

## Original Research Article

# A study of proximal humerus fractures treated by PHILOS plating in a tertiary care hospital

S. Srikanth, A. Varun Kumar Reddy\*, Gudapati Omkarnath

Department of Orthopedics, Malla Reddy Medical College for Women, Hyderabad, Telangana, India

**Received:** 17 June 2019

**Revised:** 03 July 2019

**Accepted:** 04 July 2019

**\*Correspondence:**

Dr. A. Varun Kumar Reddy,

E-mail: [alurivarun@gmail.com](mailto:alurivarun@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** Proximal humeral fractures are commonly presented in the orthopedic practice. The usual method of treatment was conservative in the past. However, the results and functional outcomes were not good. With the development of proximal humeral internal locking system (PHILOS) plates, the functional outcomes are known to be improved. We in the present study tried to evaluate the functional outcomes of proximal humerus fractures treated with PHILOS plates.

**Methods:** This prospective study was conducted in all Adult patients with closed two-part and three-part fractures of the proximal humerus, those who have reported within a week of the injury were included in the study. A total of n=30 patients were included in the study based on the inclusion and exclusion criteria. A standard surgical approach with PHILOS plate was used and patients were followed up for 19 to 24 months.

**Results:** n=30 patients out of which n=16 (53.33%) were males and n=14 (46.67%) were females. The most common age group involved in the fractures was 31-35 years n=9 (30%) of the patients. Most of the patients n=21 (70%) were having Neer's two-part fractures and three-part fractures were found in n=6 (20%) and four part in n=3 (10%). The overall results in the study were 66.67% of patients had excellent results and 16.67% had good results and 10% had poor results.

**Conclusions:** PHILOS locking plates is a better treatment option for fractures of proximal humerus especially in cases of poor bone quality and comminuted fractures.

**Keywords:** Proximal humerus fractures, PHILOS plating, Functional outcome

### INTRODUCTION

Fractures of proximal humerus are the second most common fracture of upper limb accounting 4% to 5% of all fractures.<sup>1</sup> The annual fractures rate of fractures in adult individuals is 63 per thousand fractures. The incidence is on the rise due to the increase in the aging population and osteoporosis.<sup>2,3</sup> The important case of proximal humerus fractures is due to high energy trauma.<sup>4</sup> Large numbers of such fractures are stable and are with minimum deviation, and hence closed treatment is the method of choice. However, in about 15 to 20% of cases, surgical intervention is required. Operative

treatment is required for displaced, unstable fractures and those associated with dislocations.<sup>5</sup> According to recent recommendations, the fractures of proximal humerus that have been displaced greater than 45 degrees or 1 cm should be managed with closed or open reduction and operative fixation.<sup>6,7</sup> Osteosynthesis is the option employed when it is suited for patients the aim of osteosynthesis is to promote stability allows early mobilization and obtain good positioning of fractures fragments.<sup>4</sup> The selection of the type of reduction or synthesis material to be utilized depends on the pattern of the fractures, bone quality, age and levels of activity of patients.<sup>8</sup> The plate and screw fixation method is widely

popular among orthopedic surgeons. However, the use of plate and screw is also associated with complications such as loosening of the screws especially in the older patients.<sup>8</sup> Hence fixed angled locked plates were developed to allow a more stable fixation especially in cases where the bone quality is poor. The proximal humeral internal locking system (PHILOS) plate is a new generation of implant plate with a locking system. It is considered as a fixed angle implant and is designed according to the anatomy of the proximal humerus.<sup>9</sup> There is less chance of screws loosening and better purchase in the humeral head and very minimal chances of secondary loss of reduction. With this background, we in the present study tried to evaluate the functional outcomes of proximal humerus fractures treated with PHILOS plates.

## METHODS

This prospective study was conducted in the Department of Orthopedics Institute of Medical Sciences from October 2017 to March 2018. Institutional Ethical committee permission was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in their local language. Inclusion criteria were all adult patients with closed two-part and three-part fractures of the proximal humerus, those who have reported within a week of the injury. Exclusion criteria were patients with open fractures, polytrauma, critical patients, patients with pathological fractures, and those who have reported after 1 week of the fractures. A total of n=30 patients were included in the study based on the inclusion and exclusion criteria. All the involved patients were subjected to radiographic evaluation. CT scan of the shoulder was performed if intra-articular involvement or glenoid involvement or articular comminution was suspected. A standard deltopectoral approach was used in all cases. The fracture fragments were identified and after the reduction of fracture fragments, a temporary fixation with K wires was performed to hold the fracture reduction. A pre-contoured locking plate was positioned against the lateral aspect of greater tubercle and about 10mm below to avoid subacromial impingement. The PHILOS plate was applied 1 cm distal to the upper end of the greater tubercle and fixed to the humeral head with proximal locking screws and the distal screws were inserted into the humeral diaphysis. An image intensifier was used to check the reduction, plate position, length of screws to avoid penetration of screws into the glenohumeral joint. Range of motions was checked and finally, the wound was closed in layers. The arm was immobilized by using a shoulder sling and arm pouch. The wound was checked on the second postoperative day and the sutures were removed on the 14<sup>th</sup> day. Postoperatively limb elevation and active finger movements will be advised depending on pain tolerance. The patients were followed for a period of 12 months. Functional outcomes were assessed according to the Constant scoring system. The constant scores of 0 to 55

