



A STUDY ON FUNCTIONAL OUTCOME OF PROXIMAL HUMERUS FRACTURES TREATED WITH PHILOS PLATING

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ABSTRACT **Background:** Proximal humerus fractures are common and debilitating injuries. These fractures have a dual age distribution occurring either in young people following high energy trauma Usually high energy trauma associated with dislocation or in those older than 60 years with low-velocity injuries like simple fall, especially in elderly patients is due to osteoporosis and deforming forces of muscle attached. Wide range of treatment modalities ranging from conservative management to reverse shoulder arthroplasty. The non-operative method gives good results in stable and minimally displaced fractures. Displaced humeral neck fractures used to be managed conservatively in the past, but these were complicated by loss of reduction, malunion, non-union, stiffness and ultimately poor functional outcome. We took up this study to assess the efficacy and functional outcome of P.H.I.L.O.S. plating in proximal humerus. Our objectives are to study the fracture pattern with the Neer's criteria, to reconstruct the proximal humerus fracture anatomically with Philos plate, allow early shoulder mobilization and assessing the functional outcome using Constant Murley score. **Materials and methods:** It is an observational study of 30 patients (18 females and 12 males) with proximal humerus fractures that attended to the Department of Orthopaedics, Government General Hospital, Rangaraya medical college, Kakinada from December 2018 to December 2020. **Results:** The mean follow-up period was 12 months. Two patients lost follow-up. Of the remaining 28 patients, all fractures were united clinically and radiologically. At the final follow-up the mean Constant-Murley score was 69.2 (range 50 - 100). The results were excellent in 3, good in 12, fair in 10 patients, poor in 3 patients. During the follow-up 4 cases had varus mal-union, 5 had stiffness of the shoulder, 2 had superficial infection and 1 had screw penetration. No cases of hardware failure, locking screw loosening or non-union were noted. **Conclusion:** The divergent and convergent orientation of the locking screws of PHILOS plate provides stable biological fixation with good radiological union. It minimises the soft tissue dissection and gives both axial and angular stability hence, reducing the risk of fracture displacement.

KEYWORDS : proximal humerus fractures, Proximal humerus internal locking system (PHILOS), Constant and Murley shoulder scoring system

Introduction:

Proximal humerus fractures constitute 4-5% of all fractures, and they account for 45% of all humerus fractures. The major goal in the treatment of these fractures is to promote complication free healing to recreate a pain free mobile, stable and functional shoulder joint. Numerous authors have suggested that non operative treatment may be preferable for two-part, three-part and four-part fractures in elderly patients but pain and restricted movements have been reported in higher percentage of patients after this treatment approach.

Most proximal humerus fractures are either non-displaced or minimally displaced. Up to 80% of proximal humeral fractures can be treated non operatively, resulting in satisfactory results. Neer's classification⁽¹⁾ distinguishes between the number of displaced fragments with displacement defined as greater than 45° of angulation or > 1 cm of separation. These types of fractures require stable fixation.

The displaced proximal humerus fractures benefit from surgery. However, various internal fixation methods using k wires and screws, angle blade plates, external fixators, T-plates, intramedullary devices, locking compression plates, and shoulder arthroplasty have been reported. The proximal humerus has a poor cancellous bone, especially in old patients, results in high risk of failure of fixation with conventional plating system⁽²⁾. Still, none of these methods have been consistently successful. For full functional recovery anatomical reduction, stable fixation and early mobilization are required.

The PROXIMAL HUMERUS INTERNAL LOCKING SYSTEM (P.H.I.L.O.S.) plate was introduced to reduce these complications, especially in older osteoporotic individual. The locking compression plate fixation provides more excellent angular stability than the conventional implants.

The Complications with Philos plate fixation are screw protrusion into the glenohumeral joint, broken implant, screw pull out 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.

We took up this study to assess the efficacy and functional outcome of P.H.I.L.O.S. plating in proximal humerus. Our objectives were to study the fracture pattern with the Neer's criteria, to reconstruct the proximal humerus fracture anatomically with Philos plate, allow early shoulder mobilization and assessing the functional outcome using Constant Murley score⁽³⁾.

Materials and methods: Approval was obtained from the local ethical committee with number IEC/RMC/2018/375A. 30 adult patients (18 males and 12 females) with proximal humerus fractures who attended outpatient or admitted in inpatient in the department of orthopaedics, government general hospital, Kakinada from December 2018 to December 2020 were prospectively recruited. Patients with age > 18 years, with Neer's two-part, three-part and four-part Proximal humerus fractures and those who gave informed consent to the procedure were included in the study. Compound fractures, pathological fractures, fractures associated with neurovascular injuries and cervical spine injuries, and those who are unfit for surgery were excluded in this study.

