

Original Research Article

A study of the functional assessment of the outcomes of proximal humerus fractures treated with the proximal humerus internal locking system

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Received: 28 October 2025

Revised: 08 December 2025

Accepted: 09 December 2025

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ABSTRACT

Background: Proximal humerus fractures are common in adults, particularly in elderly individuals with osteoporosis. Modern fixation systems such as the PHILOS (Proximal Humerus Internal Locking System) plate aim to improve stability, reduce complications and facilitate early mobilisation. To assess the functional outcomes of displaced proximal humerus fractures managed with PHILOS plating in a tertiary care hospital.

Methods: This prospective observational study included skeletally mature adults (>18 years) with displaced proximal humerus fractures who underwent open reduction and internal fixation using PHILOS plating between July 2020 and July 2021. Exclusion criteria included open fractures, undisplaced fractures, fracture-dislocations limited to tuberosity, neurovascular injury and medical unfitness. Follow-up at 2, 6, 8 and 12 weeks assessed radiological union and functional recovery using the Constant–Murley Score. Data analysis was performed using IBM SPSS Statistics for Windows, Version 26.0.

Results: Fifty–three patients were included with a mean age of 50 years and a male–to–female ratio of 4:1. Road traffic accidents accounted for 58.5% of injuries. Radiological union was confirmed in 96% by 12 weeks. Functional outcomes were good in 13 patients, moderate in 35 and poor in 5. Superficial wound infection occurred in 3 patients and implant failure in 1.

Conclusions: PHILOS plating provides stable fixation with predominantly moderate to good short-term functional outcomes and low complication rates in displaced proximal humerus fractures.

Keywords: Constant–Murley score, Functional outcome, Internal fixation, Proximal humerus fracture, PHILOS plate

INTRODUCTION

Proximal humerus fractures constitute nearly 5% of all fractures and are a major cause of disability, especially among elderly individuals due to osteoporosis and increased risk of falls.¹ In younger age groups, these fractures usually result from high-energy trauma such as road traffic accidents.² With rising life expectancy, their incidence is steadily increasing.³ Minimally displaced fractures can be treated conservatively however, displaced

and unstable fractures often require surgical intervention.⁴ Traditional fixation devices such as K-wires and plates are associated with complications like screw loosening, non-union and implant failure, particularly in osteoporotic bone.^{5,6} The PHILOS plate was developed to provide stable angular fixation through locking screws, minimize soft-tissue damage, secure tuberosity fixation using suture-holes and allow early mobilisation, which is crucial for optimal functional recovery.^{7,8} Nevertheless, the literature reports variable outcomes depending on fracture type,

bone quality and surgical expertise.^{9,10} The present study evaluates the functional and radiological outcomes following PHILOS plating in displaced proximal humerus fractures treated at a tertiary care institute in India.

METHODS

Study design

Prospective observational study conducted from July 2020 to July 2021 at B. J. Government Medical College and Sassoon General Hospital, Pune.

Inclusion criteria

Age>18 years, Displaced 2-part, 3-part and 4-part proximal humerus fractures

Exclusion criteria

Open fractures, undisplaced fractures, isolated tuberosity fractures, associated neurovascular injury, severe medical comorbidities preventing surgery

Surgical procedure

All cases underwent open reduction and internal fixation using PHILOS plating via a standard deltopectoral approach under general anaesthesia. Temporary fixation was achieved using K-wires or sutures, followed by locking screw placement. Rotator cuff sutures were passed through plate eyelets for tuberosity stability. Passive mobilisation was started early based on patient tolerance.

Follow-up and outcome measurements

Patients were followed at 2, 6, 8 and 12 weeks with radiographs to assess union. Functional outcomes were assessed using Constant–Murley Score at 12 weeks.

Statistical analysis

Data were analysed using IBM SPSS Statistics for Windows, Version 26.0.

RESULTS

The study included 53 patients with a mean age of 50 years, predominantly males (81%). Road traffic accidents were the most common mode of injury (58.5%), followed by domestic falls (41.5%). The majority of fractures were 3-part injuries (62%), indicating an overall higher incidence of more complex fracture patterns in the study population.

The average operative duration was 112 minutes, reflecting the technical demand of the procedure. Most patients (96%) achieved radiological union by 12 weeks, demonstrating a high success rate of fixation stability.

Postoperative complications were few and included superficial wound infections (5.7%) and implant failure (1.9%). These findings highlight that PHILOS plating offers reliable fixation with a low complication profile.

At 12-week follow-up, functional assessment using the Constant–Murley Score showed that 90.5% of patients achieved moderate to good outcomes. Specifically, 24.5% demonstrated good recovery while 66% exhibited moderate functional performance. Only 9.5% had poor outcomes, with a mean constant score of 65.66. These results suggest satisfactory short-term functional restoration following PHILOS fixation.

Table 1: Demographic and injury profile.

Parameter	Value
Mean age (in years)	50 years (20–78)
Sex distribution	Male: 43, Female: 10
Mode of injury	RTA: 31 (58.5%), Domestic fall: 22 (41.5%)
Fracture type	2-part: 5, 3-part: 33, 4-part: 15

Table 2: Operative and clinical outcomes.

Parameter	Value
Mean operative time	112 minutes (88–140)
Radiological union	96% at 12 weeks
Complications	Superficial infection: 3, Implant failure: 1

Table 3: Functional outcomes at 12 weeks.

Functional grade	No. of patients (%)
Good	13 (24.5)
Moderate	35 (66)
Poor	5 (9.5)
Mean constant score	65.66 (50–82)

DISCUSSION

The present study demonstrates the effectiveness of PHILOS plating as a reliable method for managing displaced proximal humerus fractures. The high radiological union rate (96% at 12 weeks) reflects the enhanced stability provided by the locking plate design, particularly beneficial in osteoporotic bone.^{2,5}

Functional outcomes were predominantly moderate to good, comparable to previous literature showing better results in younger and more compliant patient groups.^{7,9,10} Early mobilisation helped reduce shoulder stiffness and improved recovery. Complication rates were low and mainly minor. Implant failure occurred in one patient, possibly due to technical difficulty or compromised bone quality. The superficial infections responded well to antibiotic therapy.

Limitations

Limitations include a short follow-up period and non-comparative design, which do not capture late complications like avascular necrosis. A multicentric randomised study with long-term follow-up is suggested for further validation.

CONCLUSION

PHILOS plating offers stable fixation, early mobilisation and satisfactory short-term functional outcomes with minimal complications in displaced proximal humerus fractures. It remains a preferred method of surgical management, especially in osteoporotic bone.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Yadav V, Gujar H, Pathak R. A study of the functional assessment of the outcomes of proximal humerus fractures treated with the proximal humerus internal locking system. *Int J Res Orthop* 2026;12:66-8.