were graded as poor, 56 to 70 as moderate, 71 to 85 as good, and 86 to 100 as excellent.

The data collected was entered into an Excel sheet. It was subjected to statistical analysis in MS Excel and SPSS v.16. Data was expressed in frequencies and percentages when qualitative and in mean±SD when quantitative. Unpaired student T test was used for comparing the trends for all parameters in the two groups. A p value of <0.05 was considered significant.

## RESULTS

This study included n=30 patients out of which n=16 (53.33%) were males and n=14 (46.67%) were females. The most common age group involved in the fractures was 31-35 years n=9 (30%) of the patients followed by n=7 (23.33%) in the age group 20-25 years. The other distribution of the patients based on age and sex are given in table 1.

**Table 1: Age and sex wise distribution of patients in the study.**

Age group (in years)	Male (N)	Female (N)	Total (%)
20-25	4	3	7 (23.33)
26-30	3	2	5 (16.6)
31-35	5	4	9 (30)
36-40	2	1	3 (10)
41-45	0	3	3 (10)
46-50	1	1	2 (6.67)
> 50	1	0	1(3.33)
<b>Total</b>	<b>16</b>	<b>14</b>	<b>30 (100)</b>

**Table 2: Classification of proximal humerus fractures as per Neer's classification.**

Neer's classification	Male (N)	Female (N)	Total (%)
<b>One part</b>	0	0	0 (0)
<b>Two part</b>	11	10	21 (70)
<b>Three part</b>	4	2	6 (20)
<b>Four part</b>	1	2	3 (10)
<b>Total</b>	<b>16</b>	<b>14</b>	<b>30 (100)</b>

In our study majority of patient n=22 (73.33%) of patients sustained an injury due to RTA, followed by falls on outstretched hand n=7 (23.33%) and assaults n=1(10%) cases. Most of the patients n=25 were seen in the Emergency on the day of the injury and n=4 were seen on the second-day injury and n=1 was seen on the fourth day of the injury. The Neer's classification of fractures of proximal humerus was followed in this study. Most of the patients n=21 (70%) were having Neer's Two-part fractures and three-part fractures were found in n=6 (20%) and four part in n=3 (10%) of the patients' Table 2.

**Table 3: The functional outcomes of patients based on constant scores.**

Constant score	Two-part	Three-part	Four-part	Total (%)
<b>Excellent (86-100)</b>	17	3	0	20 (66.67)
<b>Good (71-85)</b>	2	2	1	5 (16.67)
<b>Satisfactory (56-70)</b>	1	1	0	2 (6.67)
<b>Poor (0-55)</b>	1	0	2	3 (10)
<b>Total</b>	21	6	3	30 (100)



**Figure 1: AP view of the left shoulder showing the proximal humerus fracture.**



**Figure 2: AP view of the left shoulder showing treatment with PHILOS plate fixation.**

All of the cases in the study were operated within a period of 1-4 days from the time of injury. The Mean follows up period was 12 months. Fractures were assessed clinically for union and the following criteria were used: painless, unaided movements, no tenderness. Radiological union criteria were when the fractures were found with bridging trabeculae present across the fracture site covering at least 75% of its circumference. The average time for the radiological union was 13.5 weeks and the patients were functionally evaluated based on the constant scoring system. The final outcome of the procedure was graded: excellent scores 86-100, good scores 71-85, moderate scores 56-70, and poor scores 0-55, respectively and the overall functional scores are given in Table 3.

**Table 4: Surgical complications in patients with PHILOS plating.**

Complications	Male	Female	Total	%
<b>Superficial Infection</b>	2	0	2	6.67
<b>Wound dehiscence</b>	0	0	0	0
<b>AVN of the humeral head</b>	1	0	2	3.33
<b>Hardware failure</b>	1	0	1	3.33
<b>Secondary varus</b>	1	1	1	6.67
<b>Pseudoarthrosis</b>	0	1	1	3.33

Superficial infection was found in n=2 (6.67%) of managed successfully by antibiotics, AVN was seen in one male. One of the male patients had AVN of the head along with nonunion of the fragment with the shaft. Hardware failure in the form of loosening screws was seen in n=1 patient and secondary varus (8°-11°) was found in n=2 patients. Pseudoarthrosis was found in one female patient shown in Table 4.

