

Outcome of (PHILOS) plate osteosynthesis in the management of 3-part and 4-part proximal Humerus fractures in adults

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ABSTRACT

Background: Even though the proximal humerus fracture are second most common fractures in upper extremity after distal radius treatment of these displaced 3-part & 4-part fractures is still challenging because of comminution. This study attempts to analyse the functional outcome of 3-part & 4-part proximal humerus fractures with PHILOS plate and throws a light on prognostic factors for a favourable outcome.

Materials & Methods: This is a prospective study of 30 patients with neels 3-part & 4-part fractures which were surgically treated with PHILOS plating during 2011 to 2015. Evaluation of patients was done on the basis of radiological union and functional assessment using Constant-Murley shoulder score.

Results: The mean age of the patient is 42.5 years (range 18-65) with 70% male preponderance. The mean follow up is 12 months (range 8-16 months). The mean Constant-Murley shoulder score of 81 and mean loss of CCD angle of 4° at the last follow up. Favourable factor influencing the out come are young age, good bone stock, intact medial metaphyseal cortical continuity with inferior locking calcar screw with zero avascular necrosis of head of humerus.

Conclusion: Osteosynthesis with PHILOS plate in 3-part & 4-part fractures with surgical skills gives good functional outcome with low complication rate, patient age, bone stock, medial metaphyseal cortical continuity prognosticate the outcome.

Keywords: 3-part & 4-part proximal humerus fractures, PHILOS plate, inferior locking calcar screw.

INTRODUCTION

Proximal humerus fractures comprise 4% to 5% of all fractures seen in emergency departments and represent the most common humerus fracture.¹ 75% of all proximal humerus fractures occur in patients older than age 60 years.² It is the second most common upper-extremity fracture and the third most common fracture, after hip fractures and distal radial

fractures, in patients who are older than sixty-five years of age.³ The increased incidence in the older population is thought to be related to osteoporosis. The 2:1 female-to-male ratio is likely related to issues of bone density.⁴

Majority of proximal humeral fractures are either undisplaced or minimally displaced and can be treated with sling immobilization and physical therapy, but approximately 20% of displaced proximal humeral fractures may benefit from operative treatment.³ Many surgical techniques have been described, but no single approach is considered to be the standard of care. Surgeon who treats proximal humeral fractures should be able to identify the fracture pattern and select an appropriate treatment on the basis of this pattern and the underlying quality of the bone.³

Surgical options include³

Transosseous suture fixation,⁵ closed reduction and percutaneous fixation, open reduction and internal fixation with conventional & locked-plate fixation, Hemiarthroplasty.

MATERIALS & METHODS

A prospective study was conducted after obtaining institutional ethical committee approval between 2011 to 2015. 30 patients of 3-part and 4-part proximal humerus fractures fixed with PHILOS locking plate were included in the study.

Inclusion criteria

Patients with closed and displaced proximal humerus fractures with 3-part and 4- part fractures were included according to Neer's classification^{6,7}.

Exclusion criteria

Age below 18 years and above 65 years, Neer's classification^{6,7} undisplaced, 2-part fractures and fracture dislocation, compound fractures, fractures with distal neuro-muscular deficit, pathological fractures, skeletally immature patients, patients with brachial plexus injury, patients who are medically unfit for surgery are excluded from the study.

Surgical technique

All the cases were operated in Prathima Institute of Medical Sciences, Karimnagar. All the cases were operated under general anaesthesia and approach used is delto-pectoral. We have done small modification in the approach that we dissected the deltoid muscle 1cm lateral to groove so that we can preserve the cephalic vein and also the reduction of displaced greater tuberosity fracture and plate placement is proper. In all the cases we have used PHILOS plate. Emphasis was given to restore the neck shaft angle reconstruction of avulsed rotator cuff and minimal handling of the medial soft tissue sleeve. Final c-arm image intensifier check was done for proper placement of plate and screws.

