

## Comminuted Displaced Fractures of Surgical Neck of Humerus Treated by PHILOS Plating

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### Abstract

### Original Research Article

In the aged population, fractures of the proximal part of humerus hold the place for highest incidence (63/1000 per year) next to the fractures of the distal radius and hip. Codman classified these fractures based on the mode of injury. Neer proposed a modification of this classification system. Their management remains conservative for the undisplaced ones and surgical treatment for the displaced type because they may lead to complications like malunion, non-union and a bad outcome. Our present study has been conducted prospectively on the patients admitted at our department at Sree Balaji Medical College and Hospital, Chennai with fracture of the surgical neck of humerus. These patients were managed by open reduction followed by internal fixation using proximal humerus locking plate (PHILOS plate). The outcome was assessed on the basis of Neer's scoring system. Results were quite promising in our patients thus indicating the proximal humerus locking plate to be a good treatment option.

Keywords: Surgical neck, humerus, PHILOS plate, fracture.

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## INTRODUCTION

Fractures of the proximal humerus account for five to nine percent of all the fractures [1], being the second most common. Most of these type of fractures are stable and displaced only minimally, thereby validating conservative management [2]. This can be done by sling immobilisation and physiotherapy [3]. However, surgical management is necessary for displaced fractures which is quite challenging. Non-operative treatment of these displaced proximal humerus fractures have been associated with a poor outcome like non-union, malunion and avascular necrosis [4]. Various surgical modalities are available with variable results. These include closed reduction and percutaneous fixation, transosseous suture fixation [5], open reduction and internal fixation using plates, locking plate fixation and hemiarthroplasty [2, 6]. One of the advantages of closed reduction along with percutaneous fixation is it requires comparatively minimal dissection thereby lesser compromise over the vascular supply [7,8]. But this does not prove the same in osteoporotic bone. The other methods are also associated with noteworthy complications like non-union, malunion, impingement and rotator cuff impairment [8].

The proximal humerus interlocking plate (PHILOS) plate provides a good treatment option for these fractures. The locking plate is a single beam construct thereby allowing no motion in between the components - the plate, screw and bone. Thus they serve four times stronger compared to the load sharing beam constructs. As these plates are precontoured for the proximal humerus, the need for a plate to bone compression using locking screws is bypassed, also with an advantage of preservation of blood supply to the bone. They also reduce the risk of malreduction [9].

The aim of our present study is to determine the functional outcome of the displaced fractures of surgical neck of humerus treated using locking plates by Neer's shoulder score.

## MATERIALS AND METHODS

One of the major advantages of PHILOS plate is gentle reduction of the fracture by indirect methods, even in cases with a poor bone quality. This is due to the combination of plate-screw locking at fixed angle with the screws placed three dimensionally over the head of humerus, thus requiring shorter immobilisation and permitting earlier exercise.

A prospective study was conducted on patients admitted with displaced fractures of surgical neck of humerus of closed type in our department at Sree Balaji Medical College and Hospital, Chennai during the period from March 2017 to February 2018. This included a total of 15 patients - 9 males and 6 females. The patients with fractures of closed type - 2part, 3 part and 4 part fractures displacement more than 1 cm and a varus angulation of more than 45 degree were included in the study. Those with open fractures of severe comminuted type, fractures with minimal displacement and pathological fractures were excluded from the study. The mean age of the patients was 35 years.

The patients were evaluated clinically for tenderness, swelling, deformity and neuro vascular deficit. Hematological and radiological investigations were performed preoperatively and anaesthetic fitness obtained. Informed written consent was obtained from the patients.

### Operating Technique

The patients were taken up for surgery in a beach chair position under general anesthesia along with a regional block. Patients were put on perioperative intravenous antibiotic coverage. Deltopectoral approach was employed by a 8 to 10 cm incision from the coracoid process. Dissection was done more lateral to the bicipital groove to avoid vascular damage. The nervous plane between the pectoralis major and deltoid muscle was identified carefully and separated and the cephalic vein was retracted. The subscapularis muscle was incised along its fibers after making it taut in external rotation. After clearing the fracture hematoma, the fracture fragments were identified and reduced. The reduction was checked in both the views.

The PHILOS plate (proximal humerus interlocking plate) was placed and fixed with screws. The tuberosity was fixed through the plate holes. Finally reduction was confirmed using C-arm in both the views. The rotator cuff muscles were sutured and proper meticulous closure of the wound was performed. The arm was kept in a sling pouch postoperatively. Mobilisation exercises started from the first postoperative day under physiotherapist guidance. Suture removal was done by 12th postoperative day.

The patients were followed up and assessed 2 weeks, 6 weeks, 3 months and if possible 6 months postoperatively. Radiological assessment was performed in AP and lateral scapular views in internal and external rotation to look for fracture union, in terms of cortical continuity. Complications like avascular necrosis and loss of fixation were also looked for. Clinically pain, range of motion and return of function were assessed.

