

A study of the role of locking humerus plates in early mobilization of fracture of proximal humerus in adult at tertiary health care center

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Abstract

Background: Proximal humeral fractures are the second most common fractures of the upper extremity accounting for 4% to 5% of all fractures, approximately 20% of displaced proximal humeral fractures require surgery. Locking plates are biomechanically better suited for fixation of proximal humerus fracture and provide angular stability and locking screw anchorage in weak osteoporotic bones. The present study was done to evaluate functional outcome and role of locking humerus plates in early mobilization of proximal humerus fracture in adult at tertiary health care center. **Material and Methods:** In present study patients with fractures of proximal humerus were treated surgically with proximal humerus internal locking system (PHILOS) plate. Pendular exercises and assisted and passive active movements were started from the third postoperative day. Assessment of shoulder function was done using Constant and Murley scoring system at three Months and six months. **Results:** Total 32 patients were included in present study. Mean age of the patients was 47 ± 11.6 years. Male patients (69 %) were common than female patients (31 %). Road traffic accident (75 %) was most common mode of injury. According to Neer's classification, 2 part fractures (47 %) was most common, followed by 3 part fractures (38 %). Assessment of shoulder function was done using Constant and Murley scoring system, good function was noted in 69% patients, followed by excellent function in 19% patients. Fair and poor function was noted in 9% and 3% patients respectively. We noted surgical site infection in 3 patients (9 %), managed conservatively. 1 patient had stiffness and impingement. No malunion, avascular necrosis, intraoperative screw penetration or postoperative loose implant noted in patients. **Conclusion:** Proximal humerus internal locking system (PHILOS) plates is an advantageous implant in fixing proximal fractures of the humerus as it provides a good functional outcome, allows early mobilization and better patient satisfaction.

Key Words: proximal humerus fracture, proximal humerus internal locking plate, PHILOS plate, early mobilization

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INTRODUCTION

Upper limbs are important in powerful, accurate and wide range of movements for different daily activities. Proximal humeral fractures are the second most common fractures of the upper extremity accounting for 4% to 5% of all fractures, approximately 20% of displaced proximal humeral fractures require surgery.¹ The surgical modalities used are transosseous suture fixation, closed reduction and percutaneous fixation, open reduction and internal fixation with conventional plates, locking plate fixation and hemiarthroplasty which have shown to have mixed results.^{1,2} Conservative treatment is usually associated with nonunion, malunion and avascular necrosis resulting in a

painful dysfunction.³ The goals of surgery are to obtain anatomic fracture reduction and stable primary fixation to ensure rapid fracture healing and immediate post-operative functional therapy without prolonged immobilization. Locking plates were designed giving consideration to the anatomy of proximal humerus. These plates have low profile and are biomechanically better suited for fixation of proximal humerus fracture.⁴ They provide angular stability and locking screw anchorage in weak osteoporotic bones.⁵ Advantage of the locking compression plate is better anchorage of screws in osteoporotic bone. Because of the good fixation, enhanced stability will allow for early mobilization of the injured shoulder.^{6,7} The present study was done to evaluate functional outcome and role of locking humerus plates in early mobilization of proximal humerus fracture in adult at tertiary health care center.

MATERIAL AND METHODS

In present study patients with fractures of proximal humerus were treated surgically with proximal humerus internal locking system (PHILOS) plate at Department of Orthopaedics, Pacific Institute of Medical Sciences, Udaipur. Study was prospective, observational type conducted between June 2019 to October 2019. Institutional ethical committee approval was taken.

Inclusion criteria

- Patients 18-70 years age, with acute, closed, displaced proximal humeral fractures, fit for surgery.

Exclusion criteria

- Patients with associated humerus shaft fractures, associated neurovascular injury, acute infection, pathological fractures, and old fractures
- Not willing to participate or follow up, lost to follow up.

A written informed consent was taken from patients. Detailed history, clinical examination, routine investigation, preanesthetic check was done. X-ray of proximal humerus, both anteroposterior view and axillary views, was taken, and fractures were classified according to Neer's classification.⁸ All patients were operated with deltopectoral approach for exposure of all the fracture sites. Patients were operated by senior orthopaedic surgeon, having a minimum 10 years of experience. Proximal humerus internal locking system (PHILOS) plates were used. Standard postoperative care was provided to all patients. Postoperatively, all patients were immobilized in arm pouch with cuff and collar sling. Immediate postoperative X-rays were taken to assess the alignment of bone and maintenance of the optimal reduction. Pendular exercises and assisted and passive active movements were started from the third postoperative day. Rotation exercises were started after 3

weeks. Eccentric strengthening exercises and resistive strengthening were begun after fracture union was confirmed after 10 to 12 weeks. Assessment of shoulder function was done using Constant and Murley scoring system⁹ at three Months and six months. Radiological signs of healing in the form of callus formation and cortical continuity were assessed in the three months and six months follow-up radiographs. Follow up was kept till 6 months. Data was collected and statistical analysis was done using descriptive statistics. The qualitative variables were expressed in proportion and quantitative variables were summarized by mean and standard deviation.

RESULTS

Total 32 patients were included in present study. Mean age of the patients was 47 ± 11.6 years. Male patients (69 %) were common than female patients (31 %). Road traffic accident (75 %) was most common mode of injury. According to Neer's classification⁸, 2 part fractures (47 %) was most common, followed by 3 part fractures (38 %).

