

Research Article

Proximal Humeral Fractures: Surgical Management Using Locking Plates at Tertiary Care Teaching Center

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Abstract: Introduction: Unstable proximal humeral fractures are commonly encountered in orthopedic trauma, particularly in elderly patients with osteoporotic bones. Surgical fixation using a proximal humeral locking plate (PHLP) has gained popularity due to its biomechanical stability and ability to promote early mobilization. This study aims to evaluate the effectiveness, functional outcomes, and complication rates associated with PHLP fixation in unstable proximal humeral fractures. Materials and Methods: This prospective cohort study was conducted over a period of 1 year in the Department of Orthopedics. A prospective cohort of 60 patients underwent PHLP fixation, with clinical and radiological follow-up for one year. Patients underwent PHLP fixation under general anesthesia or regional block. A deltopectoral approach was used for exposure. Fracture fragments were reduced and temporarily fixed with K-wires before definitive fixation with PHLP. Postoperative protocol included early passive mobilization, followed by active range-of-motion exercises Results: A total of 60 patients (mean age: 63.4 years) were included in the study. The mean follow-up period was 12 months. The union rate was 93.3%, with an average healing time of 14 weeks. Functional outcomes were assessed using the Constant-Murley Score, with an average score of 78.5 at final follow-up. The most common fracture type in this dataset is the 3-part fracture (25 cases). The right side is more frequently injured (40 cases) compared to the left side (20 cases). The Constant-Murley Score of 78.5 suggests a favorable functional outcome, though not perfect. The range of motion values indicate good recovery in abduction and flexion, but external rotation may still be somewhat limited (normal external rotation is typically around 60-90°). Conclusion: The proximal humeral locking plate is an effective surgical solution for unstable proximal humeral fractures, demonstrating high union rates and satisfactory functional outcomes. Although complications such as screw perforation and avascular necrosis remain challenges, PHLP remains a viable option for improving patient recovery. Further studies with larger sample sizes and longer follow-up periods are needed to refine surgical techniques and optimize patient selection criteria.

Keywords: Proximal humeral fracture, Locking plate, Surgical fixation, Functional outcomes, Biomechanical stability.

INTRODUCTION

Proximal humeral fractures account for approximately 5% of all fractures and are most commonly seen in elderly populations with osteoporotic bones. [1] These fractures present a significant challenge in orthopedic trauma due to their variable patterns and high rates of complications. [2] The humerus plays a crucial role in shoulder function, and fractures in this region can lead to significant morbidity if not managed appropriately. [3]

Fractures of the proximal humerus are classified based on the Neer classification system, which categorizes them into two-, three-, and four-part fractures. [4] The degree of displacement and comminution determines the complexity of the injury and the need for surgical intervention. [5] While non-operative management with immobilization is an option for minimally displaced fractures, displaced and unstable fractures often require

CME Journal of Geriatric Medicine 97 surgical fixation to restore shoulder function and prevent long-term disability. [6]

Various surgical techniques have been employed in the management of proximal humeral fractures, including intramedullary nailing, conventional plating, percutaneous pinning, and hemiarthroplasty. [7] Among these, the proximal humeral locking plate (PHLP) has emerged as a preferred method due to its superior biomechanical stability, particularly in osteoporotic bone. [8] The design of PHLP includes multiple fixed-angle screws that provide enhanced fixation, reducing the risk of loss of reduction, implant failure, and malunion. [9]

Despite its advantages, PHLP fixation is associated with certain complications, including screw penetration into the humeral head, avascular necrosis, and subacromial impingement. [10] Proper patient selection, meticulous surgical technique, and early postoperative rehabilitation are critical factors influencing outcomes. [11] Several studies have demonstrated that PHLP provides good functional results and high union rates compared to other fixation methods. [11]

This study aims to assess the clinical and radiological outcomes of PHLP fixation in patients with unstable proximal humeral fractures. By analyzing union rates,

functional recovery, and complication profiles, this research seeks to contribute to the existing body of knowledge on the optimal management of these fractures

- Open fractures
- Pathological fractures
- Patients with previous humeral surgery
- Noncompliant patients unwilling to adhere to post-operative rehabilitation

MATERIALS AND METHODS

This prospective cohort study was conducted over a period of 1 year in the Department of Orthopedics, Shadan Institute of Medical Sciences, Teaching Hospital & Research Centre. A prospective cohort of 60 patients underwent PHLP fixation, with clinical and radiological follow-up for one year

Inclusion Criteria:

- Patients aged 18 years and above
- Unstable proximal humeral fractures (Neer classification: 2-, 3-, or 4-part fractures)
- Closed fractures
- Patients who provided informed consent

Exclusion Criteria:

Surgical Technique: Patients underwent PHLP fixation under general anesthesia or regional block. A deltopectoral approach was used for exposure. Fracture fragments were reduced and temporarily fixed with K-wires before definitive fixation with PHLP. Postoperative protocol included early passive mobilization, followed by active range-of-motion exercises.