After proper pre-operative blood and radiological work up the surgery was planned. Fractures were classified according to NEER's classification. Preoperative preparation of local part including shaving and surgical scrub were done. Injectable antibiotics were given 1 hour before surgery.

Under General anaesthesia or inter-scalene block, patients were kept in beach chair position. A Delto-pectoral approach⁽⁴⁾ was used. The fracture was reduced initially by displacing the fracture fragments. The GT fragment was usually migrated posteriorly and superiorly. A no. 2 ethibond was used to gain control over the fragment. The varus

was corrected by using an osteotome. Care was taken not to create new fractures in poritic bones. The fracture was provisionally fixed with k wires. Two k wires were placed from the shaft just lateral to the biceps tendon into humeral head, taking care that they do not come in the way of plate position. One k wire was placed from the GT fragment into the shaft medial cortex. GT and LT were brought into proper position with the help of the ethibond passing from the supraspinatus and infraspinatus through their respective holes in the philos plate. The subscapularis muscle was repaired using ethibond to the respective holes in the plate. The plate was placed at least 10mm distal to the greater tubercle tip and fixed to the humeral shaft with screws.



Figure 1 : Images showing Deltopectoral approach and Philos plate fixation .

The arm was immobilized in a shoulder immobilizer. Active range of movement of the elbow, wrist, and hand were also begun immediately after surgery. Passive R.O.M. exercises routinely were begun 3weeks postoperative. The patient was then progressed through a three-phase rehabilitation program^(5,6), consisting of passive assisted exercises early, active exercises starting at approximately six weeks postoperatively, and strengthening or resisted exercises beginning 10 to 12 weeks after surgery. Shoulder strengthening was initiated after bony consolidation was confirmed on plain radiographs, and adequate coordination of the extremity had been achieved.

Standard AP, lateral and axillary radiographic views were taken immediately after surgery. Routine follow-up radiographs were taken at 3, 6 weeks and 3,6 & 12 months postoperatively to ensure that no pin had migrated, no loss of reduction had occurred, evidence of callus formation and consolidation of fracture.

Statistical analysis:

The data was entered into excel sheet. Analysis done using appropriate statistical software. All qualitative variables were expressed as proportions or percentages with 95% confidence interval and quantitative variables were expressed as mean with standard deviation.

Results: Of 30 patients with proximal humerus fractures (n = 30) with managed with O.R.I.F. and P.H.I.L.O.S plating, the maximum age was 72 years, and the minimum was 24 years with an average age of 47.53 years. 18 were male (60%), 12 were female (40%). The common mode of injury in our study was trivial fall accounting for 16 cases (53.4%) followed by a road traffic accident in 14 cases (46.6%). 16 patients (53.4%) had left shoulder fracture and right shoulder in 14 patients (46.6%). Neer's 3part fractures constitute the majority cases. (Table - 1).

Table-1:

Neer's classification	Number of patients	Percentage
Type 1	0	0%
Type 2	10	33%
Type 3	18	60%
Type 4	2	7%
Total	30	100%

The mean time taken for fracture union was 10 weeks. The minimum time taken for fracture union was eight weeks, and the maximum time was 12 weeks. The mean time taken for skin healing was 12 days with minimum time taken was 8 days and maximum time taken was 14 days. In all patients suture removal was done within 14 days.

Functional outcome was assessed using, The Constant & Murley scoring system using the severity of pain, activities of daily living, range of Motion, and strength to determine the results. 3 cases had excellent results, 12 had good results, 10 had moderate results, and 5 had poor results (Table -2). In our study minimum Constant & Murley score was 39 and the maximum score was 93. In patients with poor and moderate results average score was 60.06. In patients with good and excellent results average score was 78.66. An overall average score was 69.2 (table-2)

Table-2:

Constant Murley score	No. of fractures	percentage
100-86(excellent)	3	10%
85-71(good)	12	40%
70-56(moderate)	10	34%
<55(poor)	5	16%
total	30	100%

10 cases had complications like 5 had stiffness of the shoulder, 2 had superficial wound infection, and one had screw penetration, 2 had varus malunion.

Case 1:



FIG-6: showing (A) pre-operative, (B) immediate post-operative, (C) 1 year followup radiological images respectively. After 12 months followup showing range of movements Abduction (D) External rotation (E) Internal rotation (F) Flexion (G).

Case-2:



FIG-7: showing (A) pre-operative, (B) immediate post-operative, (C) 1 year followup radiological images respectively. After 12 months followup showing range of movements Abduction (D) External rotation (E) Internal rotation (F) Flexion (G).

Discussion

Proximal humerus fractures are challenging to treat. The surgeon must obtain an anatomical reduction and stable fixation, and early initiation of rehabilitation of shoulder to obtain a good functional outcome. Iatrogenic risk of avascular necrosis of humeral head can be minimized by meticulous dissection of the periarticular soft tissues.

