**DOI:** 10.21088/joe.2454a.7956.11325.1

Journal of Orthopedic Education
Volume 11 Number 3, September-December 2025

ORIGINAL ARTICLE

# A Comparative Study to assess the Functional Outcome with Proximal Humerus Locking Plate Versus Primary Hemiarthroplasty for Proximal Humerus Fractures

**Arnav P. Rathod[1], Yogesh B. Rathod[2], Rajendra Baitule[3], Ganesh Pundkar[4]**

**HOW TO CITE THIS ARTICLE:**

***Arnav P. Rathod, Yogesh B. Rathod, Rajendra Baitule, et al.*** A Comparative Study to Assess the Functional Outcome with Proximal Humerus Locking Plate Versus Primary Hemiarthroplasty for Proximal Humerus Fractures. Jr. Orth. Edu. 2025; 11(3): 79–84.

## ABSTRACT

***Background:*** The choice of surgical management significantly influences the functional recovery of the shoulder. Locking plate fixation and primary hemiarthroplasty are two widely practiced modalities for managing complex proximal humerus fractures, particularly Neer's 3 and 4 part types.

***Objective:*** To evaluate and compare the functional outcomes of proximal humerus fractures treated with proximal humerus locking plate fixation versus primary hemiarthroplasty.

***Methods:*** This prospective comparative study was conducted at Dr. PDMMC, Amravati. Among a total of 50 patients with displaced 3 or 4 part proximal humerus fractures were enrolled and divided into two groups: Group A (n=25) treated with proximal humerus locking plate, and Group B (n=25) treated with primary hemiarthroplasty. Patients were followed up at regular intervals, and functional outcomes were assessed using the Modified UCLA Shoulder Score and shoulder range of motion measurements.

***Results:*** Both treatment modalities led to satisfactory outcomes; however, the locking plate group demonstrated superior results in terms of range of motion, patient satisfaction, and overall functional scores. The hemiarthroplasty group showed more consistent results in elderly patients with complex fracture pattern and lower functional demands with osteopenic bones.

**AUTHOR'S AFFILIATION:**

[1] Resident, Department of Orthopedics, Dr. Panjabrao Deshmukh Memorial Medical College and Hospital, Amravati, Maharashtra, India.

[2] Assistant Professor, Department of Orthopedics, Dr. Panjabrao Deshmukh Memorial Medical College and Hospital, Amravati, Maharashtra, India.

[3] Professor, Department of Orthopedics, Dr. Panjabrao Deshmukh Memorial Medical College and Hospital, Amravati, Maharashtra, India.

[4] Head of Department & Professor, Department of Orthopedics, Dr. Panjabrao Deshmukh Memorial Medical College and Hospital, Amravati, Maharashtra, India.

**CORRESPONDING AUTHOR:**

**Yogesh B. Rathod,** Assistant Professor, Department of Orthopedics, Dr. Panjabrao Deshmukh Memorial Medical College and Hospital, Amravati, Maharashtra, India.

**E-mail:** yogesh 14488@gmail.com

➢ **Received:** 09-07-2025 ➢ **Accepted:** 11-08-2025

***Conclusion:*** Locking plate fixation provides better functional outcomes and range of motion compared to hemiarthroplasty in selected patients with proximal humerus fractures, especially in younger individuals with good bone quality.

**KEYWORDS**

• Locking Plate • Hemiarthroplasty • Proximal Humerus • UCLA Score • Range of motion

## INTRODUCTION

Fractures of the proximal humerus (PHF) represent approximately 5-6% of all fractures in adults.[1] Increasing attention is being given to the management of these fractures in older individuals after low-energy falls, as they play a significant role in the global impact of osteoporosis and fragility-related injuries.[2,3]

PHFs typically exhibit a bimodal distribution based on age and the energy involved in the injury. Clinicians should be aware of this pattern, distinguishing between high-energy incidents (such as motor vehicle accidents in younger patients) and low-energy events (like ground-level falls in elderly patients) when addressing these fractures.[4,5]

