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**Research Article**

# A Retrospective Comparative Study of Surgical Management of 4 Part Proximal Humerus Fractures between Internal Fixation with Philos Plate and Hemi Replacement with Neers Prosthesis

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**ABSTRACT**
**Background:** Neer recommended open reduction and internal fixation (ORIF) for three-part fracture dislocations and primary hemiarthroplasty (HA) for four-part fracture dislocations and for fractures with greater than 50% of cartilage-covered articular defect. The current study was conducted to compare surgical management of four part proximal humerus fractures between internal fixation vs hemi replacement.
**Methods**: The study is a hospital based retrospective case study, conducted in Government General Hospital, Kurnool during the period of June 2022 to June 2024. 30 patients (adults) presenting with proximal humerus fractures with a follow up period of minimum of 6 months and maximum of 18 months were included. After surgery, all patients were examined six weeks, three months, and six months later, as well as every two weeks until a fracture had healed. The constant Score were evaluated at each visit. A shoulder with affected arm X-ray was taken to check for fracture union and implant-bone interaction.
**Results:** In this study maximum age was 80 years and a minimum of 50 years with an the average age of 64.4 years. Significant differences were observed in all complications between range of movements between the two groups. Average time taken for internal fixation by hemiarthroplasty procedure was 120mins as compared to Philos which was100minutes.Blood loss was measured in terms of suction drain collection and mop count. The average amount of blood loss was 216 ml for PHILOS procedure and 356 ml for HEMIREPLACEMENT procedure.
**Conclusions:** the ROM pertaining to flexion, abduction, internal rotation, and external rotation for individuals with Philos plating was 17%, 20%, 4% and 4.6% higher than those who received Neer's hemiarthroplasty. In conclusion, our study suggests that Philos plate osteosynthesis may have superior results than hemiarthroplasty when treating four-part proximal humerus fractures in individuals aged fifty and above.

**Keywords:** Four-Part Proximal Humerus Fractures, Hemi Replacement, Philos Plate, Complications.

## INTRODUCTION

The incidence of proximal humerus fractures (PHFs) has been increasing since the 1970s.[1,2] One-fifth of PHFs are categorized as 3-part and 4-part fractures – the most severe and difficult to treat according to Neer's four-segment classification system.[3,4] Current treatment strategies for 3- and 4-part fractures include non-surgical treatment (NST), open reduction internal fixation (ORIF), hemiarthroplasty (HA), and reverse total shoulder arthroplasty (rTSA).[5] Typical NSTs involve bracing the shoulder with a standard sling, cuff and collar, and occasionally a hanging arm cast or airplane splint.[6] ORIF encompasses a wide array of techniques, from intramedullary nailing to osteosynthesis with a locking plate. This is the preferred method of treatment especially for younger patients; however, it has been linked to higher rates of nonunion, mal-union, and loss of reduction with hardware impingement in osteoporotic bone.[7,8] HA is another treatment option that may have some benefit if the proximal humerus fragments are deemed nonreconstructable.9 While pain relief with HA is generally good, patients can suffer from rotator cuff deficiency or limited motion if the humeral tuberosities do not heal well.[9] Lastly, rTSA involves the use of both humeral head

and socket prostheses with a reversal of the normal ball and socket orientation. The rTSA is becoming the treatment of choice for patients with non-reconstructable PHFs as patient can achieve excellent motion, even when the tuberosities do not heal or if the rotator cuff is incompetent. It may also be performed for NST fracture sequelae and the revision of failed HA procedures.[10]

Neer recommended open reduction and internal fixation (ORIF) for three-part fracture dislocations and primary hemiarthroplasty (HA) for four-part fracture dislocations and for fractures with greater than 50% of cartilage-covered articular defect. PHILOS (Proximal Humerus Interlocking Osteosynthesis) have been developed for fractures of the proximal humerus with these implants, better biomechanical stability could be achieved. Anatomic reconstruction for severely displaced fractures and fractures with glenohumeral dislocations aiming to achieve superior function compared with primary Hemi-Arthroplasty has been reported with PHILOS. While for undisplaced fractures, literature strongly suggests non operative treatment.[11-13]

