



“STUDY OF FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT OF PROXIMAL HUMERUS FRACTURE BY VARIOUS MODALITIES”

Orthopaedics

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ABSTRACT

Background: Proximal humerus fractures account for nearly 6-10% and are on a rise. The management of this is controversial and is challenging task. There is a significant heterogeneity among the studies in describing the best surgical procedure in proximal humerus fracture. The objective of the study is to assess and compare the functional outcome with different modalities in fixation of proximal humerus shaft fractures.

Methods: August 2018 to June 2020 prospective study was conducted after getting ethical approval at Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar. on cases admitted with proximal humerus fractures as per the inclusion criteria based on Neer's classification. Radiological evaluation was done, and surgery was performed. Postoperative follow-up was done at 1st, 4th, 8th and 14th week and outcome were evaluated for each case based on Neer's shoulder score.

Conclusion: The incidence of proximal humeral fractures has increased in last few years due to changes in life style and increase in road traffic accidents. The best management in these injuries is still inconclusive. Studies have shown non-operative and operative treatments, both give favourable results, and the confusion remains.

KEYWORDS

Neer's score, Humerus fracture, Range of motion, Functional outcome.

INTRODUCTION

Fractures of the proximal humerus represent approximately 4% of all fractures and 26% of humerus fractures^[1]. These are the second most common upper- extremity fracture and the third most common fracture, after hip and distal radial fractures. The fractures can occur at any age, but the incidence rapidly increases with age. The risk factors for proximal humeral fractures are primarily associated with low bone mineral density and an increased risk of falls. 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 patients aged less than 50 years, the mechanism is often related to high-energy trauma, such as significant falls from height, motor vehicle accidents, or athletic injuries.

The injury causing proximal humerus fracture is of great importance when it affects the young and middle age groups of the population. It leads to temporary disability and loss of working hours. Restoration of the function of the upper limb is of paramount importance.

Treatment of proximal humerus fracture has been the subject of much controversy and confusion. This is because of the complexity of these injuries, fracture displacements are without careful radiographic views and associated soft tissue injuries. Further, there has always been diversity of opinion about the care of shoulder fractures, with frequent controversies and lively debate, further more even good anatomical results achieved at operative repair may lead to poor results unless there is meticulous post operative rehabilitation, which can be more challenging in shoulder than operative technique itself.^[2,3,4]

AIMS AND OBJECTIVES OF STUDY

1. Occurrence, mechanism of injury and type of displacement of fracture of proximal humerus according to Neer's classification.
2. To Study different modalities of the fixations in proximal humerus fractures.
3. Assess and compare the functional outcome of various treatment modalities.
4. To come a conclusion about preferred modality of treatment of proximal humerus fractures.

MATERIALS AND METHODS

This study was carried out in Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, from August 2018 to June 2020, fifteen patients of proximal humeral fractures were attended in the casualty and OPD and were admitted in this hospital and were treated surgically.

We collected records of the patients by asking the patients history and examining the patients. Essential investigations of all the patients were done. The patients were operated with various modalities of fixation. Patients followed up at regular interval.

Method of Treatment:

All the patients were operated on either elective or emergency basis depending on whether fracture is closed or open. All patients were treated by one of the following methods.

1. Closed reduction and Percutaneous K- wires fixation.
2. Open reduction and Internal fixation with K-wire.
3. Open reduction and Internal fixation with Locking Compression Plate.

Post-operative care :

Post-operatively limb is immobilized in arm pouch, sutures were then removed and if secure fixation was achieved, mobilization was started in the second week with shoulder wheel exercises as per patient's tolerance. Immediate post-op X- Rays were done routine A-P and scapular view to assess the reduction of fracture and stability of fixation.

If the bone was severely osteoporotic and fixation was less than rigid, motion was delayed, otherwise redisplacement of the fracture fragments could have occurred. Shoulder wheel exercises were permitted by the second or third week and gentle passive forward flexion and internal and external rotation exercises by the third or fourth week. By the fourth to sixth week, active exercises were started. Patients were discharged with arm pouch and advise to continue pendulum exercises. Patients underwent rehabilitation as per protocol. Patients were followed from 6 weeks -1 year on OPD basis at intervals of 6 Weeks, 12 Weeks, 6 Months and 1 Year. During this period in each visit clinical evaluation of wound healing, pain, shoulder function and range of movements were assessed and recorded. Clinically fracture was considered united when there was no tenderness at the fracture site and full shoulder function is present. Radiologically fracture was regarded as united when there is no visible fracture line.

Results were evaluated by the use of Neer's shoulder score based on pain, function, range of motion and anatomy for each case assessed and recorded.