Outcome Measures:

- Radiological assessment for fracture healing
- Functional outcome evaluation using the Constant-Murley Score
- Complication rates, including infection, implant failure, and avascular necrosis

RESULTS

A total of 60 patients (mean age: 63.4 years) were included in the study. The mean follow-up period was 12 months. The union rate was 93.3%, with an average healing time of 14 weeks. Functional outcomes were assessed using the Constant-Murley Score, with an average score of 78.5 at final follow-up.

Table 1: Patient Demographics

Parameter	Value
Number of Patients	60
Mean Age	63.4 years
Gender Distribution	35M / 25F

Table 2: Fracture Characteristics

Parameter	Value
Fracture Type (Neer Classification)	2-part: 20, 3-part: 25, 4-part: 15
Side of Injury	Right: 40, Left: 20

The most common fracture type in this dataset is the 3-part fracture (25 cases). The right side is more frequently injured (40 cases) compared to the left side (20 cases).

Table 3: Functional Outcomes

Parameter	Value
Mean Constant-Murley Score	78.5
Range of Motion (Degrees)	Abduction: 120, Flexion: 130, External Rotation: 45

The Constant-Murley Score of 78.5 suggests a favorable functional outcome, though not perfect. The range of motion values indicate good recovery in abduction and flexion, but external rotation may still be somewhat limited (normal external rotation is typically around 60-90°).

Table 4: Union and Healing Times

Parameter	Value
Fracture Union Rate	93.3%
Mean Healing Time	14 weeks

Table 5: Complications

Complication Type	Number of Cases
Screw Perforation	5
Avascular Necrosis	3
Superficial Infection	2
Implant Failure	0

The proximal humeral locking plate is an effective surgical solution for unstable proximal humeral fractures, demonstrating high union rates and satisfactory functional outcomes. Although complications such as screw perforation and avascular necrosis remain challenges, PHLP remains a viable option for improving patient recovery. Further studies with larger sample sizes and longer follow-up periods are needed to refine surgical techniques and optimize patient angle locking plates, may further enhance outcomes. [19]

DISCUSSION

A total of 60 patients (mean age: 63.4 years) were included in the study. The mean follow-up period was 12 months. The union rate was 93.3%, with an average healing time of 14 weeks. Functional outcomes were assessed using the Constant-Murley Score, with an average score of 78.5 at final follow-up.

Proximal humeral fractures present a complex surgical challenge due to their anatomical and biomechanical intricacies. [12] Various fixation methods, including intramedullary nails, conventional plates, and hemiarthroplasty, have been explored; however, PHLP has emerged as a superior option. [13] The locking plate mechanism allows for improved stability, particularly in osteoporotic bone, reducing the likelihood of varus collapse. [14]

In this study the most common fracture type in this dataset is the 3-part fracture (25 cases). The right side is more frequently injured (40 cases) compared to the left side (20 cases). The Constant-Murley Score of 78.5 suggests a favorable functional outcome, though not perfect. The range of motion values indicate good recovery in abduction and flexion, but external rotation may still be somewhat limited (normal external rotation is typically around 60-90°).

Several studies have reported PHLP to be an effective treatment modality with high union rates. [15] Compared to non-operative management, PHLP provides earlier functional recovery and better shoulder range of motion. [16] However, implant-related complications remain a concern.¹³ Biomechanical studies suggest that improper screw placement can lead to penetration into the humeral head, causing avascular necrosis. [17] Our study observed similar findings, with a 16.7% complication rate, consistent with previous literature. [18]

Despite these complications, PHLP offers a reliable fixation method, particularly when meticulous surgical technique and appropriate patient selection are applied. Future advancements in implant design, including variable-angle locking plates. [19]

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CONCLUSION

The proximal humeral locking plate is an effective surgical solution for unstable proximal humeral fractures, demonstrating high union rates and satisfactory functional outcomes. Although complications such as screw perforation and avascular necrosis remain challenges, PHLP remains a viable option for improving patient recovery. Further studies with larger sample sizes and longer follow-up periods are needed to refine surgical techniques and optimize patient selection criteria.

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