Surgical management strategies for complex proximal humerus fractures include open reduction and internal fixation (ORIF) or arthroplasty either hemiarthroplasty (HA) or reverse total shoulder arthroplasty (RTSA).[14] There is controversy regarding whether ORIF or HA is superior when treating complex proximal humerus fractures and fracture-dislocations, and few studies examine the difference in outcomes.[14-16] Many surgeons agree that young patients should be treated with anatomic reduction and plate osteosynthesis in order to preserve bone stock, improve tuberosity healing, and prevent glenoid erosion and arthrosis that could result from HA despite the lack of studies comparing ORIF to HA in young patients (<50 years of age). Recent studies suggest that RTSA for 3- and 4-part proximal humerus fractures may have improved outcomes and a lower failure rate compared to HA.[16,17] The current study was conducted to compare surgical management of four-part proximal humerus fractures between internal fixation vs hemi replacement.

## MATERIAL AND METHODS

The study was a hospital-based retrospective case study, conducted in the Government General Hospital**,** Kurnool during the period of June 2022 to June 2024. 30 patients(adults) presenting with proximal humerus fractures to the OPD at Department of Orthopaedics, or presenting to the Emergency Department, at Government General Hospital**, Kurnool** with a follow up period of minimum of 6 months and maximum of 18 months.

### Inclusion Criteria

All patients above 18 years of either sex admitted to Govt General Hospital, Kurnool with 4 part proximal humerus fractures, Closed 4 part proximal humerus fractures, and Patients consenting for treatment were included in the study.

### Exclusion Criteria

Patients aged below 18 years, patients with open proximal humerus fractures, associated Shaft of humerus fractures, patients medically unfit for surgery, pathological fractures other than osteoporosis, associated head injury/vascular injury and Infection were excluded.

### Data Collection

A proforma created specifically for the study was used to record the data of patients who were admitted to the study with proximal humerus fractures 4 part (neer's classification). Patients were discharged from the hospital after receiving treatment, and they were followed up at regular intervals in the outpatient department by both clinical and radiological evaluation. Patients were followed up until the union of the fracture and their functional recovery a subsequent follow-up was carried out if necessary.

### Patient Management

Depending on their general condition, patients with these fractures were resuscitated upon arrival. The patients general state of health and evaluation evaluation of the type, size, and severity of the fracture through clinical and radiological methods.

### Clinical Examination

Proximal humerus fractures occur in both young and older populations. a complete history and physical examination must be obtained to determine the mechanism and velocity of fracture and to identify other associated injuries, such as rib, cervical, and scapular fractures, that occur in high-energy

trauma. the presentation of proximal humerus fractures is typical; patients will be tender over the shoulder with associated swelling and possible ecchymosis which typically appears within 24 to 48 hours after injury and may extend distally into the arm, forearm, chest wall, and breast over the next 4 to 5 days, is useful in identifying the timing and severity of the injury. It may appear within the first few hours after high-velocity trauma and represents more extensive soft tissue disruption. The arm of the patient will be in internal rotation. Palpation over the shoulder and any attempted movement of the extremity will elicit pain in the shoulder region. Crepitus can be noted with palpation of the shoulder. Gentle rotation of the humerus and palpation of the fracture can be used as a guide to fracture stability because stable fractures will move as a unit a complete neurovascular assessment must be performed because axillary nerve, brachial plexus, and arterial injuries can occur with proximal humerus fractures. Arterial injuries, even in the presence of a normal physical examination, should be suspected in all four-part fracture-dislocations in which the humeral head is in the axilla.

**Follow Up**

After surgery, all patients were examined six weeks, three months, and six months later, as well as every two weeks until a fracture had healed. The constant Score were evaluated at each visit. A shoulder with affected arm X-ray was taken to check for fracture union and implant-bone interaction.

