



## FUNCTIONAL OUTCOME OF FRACTURES OF PROXIMAL HUMERUS TREATED WITH PHILOS PLATE

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**ABSTRACT** Controversy surrounds the management of displaced proximal humerus fractures which accounts for 4 % of appendicular fractures and produces significant morbidity especially in elderly population. We report the functional outcome and complications of proximal humerus fractures treated by PHILOS plating (Proximal humerus internal locking system) at a mean follow up of 8 months (6-11 months). There were 19 men and 13 women with a mean age of 50.7 years (17-81). At final follow up the mean Neer's shoulder score was 82.3(70-93). Functional outcome was excellent in 18.75% cases, satisfactory in 56.25% cases and unsatisfactory in 25% cases. The study concluded that the PHILOS plate is an excellent implant for the internal fixation of majority of complex proximal humerus fractures

**KEYWORDS :** .Proximal humerus fractures; PHILOS plate; Neer's shoulder score

### INTRODUCTION

Management of displaced proximal humerus fractures remains controversial. They account for 4% of all injuries to appendicular skeleton and 26% of the humerus fractures.<sup>[1]</sup> Non-operative treatment results in poor functional outcome. The options for operative treatment include intramedullary fixation, hemiarthroplasty, closed or minimal open reduction with percutaneous fixation, open reduction and internal fixation. Neer recommended open reduction and internal fixation for displaced proximal humerus fractures<sup>[2]</sup>.

The fractures of proximal humerus have a bimodal age distribution. They occur following high energy road traffic accidents in young individuals and domestic falls in elderly population. The impacts of loss of quality of life in the patients with three & four-part fractures of proximal humerus are considerable.

The main factors that play an important role in deciding the type of management and in turn influencing the prognosis are blood perfusion of humeral head and bone quality. The objectives of treatment of proximal humerus fractures in adults are to attain and hold a satisfactory anatomical reduction and to regain the functional range of movements of the shoulder joint.

Insufficient anchorage from conventional implants may lead to early implant loosening and failure, especially in osteopenic elderly bones.<sup>[3,4]</sup> **Proximal Humerus Internal Locking System (PHILOS)** is the implant of choice in the present scenario for treatment of displaced and complex proximal humerus fractures since the design of the PHILOS plate is anatomically shaped and aims at improving purchase and pull out strength in osteoporotic bone by using a locked construct of convergent and divergent screws. With this background, we studied the functional outcome of proximal humerus fractures treated with PHILOS plate using Neer shoulder scores.

### PATIENTS AND METHODS

This prospective study of 32 patients with proximal humerus fractures was done at a single centre, Government Medical College, Thrissur from January 2015 to June 2016.

The consenting patients of all age groups were included in the study. Those who had associated neuro vascular injuries, other fractures in the same limb, previous surgery in the fractured area and musculoskeletal diseases were excluded from the study.

On admission, the patient was assessed for severity of injuries and other medical or surgical comorbidities. The primary stabilization was done by splinting. The fracture was classified according to Neer classification by analyzing three radiographs, anteroposterior, trans scapular lateral and axillary views. The written explained consent for the surgery and the study were taken.

### SURGICAL TECHNIQUE

The patients were operated in beach chair position under general anaesthesia with fluoroscopic assistance. All cases were done through a deltopectoral approach, except two by deltoid splitting approach.

The anatomical relationship between humeral head and tuberosities was reduced and fixed temporarily with K wires and sutures placed through rotator cuff tendons. The proper provisional reduction was checked under fluoroscopy. Definitive fixation using PHILOS plate was done with plate positioned lateral to bicipital groove and 1cm distal to greater tuberosity.

The limb was initially immobilized in shoulder immobilizer and mobilization was started after two weeks with pendulum and active assisted exercises. In case of severely osteoporotic or noncompliant patients mobilization was delayed. Post-operatively routine A-P and scapular views were taken to assess the reduction of fracture and stability of fixation. Patients were discharged with advice to continue pendulum exercises and active assisted movements. Active mobilization was started at 4 weeks.