**DISCUSSION**

The development of locking plates for the treatment of proximal humerus fractures has brought a new dimension to the treatment especially for the three-part, four-part, epiphyseal fractures in young patients and fractures in bone that have become fragile.<sup>10</sup> The mechanical advantage of locking plates is that sufficient stability can be achieved without plate-bone contact. The stability is provided by the locking screws and hence better results are obtained in porous bones.<sup>11</sup> The PHILOS (proximal humerus internal locked system) developed by the AO-ASIF group is the latest generation of locking compression plates.<sup>12,13</sup> The main aim of surgical treatment of displaced proximal humerus fractures is to restore the functional status of the patient as far as possible to the pre-fracture state. In the present study, the fractures were classified radiologically according to Neer's classification. The majority of cases were n=21 (70%) were two-part fractures and similar observations have been reported by other studies.<sup>14-17</sup> The age range of

the patients in the present study was 20 to 58 and the mean age was 29.5 years the mean age of the patients in this study is lower due to the fact that most n=22 (73.33%) of the fractures were due to Road Traffic Accidents. In the present study, the male was more affected than females in agreement with Vijay et al; who found male preponderance in the fractures of the humerus.<sup>18</sup> In our study, we found the right side was involved in the n=18 (60%) and left side in n=12(40%) of cases. The average duration of the interval between the injury and time of surgery was 3.25 days whereas a study by Vijay et al; found the average time lag to be 6.24 days whereas Resch et al have found the interval between 2 to 10 days.<sup>18,19</sup> The average time for the radiological union in the present study was 13.5 weeks it was in accordance to similar studies done by Ebraheim et al, Klitscher et al Kilic et al.<sup>20-22</sup> In the present study, 66.67% had excellent results and 16.67% had good results. Hirschmann et al, in their study with 64 patients with a minimum follow-up of four years, treated with locking plate, and have reported 75% excellent and good results.<sup>22</sup> They also concluded that these results continued to improve even one year after the surgery. Rose et al found 75% consolidation and excellent results.<sup>14</sup> One of the probable reasons for the better result of the present study is because our patients were relatively young and both the bone quality and surgical technique was good. In our study, the minimum follow up was 18 months in which n=25 (83.33%) patients reported no pain and the remaining n=5 (16.67%) had a mild complaint of pain occasionally during prolonged activity involving the shoulder. Fankhauser et al found good pain relief with an average constant pain score of 13.9 after one year of follow up. Secondary varus 8°-11° displacement of the proximal fragment was seen in two cases of the present study Acklin et al, observed secondary varus displacement in only one out of 29 patients, using the same implant. This is in agreement with the results of the present study.<sup>23,24</sup> Fankhauser et al, observed three cases of secondary varus displacement of the proximal fragment in their series of 29 patients. Avascular necrosis of humeral head is one of the known complications of the proximal humeral fracture commonly seen in 4 part fractures.<sup>23</sup> In the present study also we found one AVN complication in a male with 4 part fracture. Kilic et al used PHILOS for fixation of proximal humeral fractures and reported AVN in only one of 22 patients in their series.<sup>6</sup> The results in our study were comparable to those reported in the literature. The overall complication rates were lower in the present study due to standard surgical intervention and greater numbers of fractures were two-part fractures.

## CONCLUSION

Within the limitations of the present study, it can be concluded that PHILOS locking plates are a better treatment option for fractures of proximal humerus especially in cases of poor bone quality and comminuted fractures. The rates of complication can be minimized by good surgical technique and proper selection of cases.

The overall functional outcomes of PHILOS locking plates remain good.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

