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### **Results and analytical outcomes of proximal humerus plating in adults with proximal humerus fracture**

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#### **Abstract**

Fracture of proximal humerus is the second most common fracture of the upper extremity, following distal forearm fractures. Aim of the present study was to evaluate the efficacy of proximal humerus internal locking system (PHILOS) plate fixation for proximal humerus fractures. Functional outcomes of 12 men and 18 women aged 22 to 78 (mean, 58) years who underwent PHILOS plate fixation for proximal humeral fractures were reviewed. Indications for surgery were 2 part (n=9), 3 part (n=14) or 4-part (n=7) closed proximal humeral fractures with angulation of more than 45 degrees or displacement of more than 1 cm. Functional outcomes and shoulder range of movement were assessed based on the Constant scoring system. All patients will be followed up at monthly intervals for 6 months. During this period patient, will be motivated for physiotherapy and gradual normal use of the affected limb. Fracture union will be assessed clinically and radiologically. In our study of fracture proximal humerus union in most of the cases (24) occurring between 10- 14 weeks. Range of union time was 8 to 18 weeks. one case of avascular necrosis of head occur in our case. In out of 30 cases excellent result in 7 cases, Good in 16 cases Satisfactory in 5 cases and Poor in 2 cases were obtained. The PHILOS plate fixation is effective treatment for proximal humeral fractures particularly in osteoporotic bones.

**Keywords:** PHILOS, proximal humerus fractures, osteoporosis

#### **Introduction**

Fracture of proximal humerus is the second most common fracture of the upper extremity, following distal forearm fractures. Their overall incidence has been reported to be 73 cases per 100,000 individuals per year <sup>[1]</sup>. Most of these fractures occur in women over the age of 50, except for isolated greater tuberosity fractures, which occur with greater frequency in younger individuals <sup>[2]</sup>. Displaced and unstable fractures are difficult to manage and have a high morbidity. Techniques for treating complex proximal humeral fractures vary and include fixations using tension bands, percutaneous pins, bone suture, T-plates, intramedullary nails, double tubular plates, hemiarthroplasty, Polarus nails, blade plates. PHILOS (proximal humeral internal locking system) is a recently developed system of ORIF, featuring: anatomically contoured shape, non-parallel locking head screws, high rigidity, Locking and LCP combination holes. Thus, theoretically less chance of screw pullout/loosening, better purchase in the humeral head and less secondary loss of reduction. Complications associated with the PHILOS plate fixation include screw perforations into the glenohumeral joint or femoral head, screw loosening and backing out, secondary implant dislocations from the humeral head, 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 <sup>[9- 18]</sup>

#### **Materials and Methods**

This was a prospective interventional study which included, 12 men and 18 women aged 22 to 78 (mean, 58) years with proximal humeral fractures underwent PHILOS plate fixation. Inclusion criteria were in study was displaced fracture of proximal humerus in which fragment displace more than one centimeter or head angulation greater than 45°, ununited fracture of proximal humerus to be combined with bone grafting, proximal humerus fracture with distal

extension, patients with fractures that were Extensively comminuted humeral head fractures which cannot be adequately reconstructed, fractures proximal humerus in paediatrics age group, open fracture gustilo grade greater than on I and fracture of anatomical neck of humerus with dislocation of shoulder. Fractures classified according to Neer: 11 2- part fractures, 16 3-part fractures, 5 4-part fractures. The patient is brought into the beach chair position or supine position depending on surgeon or anesthetist choice and a deltopectoral approach is then performed.

Once direct or indirect fracture reduction has been achieved provisional stabilization by K-wires may be necessary. Now appropriate plate is centered against the lateral aspect of the greater tubercle and about 10mm below it to avoid subacromial impingement. The PHILOS plate was applied at least 1 cm distal to the upper end of the greater tubercle and fixed to the humeral head with proximal locking screws before the distal screws were inserted into the humeral diaphysis. Arm pouch sling will be applied. Post operatively limb elevation and active finger movements will be advised. All patients will be followed up at monthly intervals for 6 months. During this period patient, will be motivated for physiotherapy and gradual normal use of the affected limb. Functional outcomes were assessed according to the Constant scoring system, 25 with 15 points for pain, 20 points for activities of daily living, 40 points for range of movement, and 35 points for strength.<sup>19</sup> The Constant scores of 0 to 55 were graded as poor, 56 to 70 as moderate, 71 to 85 as good, and 86 to 100 as excellent.

## Results

All patients will be followed up at monthly intervals for 6 months. No implant failures recorded. No deep infections recorded. Healing in all available radiographs. One patient developed avascular necrosis of the humeral head and had all proximal screws removed. One patient had two screws penetrating the articular surface changed two months after first surgery. None of the 7 working patients had their occupational status affected. In out of 30 cases excellent result in 7 cases, Good in 16 cases Satisfactory in 5 cases and Poor in 2 cases were obtained.



