

Proximal Humeral Fractures: An Experience With PHILOS Fixation

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ABSTRACT

- Objective** To evaluate functional outcomes and complications after open reduction and internal fixation of displaced proximal humerus fractures by proximal humeral internal locking osteosynthesis system (PHILOS).
- Study design** Cross sectional study.
- Place & Duration of study** Department of orthopaedics at CMH Abbottabad, From October 2011 to September 2012.
- Methodology** Patients with displaced proximal humerus fractures treated with proximal humerus locking plate were included in the study. Patients were followed for a minimum period of ten months. Neer's classification was used to group the fractures. Open fractures and infected injuries were not included in the study. Functional evaluation was done according to the Constant-Murley scoring system.
- Results** Eighteen patients (M=14, F=4) were managed during the study period. Thirteen patients were between the ages of 20-45 year (M=12, F=1) and 5 patients were between 46-60 years (M=2, F=3). Seven patients (M=6, F=1) had 2-part fractures, 5 patients (M=3, F=2) had 3-part fractures, and 6 patients (M=5, F=1) had 4-part fractures.
- The mean follow-up period was 10 ± 2 months. Thirteen (72.2%) patients had excellent to good results, 16.6% (n=3) had fair, and 11.2% (n=2) had poor result. Average Constant Murley scores for 2-part (9 ± 1) and 3-part fractures (14 ± 2) were significantly superior to those of 4-part fractures (24 ± 2) (p value = 0.002 and 0.018, respectively). Difference between 2-part and 3-part fractures was not significant (p value=0.023). There was no significant difference between younger (≤ 45 year) and older patients (>45 year). Complications encountered in this series were reduced shoulder movements in 11% (n=2), screw perforation in 5.5% (n=1), varus mal-reduction 11% (n=2), plate impingement in 11% (n=2), infection in 5.5% (n=1). No non-union and malunion occurred in this study.
- Conclusions** Proximal humerus locking plate gives reliable fixation for 2-part and 3-part fractures of proximal humerus. Its' use in Neer's 4-part fractures was associated with poor clinical outcome.
- Key words** Fractures, Proximal humerus, PHILOS.

INTRODUCTION:

Fractures in the proximal humerus are commonly seen in orthopaedic practice. In spite of being a common orthopaedic injury (4–5 % of all fractures)

management of proximal humerus fractures remains a topic of debate.¹ Treatment is guided by multiple factors including displacement of fracture fragments, the baseline functional status of the patient, hand dominance, and age. Non-operative treatment is the standard of care for non- or minimally displaced proximal humerus fractures but significantly displaced fractures are usually treated by operation using a variety of fixation techniques.²

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The complex peri-articular anatomy, poor quality of bone and cancellous nature of proximal humerus, diverse deforming forces due to pull of attached muscles in different directions, osteoporosis and being a part of a multi-axial joint, etc. make the reduction and fixation of fractures in this area quite difficult.³

Multiple complications like stiff joint, malunion, non-unions, implant failure, and debricolage are reported.⁴ The need was to have an implant to provide a stable construct. The advent of proximal humeral internal locking osteosynthesis (PHILOS) plate system seems to have met most of these requirements.⁵ Pre-contoured PHILOS plates work on the principle of angular stability, less disruption of vascularity, three-dimensional distribution in the humeral head and less chances of plate failure. In order to have the desired results of proximal humeral fracture fixations it is mandatory that certain key principles should be strictly adhered to. These include an accurate surgical technique, good placement of the implant to avoid impingement, correct assessment of depth of screw, avoidance of screw perforation of the articular surface and adequate length of implant diaphyseal stem.⁶ This study was conducted to evaluate the functional outcomes and complications after open reduction and internal fixation of displaced proximal humerus fractures by using PHILOS.

METHODOLOGY:

This was a cross sectional study carried out in the Department of Orthopaedics at CMH Abbottabad from October 2011 to September 2012. Patients were selected on non-probability convenience sampling. The exclusion criteria were open fractures and infected cases. Selected guidelines for the treatment of displaced 2-part, 3-part, and 4-part proximal humerus fractures (angulation of the articular surface of >45 degrees or displacement of more than 1 cm between the major fracture segments) were adhered to.

Eighteen consecutive patients as per the selection criterion, of displaced proximal humerus fractures (as defined by Neer's criteria) were included in the study. Radiological evaluation was carried out for in-depth analysis of fracture pattern. Antero-posterior and axillary views of shoulder were obtained in all patients and MRI of the fractures was also used. Fractures were classified according to Neer's classification into 2-part, 3-part, and 4-part. There were seven 2-part, five two 3-part, and six 4-part fractures. Local (Ortho-med Sialkot) titanium made version of original PHILOS (Synthes) which is a pre-contoured plate according to the anatomy of proximal part of humerus, was used in all patients.