## RESULTS

A total of 15 patients with displaced fracture of surgical neck of humerus were treated by PHILOS plating in order to evaluate the radiological and functional results. Their average age was 35 years with a more of male preponderance (Male to female ratio 3:2). The mode of injury was by fall in 11 patients and by road traffic accident in four. The interval between the injury and surgery was around 2 to 3 days.

As per Neer's classification system for proximal humerus fractures, 9 patients had two-part fracture, 4 had three-part and 2 patients had four-part fracture. The average surgical duration was 95 mins. No intra operative or immediate postoperative complications were observed. One patient developed superficial surgical wound infection which subsided with debridement, antibiotics and regular aseptic dressing. Complications like screw backing, breaking of screw /plate was observed in none of our patients.

Fracture union was observed radiologically by 12 to 14 weeks. No limitation of physical activity was observed in the patients during followup except one, who had mild to moderate limitation during recreational activity.

Maximum abduction possible at followup was 160 degrees. Forward flexion was possible upto a maximum of 170 degrees. Full range external rotation was possible in most cases. None of the cases experienced complications like shoulder impingement or avascular necrosis.

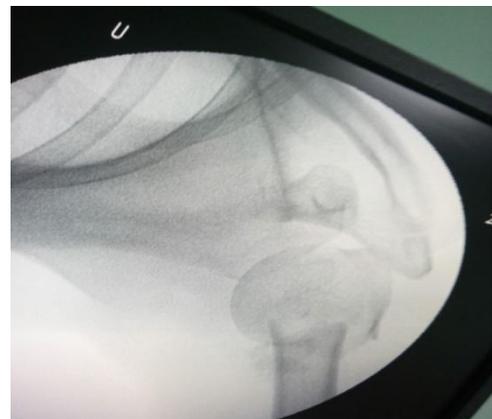
As per Neer's scoring system (Table-1), 5 patients (33.3%) had excellent results, 8 patients (53.3%) had a satisfactory outcome and 2 patients (13.3%) had unsatisfactory results.

**Table-1: Neer's scoring system**

Functional	
<b>Pain</b>	
No Pain	35
Slight, occasional, no compromise in activity	30
Mild, no effect on ordinary activity	25
Moderate, tolerable, makes concessions	15
Marked, serious limitations	5
Totally disabled	0
<b>Function</b>	
Strength- normal	10
Good	8
Fair	6
Poor	4
Trace	2
Zero	0
Reaching- Top of Head	2
Mouth	2
Belt buckle	2
Opposite axilla	2
Brassiere hook	2
Stability- lifting	2
Throwing	2
Pounding	2
Pushing	2
Hold overhead	2
<b>Range of Motion</b>	
Flexion- 180 <sup>0</sup>	6
170 <sup>0</sup>	5
130 <sup>0</sup>	4
100 <sup>0</sup>	3
80 <sup>0</sup>	2
<80 <sup>0</sup>	1
Abduction 180 <sup>0</sup>	6
170 <sup>0</sup>	5
140 <sup>0</sup>	4
100 <sup>0</sup>	3
80 <sup>0</sup>	2
<80 <sup>0</sup>	1
Extension 45 <sup>0</sup>	3
30 <sup>0</sup>	2
15 <sup>0</sup>	1
<15 <sup>0</sup>	0
External Rotation 60 <sup>0</sup>	5
30 <sup>0</sup>	3
10 <sup>0</sup>	1
<10 <sup>0</sup>	0
Internal Rotation 90 <sup>0</sup>	5
70 <sup>0</sup>	4
50 <sup>0</sup>	3
30 <sup>0</sup>	2
<30 <sup>0</sup>	0
<b>Anatomy (Rotation, Angulation)</b>	
None	10
Mild	8
Moderate	4
Marked	0-2
<b>Results</b>	
90-100 Points	Excellent
80-89 Points	Satisfactory
70-79 Points	Unsatisfactory
<70 Points	Failure



**Fig-1(a):** Anteroposterior view of left shoulder taken in C-arm showing displaced fracture of the surgical neck of humerus with varus angulation



**Fig-1(b):** Axial view of the same patient taken on C-arm



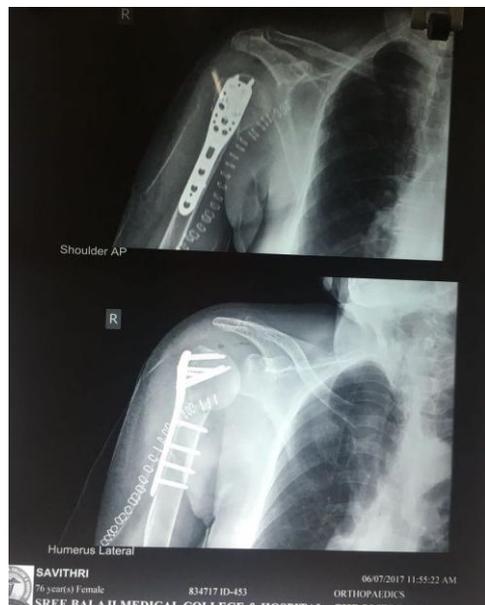
**Fig-1(c): Intraoperative picture – Fracture reduced and PHILOS plating being done**



