Original research article

Outcome of the Proximal Humerus Fractures in Adults Fixed with Proximal Humerus Internal Locking System (PHILOS) Plate by using Deltopectoral Approach

Dr. Anis Surti[1], Dr. Rajendra Prasad Ghosliya[2], Dr. Mukul Jain[3], Dr. Naveen.S[4], Dr. Harish Kumar Jain[5]

[1]Senior Resident, Department of Orthopaedics, Jhalawar Medical College, Jhalawar

[2]Senior Resident, Department of Orthopaedics, Jhalawar Medical College, Jhalawar

[3]Assistant Professor, Department of Orthopaedics, Jhalawar Medical College, Jhalawar

[4]Senior Resident, Department of Orthopaedics, Jhalawar Medical College, Jhalawar

[5]Senior Professor and Head of Department, Department of Orthopaedics, Jhalawar Medical College, Jhalawar

Corresponding Author: Dr. Naveen.S

Abstract

Background: One of the most frequent fractures and ones with treatment options that can be challenging is proximal humerus fractures. With a focus on technical challenges and issues, the study's objective is to evaluate the effectiveness and functional outcome of PHILOS (proximal humerus internal locking system) plates in proximal humerus fractures.

Materials and Methods: This investigation was carried out at the Jhalawar Medical College Hospital's Orthopaedics Department. 22 patients who had suffered proximal humerus fractures were included in the study. Through a Deltopectoral approach, they received treatment with PHILOS (proximal humerus internal locking system) plates. Patients were assessed clinically and radiologically with the relevant X-rays at each follow-up.

Results: Our series of patients' end outcomes were assessed using Neer rating standards. In 18 (81.81%) of the patients we treated in our facility, we got good to excellent results. According to Neer's Criteria, all patients who had outstanding results or good results had normal muscle function and functional range of motion. In 4 (18.18%) of the patients, the outcomes were unsatisfactory. One of the patients developed plate impingement and was unable to abduct over 90 degrees. One case of Varus malunion occurred, decreasing neck shaft angle by 120 degrees, which is seen as inadequate. These patients' compliance and regular follow-up were inadequate.

Conclusion: In proximal humeral fractures, particularly comminuted fractures and osteoporotic bones in elderly patients, the PHILOS plate provides a mechanically and biologically advantageous implant, enabling early mobilisation.

Keywords: Proximal humerus fracture, PHILOS plate, Neer Score

Introduction

The second most frequent fracture of the upper limb, accounting for 4 to 5 percent of all fractures, is proximal humerus fractures[1,2]. Due to decreasing bone density, elderly people experience fractures more frequently. However, in younger age groups due to high velocity trauma[3]. The majority of stable, minimally displaced proximal humerus fractures are treated conservatively. However, in some situations, such as displaced, unstable fractures and those linked to dislocations, surgical intervention was necessary[4,5]. The goal of treatment for proximal humeral fractures is to produce a shoulder that is both pain-free and functional. This outcome is dependent on the patient's expectations, age, medical condition, bone quality, and Neer ORIF fixing methods for displaced two- and three-part fractures. A humeral prosthesis can be used to replace the humerus when the blood supply to the head of the bone is impaired in a three- or four-part fracture dislocation. The use of intramedullary nails and percutaneous or minimally invasive procedures like pinning and screw osteosynthesis are examples of traditional treatment methods. ORIF with proximal humeral plates is another. Surgery for humeral fractures may lead to implant loosening or failure, as well as nonunion. Compared to traditional implants, proximal humerus internal locking system (PHILOS) plate fixation offers more angular stability. It is a fixed-angle implant that was created using the proximal humerus anatomy[5,6]. Therefore, there are fewer chances of the screws coming undone, the humeral head is better secured, and there are almost no risks of secondary reduction loss.

Aims and Objective:

The study's objective is to evaluate PHILOS (proximal humerus internal locking system) plates effectiveness and functional outcomes in proximal humerus fractures, in terms of fracture union and shoulder function recovery and to assess the frequency of complications that could arise from proximal humerus fractures treated using PHILOS plates.

Methods and Materials:

This study was conducted in the Department of Orthopaedics, Jhalawar Medical College Hospital and consists of 22 Patients with proximal humerus fractures were included in this study.

Inclusion Criteria:

1. Adult (>18yrs) male and female patients with proximal humerus fracture who have given their consent for the procedure.
2. Patients who are medically fit for surgery.
3. Two part, three part and four part proximal humerus fractures.
4. Closed fractures.

