

Prospective Comparative Assessment of the Functional Outcome of Surgical Management of Proximal Humerus Fracture by Different Modalities

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Abstract

Aim: To assess and compare the functional outcome with different modalities in fixation of proximal humerus shaft fractures.

Methodology: The present prospective study was conducted in the Department of Orthopedics, JLNMCH, Bhagalpur for a period of four months. The study participants were informed about the study details and informed written consent was obtained from them. The history of injury of the participants, general condition and any associated soft tissue injury were evaluated. The severity of the injury was assessed to assess local injury and axillary nerve was assessed by examining any anaesthetic patch over lateral aspect of the shoulder. All the cases with proximal humerus fractures above 18 years of age and consenting for the study were included. The modality of the treatment was decided based upon the following factors: Neer's classification [grade 2 to grade 4]; presence of humeral head dislocation and comminution; valgus impaction, quality of bone, open or compound fracture and age of the patient.

Results: In this study, a total of 100 cases who fulfilled the inclusion criteria were enrolled. 54% of cases were females and 46% were males. 53% of the cases were between 41-60 years with 37% between <18-40 years and 10% of cases >60 years of age. The age range was from 19 to 68 years with a mean age of 45.7 years. 59% of the cases sustained fracture on the left side and 41% on right side. 72% of fractures were of closed type and 28% were open.

As per Neer's type of fracture classification, the most common type of fracture observed in our study cases was two-part fracture accounting to 35% of cases followed in order by three part (31%), four part observed in 26% of cases. 8 cases had fracture dislocation. Road traffic injury was the most common mechanism for injury in 51% of cases and next was a history of fall in 39% of cases. At the end of clinical and radiological union and full functional recovery the results were evaluated. Of the total 50 cases in the study, 74% cases had excellent results, 14% cases were satisfactory, 8% cases were unsatisfactory, and 4% cases had failure.

Conclusion: To conclude, the options as to the management modality used depend on the pattern of the fracture, the quality of the bone encountered the patient's goals and the surgeon's familiarity with the techniques. Principle of fixation is reconstruction of the articular surface, including the restoration of the anatomy, stable fixation, with minimal injury to the soft tissues preserving the vascular supply, should be applied.

Keywords: Humerus, internal fixation, open reduction

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Introduction

Of all fractures of the proximal humerus, about 85–90% are considered suitable for non-operative treatment: Immobilization for one or two weeks, followed by physiotherapy [1]. In these cases, fractures usually only show minor displacement, as well as little angulations, healing uneventfully in the future [2]. Indications for surgical treatment are usually based on factors like age, number of fragments, degree of displacement, baseline functional status of the patient, hand dominance, and surgical experience of the treating physician [3].

Fractures of the proximal humerus represent approximately 4% of all fractures and 26% of humerus fractures [4]. The most common mechanism of injury in proximal humeral fractures in elderly patients is a fall from standing height onto an outstretched upper extremity. In young patients, the mechanism is often related to high-energy trauma, such as significant falls from height, motor vehicle accidents, or athletic injuries. The risk factors for proximal humeral fractures are primarily associated with low bone mineral density and an increased risk of falls. Majority of these fractures are stable, minimally displaced or non-displaced and mostly managed by non-operative techniques like immobilization, splints and casts etc. However, these techniques are associated with complications and disabilities like avascular necrosis, non-union and malunion [2].

Being one of the most versatile bones its fracture can be managed with a wide variety of treatments. Humerus has a wide functionally acceptable criteria due to mobile shoulder joint and is highly amenable to conservative treatment. However, the same requires a splint or cast for 4 to 6 weeks and is cumbersome for the patient. Though functional bracing

continues to be the gold standard treatment for the diaphyseal fractures of humerus, the trend in near past has moved towards surgical fixation so as to achieve the aim of early rehabilitation and return to activities of daily living. There is a significant heterogeneity among the studies in describing the best surgical procedure in proximal humerus fracture. No single approach is considered the best of standard of care in management of fracture [5].

Aim:

To assess and compare the functional outcome with different modalities in fixation of proximal humerus shaft fractures.

