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Original Research Article

STUDY OF FUNCTIONAL OUTCOME OF PHILOS PLATING IN NEER'S TYPE II, III, IV PROXIMAL HUMERUS FRACTURES IN YOUNG ADULTS AND ELDERLY PATIENTS

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ABSTRACT

Background: Proximal humerus fractures (PHFs) are the second most common fractures of the upper extremity, with increasing incidence, especially in osteoporotic elderly women. The management of significantly displaced Neer's Type II, III, and IV fractures remains controversial due to high failure rates with conventional fixation methods. Proximal Humerus Internal Locking System (PHILOS) plates have been proposed as a reliable alternative, offering angular stability and better fixation in osteoporotic bone. **Objective**: To evaluate the functional outcomes and complications of PHILOS plating in Type II, III, and IV proximal humerus fractures in young and elderly patients. **Materials and Methods:** This prospective analytical study included 39 patients (20 males, 19 females) with displaced Neer's Type II, III, IV proximal humerus fractures treated with PHILOS plates at KIMS General Hospital, Amalapuram (February 2022 – October 2024). Open reduction and internal fixation (ORIF) was performed using the deltopectoral approach. Functional outcomes were assessed at 6 months using Constant and Murley scoring system. Complications and reoperation rates were documented. **Results:** Fracture union was achieved in 28 patients by 12 weeks, 8 by 14 weeks, and 2 by 16 weeks. Excellent results were observed in 5 (12.82%), good in 30 (76.92%), satisfactory in 3 (7.69%), and poor in 1 (2.56%) patient. The mean Constant & Murley score was 74. Complication rate was 20.51%, including screw cut out (5.12%), AVN (2.56%), impingement (2.56%), superficial infection (2.56%), delayed union (5.12%), and stiffness (2.56%). Reoperation rate was 10.25%. **Conclusion:** PHILOS plating offers a reliable and effective method for managing complex proximal humerus fractures, yielding excellent to good functional outcomes with a low complication profile when precise surgical techniques are employed.

INTRODUCTION

Proximal humerus fractures (PHFs) are the second most common fractures of the upper extremity, accounting for approximately 4–5% of all fractures and nearly 25% of humeral fractures.[1] Over the past three decades, the incidence of PHFs has significantly increased, driven by the aging population and the escalating prevalence of osteoporosis, particularly among postmenopausal women.[1,2] These fractures exhibit a characteristic bimodal distribution: high-energy trauma, such as road traffic accidents, predominantly affects young adults, while low-energy mechanisms, such as simple falls from standing height, are the main cause in elderly individuals.[1,3]

Although nearly 80% of PHFs are minimally displaced and amenable to conservative management, a significant proportion—especially those categorized as Neer's Type II, III, and IV—require surgical intervention due to displacement or angulation exceeding 1 cm and 45 degrees, respectively.[2,3] Non-operative management of such complex fractures is associated with high rates of malunion, nonunion, shoulder stiffness, and functional impairment.[3,4]

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Multiple surgical modalities have been proposed for PHF fixation, including percutaneous pinning, tension band wiring, non-locking plates, intramedullary nails, hemiarthroplasty, and reverse total shoulder arthroplasty.[3,4] However, conventional fixation methods, particularly in osteoporotic bone, are fraught with complications such as implant failure, screw cut-out, varus collapse, and poor functional recovery.[4]

The Proximal Humerus Internal Locking System (PHILOS) plate has emerged as a biomechanically superior fixation option. Its anatomically contoured design and angular stable locking mechanism ensure robust fixation even in osteoporotic bone, providing enhanced stability, reduced soft tissue disruption, and favorable functional outcomes.[5,6] Nevertheless, the success of PHILOS plating is highly contingent upon meticulous surgical technique and appropriate patient selection.

Despite its growing use, consensus on the optimal surgical approach and long-term outcomes with PHILOS plating remains limited. This study aims to evaluate the functional outcome and complication profile of PHILOS plating in Neer's Type II, III, and IV proximal humerus fractures among young adults and elderly patients in a rural Indian setting.

MATERIALS AND METHODS

This prospective analytical observational study was conducted at the Department of Orthopedics, KIMS General Hospital & Medical College, Amalapuram, Andhra Pradesh, from February 2022 to October 2024. A total of 39 patients with displaced proximal humerus fractures classified as Neer's Type II, III, or IV were enrolled based on predefined inclusion and exclusion criteria.

Inclusion Criteria

Patients aged between 18 to 80 years.

Closed proximal humerus fractures with displacement >1 cm or angulation >45 degrees (Neer's Type II, III, IV).

Patients willing to provide informed consent and comply with postoperative physiotherapy and follow-up.

Exclusion Criteria

Compound fractures (all grades).

Neer's Type I fractures.

Pathological fractures.

