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## A prospective study of outcome of fracture of proximal humerus treated with PHILOS plating

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### Abstract

**Background:** PHILOS plating is used for two to four fragmented dislocated fractures of the proximal humerus, including fractures involving osteopenic bone, pseudarthroses and osteotomies in the proximal humerus. Various studies have been conducted regarding the outcome of fracture of proximal humerus treated with PHILOS plating with variable outcomes. The present study was designed to determine the efficacy and functional outcome of PHILOS locking plate in proximal humerus fractures.

**Method:** As per study criteria, 40 patients with fracture of the shoulder was included in this study. After the admission of patients a detailed, careful history was taken to know the mechanism of injury. The patient was assessed clinically to evaluate general condition, vitals were recorded and an examination of fracture site was done to know the Swelling, deformity, loss of function and nerve injury, distal vascularity. Radiological assessment was done and fracture was classified and a preoperative routine haematological investigation was done.

**Result:** Regarding complications of surgery, postoperative infection was found in 2(5%) patients, stiffness of the shoulder was present in 2(5%) patients, one patient developed malunion and Osteonecrosis was present in one patients. The constant score was excellent in 20 (50%) patients; it was good in 18(45%) patients and fair in 2(5%) patients.

**Discussion and conclusion:** From the present study we can conclude that PHILOS plating provides good fracture stabilization in the treatment of proximal humeral fractures. Stiffness of the shoulder was a common complication but present in 5% of patients. The postoperative outcome was excellent in most of the patients.

**Keywords:** Proximal humerus, fracture, PHILOS plating, outcome

### Introduction

A fracture of proximal humerus is also called a fracture of the shoulder. It is common in the elderly associated with low-energy fall precipitated by osteoporosis. This fracture account 5-6% of all adult fractures [1, 2]. Anatomically proximal humerus is complex. It has two necks (anatomical and surgical) and two tuberosity (greater and lesser) in addition to that other structures are bicipital groove/intertubercular sulcus, medial calcar, and insertion sites for the deltoid, pectoralis major, and latissimus dorsi muscles [3, 4]. The surgical neck which is an area of constriction distal to the tuberosities is the common site of fracture. The deforming forces of attachment of muscle and neurovascular structures in that area makes it more vulnerable for non-union and complication [5].

Various surgical and non-surgical treatment options are available for the management of proximal fracture of the humerus. That includes hemiarthroplasty, plate osteosynthesis, percutaneous fixation, intramedullary nailing, reverse shoulder arthroplasty and selection of treatment method depends upon type and severity of the fracture, age of patients, expertise of surgeon and condition of patients [6].

PHILOS plating is used for two to four fragmented dislocated fractures of the proximal humerus, including fractures involving osteopenic bone, pseudarthroses and osteotomies in the proximal humerus. Various studies have been conducted regarding the outcome of fracture of proximal humerus treated with PHILOS plating with variable outcome. Shahid R, Mushtaq A, Northover J, Maqsood M has concluded that the PHILOS plate is a reliable implant [7].

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Gaheer RS, Hawkins A *et al.* has concluded that Good fracture stability can be achieved early, allowing early mobilization without compromising fracture union [8]. Doshi C, Sharma GM, Naik LG, Badgire KS, Qureshi F has concluded that PHILOS plating has a good functional outcome. However, proper patient selection, thorough knowledge of the anatomy and biomechanical principles are the pre-requisites for a successful surgery.

We have designed this study to determine the efficacy and functional outcome of PHILOS locking plate in proximal humerus fractures and incidence of complications that may occur with it in our clinical setup.

**Material and method**

**Place and time of study:** This study has been conducted in the department of orthopaedics, Konaseema institute of medical sciences, Amalapuram, Andhrapradesh from January 2017 to November 2020.

**Type of study:** This is a prospective observational study.

**Ethics:** Approval from the institutional ethics committee was taken before start of the study. Written informed consent was obtained from all patients before enrolling them for the study.

**Selection of patients**

The patients admitted in the department of orthopaedics with displaced fracture of the proximal end of the humerus were enrolled for this study as per the following exclusion and inclusion criteria.

**Inclusion criteria**

- Age more than 18 years
- Both sex
- Based on Neer's classification two-part, three-part, and four-part fractures of the proximal humerus
- Both open and closed fractures of the proximal humerus

**Exclusion criteria**

- Less than 18 years
- Acute infection
- Pathological fracture and malignancy

**Method**

As per study criteria 40 patients with fracture of shoulder was included in this study. After admission of patients a detailed, careful history was taken to know the mechanism of injury. Patient was assessed clinically to evaluate general condition, vitals were recorded and examination of fracture site was done to know the Swelling, deformity, loss of function and nerve injury, distal vascularity. Radiological assessment was done and fracture was classified and preoperative routine haematological investigation was done.

**Surgical procedure:** - Patient was placed in supine and beach chair position under the regional block. After the assessment of shoulder images by fluoroscopy the operative field was prepared and draped in a sterile manner. The deltopectoral approach was used, the ceohalic vien was identified and retracted laterally. Soft-tissue dissection is performed until fracture site is visualized. The humerus head was reduced carefully and temporary fixation was done by two or three k-wires under fluoroscopy guidance by checking in both AP and Lateral views. Then, the plate was placed in a position lateral to the intertubercular sulcus and fixed with angle stable screws to both head and shaft. Position of plates and screws were checked by fluoroscopy to see the length of the screws.

