Functional outcome and complication of PHILOS plating in proximal humeral fractures

Dr. DV Prasad, Dr. Mahmmod Akram Abdul Rahim Saji, Dr. Ashish Pareek, Dr. Vinoth Kumar Loganathan, Dr. Ranjan Kumar Gupta and Dr. Ajinkiya Jadhoo

DOI: [https://doi.org/10.22271/ortho.2018.v4.i4.l.118](https://doi.org/10.22271/ortho.2018.v4.i4.l.118)

Abstract

Introduction: Proximal humeral fractures account for 5% of all fractures. Displaced and unstable fractures are difficult to manage. New plating techniques have been developed to improve stability.

Aim: Aim of this study was to evaluate functional outcome and complication of Proximal Humeral Internal Locking System (PHILOS) in proximal humeral fractures.

Materials and Methods: Thirty patients of proximal humeral fractures were treated by open reduction and proximal humeral internal locking system (PHILOS) plate fixation. Out of thirty patients of proximal humeral fractures are 24 Male and 6 Female with age group of 22years to 62years. Fractures were caused by low-energy trauma (fall from height) 14(46.66%) patients, RTA 10(33.33%) patients and Direct trauma 6(20%) patients. All fractures were closed with no associated injuries and according to Neer classification, classified as 2-part (n=17) and 3-part (n=13). Functional outcomes and shoulder range of movement were assessed based on the Constant scoring system.

Results: Out of 30 cases 24 (80%) healed satisfactorily, one case of 3-part fracture in whom there was fracture collapse and one case 3-part fracture developed non-union, one case of 3-part fracture screw penetration of the humeral head at 8 weeks developed avascular necrosis and two cases with valgus 3-part fracture who had malunion. No wound infections and vascular injuries. One case with axillary nerve palsy recovered within 2 months.

Discussion: In our study constant shoulder score was 70. 14 patients had a score above 75, 12 were scored between50-75 and 4 were below 50.

Conclusion: PHILOS plate provided stable fixation in displaced proximal humeral fracture.

Keywords: proximal humeral internal locking system (PHILOS)

Introduction

In the aging population, the proximal humerus fracture is the third most common osteoporotic fracture type after hip and distal radius fractures constitute 5% of all fractures and they account for 45% of all humeral fractures. When considering adults over the age of 40 years, this increases to 76%. [1-2].

These fractures have a dual age distribution occurring either in young people following low energy trauma or in those older than 50 years with low velocity injuries. The mechanism of low-energy injury in elderly patients is usually falling from standing [3].

Approximately 85% of patients with a proximal humerus fractures are non-dislocated and treated conservatively resulting in satisfactory results [4]. Most of the proximal humerus fractures are either non-displaced or minimally displaced and can be treated non surgically [5]. Nonsurgical options focus on early functional exercises with the goal of achieving a functionally acceptable range of motion (ROM). For the 15% to 20% of displaced proximal humerus fractures that may benefit from surgery, no single approach is considered to be the standard of care [6].

Various methods of treating proximal humerus fractures are intramedullary devices [7], internal fixation using tension bands [8], K-wires, percutaneous pins [9-10], bone suture [11] and screws, T-plates [12-15], blade plates [16] and shoulder arthroplasty [17-18]. Complications of these fixation non-union, mal union, avascular necrosis, cutout or back-out of screws and plate, rotator cuff
Impairment, nail migration and impingement syndromes. Proximal Humeral Internal Locking System (PHILOS) plate has been introduced to reduce these complications especially in older osteoporotic individual. Even minimally displaced fracture can be treated with philos plate to early mobilise the fracture thereby to avoid shoulder stiffness. Highly comminuted fractures can be reconstructed with rotator cuff sutural ties with plate and thereby enhance the functional outcome.

Aim
Aim of this study was to evaluate functional outcome and complication of Proximal Humeral Internal Locking System (PHILOS) in proximal humeral fractures.

Materials and Methods
Thirty patients of proximal humeral fractures were attended in the casualty and OPD and admitted in the hospital were treated by open reduction and proximal humeral internal locking system (PHILOS) plate fixation. This study conducted at Pravara Rural Hospital, Loni, between October 2016 to November 2018.