Post operatively, the shoulder was immobilised in arm chest pouch and gentle intermittent passive pendulum exercises were started after 48 hrs. In patients with gross senile osteoporotic fractures U slab was applied for 3 weeks and gentle passive motion exercises of shoulder started after 3 weeks.

All the patients were regularly followed and evaluated clinically and radiologically for shoulder functional motion and radiological union using Constant-murley shoulder score.⁸

RESULTS

The study was conducted in the Department of Orthopaedics traumatology and rehabilitation, Prathima Institute of Medical Sciences from 2011 to 2015. During this period out of 100 patients with proximal humerus fractures only 30 patients were included in the study with Neer 3-part and 4-part fractures classification and these were treated surgically with PHILOS locking plate [Figure 1].

The age incidence ranges from 18-65 were included in the study and the mean age is 42.5 years with male preponderance of 70%. Side predilection more common on the right side of about 60%. In the present scenario the commonest mode of injury is road traffic accidents which is high velocity injuries constitute of about 70% is the reason for more number of 3 and 4 part fractures followed by trivial fall 20%. Most of the cases were operated within 1st week (55%) and only 10% cases were done beyond 3 weeks due to delayed presentation. Bone graft is not used in any of the cases and the clinical & radiological union rate is 100%. The mean neck shaft angle (NSA) or neck shaft angle calculated using immediate post operative radiograph was 134° and after fracture union is 130° with a mean collapse of 4°.

The functional range of motion was calculated using Constant-murley shoulder score⁸ with a mean range of flexion of 135°, abduction of 130°, and external rotation of 80°.

The mean Constant-Murley score⁸ is 81 at the last follow up. The younger age group and less medial wall comminution cases showed better constant murley score and when compared to elderly and more medial wall comminuted cases both in 3-part and 4-part fractures.

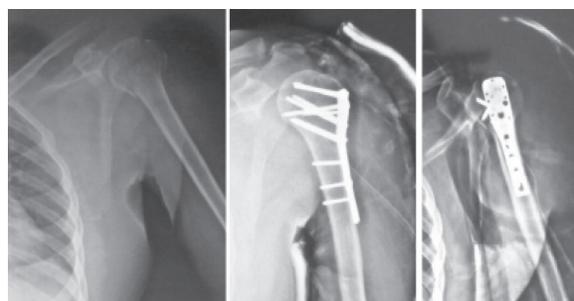


Fig1: A case 3 part fracture with PHILOS plate.

DISCUSSION

Proximal humerus fracture constitutes 4-5% of all fracture of long bones. It constitutes for 2-3% of fractures of upper limb. Incidence of these fractures are 73 per one lakh population & 75% of these fractures are seen in elderly. 80-85% of these fractures are amenable to conservative treatment remaining 15-20% are significantly displaced and require some type of internal fixation.^{7,9,10}

We undertake the study of significantly displaced more complex fractures that are Neer's type 2 (3-part) and type 3 (4-part) because increase incidence of these fractures in last few decades due to increase in high & very high velocity injuries in road traffic accidents. In our study RTA constitute of 70% of cases.

Many studies have shown that the displaced fractures of the proximal humerus have poor functional outcome when left untreated or conservatively managed with plaster cast because of severe comminution & displacement of fragments.^{11,12,13,14,15} Due to awareness of its complexity and complication, these fractures have stimulated a growing interest in finding the optimal treatment. An adequate anatomical reduction and early rehabilitation is a strong predictor for good functional outcome.

Recent advances in understanding of anatomy, good surgical skills, wide variety of implants and instrumentation has led to various modalities of treatment of these fractures like percutaneous pinning,^{16,17} external fixation, bone grafting or bone cement supplementation, plate fixation or prosthetic replacement.

Our study of 30 cases was done to analyse outcome of 3-part, 4-part fracture fixation using PHILOS plate.^{18,19,20,21} We found in our study that age had an influence on the outcome. Elderly patients demonstrated lower constant-murley score when compared to younger age group.