Statistical Analysis: All the patients' details were entered in Microsoft excel. All categorical variables were presented as frequency and percentages and continuous variables were presented as mean and SD. Chi-square test/Fisher exact test was used to compare the difference between proportions. The significance of difference between means of continuous variables between two groups were compared using unpaired t test. IBM SPSS version 26$^{th}$ was used for statistical analysis. A p values less than 0.05 was considered as statistically significant.

**RESULTS**

In our study maximum age was 80 years and a minimum of 50 years with an the average age of 64.4 years. The right side was affected in 19cases and left in11 cases. No. of male patients in our series, were 17 and female were 13. Out of the 30 patients, 15 of them underwent fixation with Philos plate osteosynthesis and the rest of them were treated with HEMIREPLACEMENT. (Figure 1 and Table 1)

Average time taken for internal fixation by hemiarthroplasty procedure was 120mins as compared to Philos which was100minutes.Blood loss was measured in terms of suction drain collection and mop count. The average amount of blood loss was216ml for PHILOS procedure and 356ml for HEMIREPLACEMENT procedure. (Table 2)

**Intra Operative Complications**

In PHILOS LOCKING PLATE patients, complications were intra operatively Varus angulation, Sub acromial impingement, Tuberosity displacement, each one patient. In

**HEMIREPLACEMENT patients,** Mal positioning of implant, over stuffing of joint, Tuberosity displacement each one patient. (Table 3 and 4)

**Postoperative Complications**

In hemireplacemenet patients, one case of wound infection at the operative site which required intravenous antibiotics for a period of 3 weeks. The wound healed without the need for any further interventions. No other complications like Deep Venous Thrombosis, systemic infection etc. were noted. (Table 3 and 4)

**Delayed Complications**

In our PHILOS patients, we had 3 cases of delayed union. All cases of the delayed union were followed up closely and no interventions were required as there was no case of non-union noted.1 cases with avascular necrosis of humerus were noticed due to the excessive medial hinge comminution noted at the fracture sites which were functionally disabling the patient with pain during shoulder movements. One case with varus angulation but union of fracture without any functional disability. In Hemireplacement patients, 2 cases had shoulder stiffness. 1 case had tuberosity displacement due to non union had functional disability while performing shoulder movements. They were physiotherapy to strengthen shoulder muscles. 2 cases have acromio humeral distance less than 7mm leading to subacromial impingement and one

case prosthetic loosening. (Table 5 and 6)

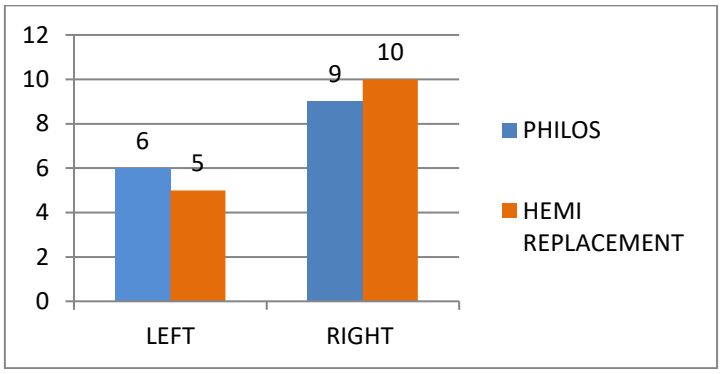


Figure 1: Side Distribution

Table 1: Age in Years Distribution

| Age in years | No of patients |
|---|---|
| Below 50 | 0 |
| 50-60 | 11 |
| 61-70 | 12 |
| 71-80 | 7 |
| Above 80 | 0 |

Table 2: Intraoperative Details

| Criteria | HEMIREPLACEMENT (AVRG) | PHILOS (AVRG) |
|---|---|---|
| Duration of Surgery | 120 | 100 |
| Blood loss | 216 | 356 |
| **Reduction** | | |
| Easy | 11 | 8 |
| Difficult | 4 | 7 |

