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# Surgical Management of Fracture of Proximal Humerus by Philos Plate and Screws: A Case Study

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**Received:** March 20, 2023; **Accepted:** March 30, 2023; **Published:** May 05, 2023

## Abstract

**Background:** Proximal humerus fracture accounts for about 5% of all fractures in recent advances proximal humerus fractures are often managed operatively with PHILOS plate which provides greater angular stability and study was aimed at to assess functional outcome of PHILOS plate fixation in proximal humerus fractures.

**Results:** CM scoring and DASH scoring was applied to analyze the functional outcome among the cases. Most of the patients had excellent outcome (52%) followed by good (26%), fair (8%) and poor (15%) outcome according to CM scoring and according to DASH scoring 20.21 was mean score and mean CM score was 77.62. Complications observed were impingement in 1 patient, avascular necrosis in 2 patient and non-union in 1 case.

**Conclusions:** We conclude that the use of PHILOS plate for the fixation of proximal humerus fractures is a good device as it provides rigid fixation and early mobilisation and prevented complications. Precontoured locking plates work on the principle of angular stability, divergent screws, less disruption of vascularity and less chances of plate failure.

**Keywords:** Proximal humerus; PHILOS plate; Constant and murley score; DASH score

## Introduction

Proximal humerus fractures accounts for approximately 4-5% of all the fractures and are next to hip fractures and distal radius fractures in the elderly population [1]. Most patients are elderly, which is due to the risk for their bones to be osteoporotic or brittle. The bone quality seems to be crucial both for the surgical intervention and the functional outcome. Most patients about 80% with undisplaced proximal humerus fractures can be treated conservatively with good functional outcome. Surgery should be considered in about 20% of patients [1-3]. Many different techniques have been described for treatment of proximal humerus fractures such as transosseous suture fixation, tension band wiring, standard plate, and screw fixation, hemireplacement arthroplasty, percutaneous wire, and screw fixation [4]. Precontoured locking plates work on the principle of angular stability, divergent screws, less disruption of vascularity and less chances of plate failure.

Locking plate modality is the gold-standard modality in the treatment of proximal humerus fractures and is chiefly used to overcome certain issues like metaphyseal comminution and have reduced the incidence of these complications [5,6].

Complications associated with the PHILOS plate fixation include screw penetration into the glenohumeral joint, screw loosening and back out, avascular necrosis of the humeral head, pseudoarthrosis with a broken plate, subacromial impingement requiring plate removal, nonunion, malunion due to loss of purchase in the humeral head, broken distal screws with separation of the plate from the bone, and transient axillary nerve palsies [7].

In proximal humerus fractures, PHILOS plate offers a good functional outcome with context to the early joint mobilisation and rigid fixation of the fracture [8]. The locking plate can be used with a minimally invasive technique which permits indirect fracture reduction thus lowering the possibility of avascular necrosis (AVN) and lowering of time of immobilization reduces the possibility of frozen shoulder [9,10]. Furthermore, the proximal locking screw having the capability of being applied in multidirections makes it a fixating device with a high stability in osteoporotic bones [11]. Considering these advantages and the scarcity of data on the efficacy and the functional outcome following internal fixation with PHILOS plate for displaced proximal humerus fractures, the present study was planned.

## Case Study

**Methods:** A total of 31 cases sustained proximal humerus fracture and were operated with open reduction and internal fixation with PHILOS plate and screws of which 4 patients died due to medical comorbidities during post op period and total of 27 patients were studied. Follow up of these patients were done at 6 weeks, 12 weeks and 24 weeks after surgery and functional outcome was evaluated using Constant and Murley (CM) scoring and disabilities of the arm, shoulder, and hand (DASH) scoring.

**Inclusion Criteria:** All skeletally mature patients more than 18 years, simple fractures, displaced proximal humerus fractures, NEER two-three- and four-part fracture were included [12].

**Exclusion Criteria:** Pathological fractures, failure of conservative treatment, any associated fractures in ipsilateral limb were excluded.

**Evaluation of patients:** The local examination of injured shoulder was done to look for the attitude, swelling, deformity and loss of function. Any nerve injury was also carefully looked for and noted by regiment batch sign. Local neurological deficit of axillary nerve over lateral aspect of shoulder was assessed by looking for anaesthetic patch. Fracture was stabilized temporarily by shoulder immobiliser. A thorough preoperative assessment of the patients was done, which included general condition of the patient and clinical (inspection, palpation, measurements, movements, associated injuries) and radiological assessment of the type of the fracture.