Exclusion Criteria:

1. Children with age <18yrs.
2. Patients unfit for surgery.
3. Patients not willing for surgery.
4. Patients with acute infection.
5. Humerus shaft fracture.
6. Associated with neurovascular injuries.
7. Pathological fractures.
8. Open fractures of proximal humerus.

Preoperative evaluation:
As soon as the patient arrived at the emergency room, they underwent an airway, breathing, circulation, disability, and exposure (ABCDE) evaluation. If necessary, resuscitative treatments including IV fluids, continuous oxygen inhalation, fracture immobilization with pop 'U'slab/Shoulder immobiliser, and arm pouch administration were done. A thorough history of the patient's age, sex, mechanism of injury and related illnesses was collected. An X-ray of the afflicted shoulder and arm was taken in the AP and lateral views, and routine blood tests were completed.

Operative Techniques :
General anaesthesia was used in all patients.

Patient Position and Draping:
Placing the patient in the beach chair position on the OT table, push the affected side forward while allowing the arm to fall backward by tucking a sandbag under the medial border of the scapula. Leave the arm undraped because it will need to be moved while the approach is being made.

Surgical Approaches[7]:
Surgical approach used is Deltopectoral approach.

Deltopectoral approach:
The incision begins just above the coracoid process, which can be felt in the clavicular concavity's lowest point, which lies distally toward the acromio-clavicular joint. Starting slightly above the coracoid process and moving along the deltopectoral groove, an 8 to 10 cm incision was made. The deltoid muscle, which is supplied by the axillary nerve, and the pectoralis major muscle, which is supplied by the medial and lateral pectoral nerves, are located in the intravenous plane. Separate the two muscles by pulling the pectoralis major medially and the deltoid laterally. Either laterally or medially, the vein is retracted. Before access can be acquired to the anterior portion of the shoulder joint, the short head of the biceps and the corocobracialis must be moved medially.

The transversely oriented fibres of the subscapularis muscle are located beneath the tendons. Stretch the subscapularis by externally rotating the arm, which will bring the muscle belly into the incision and make it easier to distinguish its superior and inferior borders. Use a blunt object to separate the suscalpularis between its implantation onto the smaller tuberosity of the humerus and the capsule. Wherever the chosen repair needs to be done, incise the capsule longitudinally to enter the joint.

Fig.1: Locking plates, screws & General instruments

Fig.2: General instruments

Procedure [7,8,9]**:**

A prophylactic dose of 1 gm ceftriaxone was administered intravenously to all patients prior to surgery. The fracture was revealed and minimised using a deltopectoral approach with a minimum amount of soft tissue dissection. In a nutshell, the larger tuberosity and humeral head's anatomical connection was shortened and momentarily stabilised using K wires. A joystick method was utilised when the humeral head was clearly rotating or moving. The arm was then abducted with traction and rotated to further decrease the shaft fragment. Under the image intensifier, reduction was verified. The locking plate used for definitive fixation was positioned 1 cm distal to the larger tuberosity and lateral to the bicepital groove to spare the long head of the biceps tendon. Preoperative planning determined the screws to be used, and all four head screws were intended to be inserted to the head fragment. The inferior screws

supporting the humeral head were considered critical. Proximal locking screws were inserted to hold the humeral head.

Through an external guide, all proximal locking screws were inserted unicortically, and intraoperative fluoroscopy verified that they were all inside the humeral head. To see where the screws should go, axillary views that are 90 degrees apart and AP (internal and external rotation) views were employed. Bicortically inserted screws were used for the distal shaft. There were at least three bicortical screws used. To validate a successful fracture reduction, the location of the plate, and the appropriate length of screws in the humeral head, fluoroscopic pictures were acquired.

The rotator cuff, larger tuberosity, and lesser tuberosity were stitched to the plate using non-absorbable sutures in the event of significant comminution or instability. On the table, the shoulder's range of motion was examined for impingement. A sterile bandage is placed over the incision once it has been thoroughly cleaned and hemostasis has been achieved.