Hemiarthroplasty has emerged as a preferred treatment over ORIF for elderly patients with complex proximal humerus fractures. While ORIF aims to preserve the native anatomy and may offer better early range of motion, it carries higher risks of complications and reoperations, particularly in osteoporotic bone. Hemiarthroplasty, on the other hand, provides more reliable long-term outcomes, including improved forward flexion and lower revision rates, making it a favorable option for patients over 65 with three or four-part fractures. However, Hemiarthroplasty may result in reduced external rotation and has concerns regarding prosthesis longevity in younger, active individuals. Therefore, the choice between ORIF and RTSA should be individualized, considering factors such as patient age, bone quality, fracture complexity, and functional demands.[6]

There is a void in the literature directly regarding comparision of outcomes of hemiarthroplasty and locking compression plate fixation in terms of range of motion, pain relief, patient satisfaction, and overall functional results. However, locking compression plate fixation technique is associated with higher rates of complications, including implant failure, avascular necrosis, and the need for revision surgeries.[7] The current study was designed to evaluate and compare the surgical outcomes of two treatment modalities proximal humerus locking plate fixation and primary hemiarthroplasty in managing 3 and 4-part proximal humerus fractures. The study aims to determine whether one approach offers superior results over the other in the treatment of these complex fractures by assessing postoperative functional outcomes.

### Aims & Objectives

To assess the functional outcome of using proximal humerus locking plate & primary hemiarthroplasty for proximal humerus fractures & To compare Range of Motion at various follow ups for proximal humerus locking plate and primary shoulder hemiarthroplasty.

## MATERIALS AND METHODS

Observational study was conducted in Department of Orthopedics among on patients with proximal humerus fractures. The patients were divided into 2 groups for study purpose

*Group 1:* Patients who were managed by proximal humerus locking plate.

*Group 2:* Patients who were managed by primary hemiarthroplasty shoulder.

**Inclusion criteria:** Patients above 18 years of age, Patients should present with three or four-part proximal humerus fracture, Closed fractures

**Exclusion criteria:** Patients presenting with one or two-part humerus fracture, Patients with neurological or psychiatric disorders, Patients not giving consent, Open fractures, Associated glenoid fractures, Loss to follow up/dead were excluded

A period-based study was conducted on a total of 50 cases. Simple Random sampling technique was used.

**Method of Collection of Data**: A comprehensive history was collected using a study proforma, with particular focus on the mechanism of injury. Baseline clinical features and associated symptoms were evaluated through detailed history and physical examination. Data were gathered from patients presenting with proximal humerus fractures as follows. The fracture was classified according to Neer's classification.

### Surgical Technique

***Locking Plate (PHILOS Plating):*** The deltopectoral approach was employed, involving an incision from the coracoid process toward the deltoid attachment along the deltopectoral groove. Deep dissection identified and laterally reflected the cephalic vein, exposing the fracture site. The fracture hematoma was cleared after locating the subdeltoid space. The fracture was reduced and temporarily stabilized with Kirschner wires, with adequate reduction confirmed via image intensification. The locking plate was positioned 5–8 mm distal to the upper edge of the greater tuberosity and 2 mm posterior to the bicipital groove, ensuring a sufficient gap between the plate and the long head of the biceps tendon. Once fracture reduction and screw positioning were deemed satisfactory, the plate was secured with angular stable screws in the humeral head. Final fluoroscopic visualization confirmed the placement.

### Surgical Procedure

***Hemiarthroplasty:*** The same deltopectoral approach was used. The short head of the biceps and coracobrachialis muscle were displaced medially to access the anterior shoulder joint. The greater and lesser tuberosities were retracted using Ethibond sutures. The fractured humeral head was removed with a bone clamp, and its height and diameter were measured using a humeral head template to select a matching humeral head component. The medullary canal was prepared through sequential reaming, and a trial was conducted to ensure accurate sizing and placement, with the elbow at 90-degree flexion, parallel to the floor, and in zero-degree rotation while maintaining 30-degree retroversion. The appropriately sized implant was inserted using bone cement, and the greater and lesser tuberosities were secured to the implant with non-absorbable sutures. The incision was closed in layers, and a post-operative X-ray was performed.