Table 1: General characteristics

Variables	No. of patients/ Mean ± SD	Percentage (%)
Mean age of the patients	47 ± 11.6 years	
Gender distribution		
Male	22	69 %
Female	10	31 %
Mode of injury		
Road traffic accident	24	75%
By slip and fall	5	16%
Fall from height	3	9%
Type of fractures based on Neer,s classification ⁸		
2 Part	15	47%
3 Part	12	38%
4 Part	3	9%
Fracture Dislocation	2	6%

Assessment of shoulder function was done using Constant and Murley scoring system⁹, good function was noted in 69% patients, followed by excellent function in 19% patients. Fair and poor function was noted in 9% and 3% patients respectively.

Table 2: Constant and Murley scoring system⁹

Total score	Result	No. of patients	Percentage (%)
100-90	Excellent	6	19%
80-89	Good	22	69%
70-79	Fair	3	9%
0-70	Poor	1	3%

We noted surgical site infection in 3 patients (9 %), managed conservatively. 1 patient had stiffness and impingement. No malunion, avascular necrosis, intraoperative screw penetration or postoperative loose implant noted in patients.

Table 3: Complications:

Complications	Number of patients	(%)
Surgical site infection	3	9%
Malunion		
Avascular Necrosis	1	3%
Impinge	1	3%
Stiff	1	3%
Screw penetration	1	3%
Implant loose		

DISCUSSION

Proximal humerus fractures occur most commonly following fall on out stretched hand and road traffic accidents. Most common in old age due to osteoporosis. Fractures in younger age group adolescents is most commonly following direct trauma to shoulder in road traffic accidents, sports injuries, and fall from height. Earlier proximal humerus fractures were considered simple and were managed by plaster cast techniques, slings and slab etc. Now they have gained more importance because of its complexity and complications. Anatomical reduction and rehabilitation is most important part of fracture management and strong predictor for good functional outcome. Many studies have shown that the displaced fractures of the proximal humerus have a poor functional outcome when not treated because of severe displacement of fragments.^{10,11} In the present study, we assessed shoulder function using Constant and Murley scoring system⁹, good function was noted in 69% patients, followed by excellent function in 19% patients. Fair and poor function was noted in 9% and 3% patients respectively. Dhruv Pandya studied 41 patients treated with PHILOS plating, 22 patients had excellent scores, 10 had satisfactory scores, 5 had unsatisfactory scores and 4 had poor outcome scores.¹² While in study by Patel VA *et al.*,¹³ mean score was 75.04. 45% (n=9) patients had excellent result, 25% (n=5) had good result, 20% (n=4) had fair result and 10% (n=2) had poor result. One patient had a varus fall which directs to Intra-articular screw penetration and two patients had superficial infection. Our results were better than these studies. In a similar study by Sudkamp *et al.*,⁶ had 187 patients with open reduction and internal fixation of proximal humerus fractures using a locking proximal humerus plate. Average Constant score was 70.6, with average active elevation was 132° and the external rotation of the limb was 45°. The overall complication rate was 34%, and the common complication was intraoperative screw penetration into the humeral head. Hatzidaki *et al.* studied 38 patients treated with locked angular-stable intramedullary implant fixation. All fractures were healed primarily. The mean Constant score was 71, 37 (97%) of 38 patients had satisfactory score.¹⁴ Complications following proximal humerus fracture and management can be broadly classified as ones due to the

fracture itself and ones due to the management options. Complications like stiffness, avascular necrosis and secondary osteoarthritis are often related to the severity of the fracture. Complications like malunion, implant failure and non-union are often related to the treatment option chosen.^{15,16} Jebaraj JPV¹⁷ in his study encountered 3 (10%) complications such as 1 case of osteonecrosis and impingement, 1 case of wound infection and 1 case of screw cut-out but did not encounter any cases of non-union, implant breakage. Similar findings were noted in present study. Other treatment option for proximal humerus fractures such as percutaneous K-wires, external fixators, J nails, and Rush nails are more biological and less invasive. Neither the reduction achieved with them is anatomical (due to closed techniques) nor the fixation is rigid enough for initiation of early range of movement. To add to it, complications such as pin-tract infections further limit their use.¹⁸ Biomechanical studies comparing locking plates versus non locking plates for open reduction and internal fixation of displaced proximal humerus fractures reported many biomechanical advantages, increased torsional and pull out strength, and less complication rate to locking plates as compared to non-locking plates.^{19,20} Proximal Humeral Internal Locking system (PHILOS) provides an angle stable construct with a combination of both divergent and convergent screw orientation and hence decreasing pull out of screws and decreasing chances of failure of fixation. Bone healing is achieved indirectly by callus formation when using locking screws exclusively. Implant locks the bone segments in their relative positions regardless of degree of reduction. stability under load by locking the screws to the plate ,the axial force is transmitted over the length of the plate and the risk of a secondary loss of the intra operative reduction is reduced. Proponents of locking plate fixation often cite better fixation, early mobilization, head preservation, restoration of range of motion and satisfactory function as some of the major advantages of locking plate construct.^{21,22} The limitations in our study were small sample size, a single method of fracture fixation. The small sample size in our study can overestimate the results. Large sample studies comparing various fixation methods in proximal humerus fractures are needed.

CONCLUSION

Proximal humerus internal locking system (PHILOS) plates is an advantageous implant in fixing proximal fractures of the humerus as it provides a good functional outcome, allows early mobilization and better patient satisfaction.

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