Materials and Methods

The present prospective study was conducted in the Department of Orthopedics, JLNMCH, Bhagalpur. for a period of four months. The study participants were informed about the study details and informed written consent was obtained from them. The history of injury of the participants, general condition and any associated soft tissue injury were evaluated. The severity of the injury was assessed to assess local injury and axillary nerve was assessed by examining any anaesthetic patch over lateral aspect of the shoulder.

Inclusion criteria:

All the cases with proximal humerus fractures above 18 years of age and consenting for the study were included. [Neer's classification: grade 2 to Grade 4] [6].

Exclusion criteria:

Cases with Pathological fractures, with distal neuro vascular deficit, poly trauma patients with injury severity score >16,

shaft humerus fractures with proximal extension.

Radiological evaluation

Radiological evaluation of all the included cases were done as per the Neer's trauma series which include AP view of the scapula, lateral "Y" view of the scapula, axillary view and occasionally the velpeau view was taken. All the routine surgical investigations were done on the included cases and anaesthetic fitness was also evaluated. The modality of the treatment was decided based upon the following factors: Neer's classification [grade 2 to grade 4]; presence of humeral head dislocation and comminution; valgus impaction, quality of bone, open or compound fracture and age of the patient. General anaesthesia was used in all the patients. One of the following methods was used as treatment in all the cases.

- Closed reduction and percutaneous K-wires fixation.
- Open reduction and internal fixation with K -wire.
- Open reduction and internal fixation with ethibond sutures.
- Open reduction and internal fixation with locking compression plates.
- Closed reduction and internal fixation by Intramedullary nail.
- Shoulder hemi arthroplasty.

The operated limb was immobilized in arm pouch and mobilization was started in 2nd week with shoulder wheel exercises as per patient's tolerance. Post-operative radiological evaluation was done to assess reduction and stability of fixation. Gentle passive forward flexion and internal and

external rotation exercises by end of 3rd week and active exercises by 4th to 6th week were done. Patients were followed on OPD basis at the end of 6 weeks to one year and full functional evaluation with range of movements and function was assessed and recorded. Results were evaluated for each case based on Neer's shoulder score based on pain, function, range of motion and anatomy. The maximum points are 100 and on overall score the patient's outcome was grouped as excellent >89 units; satisfactory 80-89 units; unsatisfactory 70-79 units and failure <70 units.

Results:

In this study, a total of 100 cases who fulfilled the inclusion criteria were enrolled. 54% of cases were females and 46% were males. 53% of the cases were between 41-60 years with 37% between <18-40 years and 10% of cases >60 years of age. The age range was from 19 to 68 years with a mean age of 45.7 years. 59% of the cases sustained fracture on the left side and 41% on right side. 72% of fractures were of closed type and 28% were open.

As per Neer's type of fracture classification, the most common type of fracture observed in our study cases was two-part fracture accounting to 35% of cases followed in order by three part (31%), four part observed in 26% of cases. 8 cases had fracture dislocation. Road traffic injury was the most common mechanism for injury in 51% of cases and next was a history of fall in 39% of cases.

Table 1: Patients demographic, surgical, and post-surgical details

Distribution of cases	Number (n=100)
Age wise (years)	
≤18-40	37
41-60	53
>61	10
Gender	

Male	46
Female	54
Side of fracture	
Right	41
Left	59
Type of fracture	
Closed	72
Open	28
Neers's type of fractures	
2 part	35
3 part	31
4 part	26
Fracture with dislocation	08
Cause of injury	
Road traffic accident	51
Fall	39
Others	10
Surgical treatment	
ORIF with LCP	41
ORIF with K-wire	17
ORIF with K-wire and cancellous screws	9
Percutaneous pinning	20
Shoulder hemiarthroplasty	5
CRIF with intramedullary nailing	7
ORIF with ethibond suture	1
Clinical union (in weeks)	
11	11
12	32
13	17
14	22
15	18
Radiological union (in weeks)	
16-18	63
19-20	24
>20	13

41% were managed by open reduction and internal fixation with locking compression plate using 4.5 mm cortical screw plates and 6.5 mm cancellous screws. Percutaneous pinning was done in 20 cases; shoulder hemiarthroplasty in 5 cases

and open reduction internal fixation (ORIF) with ethibond suture in one case. Open reduction with K-wire was done in 17 cases and open reduction with K-wire and cancellous screws in 9 cases. Closed reduction with intramedullary nailing was

done in 7% cases. Clinical union was observed in 43% of cases by 12 weeks and the average time taken was 12.8 weeks. 63% of cases developed radiological union between 16-18 weeks and the average time was 17.8 weeks.

