

Study on outcome and complications of surgical management of proximal humerus fractures using locking compression plate

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Abstract

Background: Proximal humerus fractures are the commonest fracture of humerus. Surgical interventions are helpful in better fixation and early recovery but the chances of complications are high. The present study was conducted to assess the complications of surgical management of proximal humerus fracture using Proximal humeral internal locking system (PHILOS) plate and its functional outcome. **Methods:** The present study was hospital based conducted upon patients above 18 years of age suffering from proximal humerus fracture and treated with open reduction and locking compression plate. Functional outcomes and complications were noted. **Results:** 28.1% were below 40 years of age and 53.1% were due to fall. General anaesthesia was used in 59.4% patients. In 71.9% cases, complications were not seen. Pain was present in 15.6%, stiffness in 12.5%, plate impingement in 9.4% and Varus malunion in 6.3%. Excellent result was seen in 21.9%. It was good in 46.9%, fair in 25% and poor in 6.3% cases. **Conclusion:** This technique helped in better fixation of the fracture and early mobilization.

Key words: Complications, Locking Compression Plate, Outcome, Proximal Humerus Fracture

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INTRODUCTION

Proximal humerus fractures account for 5-6% of all fractures and are the commonest fracture of humerus. Age above 70 years, female sex and osteoporosis have been reported to be the risk factors for this condition. Most of the cases are due to fall from standing height. Increased frequency of road traffic accidents and increased life expectancy have led to increase in incidence of this fracture.¹ Most of these fractures show minimal displacement and can be managed well by conservative treatment by external fixation. 20% cases show significant

displacement needing operative intervention.² Various surgical techniques were developed in 20th century for its management including open reduction and internal fixation using plates/ tension-band fixation, closed reduction and percutaneous intervention using pinning / k-wires, hemiarthroplasty, intramedullary nailing etc.³ Surgical interventions are helpful in better fixation and early recovery but the chances of complications are high. The complications include loss of reduction, implant failure, non-union / malunion and osteonecrosis of the humeral head. To overcome these, locking compression plates have been introduced which lead to improved fixation because of angular stability of the screws locking in the plate and their three-dimensional distribution in the humeral head. However, this technique is technically demanding. Better angular stability can be achieved using Proximal humeral internal locking system (PHILOS) plate fixation. It provides better anchorage of screws in osteoporotic bone, with good functional outcomes.⁴ Only few studies have been conducted to find the frequency of complications associated with this surgery and the functional outcome seen. The present study was conducted to assess the same and fill the gap.⁵⁻⁶

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Aims and objectives: The present study was conducted to assess the complications of surgical management of proximal humerus fracture using Proximal humeral internal locking system (PHILOS) plate and its functional outcome.

MATERIAL AND METHODS

Study setting: The present study was hospital based in nature conducted at the department of Orthopaedics, ANMMCH, Gaya, Bihar which is a teaching hospital in Gaya division catering to patients from the neighbouring districts.

Duration and type of study: The present study was conducted between October 2017 to June 2019. Data collection was done between March 2018 to February 2019.

Study subjects: Patients receiving treatment at the Orthopaedics Department of the institute and suffering from proximal humerus fracture were included.

Inclusion criteria: Patients above 18 years of age suffering from proximal humerus fracture and treated with open reduction and locking compression plate were included in the present study.

Exclusion criteria: Patients with pathological fracture, those treated conservatively and those who refused to give consent were excluded.

Sampling: All the patients reporting during the study period and fulfilling selection criteria were included in the present study. A total of 32 cases were included.

Data collection procedure: The patients were visited in the wards and careful history was taken. Clinical evaluation for general condition and local injury was done for swelling, deformity, loss of function and altered attitude. Any associated nerve injury was also assessed. Each patient was evaluated radiologically with three standard views namely scapular AP view, scapular lateral views and trans-axillary views. Neer’s classification based on the anatomical relationship of 4 major anatomical segments i.e. articular surface, greater tuberosity, lesser tuberosity and the proximal shaft beginning at the level of the surgical neck was used for classification of the fracture. Surgery was performed in supine position using the deltopectoral approach. Fracture fragments were reduced and reduction was held temporarily using Kirschner wires. Definitive fixation with proximal humerus locking plate was done with plate positioned at least 5 mm distal to the upper end of the greater tuberosity and at least 2 mm posterior to the bicipital groove. Multidirectional screws were used to fix proximal fragments. Careful repair of rotator cuff, capsule and subscapularis muscle tears/avulsions was done. The post operative rehabilitation protocol included immediate passive and active assisted range of motion exercises up to 60 degrees of abduction and elevation with no forced external rotation for 6 weeks.

Full ROM with active exercises was started at 6 weeks. Patients were followed up on OPD basis at two weeks postoperatively, then monthly till 6 months. Post-operative complications and functional outcome were noted.

Data analysis: Data was entered in Microsoft Excel 2010 and analyzed using Statistical Package for Social Sciences (SPSS) v 16.0. Numerical variables were expressed as Mean and SD and categorical variables as frequency and percentages. Statistical tests were done as needed. p-value of <0.05 was considered to be statistically significant.

Ethical consideration and permission: Approval from Institutional Ethics Committee was obtained for the study. Informed consent was taken from the study subjects after informing them about the importance of the study. Confidentiality of records were maintained.

RESULTS

A total of 32 patients were included in the present study. Table-1 shows the age distribution of patients. Most of the patients belonged to the age group of 40-50 years (34.4%) . 28.1% were below 40 years of age while only 6.3% were more than 60 years old.

Table 1: Age of the patients (n=32)

Age (in years)	Frequency	Percentage (%)
<40	9	28.1
40-50	11	34.4
50-60	10	31.3
>60	2	6.3

Table-2 shows the mode of injury. 53.1% of the cases were due to fall while in the remaining, the cause of injury was road traffic accident.

