is often required for more complex fractures, particularly those that are displaced or unstable. Among the available

surgical options, the Proximal Humerus Internal Locking System (PHILOS) has become the gold standard, especially for managing fractures in osteoporotic bone (5). Despite its widespread use, the literature remains inconclusive regarding the optimal surgical strategy for proximal humerus fractures, with studies showing variable outcomes based on the type of fixation used. The use of percutaneous pinning and PHILOS plating are two of the most common methods employed for fracture fixation. Both techniques have shown favourable outcomes, but the choice between them often depends on the fracture pattern, patient characteristics, and surgeon preference (6).

Given the lack of consensus and the variations in outcomes across different patient populations, this study aims to compare the functional results of percutaneous pinning and PHILOS plating for proximal humerus fractures using the Constant and Murley score as a measure of functional outcome. The findings of this study could help guide clinical decision-making by providing a clearer understanding of the relative effectiveness of these two treatment modalities in our local patient population.

MATERIAL AND METHODS

This study was conducted as a randomized controlled trial in the Department of Orthopaedic Surgery at Services Hospital, Lahore. The trial was carried out over a period of 18 months, from January 16, 2020, to December 31, 2021. A non-probability consecutive sampling technique was employed to select a total of 128 patients who met the

inclusion and exclusion criteria. The sample size was calculated using the WHO sample size calculator, with 64 patients assigned to each group. Patients of both genders, aged 18 to 65 years, who presented with proximal humeral fractures of Neer's 2-part, 3-part, or 4-part types were included. Patients with pathological fractures due to metastasis, recurrent fractures, advanced osteoarthritis of the shoulder joint, and open type fractures were excluded from the study.

After obtaining approval from the Institutional Review Board (IRB) and ensuring compliance with the principles outlined in the Helsinki Declaration, informed consent was taken from all participants. Demographic details, including age, gender, anatomical side, and fracture type, were documented. The participants were then randomly assigned into two groups using the lottery method. Group A consisted of patients who underwent closed reduction and fixation with Kirschner wires (K-wires) under image intensification, while Group B received open reduction and internal fixation using PHILOS plates under general anaesthesia.

Functional outcomes were evaluated using the Constant and Murley score at 24 weeks postoperatively. Patients with scores classified as "excellent" or "good" were considered to have favourable outcomes. Data collection was done meticulously through direct assessment of patients, and all results were recorded for both quantitative and qualitative variables. Quantitative variables, such as age and Constant and Murley scores, were expressed as means and standard deviations. Qualitative variables, such as gender, anatomical side, and fracture type, were expressed as frequencies and percentages.

Table 1: Age and Gender Distribution

Variable	Percutaneous Pinning (n=64)	PHILOS Plate (n=64)	p-value
Mean Age (years)	55.00 ± 4.339	51.52 ± 7.042	0.023
Male (%)	24 (18.8%)	23 (18.0%)	0.0855
Female (%)	40 (31.2%)	41 (32.0%)	0.0855

In terms of fracture type, 49.2% of patients (n=63) presented with Neer's 2-part fractures, while 50.8% (n=65) had Neer's 3-part fractures. In Group A, 24.2% (n=31) had Neer's 2-part fractures, and 25.8% (n=33) had Neer's 3-part fractures. In

Table 2: Fracture Type Distribution

Fracture Type	Percutaneous Pinning (n=64)	PHILOS Plate (n=64)	p-value
Neer's 2-part fracture	31 (24.2%)	32 (25.0%)	0.860
Neer's 3-part fracture	33 (25.8%)	32 (25.0%)	0.860

The functional outcome, assessed by Constant and Murley's score, was 84.58 ± 8.561 in the Percutaneous Pinning group and 86.48 ± 7.622 in the PHILOS Plate group. Although the PHILOS Plate group had a higher mean score, the difference was not statistically significant (p = 0.186).

Table 3: Functional Outcome (Constant and Murley's Score)

Group	N	Mean Score ± SD	p-value
Percutaneous Pinning	64	84.58 ± 8.561	0.186
PHILOS Plate	64	86.48 ± 7.622	0.186

The data analysis was performed using SPSS version 25. Independent sample t-tests were applied to compare the mean Constant and Murley scores between the two groups, with a p-value of less than 0.05 considered statistically significant. In addition, chi-square tests were employed to compare functional outcomes between the two groups. Stratification of data was conducted according to age, gender, type of fracture, duration of fracture, and anatomical side. For each stratum, the functional outcomes of the two groups were compared using chi-square tests, with a p-value of less than 0.05 considered significant.

The study adhered to ethical standards by maintaining the confidentiality and anonymity of patient data. All patients were provided with comprehensive information about the study's objectives and their right to withdraw at any point. This ensured ethical integrity in line with the Declaration of Helsinki (4).

RESULTS

A total of 128 patients were included in this study, divided equally into two groups: Group A (Percutaneous Pinning) and Group B (PHILOS Plate), with 64 patients in each group. The mean age in Group A was 55.00 ± 4.339 years, while the mean age in Group B was 51.52 ± 7.042 years. The difference in age between the groups was statistically significant (p = 0.023).

The gender distribution in Group A showed 18.8% males (n=24) and 31.2% females (n=40), whereas in Group B, 18.0% were males (n=23) and 32.0% were females (n=41), with a p-value of 0.0855.

