

OUTCOMES IN PATIENTS WITH PROXIMAL HUMERUS FRACTURES UNDERGOING OPEN REDUCTION AND INTERNAL FIXATION WITH PROXIMAL HUMERUS LOCKING PLATE

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Abstract

Background & Objective: Despite of conservative management for proximal humeral fractures, open reduction and internal fixation with proximal humeral locking plate has become the most frequent treatment for these fractures especially in elderly and osteoporotic population. A lot of complications are associated with proximal humerus internal locking system (PHILOS) plate including intra articular screw penetration, screw cut out, varus malunion, loss of reduction, nonunion and infections. Efforts have been made to improve the locking plate fixation technique and strengthen the fixation more resilient to head collapse, screws cut out, screw penetration and loss of fracture reduction.

Methods: It was an observational study conducted in the Department of orthopaedic surgery, Services Hospital Lahore. About 30 patients having isolated proximal Humerus fracture with age between 40-75 years being treated with proximal humeral locking plate were included in the study after permission from ethical review board. Patient with head, spine, abdomen and chest injury or poly trauma were excluded. There were Eight with 2 – part, 15 with 3- part fractures and 7 with 4- part fractures. All these patients were followed at interval of 3 weeks, 6 weeks, 3 months, 6 months and at one year.

Results: In all our 30 patients, fracture united 3 months after the surgery. In 05 patients there were screw penetration in the shoulder joint. In these 05 patients, 03 patients developed avascular necrosis (AVN) and underwent shoulder arthroplasty. Loss of reduction was present in 04 patients in whom the revision surgery was done with addition of bone graft. Range of movements were significantly less in patients with 4- part fracture(forward elevation was 95 degree and head shaft angle was 100 degree in these patients while external rotation was 22 to 30, in rest of 35 patients it was within the normal range. Mean DASH score (Disabilities of Arm, Shoulder and Hand) after 6 weeks was 3.2 – 58.4 while after one year at the end of final follow up it was 13.3 – 48.6.

Conclusion: Our results reveal that PHILOS fixation technique is an acceptable stabilization procedure for proximal humeral fractures. One must be aware of potential hardware complications. For unstable proximal humerus fractures locking plates is a reasonable option especially in 3- part and 4- part fractures in osteoporotic bone. But at the same time it has got high complication rate like screw penetration in the joint, loss of fracture reduction and varus malunion etc.

Key words: Proximal Humerus fracture, Proximal Humeral locking plate, screw penetration, osteoporotic bone.

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Proximal humerus fractures are amongst the most frequent fractures after femur neck and distal radius fractures. These account for 4-6% of all fractures.¹ These fractures have uni modal distribution peaking as the age progresses i.e. these are common in osteo-porotic bone. As a result of high prevalence

and rise in incidence, these fractures are exerting significant healthcare burden. Complex proximal fractures with displacement occur most commonly in elderly female with comorbidities and have devastating effects on the quality of work and life.^{1,2,3}

Proximal Humerus includes the head, greater tuberosity, lesser tuberosity and Humerus shaft. Fractures of anatomical neck can result in significant compromise on the vascularity with resultant avascular necrosis of head of Humerus. Anatomically greater tuberosity lies on the lateral aspect while lesser tuberosity lies on the anterior border of Humerus proximally.^{4,5}

Axillary nerve is the most commonly nerve injured followed by Suprascapular nerve being the second most common nerve injury in proximal Humerus fractures^{6,7}

Blood supply of Humerus comes from the anterior and posterior circumflex Humeral artery. Anterior circumflex humeral artery provides 30% perfusion of Humerus head while posterior circumflex humeral artery provides 64% of blood to the head of Humerus. Therefore in proximal Humerus blood perfusion is preserved even if the anterior circumflex humeral artery is damaged.^{8,9}

In the elderly females the most common mechanism of injury is fall from standing height, followed by high energy trauma such as motor vehicle accident, fall from height and seizures. Pathological fractures can occur with trivial trauma. In Young patients proximal fractures caused by high energy trauma such as motor vehicle accidents or as a result of sports injury.^{10,11}