Intra-operative pictures

Fig.3: Skin Incision

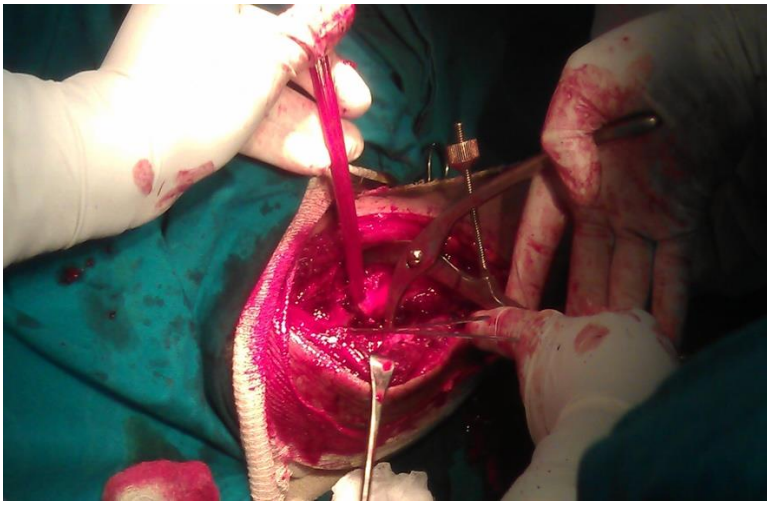


Fig.4: opening and reduction of fracture

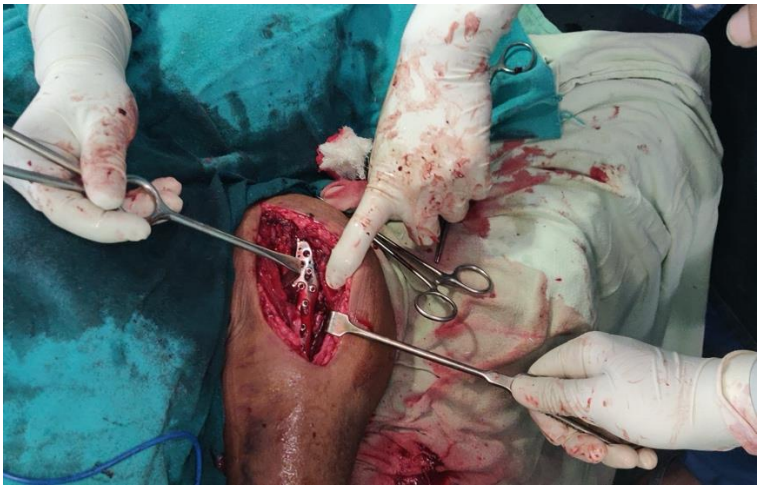


Fig.5: Placement of the proximal humerus locking plate

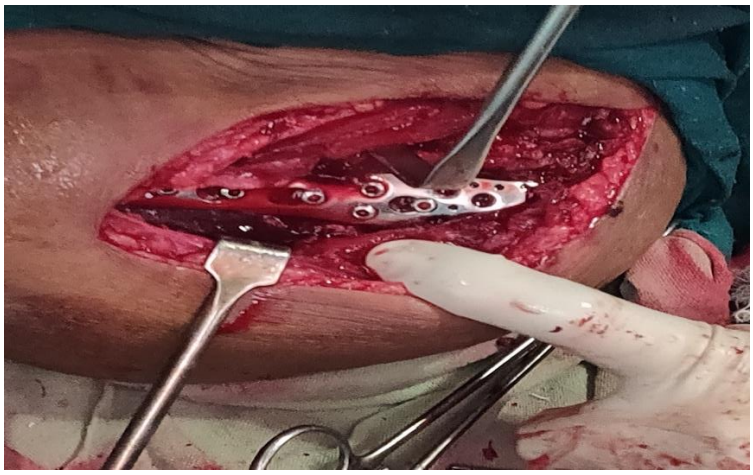


Fig.6: Locking plate placement and fixation

Fig.7: Skin closure after fixation of plate

Postoperative management :

All patients are immobilized in shoulder immobiliser. Appropriate antibiotics and analgesics were used. Immediate post operative radiographs were taken to determine the bone alignment and maintenance of reduction. Sutures removed first alternate by 10th day and complete by 14th day.

Rehabilitation[4,10,11]:

- Pendulum exercises are started after pain disappear.
- Passive range of motion started at 1st week
- The active range of motion was started at 2-4 weeks postoperatively depending on stability of osteosynthesis and bone quality.
- 4th to 6th week immobiliser removed
- Active assisted movements started up to 90° abduction with no forced external Rotation.
- 6th to 8th week-full range of movements with active exercises started.
- Further follow ups were done at 6 weeks and 12 weeks and 24 weeks.

