

Osteosynthesis with Locking Plate for Proximal Humerus

Fracture

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Citation

Mishra AK. Osteosynthesis with Locking Plate for Proximal Humerus Fracture. *Kathmandu Univ Med J.* 2018;63(3):244-7.

ABSTRACT

Background

Approximately 5% of all fractures consists of proximal humeral fractures. In the elderly population, most of these fractures are related to osteoporosis. Internal fixation has led to unpredictable results, especially in patients with osteopenic bone and those with comminuted fractures.

Objective

To evaluate functional outcome and complications following proximal humerus fracture fixation using locking plate.

Method

This prospective observational study was conducted at Nepal Medical College and Teaching Hospital from February 2014 to June 2015. We reviewed 35 patients with proximal humerus fractures, who underwent open reduction and internal fixation with locking plate. Functional outcome was evaluated according to the Constant-Murley shoulder assessment.

Result

Fracture union was achieved in all cases with the mean time to union being 14.6 weeks (11-24 weeks). At the final follow up the mean constant murley score was 73.6 (48-94). There was total 8(22.85%) cases who developed complication.

Conclusion

Internal fixation with the locking plate for proximal humerus fractures provides stable construct with better functional outcome as it allows early shoulder mobilization.

KEY WORDS

Locking plate, Osteosynthesis, Proximal humerus fracture

INTRODUCTION

Approximately 5% of all fractures consists of proximal humeral fractures.¹ These fractures are the third most common fracture in elderly patient occurring mainly due to trivial injury in due to osteoporosis.²⁻⁴ In younger patients these fractures occur due to high energy trauma.⁵ The stable and minimally displaced fractures can be treated conservatively, whereas displaced and unstable fractures treatment remain controversial, especially if the bone is osteoporotic.⁶ The proximal humerus fracture can be treated with several methods like close reduction and percutaneous K wire fixation, External fixator, open reduction followed by fixation with sutures, Intramedullary nail, locking plates and hemiarthroplasty.⁷⁻¹⁰ All these treatment modalities have their own merits and demerits associated with different outcomes and complications like loss of reduction, failure of the implant, nonunion, malunion, avascular necrosis of the humeral head, migration of the nail and impingement syndrome.¹¹⁻¹³ These complications are more commonly seen in elderly patients, to minimize these complications, proximal humerus internal locking plate has been developed. Proximal humeral locking plate improves screw fixation as it has got two fixation techniques in one implant, dynamic compression with standard screws and angular stability with locking screws proving both axial and angular stability, so it avoids screw loosening as well as loss of reduction. These plates maintain the vascularization of the humeral head with high pullout strength and good anchorage in both Multifragmentary fractures as well as in osteoporotic bone. This study was carried out to evaluate functional outcome and complications following proximal humerus fracture fixation using locking plate.

METHODS

This prospective observational study was conducted at Nepal Medical College and Teaching Hospital from February 2014 to June 2015. We reviewed 35 patients with proximal humerus fractures, who underwent open reduction and internal fixation with locking plate.

The study was approved by the Institutional Ethical Board. The patients included in study were skeletally matured, fracture having a displacement of > 1 cm between the major fracture segments or angulation of the articular surface of > 45 as outlined by Neer. The open fracture, pathological fracture or refracture, failed conservative treatment, previous operative treatment of the proximal part of the humerus, concomitant ipsilateral fracture of the distal part of the humerus or the elbow joint and polytrauma patients were excluded from the study.

There were 11(31.42%) men and 24(68.58%) women with a mean age of 51.1 years, ranging from 28-74 years. There were 16 patients injured with trivial fall injury, 12 from road traffic accident and fall from a height in 7 patients. The right

side of injury was seen in 21(60%) patients and 14(40%) had a left side injury. The fracture was classified according to Neers classification system. A total of 7 patients had two part fractures, 13 had three part fractures and 15 had 4 part fractures of proximal humerus. The CT scan was done in 28 patients, those who were classified as Neers three- and four-part fracture.

The surgery in all cases was performed under general anaesthesia with the patient in a 'beach chair' position. A deltopectoral approach was used with minimal soft-tissue dissection to expose the rotator cuff and tuberosity of proximal humerus. The sutures were inserted into Subscapularis, Supraspinatus and Infraspinatus tendon just superficial to tendon's bony insertion to hold the fragments. The fracture was reduced and temporally fixed with Kirschner wires. The reduction was checked fluoroscopically and then a locking plate was placed about 5 to 8 mm distal to the tip of greater tuberosity, aligned properly along the axis of the humeral shaft and slight posterior to bicipital groove. Fracture reduction and plate position were reconfirmed under image intensifier once the fixation was done.

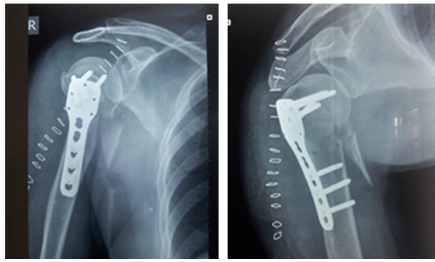
Post-operatively the arm was supported in a sling. Pendular movements were started from the first post-operative day and the shoulder was mobilised with active assisted exercises and active exercises was started after six weeks of surgery. The patients were in regular follow up at two, six weeks and at three month intervals upto one year. Radiological imaging was used to determine the bony union and functional outcome was evaluated according to the Constant–Murley shoulder assessment,¹⁴ the scoring system of which comprises four parts: pain, power, activities of daily living and range of movement.