A lot of classifications has been described for proximal humeral fractures including AO classification, Kocher, Codman and Jakob and Ganz system. The most commonly used classification is Neer Classification which divides the proximal Humerus into four functional and conceptual parts i.e. greater tuberosity, lesser tuberosity, head and Humerus shaft for treatment purpose. The part should be displaced greater than 1cm or should have 45° of angulation. The greater tuberosity is an exception for this rule. It should be fixed when it is displaced more than 0.5cm.^{12,13}

Fractures which are displaced, open fractures, fractures with metaphyseal comminution, fracture dislocation, head split fractures, anatomical neck fractures and fractures with neurovascular injury should be treated surgically(as recommended by Neer).

Many different techniques regarding osteosynthesis of proximal Humerus fractures have been described. Osteosynthesis with proximal humeral locking plates are the most commonly performed procedure especially in case of osteoporotic bone. The complications associated with PHILOS plate are head collapse, varus malunion, loss of fixation, pseudoarthrosis, wound infection and avascular necrosis of humeral head. Despite of the availability of intramedullary nail and PHILOS Plate, most of the surgeon agree that 3 part and 4 part fractures should be treated with Endo prosthesis and with Reverse shoulder arthroplasty.^{14,15}

All currently available techniques suggest that there is no evidence based treatment scheme for proximal Humerus fractures for implementation.¹⁶

METHODS

This prospective observational study was carried out at department of orthopaedic surgery services hospital Lahore from Jan 2018 to Jan 2020. After permission from Ethical Review Board, a total number of 30 patients, aged between 40-75 years, presenting to the emergency department with proximal Humerus fractures were enrolled in the study. All these fracture were classified according to Neer's classification.

After admission, each patient underwent x-rays of Humerus with shoulder and elbow joints both AP & Lat views. After fitness of patient for G/A, the fracture was exposed with standard Delto pectoral approach and was fixed with PHILOS plate 1cm below the upper end of greater tuberosity. All fracture Fragment were reduced indirectly by traction sutures placed in Subscapularis or Rotator cuff tendon.

Patients with open fractures, pathological fractures and fractures older than 3 weeks were excluded from the study. Each patient was followed at interval of 03 weeks, 06 weeks, 03 months, 06 months and one year after the surgery. At each follow up every patient under-

went x rays of shoulder joint AP and Lateral view and shoulder joint movements during these follow ups were measured.

RESULTS

The results of the study showed that 23 patients had age more 55 years (55-65 years) while 7 patients had age of less than 55 years (40-55 years). All the fractures were categorized according to the Neer’s classification which showed that there were 08 with part 2 fractures, 15 with part 3 and 7 patients had 4 part fractures. All fractures united on an average within 03 months after the surgery (12-18 weeks).

Most common complication was screws penetration in the shoulder joint as the result of collapse of fracture fragment of head of Humerus in 05 (16.6%) patients. This happened after 12 weeks in 03 patients while in 02 patients this occurred after 6 weeks. Among these 05 patients, 04 patients had 4 part fractures while 01 patient had 3 part fractures. All these screws were removed. Out of these 05 patients, 03 patients developed AVN and underwent Reverse Shoulder Arthroplasty.

There was loss of reduction in 05 (16.6%) patients at 6 weeks. We performed the revision surgery in these patient with bone graft. Out of these 05 patients, 04 patients developed Varus mal union 03 months after the 2nd surgery. In these 04 patients, 02 patients had 2 part fractures. 01 patient developed implant failure after 03 months and surgery was revised in this patient (part 2 fracture).

Range of movements were significantly less in patients with 4 part fracture. Forward elevation in 05 patients with 4 part fractures was 95 degree and head shaft angle was 100 degree in these patients. The external rotation was 22-30 degree. In rest of 25 patients, the forward Elevation was 150 degree (130-170 degree) while external rotation 45 degree (35-45 degree). The head shaft angle was 120-135 degree (129 degree).

Mean DASH score after 6 weeks was 30.2-58.4 while after 3 months it was 24.2-56.5. It was 20.3-51.5 after 06 months while after 1 year at the end of final follow up it was 13.3-48.6.