Fracture-dislocations or fractures with neurovascular compromise.

Patients with uncontrolled systemic illnesses or neuromuscular disorders.

Unwillingness to participate in follow-up.

Surgical Technique

All patients underwent open reduction and internal fixation (ORIF) with a PHILOS plate through the standard deltopectoral approach. Intraoperative reduction was achieved by restoring the medial calcar support, correcting varus/valgus malalignment, and securing both tuberosities with non-absorbable ethibond sutures passed through plate holes for added stability. Screw placement, especially calcar screws, was meticulously planned under fluoroscopic guidance to ensure angular stability and prevent articular penetration.

Postoperative Protocol:

All patients were immobilized in a shoulder immobilizer for four weeks. Passive and assisted range of motion (ROM) exercises commenced after four weeks, progressing to active ROM and strengthening exercises from 8 to 12 weeks postoperatively.

Follow-up and Assessment:

Radiological evaluations were performed postoperatively at 3 weeks, 6 weeks, 12 weeks, and at 6 months to assess fracture union. Functional outcomes were evaluated at 6 months using the Constant and Murley Shoulder Score. Complications and reoperations were documented.

Statistical Analysis

Data analysis was performed using SPSS software with a p-value <0.05 considered statistically significant..

RESULTS

This study included 39 patients with displaced proximal humerus fractures classified as Neer's Type II (n=4; 10.25%), Type III (n=23; 58.97%), and Type IV (n=12; 30.76%). The study population comprised 20 males (51.28%) and 19 females (48.71%), with a mean age of 54 years (range: 27–80 years). The predominant mechanism of injury was self-fall (53.84%), followed by road traffic accidents (46.15%). Right-sided fractures were observed in 21 patients (53.84%) and left-sided fractures in 18 patients (46.15%).

Radiological union was achieved in:

28 patients (71.79%) within 12 weeks,

8 patients (20.51%) by 14 weeks,

2 patients (5.12%) demonstrated delayed union, consolidating by 16 weeks.

Functional outcomes at six months, assessed using the Constant and Murley scoring system, revealed:

Excellent results in 5 patients (12.82%),

Good results in 30 patients (76.92%),

Satisfactory results in 3 patients (7.69%),

Poor result in 1 patient (2.56%).

The mean Constant and Murley score for the cohort was 74.

A total of 8 complications (20.51%) were recorded:

Screw cut-out: 2 patients (5.12%),

Avascular necrosis (AVN): 1 patient (2.56%),

Subacromial impingement: 1 patient (2.56%),

Superficial surgical site infection: 1 patient (2.56%),

Delayed union: 2 patients (5.12%),

Severe shoulder stiffness: 1 patient (2.56%).

Reoperation was required in 4 patients (10.25%)—specifically for AVN (1 patient), screw cut-out (2 patients), and impingement (1 patient). Superficial

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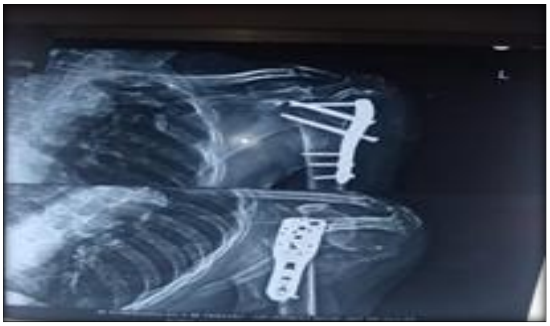
infections were managed conservatively with targeted antibiotics.

Figure 1: Clinical photo at 6 months showing functional status Excellent C& M score 86

Fig 2 Good functional score C &M score 75

Fig 3 Satisfactory functional score-C&M score -68

Figure 4: Fracture healed at 12 weeks



Complication-screw cut out

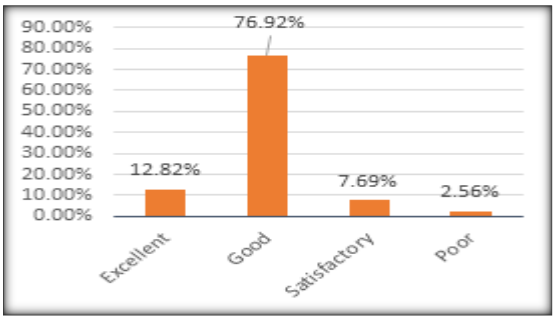


Figure 5: Our series Result

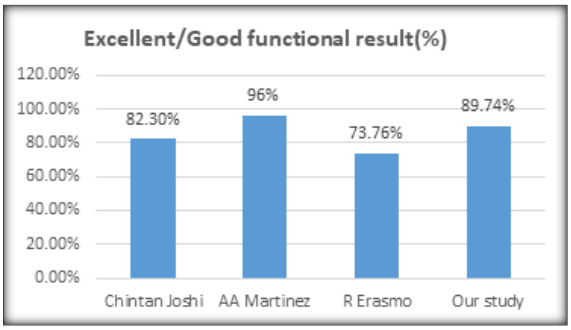


Figure 6: Comparison with the result published earlier

Table 1: Functional result chart

Result	Chintan Joshi	AA Martinez	R Erasmo	Our Series
Excellent	13.30%	24%	9.57%	12.82%
Good	69.00%	72%	64.19%	76.92%
satisfactory	11.72%	0%	20.98	7.69
Poor	5.66%	4%	6.17%	2.56%

