

A prospective study to assess the surgical outcome in three and four part proximal humerus fracture with PHILOS plate



Orthopaedic

KEYWORDS: PHILOS Plate, Three and four-part proximal humeral fractures;

DR.NIHAL.R.RAI

POSTGRADUATE DEPARTMENT OF ORTHOPAEDICS SURGERY YENEPOYA MEDICAL COLLEGE DERLAKATTE

SHARATH BELLEMANE

ASSISTANT PROFESSOR DEPARTMENT OF ORTHOPAEDICS SURGERY YENEPOYA MEDICAL COLLEGE DERLAKATTE

ABSTRACT

Background: Optimal surgical management of three and four-part proximal humeral fractures in osteoporotic patients is controversial, with many advocating prosthetic replacement of the humeral head. Proximal humerus interlocking osteosynthesis that maintain angular stability under load have been proposed as an alternative to hemiarthroplasty for the treatment of three and four-part proximal humeral fractures.

Methods: The records of 50 patients with mean age of 57.5 years. Neer three part proximal humeral fracture were 18 , four-part proximal humeral fracture were 32. All patients were treated surgically between Jan 2008 to dec 2010.All patients had radiographic and clinical follow-up performed at 1 ,3, 6 month and 1 yr, Clinical outcomes were measured with use of the Constant-Murley system. This study was based on level 1 of evidence

Results: The mean Constant score (and standard deviation) at the time of final follow-up was locked-plate. The mean Constant score was 80 (range, 40–100). Complications with this fixation included osteonecrosis in 1 patient, malunion in 1 patient, Axillarynervepalsy in 1 patient, Impingement syndrome in 1 patient.

Conclusions: The most important factor for favorable outcome in 3 and 4 part fractures in proximal end humerus gives accurate anatomical reduction which is achieved by locking plate osteosynthesis with multiplanar screws . It is a safe and effective method with minimal tissue damage, higher primary stability and load transfer through the implant are important to avoid complications. The PHILOS Plate produces promising functional outcomes.

INTRODUCTION

Proximal humerus fractures are one of the commonest fractures occurring in elderly population. These account for approximately 4-5% of the fractures [1]. The fractures occur more commonly in elderly patients after cancellous bone in the humeral neck has been weakened by senility and osteoporosis [2]. Due to increasing incidence of high velocity trauma this has complicated fracture patterns in proximal humerus. It has been an enigma regarding the management, because of numerous muscle attachment, weak bone and paucity of space for fixing implant in the fracture of proximal humerus.

The 3 & 4 parts fractures represents 13 to 16% of proximal humerus fracture. These displaced and unstable fractures are difficult to manage and have a high morbid out come.

The treatment goal is to achieve a painless shoulder with full function. Various methods have been described including k-wire fixation, rush nailing, intramedullary nailing, plating and prosthesis replacement.

The suitable treatment of these fractures is still debatable, since most of these fractures are liable to a failure of osteosynthesis, AVN of the humeral head and also a nonunion/malunion of the fracture, which may all results in painful shoulder with poor outcome. Moreover prosthesis replacement of the 4 parts humeral fractures has also yielded unsatisfactory results with regards to function [3, 4]

To overcome the complication associated with this fracture, AO-ASIF has recently developed a new plate (PHILOS), which aims to preserve the biological integrity of the humeral head and secure an anatomical reduction with multiple screws with angular stability. The PHILOS plate results in enhanced osteosynthesis and stability. This has lower rates of implant failure and subsequent loss of reduction, allowing early mobilization and improved clinical outcome[5,6]

The purpose of this study is to analyses our experience from the use of PHILOS Plate for treatment of 3 and 4 part proximal humeri fracture

MATERIALS AND METHODS

Between Jan 2008 to dec 2010,50 unstable displaced proximal humerus fracture(24 males ,26 females) in which type 3 fracture were 18 cases ,type 4 were 32 cases.(fig 1&2) All were treated with open reduction internal fixation with philos plate.Mean age of the patients was 57.5 (40 to 75 yr)

Inclusion criteria consisted of age >18yr and closed 3&4 part displaced, unstable proximal humeral fracture. i.e.an angulation of the articular surface of more than 45°, a displacement between the major fracture fragments of more than1 cm.Patient with fracture older than the 4wks or h/o pathological fracture were excluded

Scheduled follow-up controls were performed at 1, 3, 6 month and 1 yr, including a measure of the active and passive range-of-motion and strength of the involved shoulder. The functional outcome was assessed according to the scoring of Constant (Constant and Murley 1987). The Constant score was graded as poor (0–55 points), moderate (56–70), good (71–85), or excellent (86–100).