During each follow up visit clinical evaluation of wound healing, pain, function, shoulder range of movements were assessed and properly recorded. The bone healing of the fracture was assessed by radiographs. Results were interpreted using Neer's shoulder score which includes pain, function, stability, range of motion and bony anatomy.<sup>[5]</sup> The patients were given scores accordingly in Neer's system with maximum score of 100 units. The outcomes were compared based on age and fracture classifications. Each patient was evaluated using this criterion during their visit to the outpatient clinics at 3 weeks, 6 weeks, 9 weeks, 3 months, and then every 3 months.

### RESULTS

The mean follow up was 8 months. The study included 19(59.37%) males and 13(40.62%) females. The Male to Female ratio was found to be M: F= 1.46:1. Age variation of the patients in the series was from 17 to 81 years with a mean age of 50.7 years. Fifty percentage of patients were above 50 years of age.

The most common mode of injury observed in this series was road traffic accident accounting for 16 patients (50%). Followed by fall accounting for 14 patients (43.75%) and two patients had a history of seizure (6.25%). There were 20(62.5%) right sided fractures and 12 (37.5%) left side fractures in the study.

There were seven (35%) 2-part fractures, sixteen (50%) 3-part fractures and 6(18.75%) 4-part fractures. The fracture dislocation type was observed in one patient (3.12%). The outcome was evaluated using NEER'S Score. In this series, the mean score was 82.3. There were 6 (18.75%) excellent, 18(56.25%) satisfactory, 8(25%) unsatisfactory results but none of the case was a failure according to the study.

**TABLE 1: DISTRIBUTION OF OUTCOME**

Outcome	No. of patients	Percentage	Mean Neer score
Excellent	6	18.75	91
Satisfactory	18	56.25	83
Unsatisfactory	8	25	74
Failure	0	0	0
<b>Total</b>	<b>32</b>	<b>100</b>	<b>82.3</b>

When the final outcomes were analyzed according to the age groups, we found out that satisfactory results were obtained mainly in younger age groups and the functional outcome was unsatisfactory mainly in above 60 years age group. The distribution of outcome based on age groups was as follows

**TABLE 2: DISTRIBUTION OF OUTCOME BASED ON AGE GROUP**

Age	Excellent	satisfactory	unsatisfactory	Failure	Mean Neer score
< 30	2	2	0	0	88
31-45	2	3	1	0	84
46-60	2	10	2	0	83
61-75	0	2	4	0	77
76-90	0	1	1	0	76
<b>Total</b>	<b>6</b>	<b>18</b>	<b>8</b>	<b>0</b>	<b>82.3</b>

When we compared outcomes based on Neer types we got better results in 2-part fractures compared to 3-part and 4-part fractures. The distribution of outcome based on NEER's classification was as follows

**TABLE 3: DISTRIBUTION OF OUTCOME BASED ON NEER'S CLASSIFICATION**

Neer classification	Outcome				Mean Neer score
	Excellent	Satisfactory	Unsatisfactory	Failure	
2 part	2	7	0	0	85
3 part	4	7	5	0	82
4 part	0	4	2	0	79
Dislocation	0	0	1	0	70
<b>Total</b>	<b>6</b>	<b>18</b>	<b>8</b>	<b>0</b>	<b>82.3</b>

During the follow up period 9(28.13%) patients had shoulder stiffness, 4(12.5%) patients had wound infection. All infections subsided with intravenous antibiotics and no additional procedures were needed. There were 3 (9.38%) plate impingement and 2(6.25%) malunion of the fracture. Also 2(6.25%) patients were found to have minimal screw penetration to the joint. There were no incidences of non-union and osteonecrosis.

## DISCUSSION

The incidence of proximal humerus fractures has increased in last few years due to increase in longevity and increase in road traffic accidents. The best management of these is still uncertain. The decision making in the treatment of displaced fracture or fracture dislocation is very difficult. Many studies have analyzed that the displaced fracture of the proximal humerus will have a bad functional outcome when treated conservatively because of the displacement of fragments.<sup>[5]</sup>

The worst functional outcomes occur in the elderly and with four-part fractures.<sup>[6]</sup> The procedures that preserves the humeral head usually have a good functional result provided there is good alignment to prevent mal or nonunion and is necessary to restore movement.<sup>[7]</sup>

However, with the aim of getting accurate reductions, rapid healing and early mobilization and restoration of function, rigid internal fixation has been increasingly used in the cases of proximal humerus fractures. The present study was conducted to assess the functional outcome of proximal humeral fracture treated by open reduction internal fixation using Proximal Humerus Internal Locking System (PHILOS) plates. Overall, open reduction and internal fixation, although not in all studies, have yielded satisfactory results.