At the end of surgical procedure sterile dressings applied. No cast or splint was applied. Immediate post-operative x rays were taken in both AP and Lateral views.

The patient was followed follow-up every 6 weeks till fracture union and at 1 year after surgery and the constant score was used for functional assessment higher the score better was the outcome [10].



**Fig 1:** Pre-operative and post-operative x-ray of fracture of the proximal humerus



**Fig 2:** Intraoperative images of fracture of the proximal humerus

**Result**

During our study period of two years eleven months we enrolled 40 patients with fracture proximal humerus treated with PHILOS plating as per our enrolled criteria. In present study mean age of patients were 60.32±9.34 years. The most common age group with fracture proximal humerus were between 45 to 69 years of age that was 16(40%). Number of patients between 18 to 30 years of age were 4(10%), between 31 to 45 years of age were 8(20%), more than 61 years of age were 12(30%). There was female predominance.

**Table 1:** Characteristic of patients with fracture of proximal humerus

Variables	Number	Percentage
Age (Mean± SD = 60.32±9.34 years)	18 to 30	4 10
	31 to 45	8 20
	46 to 60	16 40
	More than 61	12 30
Sex	Male	16 40
	Female	24 60
Neers classification	One part	2 5
	Two-part	8 20
	Three-part	22 55
	Four-part	8 20
Mechanism of trauma	Road traffic accident	26 65
	Trivial fall	4 10
	Fall from height	10 25
Associated medical condition	osteoporosis	12 30
	Diabetes mellitus	4 10
	hypertensions	8 20

Regarding Neer's classification three-part fracture was most

common and was found in 22(55%) patients, one part fracture was found in 2(5%) patients, two part fracture was present in 8(20%) patients and for part, fracture was present in 8(20%) patients. Road traffic accident 26(65%) was a most common mode of injury, followed by fall from height 10 (25%) and trivial fall 4(10%). In present study, osteoporosis is most common associated medical condition 12(30%), hypertension was present in 8(20%) patients and 4 (10%) have diabetes mellitus.

**Table 2:** Post-operative complications of patients with fracture of proximal humerus treated with PHILOS plating

Complication	Number	Percentage
Post-operative infection	2	5
Stiffness of shoulder	2	5
Malunion	1	2.5
Non-union	0	0
Osteonecrosis	1	2.5

Regarding complications of surgery, postoperative infection was found in 2(5%) patients, stiffness of the shoulder was present in 2(5%) patients, one patients developed malunion and Osteonecrosis was present in one patients.

**Table 3:** constant score of patients with fracture of proximal humerus treated with PHILOS plating

Result	Number	Percentage
Excellent	20	50
good	18	45
fair	2	5
poor	0	0

As per table 3, the constant score was excellent in 20 (50%) patients; it was good in 18(45%) patients and fair in 2(5%) patients.

**Table 4:** Value of Constant score of patients

Constant score	Range		Mean	SD
	Min	Max		
	72	100	88.64	8.42

The mean of the constant score was 88.64± 8.42, maximum value was 100 and minimum value was 72.

**Discussion**

In present study 40 patients with fracture of proximal end of humerus was evaluated who were treated with PHILOS plating. Mean age of patients were 60.32±9.34 years. Most common age group with fracture proximal humerus were between 45 to 69 years of age that was 16(40%) and there was female predominance. Bergdahl, C., Ekholm, C., Wennergren, D. *et al.* has reported in his study that most humeral fractures occurred in patients aged fifty years or older and the majority of these were in women which support our study [11]. In our study three part fracture was most common which is supported by the work of A. Roux, L. Decroocq, S. El Batti *et al.* [12]. Road traffic accident 26(65%) was most common mode of injury followed by fall from height and trivial fall which is supported by Dr. Yogesh C Patel and Dr. Pranay R Laddha but Doshi C, Sharma GM, Naik LG, Badgire KS, Qureshi F has reported that fall from height is more common [9, 13]. Osteoporosis is most common associated medical condition which is supported by the work of Schumaier A, Grawe B *et al.* [14].

In present study shoulder stiffness is most common

complication which is supported by the work of Ziegler P, Maier S, Stöckle U, Gühring M, Stuby FM [15]. Geiger EV, Maier M, Kelm A, Wutzler S, Seebach C, Marzi I has reported that avascular necrosis of the humeral head in two patients (7.2%) which support our study. Spross C, Platz A, Rufibach K, Lattmann T, Forberger J, Dietrich M has reported that avascular necrosis was the main reason for secondary arthroplasty which again support our study.

In our study outcome was excellent in 20 (50%) patients; it was good in 18(45%) patients and fair in 2(5%) patients which is supported by P Kosalaraman; P Balamurugan, S Marimuthu, R Ragavanandam [18]. The mean of constant score was 88.64± 8.42 which is supported by Haridas \*S J, Thyagarajan D, Dent C, Evans R, and Williams R *et al.* [19].

**Conclusion**

From present study we can conclude that PHILOS plating provides good fracture stabilization in the treatment of proximal humeral fractures. Stiffness of shoulder was common complication but present in 5% patients. Postoperative outcome was excellent in most of the patients.

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