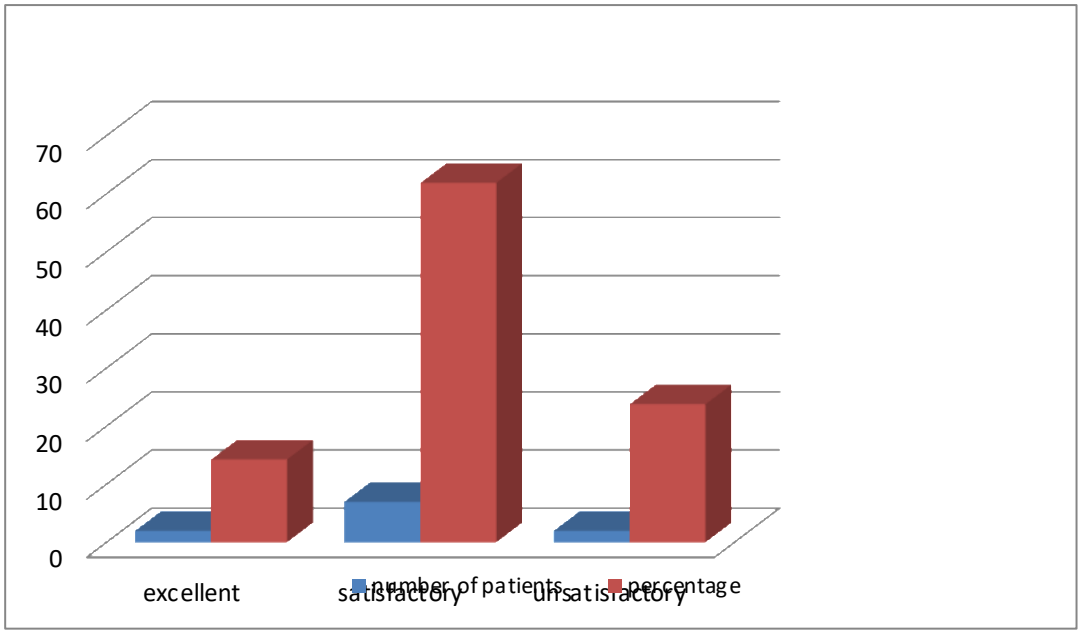
Result:

The final results were calculated using Neer's grading system, which took into account the degree of Pain, Function, Range of Motion, and Anatomy. The outcomes of 22 patients with proximal humerus fractures who had locking compression plate surgery.

In our study 2(18.18%) case had excellent results and 7 (63.63%) had satisfactory results. 2 (18.18%) had unsatisfactory results and there was no failure.

Table 1 : Distribution of patients on the basis of final result

Final result	Number of patients	%
Excellent (E)	4	18.18
Satisfactory (S)	14	63.63
Unsatisfactory (US)	4	18.18
Total	22	100



Graph 1 : Representing final result

Discussion:

About 4-5 percent of all long bone fractures are proximal humerus fractures. It accounts for 2–3 percent of upper limb fractures. Undisplaced proximal humerus fractures should be treated conservatively. It is difficult to treat misplaced fractures or fracture dislocations. If a displaced proximal humerus fracture is not treated, numerous investigations have demonstrated that the

functional prognosis would be poor[1-5]. However, ORIF is the preferred mode of care in order to achieve anatomical reductions, early mobilisation, and early restoration of function. In general, ORIF has produced positive outcomes, but not in all institutional settings. If the fracture is anatomically properly reduced and a planned rehabilitation programme is followed, the best benefits will be attained. Therefore, the focus must be on fractures that can be anatomically reduced[12]. This research was done to evaluate all types of Neer Classification of proximal humerus fracture treated by PHILLOS.

Table 2: Comparison of complications of other studies with our study

Author and year	No. of cases	Infection	Varus malunion	Avascular necrosis	Plate imping-ement	Stiffness	Screw Penetration[16]	Implant loosening
Ramchander Siwach[8] (2008)	25	-	8	-	4	-	-	4
Felix Brunner[9] (2008)	157	2	4	13	4	4	22	5
Sameer Aggarwal [13] (2010)	56	2	-	-	1	-	1	2
Chandan kumar[14] (2013)	52	1	7	-	5	-	4	-
Erasmo R[15] (2014)	82	1	4	10	3	-	3	-
Our study (2021)	22	-	1	-	6	1	-	-

Table 3: Comparison of Neer's score in different studies

Study	Neer's score
Mourdian et al(1986)[17]	86.5
Felix Brunner et al(2009)[9]	76
Our study (2017)	82.28

Conclusion:

In orthopaedics, the fracture of the proximal humerus continues to be a contentious issue. Realistic approach and appropriate surgical care of these difficult fractures depend on clinical evaluation, accurate radiographic images, patient age, and activity level. The goal of the current study was to assess the functional outcomes and complications associated with PHILOS surgical treatment of proximal humerus fractures[18].