Group B, 25.0% (n=32) had Neer's 2-part fractures, and 25.0% (n=32) had Neer's 3-part fractures. The difference in fracture types between the two groups was not statistically significant (p = 0.860).

When evaluating functional outcomes, 14.8% (n=19) in Group A achieved excellent results, 19.5% (n=25) had good results, 11.7% (n=15) had moderate results, and 3.9% (n=5) had poor outcomes. In Group B, 19.5% (n=25) had excellent outcomes, 22.7% (n=29) had good outcomes, 4.7% (n=6)

had moderate outcomes, and 3.1% (n=4) had poor outcomes. The comparison of functional outcomes

between the two groups did not reach statistical significance (p = 0.166).

Table 4: Functional Outcome Distribution

Functional Outcome	Percutaneous Pinning (n=64)	PHILOS Plate (n=64)	Total (N=128)	p-value
Excellent	19 (14.8%)	25 (19.5%)	44 (34.4%)	0.166
Good	25 (19.5%)	29 (22.7%)	54 (42.2%)	0.166
Moderate	15 (11.7%)	6 (4.7%)	21 (16.4%)	0.166
Poor	5 (3.9%)	4 (3.1%)	9 (7.0%)	0.166

The overall favourable outcome, defined as either excellent or good, was observed in 34.4% (n=44) of patients in Group

A and 42.2% (n=54) in Group B, with a p-value of 0.037, indicating a statistically significant difference.

Table 5: Favourable Outcome Distribution

Group	Favourable Outcome (n)	Percentage (%)	p-value
Percutaneous Pinning	44	34.4%	0.037
PHILOS Plate	54	42.2%	0.037

The results demonstrate that while both treatment methods resulted in favourable outcomes, patients treated with PHILOS plates had a statistically significant higher rate of favourable outcomes compared to those treated with percutaneous pinning (p = 0.037). Age and fracture type did not significantly impact the functional outcomes between the two groups.

DISCUSSION

Proximal humerus fractures are a common injury, particularly in the elderly population, and their management has been widely debated. The current study aimed to compare the functional outcomes of proximal humerus fractures managed with percutaneous pinning versus PHILOS plating, utilizing the Constant and Murley score as a measure of functional recovery. Our findings demonstrated that while both techniques produced favourable outcomes, the PHILOS plating group showed a significantly higher proportion of favourable results compared to the percutaneous pinning group (p=0.037).

The mean Constant and Murley scores in both groups were comparable, with 84.58 ± 8.561 in the percutaneous pinning group and 86.48 ± 7.622 in the PHILOS group. Although the difference in scores was not statistically significant (p=0.186), the PHILOS group had a slightly higher mean score, indicating a trend toward better functional outcomes. This finding is consistent with the literature, where PHILOS plating has been shown to provide more stable fixation, particularly in osteoporotic bone, and to result in improved functional recovery (5)(6). Previous studies, such as those by Agudelo et al. and Brunner et al., also support the use of locking plates like PHILOS in the management of proximal humerus fractures, particularly in complex fractures or those involving osteoporotic bone (4, 5).

The strengths of the current study include its randomized controlled design and the use of a standardized outcome measure, Constant and Murley score, which allows for objective comparison of functional outcomes. Additionally, the study sample was sufficient to detect significant differences in functional outcomes, as evidenced by the statistically significant result in favour of PHILOS plating.

However, there are several limitations that must be acknowledged. First, the follow-up period of 24 weeks may not have been sufficient to capture long-term complications, such as avascular necrosis or secondary osteoarthritis, which are known to occur after proximal humerus fractures (14). A longer follow-up period could provide more comprehensive data on these complications. Furthermore, the study did not account for the severity of osteoporosis, which may have influenced the functional outcomes in both groups. Osteoporotic bone presents unique challenges in fracture fixation, and patients with severe osteoporosis may have benefitted more from the stability provided by the PHILOS plate (6).

Another limitation was the exclusion of certain fixation techniques, such as the use of threaded K-wires or additional screws, which have been shown to enhance stability in some studies. The inclusion of these techniques may have altered the outcomes for the percutaneous pinning group, as previous research has suggested that combining wires with other methods can improve fracture reduction and stability (7)(16). Furthermore, the study did not assess patient-reported outcomes or quality of life, which are important considerations in the management of proximal humerus fractures, particularly in the elderly population. Future studies should incorporate these measures to provide a more holistic understanding of the impact of different fixation techniques on patient well-being (7). Despite these limitations, the study contributes valuable data to the ongoing debate regarding the optimal surgical management of proximal humerus fractures. The results suggest that PHILOS plating is associated with a higher likelihood of favorable functional outcomes, making it a desirable option, particularly in patients with more complex fractures or osteoporotic bone. Percutaneous pinning may still be a viable option in low-demand patients or those with less complex fractures, as it offers shorter surgical times and less invasive procedures (16, 17).

CONCLUSION

In conclusion, the study supports the use of PHILOS plating for the management of proximal humerus fractures,

particularly in cases where stable fixation is essential for functional recovery. Further research with longer follow-up periods and the inclusion of patient-reported outcomes is recommended to provide a more comprehensive assessment of the long-term effectiveness of these treatment modalities.

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