All the fractures were exposed using a standard delto-pectoral approach with the patient in the supine position on a radiolucent table. Fractures were reduced by manual traction and abduction to neutralize pull of the deltoid and rotator cuff muscles. After provisional stabilization of fractures by sutures and k-wires, definitive fixation with PHILOS; proximal humerus locking plate was done. Plate was applied over lateral aspect of proximal humerus and locking screws were inserted, first in the head fragment. Care was taken in placing the plate lateral to the biceps tendon and 5-8 mm distal to upper end of greater tuberosity with the help of the target jig. Postoperative x-rays were obtained in all patients.

Postoperatively arm sling was applied and continued for at least 6 ± 1 week. Passive-guarded physiotherapy was started in the second postoperative week and gradual active movements were started after 6 weeks and continued till fracture union. Forceful active range of motion exercises and passive stretching exercises were started after fracture union. Patients were followed up at 6 weeks, 12 weeks, 4 months, 6 months, and 1 year intervals. At each visit, functional evaluation was done according to Constant-Murley scoring system. The Constant Murley score was graded as >30 Poor, 21-30 Fair, 11-20 Good and <11 Excellent. Constant score and its various subcomponents were compared between 2-part, 3-part, and 4-part fractures at the last available follow-up after one year.

All the statistical calculations were done using SPSS 20 software and fisher exact test was applied. The level of significance was set at $\alpha=0.05$.

RESULTS:

Average Constant Murley scores for 2-part fractures was (9 ± 1) and 3-part fractures (14 ± 2) were significantly superior to those of 4-part fractures (24 ± 2) (p value = 0.002 and 0.018, respectively). Difference between 2-part and 3-part fractures was not significant (p value = 0.023).

Complications encountered in this series were reduced shoulder movements in 11% { type 3 (n=1) and 4 part (n=1) }, screw perforation in 5.5% {4 part (n=1)}, plate impingement in 11% { type 2 (n=1) and 3 part (n=1)}, infection in 5.5% {3 part (n=1)}, and non-union in 11% {4 part (n=2)} of cases. No cases of malunion were experienced in our study.

DISCUSSION:

Standard management for proximal humeral fractures has been with conventional T plates and screws, K wires, sutures or in many cases hemiarthroplasty.⁷ This has been associated with

high rates of unsatisfactory results and complications.⁸ The advent of locking plates which are angularly stable plates, has virtually revolutionized the fixation of these fractures. These plates have the advantage of secure fixation in multi-fragmented, metaphyseal and especially the osteoporotic bones. These results are attributable to the biomechanical studies which suggest that locking plates resist physiological loads more effectively.

In our study, 66% (n = 12) of the patients had excellent to good outcome. In comparative studies done at other centres, Agudelo J et al treated 30 patients and showed an overall excellent to good Constant score of 57.5%. The mean age in this series was 58 year (range 19-92 year) and fractures were Neer's 2-part, 3-part, and 4-part fractures.⁹ Moonot P et al in their study showed 68.7% excellent to good results. Mean age was 63 year (range 29-82 year) and fractures were Neer's, 3-part, and 4-part.¹⁰ These results are comparable to our study.

Varus malreduction has been correlated with poor outcome in many studies. In our study varus malreduction of >20 degrees occurred in 11%. (n=2; 4 part fractures). All the patients with varus malreduction had Constant score >29. All of the fractures with varus malreduction of >20 degrees united. These cases also had plate impingement in the sub acromial area. This implicates varus malreduction as a major cause of plate impingement in the sub acromial area and the leading reason is lack of use of restraint jig and free hand high placement of the plate, too far superiorly.

Screw perforation which occurred in our study in one case was seen more in series of Parmaksizoglu et al.¹¹ This screw perforation occurred because of osteoporotic bone with error of screw length. Similar incidence of screw perforation have been reported in other studies.¹² We found no significant difference in outcome between patients of age group less than or more than 60 year. Similar findings have been reported by Sudkamp N et al.¹³ No osteonecrosis occurred in our series, probably due to the fact that most of the patients with Neer's 4-part group were in the surgical neck region and hence had low risk of osteonecrosis as reported by Liu et al as well.¹¹ The occurrence of infection in one case was due to immune-compromised state consequent to diabetes.

The key variables in obtaining desirable outcomes in such fractures were found to be experience of the operator, his operative technique, training level and a keen sense of reconstruction, in addition to the presence of complications mainly because of

intraoperative technical errors. The use of PHILOS in proximal humeral fractures is highly recommended as per the results of obtained our series.

CONCLUSIONS:

PHILOS or proximal humerus locking plate fixation for 2-part and 3-part fractures has good to remarkable functional outcomes but its use in 4-part fractures is associated with less desirable outcomes in comparison to 2 and 3 part fractures. However compared to other methods of fixation of 4 part fractures there was no comparison to the comparative excellence of results obtained with PHILOS.

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