## REFERENCES

1. Neer CS II, Rockwood CA. Fractures and dislocations of the shoulder, in Rockwood and Green: Fractures in adults, Philadelphia, PA: Lippincott; 1984: 675-621.
2. Zyto K. Non-operative treatment of comminuted fractures of the proximal humerus in elderly patients. *Injury.* 1998;29:349-52.
3. Lind T, Kroser K, Jensen J. The epidemiology of fractures of the proximal humerus. *Arch Ortho Trauma Surg.* 1989;108:285-87.
4. Iannotti JP, Ramsey ML, Williams GR Jr, Warner JJ. Nonprosthetic management of proximal humeral fractures. *Instr Course Lect.* 2004;53:403-16.
5. Ko JY, Yamamoto R. Surgical treatment of complex fracture of the proximal humerus. *Clin Orthop Relat Res.* 1996;327:225-37.
6. Kilic B, Uysal M, Cinar BM, Ozkoc G, Demirors H Akpinar S. Early results of treatment of proximal humerus fractures with the PHILOS locking plate. *Acta Orthop Traumatol Turc.* 2008;42(3):149-53.
7. Codman EA. Fractures in relation to the subacromial bursa. In: Codman EA (editor), *The Shoulder: Rupture of the Supraspinatus Tendon and Other Lesions in or About the Subacromial Bursa.* Boston MA: Thomas Todd; 1934: 313-333.
8. Broos PL, Semon A. From unstable internal fixation to biological osteosynthesis. A historical overview of operative fracture treatment. *Acta Chir Belg.* 2004;104(4):396-400.
9. Smith WR, Ziran BH, Anglen JO, Stahel PF. Locking plates: Tips and tricks. *J Bone Joint Surg Am.* 2007;89(10):2298-07.
10. Clavert P, Adam P, Bevort A, Bonnomet F, Kempf JF. Pitfalls and complications with locking plate for proximal humerus fracture. *J Shoulder Elbow Surg* 2010;19:489-94.
11. Lungershausen W, Bach O, Lorenz CO. Locking plate osteosynthesis for fractures of the proximal humerus. *Zentralbl Chir.* 2003;1289(1):28-33.
12. Shahid R, Mushtaq A, Northover J, Maqsood M. Outcome of proximal humerus fractures treated by PHILOS plate internal fixation. Experience of a District General Hospital. *Acta Orthop Belg.* 2008;74(5):602-8.
13. Björkenheim JM, Pajarinen J, Savolainen V. Internal fixation of proximal humeral fractures with a locking compression plate. A retrospective evaluation of 72 patients followed for a minimum of 1 year. *Acta Orthop Scand.* 2004;75(6):741-45.



14. Rose PS, Adams CR, Torchia ME. Locking plate fixation for proximal humeral fractures: initial results with a new implant. *J Shoulder Elbow Surg.* 2007;16:202-07.
15. Siwach RC, Singh R, Rohila RK, Kadian VS, Sangwan SS, Dhanda M. Internal fixation of proximal humeral fractures with locking proximal humeral plate (LPHP) in elderly patients with osteoporosis. *J Orthop Traumatol.* 2008;9:149-54.
16. Koukakis A, Apostolou C, Taneja T, Korres DS, Amini A. Fixation of proximal humerus fractures using the PHILOS plate. *Clin Orthop.* 2006;442:115-20.
17. Wanner GA, Schmid EW, Romero J, Hersche O, von Smekal A, Trentz O, et al. Internal fixation of displaced proximal humeral fractures with two one-third tubular plates. *J Trauma.* 2003;54:536-44.
18. Sharma V, Singh B, Khare S. Management of Proximal Humeral Fractures with Proximal Humerus Locking Plated A Prospective Study. *J Orthop Trauma Rehab.* 2014;18:89-93.
19. Resch H, Povacz P, Fröhlich R, Wambacher M. Percutaneous fixation of three- and four part fractures of the proximal humerus. *J Bone Joint Surg Br.* 1997;79:295-300.
20. Ebraheim NA, Vishwas P, Adeel H. Mini-external fixation of two- and three- part proximal humerus fractures. *Acta Orthop Belg.* 2007;73:437-42.
21. Klitscher D, Blum J, Andreas D, et al. Osteosynthesis of proximal humeral fractures with the fixed angle PHILOS-plate. *Eur J Trauma Emerg Surg.* 2008;34:29-36.
22. Hirschmann MT, Fallegger B, Amsler F, Regazzoni P, Gross T. Clinical longer-term results after internal fixation of proximal humerus fractures with a locking compression plate (PHILOS). *J Orthop Trauma.* 2011;25(5):286-93.
23. Fankhauser F, Boldin C, Schippinger G, et al. A new locking plate for unstable fractures of the proximal humerus. *Clin Orthop Relat Res.* 2005;430:176-81.
24. Acklin YP, Jenni R, Walliser M, Sommer C. Minimal invasive PHILOS-plate osteosynthesis in proximal humeral fractures. *Eur J Trauma Emerg Surg.* 2009;35:35-9.

**Cite this article as:** Srikanth S, Reddy AVK, Omkarnath G. A study of proximal humerus fractures treated by PHILOS plating in a tertiary care hospital. *Int J Res Orthop* 2019;5:838-42.