During the period of entire follow up, only 12 cases developed post-operative infection and stiffness was observed in 6 cases. No other serious complications were noted in the study cases throughout the follow up period.

Table 2: Distribution of Neer's score of cases and results

Neer's score	1st week (%)	4th week (%)	8th week (%)	Final (%)	Result
<70	50 (100)	36 (72)	6 (12)	2 (4)	Failure
70-79	0	14 (28)	4 (8)	4 (8)	Unsatisfactory
80-89	0	0	36 (72)	7 (14)	Satisfactory
>90	0	0	4 (8)	37 (74)	Excellent

At the end of clinical and radiological union and full functional recovery the results were evaluated. Of the total 50 cases in the study, 74% cases had excellent results, 14% cases were satisfactory, 8% cases were unsatisfactory, and 4% cases had failure.

Discussion:

Management of proximal humerus fractures is a challenging task, and the choice of surgical management is always a controversy. These fractures have a dual age distribution occurring either in young people following high energy trauma or in those older than 50 years with low velocity injuries like simple fall. Earlier these fractures were considered simple and were managed by plaster cast technique, slings and slabs,[7] but recent advances in understanding of anatomy, good surgical skills and better instrumentation has lead to various modalities for the treatment of these fractures like percutaneous pinning,[8, 9] Intramedullary nailing, plate fixation [10, 11]or Prosthetic replacement.

Our study has focussed on outcome of fractures irrespective of age and type of surgical modality used in management of proximal humerus fracture based on Neer's classification of fracture and Neer's score of outcomes. The average age incidence and range was from 19 to 68 years with a mean of 45.7 years which was

similar to the finding in the study of Launonen et al with 52.65 years [12]. The most common mode of injury in our study was road traffic injury indicating high velocity injury as main mechanism of fracture. In our study, fracture was more common on left side (60%) than right (40%) which is similar to finding of Gerber et al and contrary to the findings of Björkenheim et al [13, 14]. The study of the type of the fracture in our study found 2-part type as the most common which is similar to the findings in the study of Vijayvargiya et al and in some of the studies 3- and 4-part fractures were more common than 2-part fractures [15].

In our present study at the end, of the total 50 cases in the study, 74% cases had excellent results, 14% cases were satisfactory, 8% cases were unsatisfactory, and 4% cases had failure. Different studies using Neer's scoring system in final outcome also reported similar pattern of results with 70-80% patient shaving excellent to satisfactory results and rest 20-30% with unsatisfactory and failure result. In our study, one case of failure was seen in elderly who underwent ORIF with K-wiring and failure was due to infection with the pin tract infection which was deep seated and lead to arthritis and failure. Our results with ORIF almost correlated with studies in literature but improved results are seen with minimal fixation techniques.

In our study, 9 cases were performed percutaneous pinning with 7 excellent result, 1 satisfactory and 1 unsatisfactory. Few of the studies reveal that percutaneous pinning is far superior to ORIF regarding functional outcome [16, 17]. The unsatisfactory results in our series were seen mostly in elderly patients who were reluctant or not compatible for rigorous rehabilitation programme. Decreased immunity status led to infection in few of these patients resulting in unsatisfactory and failure outcome.

Conclusion:

Principle of fixation is reconstruction of the articular surface, including the restoration of the anatomy, stable fixation, with minimal injury to the soft tissues preserving the vascular supply, should be applied. Good surgical skills, surgeons experience in selection of the type of surgery depending upon the factors like type of fracture are necessary to achieve correct and best outcome. Clinical evaluation, obtaining proper radiological views, age of the patient and activity holds the key for realistic approach and surgical management of complex humerus fractures.

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