The average age incidence in this study of 32 patients analyzed, ranging between 17 to 81 years was 50.70 years, which was consistent with the age incidence in studies done by Dolfi Herscovici et al<sup>[8]</sup> in

which the mean age was found to be 52 years This reveals that the proximal humerus fractures are more common in elderly population. The study showed a higher incidence of fractures in males than in females. This is in consensus with the results obtained by C. Gerber, CM Werner et al<sup>[9]</sup>, which showed a ratio of 1.35:1. The mode of injury commonly observed in this series was road traffic accidents which were found to be consistent with the study by Sameer Aggarwal, Kamal Bali et al,<sup>[10]</sup> showed that out of 47 patients of proximal humerus fracture, fall accounted for 55% of fracture, road side accident 42.5% and 1 fracture (2.5%) was caused by seizure.

In a study by Felix Brunner<sup>[11]</sup> of 157 cases 49(31%) were two-part fractures, 70(45%) were three-part fractures and 38(24%) were four-part fractures indicating that the incidence of type of fracture in our study is almost consistent with the other studies in the literature.

In our study, final functional outcome was assessed with NEER'S score and we got 18.75% excellent, 56.25% satisfactory and 25% unsatisfactory results. All cases of unsatisfactory results had complications and most of them were elderly patients and those patients with more fragments according to Neer's fracture pattern. None of patients in our study were failure. According to the study of A A Martinez et al<sup>[12]</sup> out of 58 persons studied 13(22.4%) cases had excellent, 36(62%) cases had satisfactory and 8(14%) cases had unsatisfactory outcome. One (1.7%) had failure. The results of our study are consistent with other studies in the literature. The study also showed that the functional outcome is better in younger age groups. This may be due to osteoporosis in elderly causing difficulty to obtain anatomical reduction and rigid fixation. The difficulty in initializing the post-operative rehabilitation in older patients was also a contributory factor.

When we compared the outcome based on NEER'S classification, it showed that the two-part fractures had a better functional outcome and when the fracture fragments increased the outcome tends to deteriorate. This is because when the number of fracture fragments were more it was difficult to obtain a good anatomical reduction. The results were in accordance with the results obtained in the studies by Solberg, Brian D et al<sup>[13]</sup> in 2009 and Per Olerud, Leif Ahrengart et al<sup>[14]</sup> in 2010.

Ramachander Siwach et al<sup>[15]</sup> reported 8% of malunion, 8 % of impingement and 4 % of implant loosening. According to study by Felix Brunner et al<sup>[11]</sup>, there were 1.26% of infection, 2.5 % malunion, 8.22% avascular necrosis, 2.53 % impingement, 14 % screw penetration and 2.5 % stiffness reported. The complication rate in our study was moderately higher compared to previous studies in literature. This can be due to more number of elderly patients in our study series.

The limitation of this study was the relatively small sample size and a short duration of follow up.

## CONCLUSION

PHILOS plate fixation of proximal humerus fractures provides better functional outcome. Accurate anatomical restoration of the articular surface and tuberosities can be easily achievable with the use of the PHILOS plates as it provides both divergent and convergent screw orientation to head of humerus. A strict rehabilitation protocol dedicated for the shoulder joint plays an important role in final functional outcome.

The age of the patients and Neer's fracture classification have a significant effect on the functional outcome. The higher the number of fracture fragments and age of the patient, the functional outcome tends to be less favorable. This can be attributed to poor bone quality in elderly due to osteoporosis and difficulty in achieving anatomical reduction in case of increased fracture fragments.

In conclusion PHILOS plate is mechanically and biologically an advantageous implant in fixation of displaced proximal humeral fractures.

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