Patients were evaluated for associated medical problems and reference was taken from respective departments and necessary treatment started and fitness for surgery taken. Brachial block or general anaesthesia was used in all the patients according to their medical condition. Patients placed in supine position on operating table with a small pillow at interscapular area. Drape the arm free because it will have to be moved during the approach.

## **Operative Technique**

The surgical approach preferred was Deltopectoral approach. Through delto-pectoral approach, the fracture site was exposed and reduced with minimal soft tissue dissection. Briefly, the anatomical relationship between humeral head and greater tuberosity was reduced and fixed temporarily with K wires. In case of obvious rotation or displacement of the humeral head, a joystick technique was used. Then the shaft fragment was reduced by abduction, traction, and rotation of the arm. When acceptable reduction is obtained, the PHILOS plate will be placed at least 1cm distal to the upper end of the greater tuberosity and fixed to the humeral shaft. All proximal locking screws were placed in a unicortical fashion through an external guide and confirmed to be within the humeral head with intraoperative fluoroscopy. AP (internal and external rotation) views and axillary views 90 degrees to each other were used to visualize screw placement. The distal shaft screws were placed bicortically. A minimum of three bicortical screws were used. Fluoroscopic images were taken to confirm satisfactory fracture reduction, plate positioning and proper length of screws in the humeral head. Range of motion of shoulder was checked on the table for impingement. Wound was closed in layers and sterile dressing was done.

## **Post Operative Management**

After surgery the shoulder was immobilised in a universal shoulder immobiliser. Appropriate antibiotics as well as analgesics were used. Post operative check radiographs were taken to determine the alignment of the bone and maintenance of reduction. Sutures removed by 12th day. The passive pendulum exercises are begun as soon as possible. At first week passive range of motion started. Active range of motion was started at 2 to 4 weeks postoperatively, depending on stability of osteosynthesis.

## **Follow Up**

Follow-up of patients was done at six weeks, three months and six months following the surgery. radiographs were performed at the end of six weeks, three months, and six months follow-up. Patients were evaluated based on the following parameters at the time of discharge and all the three follow up for range of motion of the shoulder, complications, clinical union, radiological union.

## **Functional Outcome**

Final outcome was evaluated by constant shoulder score and DASH scoring. CM score was conceived as a system of assessing the overall value, or functional state, of a normal, a diseased or a treated shoulder. In this score, 35 points are allocated for subjective assessments of pain and activities of daily living and 65 points are available for objective measures of range of movement and shoulder strength. A young healthy patient can therefore have a maximum score of 100 points. The final assessment using Constant shoulder score for outcome was interpreted as excellent- 86 to 100 points, good- 71 to 85 points, fair- 56 to 70 points and poor-0 to 55 points.

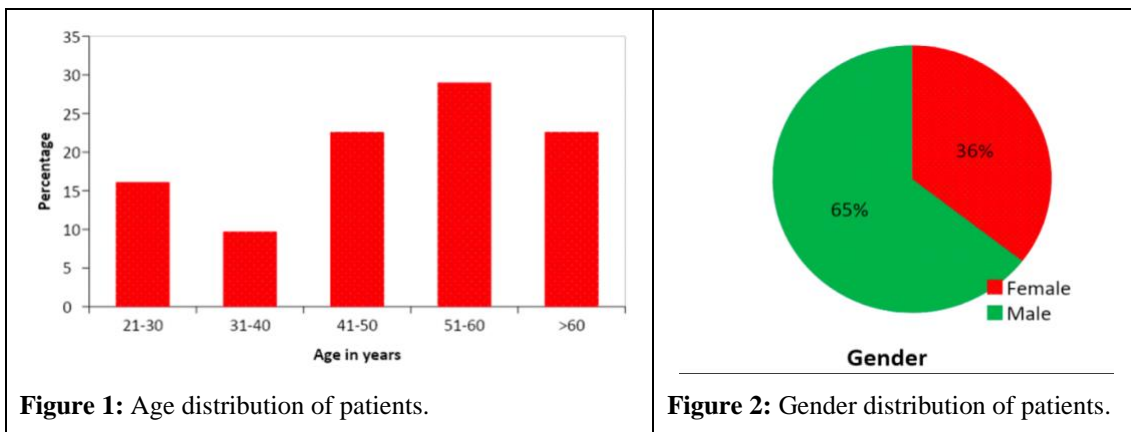
DASH scoring is a non-shoulder specific scoring system and is mainly used to assess the symptoms and physical disability in the arm. It is a 30-item patient-reported tool which is based on the symptoms, physical, social, and psychological functions. It also evaluates the sleep disturbances. Greater the score represents greater disability, and lower scores represents good functional outcome.