Including criteria
- All patients with Age of 18 years and older.
- Patients of either gender.
- Patients with non-compound two and three part fractures.
- Patients with fresh fractures of the proximal humerus.

Excluding criteria
- Patient with pathological fractures.
- Fractures with non-union.
- Patients with primary or metastatic bone tumours.
- Four part fracture proximal humerus.
- Patients with neurological deficits.
- Patients treated non-operatively for fracture proximal humerus that was not willing for surgery.

Thirty patients of proximal humeral fractures were attended in the OPD and casualty and admitted in the hospital were treated by open reduction and proximal humeral internal locking system (PHILOS) plate fixation. Out of thirty patients of proximal humeral fractures are 24 Male and 6 Female with age group of 22 years to 62 years. In our study, maximum fracture cases were reported by low-energy trauma 14(46.66%) due to fall from height, followed by RTA 10(33.33%) and Direct trauma 6(20%). Significantly more number of injuries were reported in the right side (60%) compared to left side (40%). All fractures were closed with no associated injuries. According to Neer’s classification, classified as 2-part (n=17) 3-part (n=13).

We collected records of all cases by detail history and physically examining the patients. Essential investigations were done and patients followed up taken at regular interval.

Table 1: According to Neer’s Classification distribution of patients

| Sex     | 2-part | 3-part | Total |
|---------|--------|--------|-------|
| Male    | 13     | 11     | 24    |
| Female  | 4      | 2      | 6     |
| Total   | 17     | 13     | 30    |

Functional outcomes were assessed based on the Constant scoring system. The Constant score assigns points for Pain, Range of movements, Power and Activities of daily living. Muscle strength was measured with use of a 1 kg weight in the patient’s hand and the shoulder in 90° of abduction, or, if 90° could not be reached, in maximum active abduction as described by Constant [19].
The Constant score was graded as:
- Poor (0 to 55 points)
- Moderate (56 to 70 points)
- Good (71 to 85 points)
- Excellent (86 to 100 points)

Shoulder range of movement was graded as:
- Excellent when the loss of movement was <10°
- Moderate when the loss of movement between 10°-30°
- Poor when the loss of movement >30°

Procedure of PHILOS Plate Fixation:
- Patients were placed in a beach-chair position under general anaesthesia.
- A Deltopectoral approach taken.
- The fractures were reduced and temporarily held with k-wires and sutures.
- Reduction was confirmed by using an image intensifier.
- PHILOS plate was applied with at least 4 locking proximal screws and 4 non-locking distal screws.
- Postoperatively the arm was placed in a sling.
- Passive-assisted movements were started on day 1, followed by active-assisted exercises after 3 weeks.
- Patients were assisted radiologically and functionally using the Consent shoulder score.

Case 1

Case 2

Observations and Results
Out of thirty patients according to the Constant scoring system, functional outcomes were excellent in 11 patient, good in 8 patient, moderate in 5 patient and poor in 6 patients. The mean constant shoulder score were 70. Out of thirty patients, 14 had a score above 75, 12 were scored between 50-75 and 4 were below 50.

Table 4: Constant scoring systems

| Result   | Number of Patients |
|----------|--------------------|
| Excellent| 11                 |
| Good     | 8                  |
| Moderate | 5                  |
| Poor     | 6                  |
| Total    | 30                 |

Graph 4: Constant scoring systems
Out of thirty patients shoulder range of movement was excellent in 20 cases, moderate in 4 cases and poor in 6 cases.

Table 5: Shoulder range of movement

| Shoulder range of movement | Number |
|----------------------------|--------|
| Excellent                  | 20     |
| Moderate                   | 4      |
| Poor                       | 6      |
| Total                      | 30     |
In recent decade, rigid internal fixation of fracture has been increasingly used in the operative care of proximal humeral fractures. Inspite of an early and secure functional postoperative therapy, it was believed that this implant would reduce the risk of secondary reduction loss in osteoporotic patients.