DISCUSSION

The management of displaced proximal humerus fractures, particularly Neer's Type II, III, and IV, continues to pose significant clinical challenges, especially in elderly osteoporotic patients. Conventional fixation methods, including non-locking plates and intramedullary nails, often fail to

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achieve stable fixation in osteoporotic bone, resulting in high rates of malunion, nonunion, implant failure, and compromised shoulder function.[7,8]

In our prospective study involving 39 patients treated with PHILOS plating, we observed a fracture union rate of 94.87% within 16 weeks, with excellent to good functional outcomes achieved in 89.74% of cases. These findings align closely with the outcomes reported by Erasmo et al., who demonstrated successful functional restoration in 85% of their cohort using PHILOS plates.[7] The mean Constant and Murley score in our series was 74, comparable to global benchmarks, reinforcing the validity of PHILOS plating as an effective fixation method for complex proximal humerus fractures.[14]

The biomechanical superiority of PHILOS plates is attributed to their anatomically contoured design, locking mechanism, and angular stability, which collectively facilitate effective load distribution and minimize complications such as varus collapse and screw cut-out.[8,9] Stone et al. emphasized that adjunctive measures like fibular strut graft augmentation further enhance medial column support and construct stability in comminuted fractures, particularly in severely osteoporotic bone.[8]

Despite its advantages, the success of PHILOS fixation is highly technique-dependent. The quality of fracture reduction has been consistently identified as a critical predictor of functional outcomes. Schnetzke et al. demonstrated that anatomical reduction directly correlates with improved Constant scores and lower complication rates.[10] In our study, the meticulous restoration of the medial calcar support, proper screw trajectory, and plate positioning were pivotal in reducing mechanical failures.

The complication rate in our series was 20.51%, with screw cut-out observed in 5.12% and avascular necrosis (AVN) in 2.56% of patients. This is consistent with the complication profiles reported by Beeres et al., who documented an overall complication rate of 23% in a multicentric comparative study of plate fixation techniques.[12] Gardner et al. highlighted the essential role of medial calcar support, noting that insufficient medial buttress significantly increases the risk of implant failure and varus collapse.[11] In our series, careful calcar screw placement within 12 mm of the humeral head-neck junction minimized the risk of such complications.

Reoperation was necessitated in 10.25% of patients, primarily due to implant-related issues, a rate lower than the 14–18% reoperation rates reported in broader multicenter studies.[12] Cosic et al. identified key factors associated with PHILOS fixation failures, including inadequate medial hinge restoration, varus malalignment, and insufficient screw purchase, which were meticulously addressed in our surgical protocol.[13]

Moreover, structured physiotherapy, initiated in a phased manner, played a crucial role in functional recovery. Early initiation of passive and assisted range of motion exercises, followed by gradual progression to active strengthening, significantly reduced postoperative stiffness and enhanced shoulder mobility, corroborating the rehabilitation protocols emphasized in the literature.[14]

Nevertheless, PHILOS fixation is not devoid of limitations. Risks such as intra-articular screw penetration, subacromial impingement, and late-onset AVN necessitate a comprehensive preoperative assessment and precise surgical execution.[7,10,11] Furthermore, complex fractures with severe comminution or poor bone quality may benefit from additional augmentation techniques, such as fibular strut grafts, cement augmentation of the screws to further enhance construct stability.[8,9]

Limitations

This study is limited by its small sample size, single-center design, and short-term follow-up of six months. The absence of a comparative control group restricts broader generalization. Additionally, the study population was predominantly rural, which may influence injury patterns and rehabilitation adherence compared to urban populations.

CONCLUSION

The management of displaced Neer's Type II, III, and IV proximal humerus fractures remains challenging, particularly in osteoporotic bone. This study demonstrated that PHILOS plating provides a reliable and biomechanically stable fixation method, offering excellent to good functional outcomes in 89.74% of patients with a mean Constant & Murley score of 74. The complication and reoperation rates were notably low, attributed to meticulous surgical technique, proper implant positioning, and adherence to a structured physiotherapy protocol. PHILOS plates, with their angular stability and anatomical contouring, serve as a valuable fixation option for complex proximal humerus fractures, provided patient selection is judicious and technical precision is ensured.

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