**Fig 1:** Preop Xray.



**Fig 2:** 3 month Postop Xray

## Discussion

To obtain better and reproducible results, the AO/ASIF has developed a special locking compression plate (PHILOS) for fractures of the proximal humerus. It is a screw system that merges locking screw technology with conventional plating techniques. Locking screws provide the ability to create a fixed-angle construct utilizing familiar AO plating techniques. A fixed-angle construct provides advantages in osteopenic bone or multifragmentary fractures (providing angular stability) where traditional screw purchase is compromised.

In the present study, the age of patients with proximal humerus fractures ranged between 22-78 years with an average age of 58 years. This mean age in our series was probably due to higher incidence of this fracture in osteoporotic bone, as incidence of osteoporosis increases with age. Females were affected much more commonly than males. In present study 18 patients were female and 12 patients were male. The results are comparable to that of Handschin AE, *et al.* 7 Predominant female involvement is probably due high incidence of osteoporosis in female patient. In the present study 63.33% of upper end humerus fractures were due to low energy trauma (i.e. 19 out of 30 cases); whereas 10 patients' mode of trauma was road traffic accident and in one patient mode of injury was direct blow. Out of 30 cases of proximal humerus fractures right side was involved in 16 cases and left in 14 cases. Thus, right humerus was involved more often than the left. More number of right side involvement in our study, merely reflects coincidence depending upon the position of limb at the time of injury. In total 11 patients had associated medical ailments; 5 patients of proximal humerus fractures were hypertensive, three was a known case on medication and the other two was diagnosed after admission to the hospital; four case in this study was a known case of diabetes mellitus, all four were already on treatment before the admission in hospital. In present study two cases having

both hypertension and diabetes mellitus. Associated medical conditions are known to affect the healing of fracture and have an impact on its associated complications and this is especially true in case of diabetes mellitus. Post operatively out of these 6-diabetic patients two patient presented superficial infection which was managed by antibiotics and antiseptic dressings.

Fracture classification systems are most useful when they allow accurate anatomical description, guide treatment and allow an estimation of prognosis. In our study Neer classification system were use, which is most commonly use classification system for proximal humerus. In out of 30 cases in our study there were 9 cases of type 2 fracture, 14 cases were of type 3 fracture and 7 cases were type four fracture. In the study of Geiger EV *et al.* 18 Out of 28 cases there were 8 cases of type 2 fracture, 12 cases of type 3 fracture and 8 cases of type 4 fracture. In the present study of 30 patients 13 patients were found to have osteopenia as per the radiological findings and the intra-operative findings out of which 3 patients were of type two humerus fracture, 6 patients were type three and; 4 patient were of type 4 fracture.

Osteopenia is known to adversely affect the outcome of fracture healing as it hampers the purchase of the screws within the bone. The major problem in osteoporotic fracture treatment is fixation of the device to the bone as bone failure is much more common than implant failure. But as in the study angular stable locking plate were use there is no such problem encountered. In all 13 patients with no cases of delayed union or of implant failure were recorded. Time interval between injury and the fixation of fracture was within 7 days in most of the cases i.e. 23 out of 30. In rest of the 7 cases the delay was upto a maximum of 10 days. In most of the cases delay were due medical problem for which patient were take time to be fit for surgery. In the present study out of 30 cases, patients present with early and late complications. 2 patients had postoperative superficial wound infection, which was successfully treated with incision and drainage and antibiotics. No case of deep infection was encountered.

Infection did not appear to have any long-term effect on fracture healing or the rehabilitation of the patient. In two cases one screw penetrated in the shoulder joint which was remove after one month under image intensifier.

In one case 2 screw loosening occur, however no adverse effect occurs on healing due to this. In one case of type four fracture avascular necrosis of humeral head occur for which patient have to go replacement arthroplasty.

In two cases subacromial impingement occur due to higher placement of plate. No case of malunion/nonunion, and implant failure were recorded. one case of delayed union occur. In study of Geiger EV *et al.* in total 28 cases 2 cases of avascular necrosis, 6 cases of subacromial impingement and one case of loosening of locking head screw were recorded. 18 In the present study in 30 cases of proximal humerus fractures, radiological union was seen between 8 to 22 weeks with union in most of the cases (24) occurring between 10-14 weeks. In one case avascular necrosis seen. bone grafting required in none of the cases. In the study of Kilic B *et al.* the average time for proximal humerus fracture healing treated PHILOS in 20 cases was 10 weeks, in one cases duration of union was 16 weeks and one case requires bone grafting <sup>[11]</sup>.

In the present study in case of proximal humerus fractures the results were tabulated into four groups i.e. excellent, good, satisfactory and poor, according to the criteria laid down Constant CR.19 Based on the score inference is taken out as follows. Inference: Excellent: constant score >90, Good:

constant score 75-89 Satisfactory: constant score 60-74, Poor: constant score

## Conclusion

Locking plate achieves favorable biological fixation for proximal humerus fractures with few complication. Principle of fixation is reconstruction of the articular surface, including the restoration of the anatomy, stable fixation, with minimal injury to the soft tissues preserving the vascular supply, should be applied. An adequate surgical technique will minimize complications and an aggressive rehabilitation regime will ensure the best possible result particularly in osteoporotic bones.

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