Data was entered in MS-excel data was analysed using SPSS software version 22. Results were displayed in numbers, percentages only. P value less than 0.05 was considered statistically significant.

**Results**

Majority of the patients (65%) were males and male to female ratio was 1:8:1. Most of the patients presented with age from 51 to 60 years and mean age was 49.90±15.01 years. Road traffic accident was the nature of trauma in 55% of the patients and 42% had fall and 3% seizures. 52% of the patients presented with right sided proximal humerus fracture. Neer’s classification was used to classify fractures and presented with 15 cases of 2-part fracture (50%), 13 cases of (42%) 3 part and 3 cases of 4-part fracture (10%). Most of the patients had surgery under general anaesthesia (60%).

At first follow up at six weeks, pain at fracture site was noted in all the patients (100%) and radiological union in (5%). During second follow up at three months, radiological union in 88%. Pain at fracture site was reported by 20% of the patients During third follow up at six months all the patients (96%) had clinical and radiological union. The range of motion at first, second and third follow ups increased gradually during subsequent follow ups.



**Table 1: Patient outcome as per constant score.**

Outcome	CM score	No. of Patients	%
Excellent	86-100	14	52
Good	71-85	7	26
Fair	56-70	2	7
Poor	0-55	4	15
Total	-	27	100.0

Most of the patients had excellent outcome (52%) followed by good (26%), fair (8%) and poor (15%) outcome according to CM scoring and according to DASH scoring 20.21 was mean score and mean CM score was 77.62. No statistically significant difference was observed in outcome about mechanism of injury (p=0.291), side of the fracture (p=0.865) and type of fracture (p=0.131).



**Figure 3:** Case with poor outcome complication-non-union.



**Figure 4:** Case with poor outcome complication-subacromial impingement.

## Discussion

Majority of displaced proximal humerus fractures treated with conventional plate and screws were associated with high rates of unsatisfactory outcome and complications [5]. Locking plates provide angular stability of the screws and divergent and convergent nature of the screws which prevent implant backout in osteoporotic bones and calcar screws which prevent varus malalignment [10,11]. Locking plate modality is the gold-standard modality in the treatment of proximal humerus fractures and is chiefly used to overcome certain issues like metaphyseal comminution [10].

In this study 51 to 60 years was the commonest age group comprised of 30% of the patients. The mean age was found to be  $49.9 \pm 15.01$  years and the younger patient was aged 21 years and the eldest was aged 78 years. These findings were consistent with a study by Gerber et al who reported mean age of 49.9 years. In the present study majority that is 65% of the patients were males with male to female ratio of 1.8:1 suggesting male preponderance which is in accordance with study of, Agarwal et al and Gerber et al reported male preponderance with male to female ratio of 1.7:1 and 1.35:1. The higher male to female ratio can be explained by the involvement of day to day activities of males compared to females. In the present study 55% of patients had history of RTA and 42% had history of fall and 3% with seizures.

These findings were consistent with a study done by Josetm et al who reported RTA in 53% of the patients and fall in 40% and seizures in 6%. In this present study most of the patients presented with right fracture (60%). Similar fracture pattern was reported in a study. In this study 2-part fractures were noted in most of the cases (48%) followed by 3-part (42%) and 4-part (10%). Similar to the study conducted. Majority of patients had union at 12 weeks about 92% and about 4% had union at 14 weeks and 4% had nonunion and fracture united with an average of 12.08 weeks which is similar to the study of Egol et al. In this present study patients were evaluated also using CM and DASH scoring in which mean constant score was found to be 77.62 with 78% of patients having excellent and good outcome and mean DASH score was 20.21 In this present study 4 complications were observed in 27 patients that is 8% of patients had avascular necrosis of head of humerus, 4% of patients had sub acromial impingement and 4% had nonunion similar results were shown.

## Conclusion

Proximal humerus internal locking system is a good device to stabilise proximal humerus fractures. The locking divergent screws prevent implant pullout and failure in fixation in osteoporotic fractures and the use of calcar screws prevent varus malalignment and loss of reduction by providing inferomedial support. The plate provides stable internal fixation and early mobilisation and anatomic reconstruction of tuberosities should be achieved for good functional outcome. The locking plate provides biological fixation as the periosteum and blood supply to fractured fragment is not compressed. Adequate stable fixation and appropriate physiotherapy exercises have a major role in functional outcome.

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