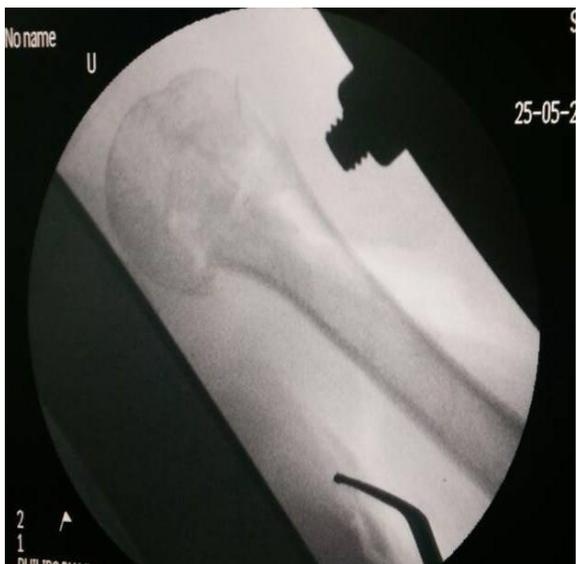
**Fig-2(b): Postoperative picture of the patient after fracture reduction and PHILOS plate fixation and stapling of the operative wound**



**Fig-1(d): C-arm picture showing the reduced fracture fixed with the proximal humerus locking plate**



**Fig-2(c): Postoperative Xray – AP and lateral views showing successful fracture reduction and fixation by PHILOS plate**



**Fig-2(a): Anteroposterior view of the right humerus of a 76 year old female showing fracture along the surgical neck**

## DISCUSSION

Fractures of the proximal humerus are quite challenging to treat. The undisplaced variety can be satisfactorily managed conservatively. However, fractures with an intra-articular extension, displaced varieties and those with severe comminution demand

surgical management [2, 11]. The primary aim of this surgical treatment is restoration of function as to resume the day to day activities earlier. The various surgical options include percutaneous K- wiring, T plate [12, 13], blade plate [14], one third tubular plate [15], tension band wiring [16], helix wiring [17], external fixator [18, 19], intramedullary nail [20, 21], locking plate [8, 10, 22, 23] and hemiarthroplasty [24].

Each method has its own advantages and disadvantages. Percutaneous pinning while associated with lesser soft tissue injury and neuro vascular complications, it does not ensure adequate reduction of the fracture thereby delaying mobilisation and healing. It is also associated with complications like infection along the tract of the pin [25]. The results of tension band wiring were quite similar to those treated nonoperatively [4, 26]. T-plates have shown poor results in patients with osteoporosis along with complications like avascular necrosis, loosening of screw [27, 28]. On the other hand, locking plates have proved to show a better functional outcome in these cases [14, 29, 30]. They have become the standard treatment of choice for fractures of the proximal humerus, especially of displaced type [31, 32]. In these locking plates, the force is transmitted to the blade of the plate through the locking screws from the bone. This helps in providing more stability and lesser complication rate [33].

In our present study, the common mode of injury was fall with a significant male preponderance. The common fracture pattern associated was 2 part fracture. The mean duration between injury and surgery was 2.5 days.

None of the patients in our study had associated neuro vascular damage. The average time to union observed radiologically was 12 to 14 weeks. The results were excellent in 33.3%, good in 53.3% and bad in 13.3% of the patients. Problems like loss of reduction, displacement of fragments were not seen in out patients. The proximal humerus locking plate provides an excellent treatment option for fractures of the surgical neck of humerus, even in patients with osteoporosis. Fragment collapse is prevented by the angular stability, proper and sufficient buttressing and support of load sharing. Thus it can be used in 2 part, 3 part and 4 part fractures, both in the young and the aged population, provided proper surgical technique is used.

## CONCLUSION

Our current study shows that the proximal humerus locking plate is an assuring treatment option for fractures of the surgical neck of humerus, including osteoporotic bones. The implant provides support inferomedially through the locking screws and buttressing effect laterally. In the whole, the PHILOS plate is better in terms of functional and radiological outcome in displaced fractures of surgical neck of

humerus. The major limitations of our study is a smaller sample and shorter period of followup with lesser osteoporotic patients. However, the treatment was much fruitful in the adult patients of our study group.

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