In the very old age group with osteoporosis, functional outcome after conventional plate osteosynthesis was poor. In order to obtain better and reproducible results, the AO/ASIF has developed a special locking compression plate (PHILOS) for fractures of the proximal humerus. Patients with good bone quality have previously been treated successfully with the conventional plate osteosynthesis.

Table 7: Functional scores achieved with different treatment options for proximal humeral fractures in the current literature. [25-28]

| Study            | Type of fixation | Constant score | Neer’s Classification |
|------------------|------------------|----------------|-----------------------|
| Kuchle et al (2006) | Cloverleaf plate | 72.4           | 2,3& 4 part fracture   |
| Ketter et al (2006) | Angle stable humerus plate | 70.0 | 2,3& 4 part fracture   |
| Lill et al (2003) | Angle stable humerus plate | 72.5 | 2,3& 4 part fracture   |
| Kollig et al (2003) | T plate, screws & k wires | 72.1 | 3& 4 part fracture     |
| Wigman et al (2002) | Classic T Plate cerclage | 80.0 | 3& 4 part fracture     |
| Gerber et al     | Internal fixation | 78             | 2,3& 4 part fracture   |
| Hessman et al    | T plate          | 69             | 2,3& 4 part fracture   |
| Our study        | PHILOS plate     | 70             | 2 & 3 part fracture    |

In our study Constant shoulder score were 70.
- 14 patients had a score above 75.
- 12 were scored between 50-75.
- 4 were below 50

In our study the PHILOS plate fixation was suitable for proximal humeral fractures. Out of 30 cases of proximal humeral fractures 24 (80%) healed satisfactorily. One case of 3-part proximal humeral fracture in which there was fracture collapse and one case 3-part fracture developed non-union. One case of 3-part fracture screw penetration of the humeral head at 8 weeks developed avascular necrosis. Two cases with valgus 3-part fracture who had malunion. One case of proximal humeral fracture with axillary nerve palsy recovered within 2 months. No wound infections and vascular injuries.

Table 6: Complications

| Complications         | Number |
|-----------------------|--------|
| Satisfactorily        | 24     |
| Non-union             | 1      |
| Collapse              | 1      |
| Avascular necrosis    | 1      |
| Malunion              | 2      |
| Axillary nerve palsy  | 1      |
| Total                 | 30     |

In our study the PHILOS plate fixation was suitable for proximal humeral fractures. Out of 30 cases of proximal humeral fractures 24 (80%) healed satisfactorily. One case of 3-part proximal humeral fracture in which there was fracture collapse and one case 3-part fracture developed non-union. One case of 3-part fracture screw penetration of the humeral head at 8 weeks developed avascular necrosis. Two cases with valgus 3-part fracture who had malunion. One case of proximal humeral fracture with axillary nerve palsy recovered within 2 months. Complication rate of PHILOS plate fixation was low, probably because our patients were young and both the bone quality and surgical technique were good.

Conclusion
Accurate anatomical reduction gains and early fracture fixation are more important than the implant used, to get a good final functional outcome and this factor is independent from the implant design and procedure selected. There is no much difference among 2&3 parts of fracture with PHILOS plate. All are nearly more or less with good function outcome.

In general, Proximal humeral internal locking system (PHILOS) plate for the treatment of proximal humeral fractures leads to a satisfactory functional outcome in majority of the patients. PHILOS plate provided stable fixation in proximal humeral fractures.

References
1. Neer CS II, Rockwood CA. Fractures and dislocations of the shoulder, in Rockwood and Green: Fractures in
1. Bigliani LU, Flatow EL, Pollock RG. Fractures of the proximal humerus. In: Rockwood CA, Green DP, Bucholz RW, Heckman JD, eds. Fractures in adults. Philadelphia, etc: Lippincott-Raven, 1996, 1055-107.

2. Lind T, Kroner K, Jensen J. The epidemiology of fractures of the proximal humerus. Arch Orthop Trauma Surg. 1989; 108:285–7.

3. Neer CS II, Displaced proximal humeral fractures. Part II. Treatment of three-part and four-part displacement. J Bone Joint Surg [Am]. 1970; 52-A:1090-103.