Table 2: Mode of injury (n=32)

Mode of injury	Frequency	Percentage (%)
RTA	15	46.9
Fall	17	53.1

Table-3 shows the anaesthesia used. In 59.4% patients, general anaesthesia was used while brachial plexus block was done in remaining.

Table 3: Anaesthesia used

Final outcome	Frequency	Percentage (%)
General	19	59.4
Regional	13	40.6

Table-4 shows the complications seen. In 71.9% cases, complications were not seen. Pain was present in 15.6%, stiffness in 12.5%, plate impingement in 9.4% and Varus malunion in 6.3%.

Table 4: Complications seen

Complications*	Frequency	Percentage (%)
Nil	23	71.9
Stiffness	4	12.5
Plate impingement	3	9.4
Varus malunion	2	6.3
Pain	5	15.6

*- multiple response

Table-5 show the final outcome on the basis of dash score. Excellent result was seen in 21.9%. It was good in 46.9%, fair in 25% and poor in 6.3% cases.

Table-5: Final outcome based on dash score

Final outcome	Frequency	Percentage (%)
Excellent	7	21.9
Good	15	46.9
Fair	8	25
Poor	2	6.3

Table-6 shows the range of motion at six months. Mean range of flexion was $118.3 \pm 13.9^\circ$, that of abduction was $109.2 \pm 11.7^\circ$, external rotation as $61.5 \pm 7.4^\circ$ and internal rotation as $58 \pm 10.8^\circ$.

Table 6: Range of motion at six months

Range of motion	Mean	SD
Flexion	118.3	13.9
Abduction	109.2	11.7
External Rotation	61.5	7.4
Internal Rotation	58	10.8

DISCUSSION

Proximal humerus fractures constitute a significant proportion of case of upper limb injury. Undisplaced fractures are best managed conservatively. Management of displaced fractures is debated. Different researchers have got varying results in these cases. Hence, the present study included 32 cases of proximal humerus fracture managed by locking compression plate and explored the complications and final outcome in these cases. In the present study, most of the patients belonged to the age group of 40-50 years (34.4%). 28.1% were below 40 years of age while only 6.3% were more than 60 years old. Arumugam et al found that proximal humerus fractures were found to have a high incidence in the 41 to 50 age group.⁵ Aggarwal et al observed that mean age of the patients was 58.51 years.^[6] Kolusu et al found that 70.60 % of patients were above 70 years suggesting an age-related osteoporotic fracture.⁷ 53.1% of the cases were due to fall while in the remaining, the cause of injury was road traffic accident. Arumugam et al commented that most of the injuries were caused by road traffic accident and another cause was fall from height and following a slip and fall.⁵ Joshi et al found that most common mode of injury was road traffic accidents (61.1%) followed by domestic falls (36.1%) and assaults (2.8%).^[8] Aggarwal et al also found that falls accounted for 55% of fractures, road side accidents 42.5% and 1 fracture was caused by seizure.⁶ In 59.4% patients, general anaesthesia was used while brachial plexus block was done in remaining. Bhadbhade et al found that 67% needed general anaesthesia.⁹ In 71.9% cases, complications were not seen. Pain was present in 15.6%, stiffness in 12.5%, plate impingement in 9.4% and Varus malunion in 6.3%. Arumugam et al reported that

10% cases had plate impingement, 6.7% had varus malunion and 6.7% had stiffness.^[5] Bhadbhade et al found that all the patients (100%) had clinical and radiological union. Pain was reported by 10% of the patients while complications noted were varus malunion (3%), malunion (3%) and stiffness (13%).⁹ Excellent result was seen in 21.9%. It was good in 46.9%, fair in 25% and poor in 6.3% cases. Mean range of flexion was $118.3 \pm 13.9^\circ$, that of abduction was $109.2 \pm 11.7^\circ$, external rotation as $61.5 \pm 7.4^\circ$ and internal rotation as $58 \pm 10.8^\circ$. Arumugam et al found that 13.3% cases had excellent results and 63.4% had satisfactory results. 23.3% had unsatisfactory results and there was no failure. They found that all patients with excellent results and satisfactory results had normal muscle function and functional range of motion according to Neer's criteria.⁵ Aggarwal et al observed that the functional outcome was found to be moderate to excellent in 90% of our patients. However, almost 10% patients had poor outcome.^[6] Bhadbhade et al reported that most of the patients had good outcome (47%) followed by fair (26%), excellent (20%) and poor outcome (7%).⁹ Jordan et al in their review commented that proximal humeral fixation showed a 98% union rate, an average Constant-Murley score of 74.3, flexion of 139° and external rotation of 48° .¹⁰ 13.7% cases required repeat surgery. Avascular necrosis, loss of fixation, screw perforation and mechanical impingement were the additional complications seen. Hence, any benefit should be balanced against a high complication risk. Navarro et al in their systematic review commented that there were not enough data to present results regarding differences in clinical result, quality of life or complications when different kinds of plate fixation with or without angle-stable screws, plate fixation with or without screws supporting the fracture medially, internal fixation and arthroplasty were compared.¹¹ The certainty of evidence was rated as very low.

CONCLUSION

The present study was conducted to assess the functional outcome and complications of surgical management of proximal humerus fractures using locking compression plate. It is concluded that this technique helped in better fixation of the fracture and early mobilization. Use of divergent or convergent screw orientation to head of humerus helped in improved resistance to pull out and failure of fixation. Locking plates decreased the chance of stripping the thread in osteoporotic bone, as the plate/bone interface is not loaded along the screw axis. As the underlying periosteum and blood supply to the fractured regions are much less compressed, the biological fixation is also improved. The chances of complications are minimal and the functional outcome is good in most of the cases.

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