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

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 prosthetic 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 prosthetic 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 75yr)

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 45º, a displacement between the major fracture fragments of more than 1 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        |
| Mean <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           |
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).

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 prosthesis 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 these 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.

**References**

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