4. Horak J, Nilsson BE. Epidemiology of fracture of the upper end of the humerus. Clin Orthop. 1975; 112:250-3.

5. Anad Kumar, Govardhan RH. Outcome Analysis of internal fixation of proximal humerus fracture, 2014, 2-3.

6. Zifko, B, Poigenfurst, J, Pezzei, C, Stockley I. Flexible intramedullary pins in the treatment of unstable proximal humeral fractures. Injury. 1991; 22:60-2.

7. Cornell CN, Levine D, Pagnani MJ. Internal fixation of proximal humerus fractures using the screw-tension band technique. J Orthop Trauma. 1994; 8:23-7.

8. Resch H, Hubner C, Schwaiger R. Minimally invasive reduction and osteosynthesis of articular fractures of the humeral head. Injury. 2001; 32(1):S25-32.

9. Jaberg H, Warner JJ, Jakob RP. Percutaneous stabilization of unstable fractures of the humerus. J Bone Joint Surg Am. 1992; 74:508-15.

10. Ko JY, Yamamoto R. Surgical treatment of complex fracture of the proximal humerus. Clin Orthop Relat Res. 1996; 327:225–37.

11. 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; 68:1410-4.

12. Kristiansen B, Christensen SW. Plate fixation of proximal humeral fractures. Acta Orthop Scand. 1986; 57:320-3.

13. Esser RD. Open reduction and internal fixation of three- and four-part fractures of the proximal humerus. Clin Orthop Relat Res. 1994; 299:244-51.

14. Wijgman AJ, Roolker W, Patt TW, Raaymakers EL, Marti RK. Open reduction and internal fixation of three and four-part fractures of the proximal part of the humerus. J Bone Joint Surg Am. 2002; 84:1919-25.

15. Meier RA, Messmer P, Regazzoni P, Rothfischer W, Gross T. Unexpected high complication rate following internal fixation of unstable proximal humerus fractures with an angled blade plate. J Orthop Trauma 2006; 20:253-60.

16. Zytó K, Wallace WA, Frostick SP, Preston BJ. Outcome after hemiarthroplasty for three- and four-part fractures of the proximal humerus. J Shoulder Elbow Surg. 1998; 7:85-9.

17. Robinson CM, Page RS, Hill RM, Sanders DL, Court-Brown CM, Wakefield AE. Primary hemiarthroplasty for treatment of proximal humeral fractures. J Bone Joint Surg Am. 2003; 85:1215-23.

18. Constant C, Murley A. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res. 1987, 160-164.

19. Cofield RH. Comminuted fractures of the proximal humerus. Clin Orthop. 1988; 230:49-57.

20. Movin T, Sjöden GO, Ahrengart L. Poor function after shoulder replacement in fracture patients: a retrospective evaluation of 29 patients followed for 2-12 years. Acta Orthop Scand. 1998; 69:392-6.

21. Cordasco FA, Bigliani LU. Complications of proximal humerus fractures. Tech Orthop. 1997; 12:50.

22. Frigg R. Development of the locking compression plate. Injury. 2003; 34(2):6-10.

23. Wijgman AJ, Roolker W, Patt TW, Raaymakers EL, Marti RK. Open reduction and internal fixation of three and four-part fractures of the proximal part of the humerus. J Bone Joint Surg (Am). 2002; 84:1919-25.

24. Koval KJ, Gallagher MA, Marschiano JG, et al. Functional outcome after minimally displaced fractures of the proximal part of the humerus. J Bone Joint Surg Am. 1997; 79:203-20.

25. Sanders BS, Bullington AB, McGillivary GR, et al. Biomechanical evaluation of locked plating in proximal humeral fractures. J Shoulder Elbow Surg. 2007; 16:229-23.

26. Koukakis A, Apostolou CD, Taneja T, et al. Fixation of proximal humerus fractures with the PHILOS plate: Early experience. Clin Orthop Relat Res, 2006, 115-120.

27. Rose PS, Adams CR, Torchia ME, et al. Locking plate fixation for proximal humerus fractures: Initial results with a new implant. J Shoulder Elbow Surg. 2007; 16:202-207.