Table 3: Intraoperative Complications (PHILOS)

| Intraoperative complications | NUMBER OF CASES | PERCENTAGE |
|---|---|---|
| Varus angulation | 1 | 6.66% |
| Sub acromial impimgment | 1 | 6.66% |
| Tuberosity displacement | 1 | 6.66% |
| Axillary nerve injury | 0 | 0% |
| Screw penetration | 0 | 0% |

Table 4: Intraoperative Complications (HEMIREPLACEMENT)

| Intra op complication | No. of cases | Percentage |
|---|---|---|
| Malpositioning of implant | 1 | 6.33% |
| Overstuffing of joint | 1 | 6.66% |
| Tuberosity displacement | 1 | 6.66% |

Table 5: Delayed Complications: Philos Patients

| Delayed complications | No. of cases | Percentage |
|---|---|---|
| Delayed union | 3 | 20% |
| Avn humerus head | 1 | 6.66% |
| Implant failure | 0 | 0% |
| Varus collapse | 1 | 6.66% |
| Shoulder stiffness | 0 | 0% |
| Deltoid weakness | 0 | 0% |

Table 6: Delayed Complications: HEMIREPLACEMENT

| Delayed complications | No. of cases | Percentage |
|---|---|---|
| Stiffness | 2 | 13.33% |
| A-H distance less than 7 mm | 2 | 13.33% |
| Tuberosity non union | 1 | 6.66% |
| Loosening | 1 | 6.66% |

Table 7: Mean ROM Scores in Philos and Hemiarthroplasty Series

| Movements | Technique | Mean | P Value |
|---|---|---|---|
| Flexion | PHILOS | 150 | 0.0171 |
| | HEMIARTHROPLASTY | 131.33 | |
| Abduction | PHILOS | 144 | 0.0056 |
| | HEMIARTHROPLASTY | 123.33 | |
| External Rotation | PHILOS | 74.6 | 0.0354 |
| | HEMIARTHROPLASTY | 70.66 | |
| Internal Rotation | PHILOS | 76.66 | 0.0695 |
| | HEMIARTHROPLASTY | 72 | |
| | HEMIREPLACEMENT | 29.26 | |

Significant differences were observed in all complications between range of movements between the two groups. (Table 7)

## DISCUSSION

The number of proximal humerus fractures has been going up in recent years due to changes in life style and increase in road accidents, compared to previous years. Treatment options used to be limited to t-butresss plate, tbw and the like but managing these injuries remains uncertain. Most undisplaced proximal humerus fractures can be treated conservatively. Treating displaced or dislocated fractures remains challenging. Study was done to compare the functional outcomes of patients with four-part proximal humerus fractures treated with two different devices: Philos and Hemireplacement. Our study included 30 patients with four-part proximal humerus fractures, half treated with Philos and the other half with hemi replacement. all patients were randomly selected from the Kurnool government general hospital between June 2022 and June 2024.

Regarding age, our patients ranged from 50-80 years old, with an average age of 64.4 years. The main cause of fractures in older people was trivial falls. we found similar observations in other studies by Santhosh Kumar Sahuu and Arinndam Chatterjee study, Gerber C etal study and Sameer Aggarwal study. [18,19,20]

Previous studies investigating the best method for surgical treatment of more complex proximal humerus fractures have had varying conclusions. Solberg et al[14] found significantly improved Constant scores in patients treated with locked plating for 3- and 4-part fractures, including fracture-dislocations. However, another more recent study found no difference in Constant scores or SF-36 scores between patients treated with ORIF or HA for fracture-dislocations of the proximal humerus.[16] Similar to our data, a number of studies reporting complications predominantly found osteonecrosis and screw cutout to be the most frequent complications following ORIF.[14,16]

## CONCLUSION

In summary, the rom pertaining to flexion, abduction, internal rotation, and external rotation for individuals with Philos plating was 17%, 20%, 4% and4.6%higher than those who received neer's hemiarthroplasty. In conclusion, our study suggests that Philos plate osteosynthesis may have superior results than hemiarthroplasty when treating four-part proximal humerus fractures in individuals aged fifty and above.

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