When paired with a divergent or convergent screw orientation to the humeral head, the fixation is more resistant to pulling out and failing. Furthermore, stability in conventional plating methods depends on compression between the underside of the plate and the bone; this is not the case with locking plates. As the plate/bone interface is not loaded along the screw axis, the

risk of stripping the thread in osteoporotic bone is decreased. The underlying periosteum and blood flow to the fractured regions are significantly less squeezed as a result, allowing for a more physiologic fixing.

The best outcomes come from surgical techniques that produce stable fixation. Physiotherapy should be started right after fixation. The surgical management of the proximal humerus fracture's functional success depends heavily on the rehabilitation programme. In conclusion, the PHILOS plate is a beneficial implant in proximal humeral fractures, particularly in comminuted fractures and in osteoporotic bones in older patients, permitting early mobilization[19].

Case 1

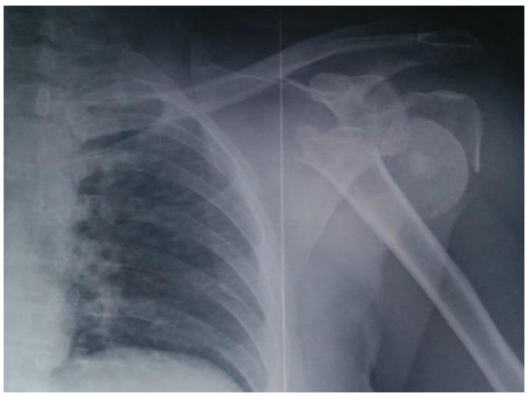


Fig.8: Pre-operative X-ray AP view

Fig.9: Immediate Post operative

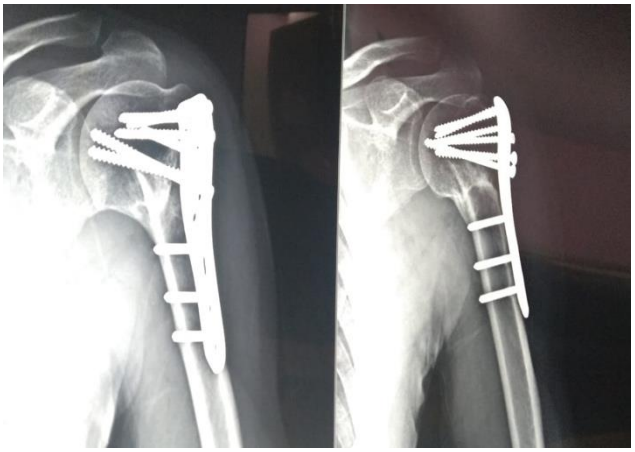


Fig.10: After 24 weeks

Fig.11: Range of movements after six months

Case 2

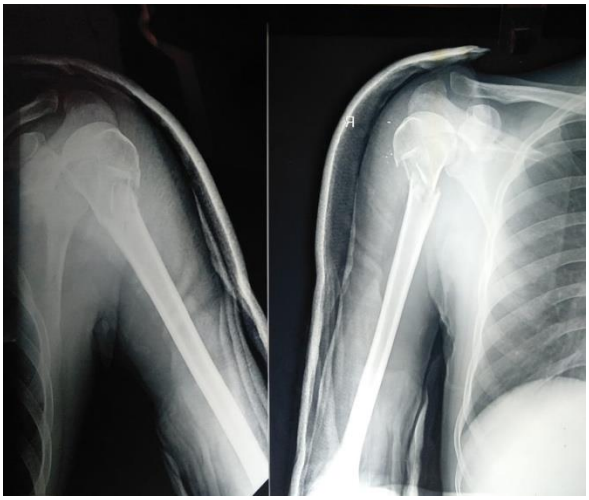


Fig.12: Pre-operative X-ray AP View

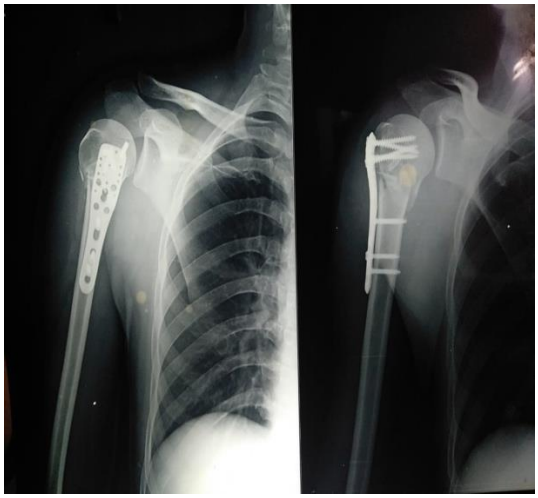


Fig.13: Immediate Post operative

Fig.14: X-ray after 24 weeks

Fig.15: Range of movements after six months

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