Demographic data			
Results		lost for follow up	actual no
Number	(n=50)	6	44
Gender			
Female	26	4	22
Male	24	2	22
Fracture pattern			
Neer 3	18	2	16
Neer 4	32	4	28
Age (years)			
Mean	57.5(40-75)		
<60 years old	22	2	20
>60 years old	28	4	24

Constant scoring system

Category Score

Pain	(15 points)
None	15
Mild	10
Moderate	5
Severe	0

Activities of daily living	(20 points)
Activity level	
Full work	4
Full recreation/sport	4
Unaffected sleep	2
Positioning	
Up to waist	2
Up to xiphoid	4
Up to neck	6
Up to top of head	8
Above head	10
Range of motion	(40 points)
Forward elevation	
0°–30°	0
31°–60°	2
61°–90°	4
91°–120°	6
121°–150°	8
151°–180°	10
Lateral elevation	
0°–30°	0
31°–60°	2
61°–90°	4
91°–120°	6
121°–150°	8
151°–180°	10
External rotation	
Hand behind head with elbow held forward	2
Hand behind head with elbow held back	2
Hand on top of head with elbow held forward	2
Hand on top of head with elbow held back	2
Full elevation from on top of head	2
Internal rotation	
Dorsum of hand to lateral thigh area	0
Dorsum of hand to buttock	2
Dorsum of hand to lumbosacral junction	4
Dorsum of hand to waist (3rd lumbar vertebra)	6
Dorsum of hand to 12th dorsal vertebra	8
Dorsum of hand to interscapular region (DV7)	10
Strength	35

Operative technique

The patients were operated within 5 days of injury. All patients received a prophylactic dose of 1.5 g Cefuroxime intravenously preoperatively was given. A delto-pectoral approach (fig 3) was used, with the patient in a beach-chair position. The fragments were indirectly reduced with the help of traction sutures, which were placed in the insertions of rotator cuff tendons, and by extremity rotation. When acceptable reduction was obtained, the PHILOS plate was placed at least 1 cm distal to the upper end of the greater tuberosity and fixed to the humeral shaft. An aiming device was then attached to the upper part of the plate, and the head fragments were secured with Kirschner wires after image intensifier control. The required lengths of the locking head screws were determined with a direct measuring device and 4-6 locking screws were then inserted using a specially designed hexagonal screwdriver. The arm was placed in a humeral pouch after wound closure. Passive elevation, pendulum and rotation exercises were started on the 2nd or 3rd postoperative day. Active range-of-motion exercises with terminal stretching exercise were started at 4–6 weeks.

Results

In the setting of a prospective study we operated in our hospital 50 patients. 26 of these patients were females (52%). 24 cases were males (48%). Overall mean age was 57.5 years. According to the near classification system 18 fractures were type 3, lost for follow up 2 cases (36%), 32 cases type 4, and lost follow up were 4 cases (64%)

Patients were followed up for 1,3,6 months and 1 year (fig 4&5). The follow up rate then 82%. All fractures healed in satisfactory position. One patient had a malunion with a valgus 4-part fracture.

The humeral head was in a valgus position, with the lesser tuberosity displaced internally and the greater tuberosity displaced superiorly. No wound infections, vascular injuries, or loss of fixation were noted. Two patients with axillary nerve palsy recovered spontaneously within 3 months. One patient developed avascular necrosis.

According to the Constant score, functional outcomes were excellent in 7 (18%) patients, good in 27 (60%), moderate in 6 (15%), and poor in 2 (7%). The mean Constant score was 80 (range, 40–100).

The shoulder range of movement was excellent in 34 (76%), moderate in 8 (20%), in and poor in 2 (4%).

Five patients were seen with impingement symptoms on abduction. There was no significant difference in outcomes between patients with 3-part and 4-part fractures. 34 (77.2%) patients were able to return to their pre-injury activity level

Results		
No. (%) of patients	3-part fracture (n=16)	4-part fracture (n=28)
Constant score		
Excellent	3 (18)	4 (14.2)
Good	11 (68.75)	18 (64.28)
Moderate	2 (12.5)	4 (14.2)
Poor	0 (0)	2 (7.1)
Shoulder range of movement		
Excellent	12 (75)	22 (78.5)
Moderate	4 (25)	4 (14.2)
Poor	0 (0)	2 (7.0)
Complications		
Axillary nerve palsy	1 (6.25)	1 (3.5)
Impingement	2 (12.5)	3 (17.85)
Return to pre-injury Activity Level	12 (75)	22 (78.5)
Malunion	0	1 (3.5)
Avascular necrosis	0	1 (3.5)

Discussion

The 3 & 4 parts fracture represents 13 to 16% of proximal humerus fracture. These displaced and unstable fractures are difficult to manage and have a high morbidity rate (7).