Pre-operative assessment of patient age, bone stock, medial metaphyseal comminution are 3 main factor influence the functional outcome. Intra operatively good anatomical reduction with medial cortical continuity which is maintained with inferior locking screws (also called calcar screws) in fixed angle philos plate gives good results. The mean centrum column diaphyseal (CCD) angle or neck-shaft angle intraoperatively & immediate postoperatively was 134°. All the patients are followed up for a mean period of 12 months (8-16mths) and we found the decrease in angle by 4° i.e; 130°. Fractures with medial metaphyseal comminution (solberg et al²²) attribute to the varus collapse. Fracture with intact medial neck do not have significant varus collapse and neck shaft angle is maintained adequately. We have always used a inferior calcar screw through the neck into the head to prevent the medial compressive collapse of medial comminuted portion. Fixed angle locking PHILOS system gives good stable fixation with early mobilisation had a good functional out come as per constant-murley shoulder score.

As PHILOS system gives biological fixation without much vascular compromise to the head of humerus so chances of complication of avascular necrosis of head of humerus is very rare which is zero percent in our study. Other complications like impingement syndrome is seen in one patient due to improper placement of plate and shoulder stiffness in two patients due to prolonged immobilisation in very severe osteoporotic patients.

Proper preoperative evaluation & steady technical skills intraoperatively i.e; correct placement of plate prevents complications like impingement syndrome & stiffness of joint in the later date. The mean constant-murley shoulder score of 81 is comparable with other studies given in the Table:1.

There limitations of our study is small sample size, limited follow up & complex fracture pattern.

CONCLUSION

Osteosynthesis in 3-part & 4-part proximal humerus fractures with Proximal humerus interlocking system (PHILOS) plate gives good functional outcome with low complication rate in skilled surgical hands. Patient age, bone stock, & medial metaphyseal cortical continuity prognosticate the outcome.

Table 1: Comparison of Constant – Murley score of PHILOS plate of our study with other studies

Investigator	Method of treatment	Constant – Murley score
Geiger E V et al	Proximal humerus PHILOS plating	58
Moonot P et al ²¹	3 & 4 part#'s PHILOS plating	67
Solberg B D et al ²²	3&4 part #'s locking plate fixation	70
Koukakis A et al ²³	Proximal humerus PHILOS plating	76
Bandolovic A et al ²⁴	Osteoporotic #'s PHILOS plating	91
Kumar G N et al ²⁵	Neer's classification PHILOS plating	79
Robinson C M et al ²⁶	Screws & Butress plating	68
Our study	3 & 4 part#'s PHILOS plating	81

REFERENCES

- Lind T, Kroner K, Jensen J. The epidemiology of fractures of the proximal humerus. Arch Orthop Trauma Surg. 1989;108:285-287.
- Jakob RP, MiniaciA, Anson PS, Jaberg H, OsterwalderA, Ganz R. Four-part valgus impacted fractures of the proximal humerus. J Bone Joint Surg Br 1991;73:295-8.
- Shane J Nho, Robert H Brophy, Joseph U Barker, Charles N Cornell, John D MacGillivray. Innovations in the Management of Displaced Proximal Humerus Fractures. J Am Acad Orthop Surg January 2007 ;15:12-26.
- Filippo Castoldi, Andrea Cimino, Davide Bonasia. Proximal Humerus Fractures: Understanding and Managing the Fracture. In: Filippo Castoldi, Davide Blonna and Marco Assom, editors. Simple and Complex Fractures of the humerus. 1st edition. Italia. Springer. 2014 pg 11-12.
- Dimakopoulos P, Panagopoulos A, Kasimatis G. Transosseous suture fixation of proximal humeral fractures. Bone Joint Surg Am. 2007 Aug;89(8):1700-9.
- Richard A Brand, Louis U Bigliani. Biographical Sketch: Charles S. Neer, II, MD (1917– 2011). Clin Orthop Relat Res. Sep 2011; 469(9): 2407–2408.
- Neer CS. Displaced proximal humeral fractures. I. Classification and evaluation. J Bone Joint Surg Am. 1970;52:1077–1089.
- Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res. 1987;214:160-4.
- Edward A Perez. Chapter 57 Fractures of the Shoulder, Arm, and Forearm. In: S Terry Canale, J H Beatty editors.