Defining correct treatment guidelines through analysis of current treatment options is becoming increasingly important as the prevalence of osteoporotic fractures of proximal humerus are expected to rise in the next decades

In normal conventional plates, the chance of backing out or cutting out of screws is more. It is difficult to hold the bony fragments as they are highly fragile due to osteoporosis, thereby affecting the proper reduction. The philos plate helps in circumventing these complications through a combination of multi-directional locking screws for the head and locking screws in the shaft especially in osteoporotic patients. The locking compression plate fixation provides more excellent angular stability than do conventional implants. They provide more stable

buttress laterally, and the diverging screw options in the cancellous bone makes them the implant of choice in complex fractures. The forces are transmitted from the bone to the screw head and then to the plate, and thus these plates have better stability than the non-locking plates. It works as a locked internal fixator and provides better anchorage of screws in osteoporotic bone with good functional outcomes.

In our study the mean age was found to be 47.53 years which is comparable to other studies, Mauro emilo et al⁽⁷⁾. which had mean age 61.8 years AA Martinez et al⁽⁸⁾. et al. had mean age 61 years .

In this study, majority (60%) were with Neer's 3part fractures. Kristiansen and Christensen have reported a high incidence of fixation failure following use of T-buttress plates in fixation of proximal humerus fractures. Wiggman et al⁽⁹⁾. reported good intermediate and long-term results in 87% of patients who had three-and four-part fractures fixed with T-buttress plate.

The average clinical output obtained in the study, with a mean the Constant-Murley score of 69.2 points is satisfactory. In their retrospective study of neers 3 and 4 part fracture, Solberg showed The Constant scores for the three-part fractures of the proximal humerus in the locked-plate were 71.6 and the scores for the four-part fractures of the proximal humerus in those groups were 64.7. Kettler et al⁽¹⁰⁾ reported a Constant- Murley score between 52 to 72 points after ORIF with the PHILOS plate. Hente et al⁽¹¹⁾ reached a mean Constant Murley score of 55 point. The outcome seems to correlate with fracture severity, anatomic reduction, aetiology, bone quality, length of time elapsed from injury to surgery, concomitant injuries, and the implant's exact positioning and fixation.

In our study functional outcome was poor in 5, moderate in 10, good in 12 , excellent in 3. AA Martinez in their retrospective study assessed the functional outcome on proximal humeral fractures who underwent Philos plate fixation Functional outcome was poor in 1, moderate in 8, good in 36 and excellent in 13 patients.

In our study, the complication rate was 27 %. Eight patients ended up with complications among which, stiffness was reported in 5 cases and superficial infection in two cases who had concomitant diabetes and in 1 case screw penetration. Egol et al⁽¹²⁾. observed one case of acute infection in their series of 51 patients who mainly had 3 and 4 part fractures. Gardner et al. reported one superficial infection in one patient that managed with oral antibiotics. Humerus head screw penetration is noted in various studies. There is one single such case in our study. We have used intraoperative fluoroscopy monitoring of the drill bit while drilling and monitored the screw position in two views to avoid articular penetration. Varus malunion is one of the complications following fixation of proximal humerus fracture. It is defined as a head shaft angle of humerus fewer than 120 degrees. In our study, there are 2 cases of varus malunion noticed. Moonot et al⁽¹³⁾. reported the occurrence of malunion in 3part proximal humerus fractures. Bjorkenheim et al. reported 26.3 % of the fractures having 2, 3 and 4part united in slightly Varus position after open reduction and internal fixation with locking plate.

A relatively small sample size (30 cases) and shorter follow up are the main limitations of this study. Our results demonstrate both the potential benefits and problems of using the P.H.I.L.O.S. plate. We have obtained good functional results and fracture union.

Jan-Magnus Bjorkenheim et al⁽¹⁴⁾. study concluded that the Philos method appears safe and can be recommended to treat proximal humerus fractures with poor bone stock.

Emanuel V Geiger study showed that the P.H.I.L.O.S. plate provides sufficient fracture stabilization in treating proximal humeral fractures of elderly patients.

M A Fazal concluded that Philo's plate fixation provided stable fixation, minimal metalwork problems and enabled early range-of-motion exercises to achieve acceptable functional results.

Conclusion:

PHILOS plate is advantageous & safe implant in fixing proximal comminuted and displaced 2- and 3-part fractures in both younger, active patients and especially elderly osteoporotic bone. Medial

metaphyseal cortical continuity, good bone stock, age of patient determines the outcome. It has the advantage of a high degree of angular and axial stability. The convergent and divergent arrangement of the locking screws engaging in the humeral head prevent pull out and failure of fixation. It provides early mobilization with excellent radiographic and functional result allows the patient to regain good shoulder function and return to work early. Early post-operative rehabilitation is the key to obtain a better functional outcome.

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