The goal of the treatment is to achieve a painless shoulder with good functional outcome. Various methods have been used including k-wire fixation, rush nailing, intramedullary nailing, plating and prosthesis replacement.

The suitable treatment for these fractures are still debatable, since most of these fractures are liable to a failure of osteosynthesis, AVN of the humeral head and also a nonunion/malunion of the fracture, which may all result in painful shoulder with poor outcome. Moreover prosthetic replacement of the humeral head fractures has also yielded unsatisfactory results with regards to the function.

The other modalities of treatment such as simple T plate fixation with 2 cancellous screws in humeral head resulted in a high failure rate in elderly patients with osteoporotic bone. Tension band wiring and non-operative treatment had similar functional outcomes. T plate fixation also had a high complication rate, including deep infection, impingement needing plate removal, and avascular necrosis. A hemiarthroplasty was recommended in elderly patients with poor bone stock. Although hemiarthroplasty achieved good pain relief; its functional results were unpredictable and its strength poor. Polarus nail fixation yielded good results and was useful in combined neck and shaft fractures, but the complication rate was high (proximal screw loosening, revision surgery, and lateral metaphyseal comminution predisposing to implant failure). Revision surgery was required in 17% of patients due to non-union, avascular necrosis, screw migration, or inadequate position of the implant (8).

Locking proximal humeral plate fixation achieved acceptable functional results in elderly and in osteoporotic bones.

In this study, PHILOS plate fixation provided stable fixation with minimal metallurgy problems and enabled early range-of-motion to achieve functionally acceptable results. Nonetheless, the choice of treatment should be based on patient age, functional requirements, bone quality, fracture pattern, and the surgeon's preference. Prospective randomised trials are needed to compare different methods of fixation.

In this study, the Philos plate fixation was suitable choice for 3- and 4-part proximal humeral fractures. Its complication rate were low, probably because the patients were relatively young, and both the bone quality and the surgical technique were good. During dissection and head penetration with proximal interlocking screws, care should be taken to avoid damage of the anterior humeral circumflex artery and the axillary nerve. The screw position must be checked intra-operatively with image intensification.

It is found that in our study 70-80% with the good to excellent results according to constant murley scoring system. The shoulder range of movement was excellent in 76%. Around 77% patients were able to return to their pre-injury activity level. All fractures healed in satisfactory position, except in one patient with a valgus 4-part fracture who had avascular necrosis another with the malunion. No wound infections, vascular injuries, or loss of fixation were noted. Two patients with axillary nerve palsy recovered spontaneously within 3 months. One patient who ended with the avascular necrosis was operated with the hemiarthroplasty.

Conclusion

The most important factor for favorable outcome in 3 and 4 part fracture in humerus is good anatomical reduction which is achieved by locking plate osteosynthesis with multiplanar screws and it is a safe and effective method with minimal tissue damage, higher primary stability and load transfer through the implant are important to avoid complications. The PHILOS Plate produces promising functional outcomes. The suggested surgical approach reduces the risk of soft-tissue damages and provides early functional recovery.



Fig1.Pre-op X-ray

fig2: CT scan



Fig3: intra operative

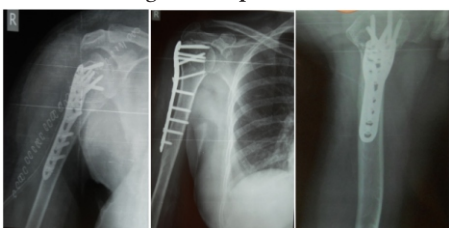


Fig4: post op x-rays fig5: follow up after 6 month

References

1. Lind T, Kroser K, Jensen J. The epidemiology of fractures Of the proximal humerus. Arch Ortho Trauma Surg 1989; 108:285-287.
2. Kannus P, Palvanen M, Niemi S et al. Osteoporotic fractures Of the proximal humerus in elderly Finnish persons:Sharp increase in 1970-1998 and alarming projections for The new millennium. Acta Orthop Scand 2000; 71: 465-470.
3. Paavolainen P, Björkenheim J-M, Slätis P, Paukku P: Operative Treatment of severe proximal humeral fractures. Acta Orthop Scand 1983; 54:374-379.
4. Wiggins 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-A: 1919-1925.
5. Frigg R: Development of the Locking Compression Plate.Injury 2003; 34 (Suppl 2):6-10.
6. Ring D, Jupiter JB: Internal fixation of the humerus with Locking compression plates. Techniques in Shoulder and Elbow Surg 2003; 4(3):169-171.