DISCUSSION

Operative treatment of displaced and comminuted proximal Humerus fractures are complex and challenging for the orthopedic surgeons.⁴ Proximal Humeral locking plate has demonstrated good clinical outcomes but it is frequently associated with high complications

Table 1: Results of post-operative assessment of DASH score

Parameter	6 weeks	3 months	6 months	1 year
DASH score	30.2-58.4	24.2-56.5	20.3-51.5	13.3-48.6

rate.³ Main complications are AVN of head of Humerus and sub acromial impingement with limited movements of shoulder joint. Another bothersome complication is screw penetration in the head of Humerus because of osteoporosis of the bone.²

In the present study the common complications were screw penetration in the shoulder joint followed by AVN of head of Humerus with loss of reduction and limited movements of the shoulder joint.

Lot of studies are consistent with our study that although proximal Humerus locking plate provides better stability but it is associated with complications because of poor bone stock.

In a study conducted by Barlow JD et al^{13,14} open reduction and internal fixation with PHILOS plate was associated with high complications rate in patients above 60 years of age because of osteoporosis. They suggested a refinement of surgical techniques for fixation of these fractures.

Kavuri V et al.¹⁵ conducted a study regarding the fixation of proximal Humerus fractures with locking plate, reveals that growing use of proximal locking plate provides the adequate fixation of proximal Humerus fractures. At the same time it is associated with high complications rate. The common complication in their study was screw penetration followed by varus collapse, limitations of shoulder movement, AVN of humeral head, infection, non union and adhesive capsulitis.

Ali et al. concluded from his study that proximal Humerus fractures are challenging issue for surgical management of these fractures. Open reduction and internal fixation with PHILOS plate has given accept-

able result in 3 part and 4 part fractures while the prognosis for intervention is poor for 4 part fractures.

In another study conducted by Siddalingamurthy et al.⁵ on 25 patients with proximal humeral fractures fixed with proximal humeral locking plate, they came to the conclusion that proximal humeral locking plate fixation has provided satisfactory result in 2 part, 3 part and 4 part fractures. The 3 part and 4 part fracture fixation has got high complication rate.

In his study regarding the functional outcomes of PHILOS plate fixation in proximal Humerus fractures in 15 patients, SK K Shashi et al.⁷ came to the conclusion that PHILOS plate provides good and stable fixation in elderly osteoporotic patients.

According to study of Dhruv Pandya and Krunal Soni while analysing the functional outcome of proximal Humerus plate in proximal Humeral fractures, they came to the conclusion that Proximal humeral locking plate is a preferred technique for fixation of proximal Humerus fractures.⁸ However the complications are not uncommon with this procedure.

In his study A.E Abdel Salam et al.¹ came to the conclusion that locking plates are advantageous especially in patients with osteoporotic proximal Humerus fractures. Although the reduction accomplished by PHILOS plate are preserved and has favorable outcomes. Still the complications rate especially screw perforation into joint are common.

All these studies suggest that PHIOS plate is a preferred treatment option for all proximal Humerus fractures. It provides a stable construct with divergent and convergent screws orientation with decreased chances of screw pull-out and implant failure.^{6,9} Laterally it provides the buttressing effect and medially it prevents the varus displacement of the fracture. In spite of this, complications also common with PHILOS plate like screw cut-out, AVN and Varus mal-union. These can be attributed to fracture pattern specially in 3 part and 4 part fractures, poor fixation technique and improper placement of implant^{10,12}. There for proper fixation technique, implant positioning and exact fracture pattern with pre-operative planning having 3D

CT-Scan are essential to achieve the good functional out-comes.¹¹

CONCLUSION

PHILOS plate provides good stable fixation in proximal Humerus fractures especially in 3 part and 4 part fractures in elderly population. It has got high complication rate in this age group because of osteoporosis resulting in screw pull-out, AVN of head of Humerus and varus mal-union

Study has limitations because Sample size in our study was small. A long follow up is desirable to know the functional out-comes especially in 3 part and 4 part fracture pattern of proximal Humerus.

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