**Postoperative Rehabilitation:** Both groups followed an identical rehabilitation protocol. The affected limb was immobilized in a shoulder immobilizer for the first two weeks. Following immobilization, patients performed Phase I exercises for two weeks to enhance grip strength and elbow range of motion (ROM).

**Study Tool**: Modified UCLA score was used to quantify functional outcome.

## RESULTS

**Table 1:** Agewise Distribution of Patients

| Age | Group | | Total |
|---|---|---|---|
| | Locking Plate | Hemiarthroplasty | |
| 30-40 years | 3 | 1 | 4 |
| 40-50 years | 3 | 3 | 6 |
| 50-60 years | 7 | 7 | 14 |
| 60-70 years | 6 | 10 | 16 |
| 70-80 years | 4 | 4 | 8 |
| 80-90 years | 2 | 0 | 2 |
| **Total** | **25** | **25** | **50** |
| **P-Value** | Chi sq-9.03, p- 0.534 Insignificant | | |

In younger age groups (30–60 years), Locking Plate fixation was more commonly employed. In the 60–70 age group, Hemiarthroplasty was more prevalent. In the oldest age group (80–90 years), only Locking Plate fixation was used. p-value is >0.05, the result is statistically insignificant.

**Table 2:** Distribution of Patients According to Mode of Injury

| Mode of Injury | Group | | Total |
|---|---|---|---|
| | Locking Plate | Hemiarthroplasty | |
| Direct Fall | 10 | 8 | 18 |
| RTA | 15 | 17 | 32 |
| **Total** | 25 | 25 | 50 |

Among patients injured by direct falls, 10 were treated with Locking Plates and 8 with Hemiarthroplasty. In contrast, among those injured in RTAs, 15 received Locking Plate fixation and 17 underwent Hemiarthroplasty.

**Table 3:** Mean Total UCLA Score at Different Time Intervals

| Time Interval | Mean Total UCLA Score | | P Value |
|---|---|---|---|
| | Hemiarthroplasty | Locking Plate | |
| | Mean score± SD | Mean score± SD | |
| 1 Month | 12.21 ± 4.57 | 15.11 ± 4.47 | 0.003 |
| 3 Month | 16.12 ± 2.74 | 20.28 ± 3.86 | 0.001 |
| 6 Month | 19.12 ± 3.16 | 23.21 ± 3.87 | 0.002 |
| 12 Month | 25.38 ± 4.79 | 29.15 ± 4.43 | 0.001 |

At each post-operative interval 1, 3, 6, and 12 months patients treated with Locking Plate fixation demonstrated higher mean UCLA scores compared to those who underwent Hemiarthroplasty. Specifically, at 1 month, the mean scores were 15.11 ± 4.47 for Locking Plate and 12.21 ± 4.57 for Hemiarthroplasty (p = 0.003). This trend continued at 3 months (20.28 ± 3.86 vs. 16.12 ± 2.74; p = 0.001), 6 months (23.21 ± 3.87 vs. 19.12 ± 3.16; p = 0.002), and 12 months (29.15 ± 4.43 vs. 25.38 ± 4.79; p = 0.001). The p-values at each interval indicate that these differences are statistically significant, suggesting a consistent advantage of Locking Plate fixation over Hemiarthroplasty in terms of functional recovery.