- Campbell's Operative Orthopaedics. Volume 1. 12th edition. Philadelphia. Elsevier Mosby. 2013. Pg 2837-2851
10. Robinson CM: Volume 1. Chapter 35, Fractures of the Proximal. In Bucholz RW, Heckman JD, Court-Brown CM, Tornetta P 3rd, editors: Rockwood and Green's fracture in adults, ed 7, Philadelphia, 2010, Lippincott Williams & Wilkins
 11. Gerald R. Williams and Kirk L. Wong, 2000: "Two-part and three part fractures-Management of proximal and distal humerus fracture". Orthop Clin North Am, January 31 (1) : 1-21.
 12. Anthony F. Depalma and Richards Cautilli. Fractures of the upper end of the humerus. Clin. ortho. 20, 1971: 73-93.
 13. Neer CS II, Rockwood CA: Fractures and dislocations of the shoulder, in Rockwood CA, Green DP (eds) : Fracture in adults, Philadelphia, PA, Lippincott, 1984: 675-721.
 14. Scott E. Powell, Robert W. Chandler. Fractures of the proximal humerus. Chapter-11, In: Text book of Operative techniques in upper extremity sports injuries. Ed. Frank W. Jobe, Mosby, 1995: p. 313-340.
 15. Zyto K. Non-operative treatment of comminuted fracture of proximal humerus in elderly patients. Injury, 1998; 29: 349-52.
 16. Krappinger D, Bizzotto N, Riedmann S, Kammerlander C, Hengg C, Kralinger FS. Predicting failure after surgical fixation of proximal humerus fractures. Injury. 2011;42(11):1283-8.
 17. Rowles DJ, McGrory JE. Percutaneous pinning of the proximal part of the humerus. An anatomic study. J Bone Joint Surg Am. 2001;83:1696
 18. Hawkins RJ, Bell RH, Gurr K. The three part fracture of the proximal part of the humerus. Operative treatment. J Bone Joint Surg Am. 1986;68(9):1410-4.
 19. Sproul RC, Iyengar JJ, Devic Z, Feely BT. A systematic review of locking plate fixation of proximal humerus fractures. Injury. 2011;42(4):408-13.
 20. Geiger EV, Maier M, Kelm A, Wutzler S, Seebach C, Marzi I. Functional outcome and complications following PHILOS plate fixation in proximal humeral fractures. Acta Orthop Traumatol Turc. 2010;44(1):1-6.
 21. Moonot P, Ashwood N, Hamlet M. Early results for treatment of three- and four-part fractures of the proximal humerus using the PHILOS plate system. J Bone Joint Surg Br. 2007;89(9): 1206-9.
 22. Solberg BD, Moon CN, Franco DP, Paiement GD. Locked plating of 3- and 4-part proximal humerus fractures in older patients: the effect of initial fracture pattern on outcome. Orthop Trauma. 2009;23:113-9.
 23. Koukakis A, Apostolou CD, Taneja T, Korres DS, Amini A. Fixation of proximal humerus fractures using the PHILOS plate: early experience. Clin Orthop Relat Res. 2006;(442):115-20.
 24. Bandalovic A, Cukelj F, Knežević J, Ostojic M, Pavic A, Parac Z. The Results of Internal Fixation of Proximal Humeral Osteoporotic Fractures with PHILOS Locking Plate. Psychiatr Danub. ? 2014;26(2):376-81.
 25. Kumar GN, Sharma G, Sharma V, Jain V, Farooque K, Morey V. Surgical treatment of proximal humerus fractures using PHILOS plate. Chin J Traumatol. 2014;17(5):279-84.
 26. Robinson CM, Page RS. Severely impacted valgus proximal humerus fractures. J Bone Joint Surg Am. 2004;86(1):143-55.

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