RESULTS

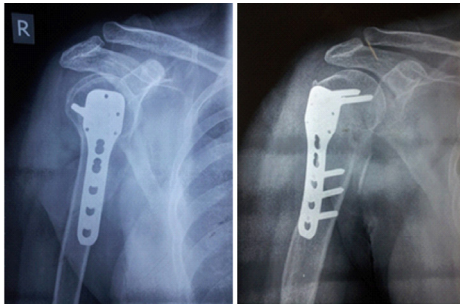
The bony union was assessed by clinical absence of pain and tenderness with obliteration of the fracture line in x-ray, which was achieved in all cases with the mean time being 14.6 weeks (11-24 weeks). Among them 29(82.85%) patients had union between 11-18 weeks and 6(17.15) of them had between 18-24 weeks. (Case I: fig 1a, 1b, 1c) (Case II: fig 1a,1b,1c)



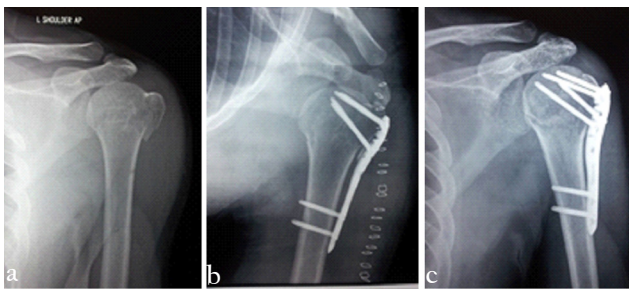
Case I, Figure 1 a. Preoperative radiograph and CT scan



Case I, Figure 1 b Immediate Post operative



Case I, Figure 1 c. Preoperative radiograph and CT scan



Case II, Figure 2. a (Preoperative), b (post-operative), c (3 months follow up)

At the final follow up the maximum number of the patients had an excellent result with only 1 patient had a poor result with the mean constant murley score of 73.6(48-94). (Table 1)

Table 1. Constant Murley score

Score	Number of patients	Percentage
Excellent	27	77.14
Good	4	11.43
Fair	3	8.57
Poor	1	2.86
Total	35	100

There was total 8(22.85%) cases who developed complication, 3(8.57%) patients had a superficial infection, 4(11.2%) had a sub acromial impingement and 1(2.85%) had a Varus Malunion.

DISCUSSION

The proximal humerus fracture incidence is increasing due to high energy trauma and increase in life expectancy of elderly population. The fracture fixation for proximal

humerus is challenging and treatment still remains controversial. In past, various fixation methods were used for treatment of proximal humerus fracture with variable functional outcome and complications.

The percutaneous k wire fixation maintains vascularity with minimal soft tissue damage but they don't provide stable anatomic reduction and avoid early mobilization with high rate of pin tract complication.¹⁵ These fractures treated non-operatively or fixation done with tension band wiring have no difference in functional outcome in different studies.¹⁶

Nailing is biomechanically superior over plating as it is a load sharing devise, but due to the entry site there is a metaphyseal comminution.¹⁷ There is a high chances of implant failure in non-locking plate, specially with inadequate bone stock and high rate of complication is seen. Locking plates have better torsional stability than non-locking plates as suggested by the Siffri et al. cadaveric study.¹⁸ The choice of the treatment for displaced four part fracture in elderly person is hemiarthroplasty with good functional outcome but range of the movements are compromised.¹⁹ All of these methods are associated with different outcomes and complications.

The functional outcome in our study after fixation of proximal humerus fracture with locking plate was 73.6 mean constant score, which is comparable to other studies. (Table 2)

Table 2. Functional Outcome

Study	No. of patients	Mean Constant score
Bjorkenheim et al. ²³	72	74
Koukakis et al. ²⁴	20	66.5
Moonot et al. ²⁰	32	66.5
Sudkamp et al. ²¹	187	85.1
Kumar et al. ²²	51	79
Present study.	35	73.6

In our study, the overall complication rate was 22.85% (8 cases). The main complication was Subacromial impingement, superficial infection and varus malunion.

Subacromial impingement in our study was found in 4 patients, where Moonot et al. observed 4 case in 32 patients, Sudkamp et al. also observed 4 cases in the series of 187 patients, whereas only 1 case were observed by Kumar et al. study among 51 patients.²⁰⁻²²

Superficial infection in our study was observed in 3 patients, which healed with oral antibiotics treatment. Moonot et al. observed 2 case of acute infection in 32 patients, similarly Sudkamp et al. also observed 2 cases in the series of 187 patients whereas only 1 case were observed in Kumar et al. study out of 51 patients.²⁰⁻²² Varus malunion in our study was developed in 1 patient whereas Moonot et al.

observed 2 case of varus Malunion in 32 patients, similarly Kumar et al. observed 4 cases among 51 patients.^{20,22} The penetration of the screw in joint were noted in various studies bit in our study none of the patients had penetration of screw probably due to use of fluoroscopic imaging intraoperatively during drilling and also monitored while screw insertion and avoid articular penetration.

There were no single cases of AVN of humeral head observed in our study may be due to short term follow up as it requires long term follow up for observation.

The smaller number of the patients with short period of follow up time were the limitations of the study.

CONCLUSION

Internal fixation with the locking plate for proximal humerus fractures provides stable construct with better functional outcome as it allows early shoulder mobilization.

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