**Table 4:** Functional Outcome at Different Time Interval

| Time Interval | Functional Outcome | Locking Plate | Hemiarthroplasty | P Value |
|---|---|---|---|---|
| 1 Months | Excellent | 0 | 0 | |
| | Good | 0 | 0 | p-0.432 Insignificant |
| | Fair | 5 | 3 | |
| | Poor | 20 | 22 | |
| 3 Months | Excellent | 0 | 0 | |
| | Good | 2 | 0 | p-0.02 Significant |
| | Fair | 06 | 6 | |
| | Poor | 17 | 19 | |
| 6 Months | Excellent | 0 | 0 | |
| | Good | 8 | 0 | p-0.001 Significant |
| | Fair | 12 | 14 | |
| | Poor | 5 | 11 | |
| 12 Months | Excellent | 13 | 7 | |
| | Good | 8 | 11 | p-0.03 Significant |
| | Fair | 3 | 6 | |
| | Poor | 1 | 1 | |

The table compares functional outcomes of patients treated with Locking Plate fixation versus Hemiarthroplasty for shoulder injuries over a 12-month period. At 1 month, both groups predominantly exhibited poor outcomes, with no significant difference (p = 0.432). By 3 months, the Locking Plate group showed slight improvement, with some patients achieving good or fair outcomes, while the Hemiarthroplasty group remained largely poor; this difference was statistically significant (p = 0.02). At 6 months, the Locking Plate group continued to improve, with more patients reaching good or fair outcomes, whereas the Hemiarthroplasty group had fewer good outcomes and more poor ones, indicating a significant advantage for Locking Plate fixation (p = 0.001). By 12 months, the Locking Plate group had a higher number of patients with excellent outcomes compared to the Hemiarthroplasty group, with the difference remaining statistically significant (p = 0.03).

## DISCUSSION

The comparative analysis of functional outcomes between Locking Plate fixation and Hemiarthroplasty for proximal humerus fractures reveals a consistent advantage for Locking Plate fixation over a 12-month postoperative period. Patients treated with Locking Plate fixation demonstrated significantly higher mean UCLA Shoulder Scores at each interval 1, 3, 6, and 12 months indicating superior shoulder function and patient satisfaction compared to those who underwent Hemiarthroplasty. These findings suggest that Locking Plate fixation may facilitate more effective anatomical restoration and early mobilization, leading to improved functional recovery. However, it's important to consider individual patient factors such as age, bone quality, and fracture complexity when selecting the appropriate surgical intervention. Further research, including randomized controlled trials with larger sample sizes, is warranted to validate these results and inform clinical decision-making. The comparative analysis of Locking Plate fixation versus Hemiarthroplasty for proximal humerus fractures reveals distinct differences in functional outcomes over a 12-month period. Initially, at the 1-month postoperative mark, both groups exhibited predominantly poor outcomes, with no statistically significant difference ($p = 0.432$). However, from the 3-month follow-up onward, patients treated with Locking Plate fixation demonstrated progressively better functional outcomes compared to those who underwent Hemiarthroplasty, with statistically significant differences observed at 3 months ($p = 0.02$), 6 months ($p = 0.001$), and 12 months ($p = 0.03$). These findings suggest that Locking Plate fixation may offer superior functional recovery in the medium to long term.

Supporting these observations, a study by Deng *et al*[7]. indicates that while both surgical methods are utilized for proximal humerus fractures, Locking Plate fixation has become increasingly favored due to advancements in internal fixation technology, offering improved outcomes in certain patient populations. Conversely, Hemiarthroplasty has been associated with higher rates of postoperative complications and less satisfactory joint function in some cases. Therefore, while both surgical options remain viable, the choice of treatment should be individualized, taking into account patient specific factors such as age, bone quality, fracture complexity, and surgeon expertise. The incidence and types of complications vary from one document to another, such as fracture nonunion, dislocation, infection, avascular necrosis (AVN), internal fixation, or prosthesis loosening or rupture.[8,9]

## CONCLUSION

In conclusion, the comparative analysis of Locking Plate fixation and Hemiarthroplasty for proximal humerus fractures indicates that Locking Plate fixation generally leads to better functional outcomes, as evidenced by higher mean UCLA Shoulder Scores at 1, 3, 6, and 12 months postoperatively. These findings align with several studies reporting superior shoulder function with Locking Plate fixation. However, it's important to note that Locking Plate fixation may be associated with higher complication and revision rates, particularly in older patients or those with complex fractures.

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