FUNCTIONAL ASSESSMENT EVALUATION OF RESULTS BY MEANS OF NEER'S SHOULDER SCORE: EVALUATION

1. Pain Total 35 Unit

a. No Pain	35
b. Slight or Occasional	30
c. Mild, No effect in ordinary activity	25
d. Moderate, tolerable, starting to affect ordinary activity	15
e. Marked, serious limitation of ordinary activity	5
f. Total Disablement	0

2. Functional Ability Total 30 Units

a. Strength		b. Reaching		c. Stability	
• Normal	10	• Above head	2	• Lifting	2
• Good	8	• Mouth	2	• Throwing	2
• Fair	6	• Belt buckle	2	• Carrying	2
• Poor	4	• Opposite axilla	2	• Pushing	2
• Trace	2	• Brassiere hook	2	• Hold over head	2
• Zero	0				

3. Range of Motion Total 25 Units

Flexion	Extension		Abduction		External rotation		Internal rotation		
• 180°	6	• 45°	3	• 180°	6	• 60°	5	• 90°	5
• 170°	5	• 30°	2	• 170°	5	• 30°	3	• 70	4
• 130°	4	• 15°	1	• 140°	4	• 10°	1	• 50°	3
• 100°	2	• <15°	0	• 100°	2	• <10°	0	• 30°	2
• 80°	1			• 80°	1			• <30°	0
• <80°	0			• <80°	0				

4. Anatomy Total 10 Units

Rotation, Angulation, Joint incongruity, Retracted Tuberosities, Non-union, AVN

- None 10
- Mild 8
- Moderate 4
- Severe 0-2

These criteria were proposed by Neer. The maximum points are 100 units:

- Pain : 35 Units
- Function : 30 Units
- Range Of Movement : 25 Units
- Anatomy : 10 Units

On overall scores, the patients were grouped into:

1. Results Score
2. Excellent : > 89 units
3. Satisfactory : 80-89 units
4. Un-Satisfactory : 70-79 units
5. Failure : < 70

CASE OF OR&IF WITH LOCKING COMPRESSION PLATE

FIG. 1 : pre op x-ray: three part fracture



FIG. 2 : follow up x-ray at 16 weeks revealing fracture union

OBSERVATIONS AND RESULTS

Most of the patients were brought to the causality or admitted through outpatient department basis clinical history was elicited. Careful clinical examination of skeletal system and soft tissue injuries was done and recorded. Radiographs of the arm anteroposterior and trauma series were done. Arm was immobilized in a "U" Slab and arm sling.

Once patient's general condition stabilized operative fixation was done.

Most of the cases were approached by delto pectoral approach .Fractures was anatomically reduced and fixed with Locking compression plate with 4.5 mm cortical screws and 6.5mm cancellous screws for three patients. Six patients underwent Percutaneous pinning. Six patients underwent open reduction and k-wires fixation. Fixation rigidity was checked on table. Patients were mobilized in the arm pouch, all patients were encouraged pendulum exercises in the second week. Sutures were removed on the 12th post operative day. All Patients were transfused one unit of compatible blood per-operatively. Per-operatively no complication was noted, except for increased blood loss in three patients. Immediate post operative complications were seen as post operative infection in one patients. Late complications seen were stiffness in two patients to a marked degree and moderate stiffness in three patients.

AGE INCIDENCE OF FRACTURES

In our series of fifteen patients, six were in the age group of less than 21-40 years (40%), six in the age group of 41-60 (60%).

Table 1: Age distribution of patients studied

Age in years	Number of patients	%
21-40	6	40.0
41-60	9	60.0
Total	15	100.0

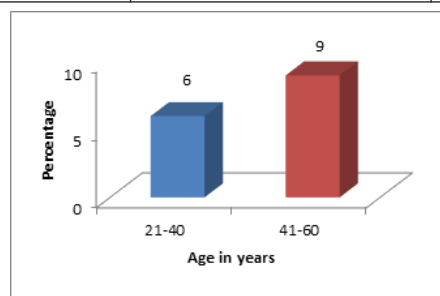
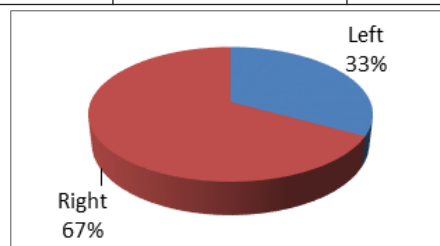


Table 2: Distribution of Side of patients studied

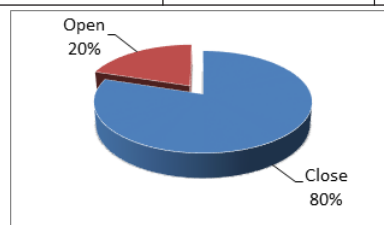
Side	Number of patients	%
Left	5	33.0
Right	10	67.0
Total	15	100.0

**Side****FRACTURE TYPE**

In our study 12 cases (80%) were closed fracture and only three cases (20%) were open fracture.

Table 3: Distribution of Closed/Open of patients studied

Closed/Open	Number of patients	%
Closed	12	80.0
Open	3	20.0
Total	15	100.0



Closed/Open TYPE OF FRACTURE

The common type of fracture observed in our series was two part fracture accounting for six of fifteen patients (40%), along with three-part fracture accounting for six of fifteen patients (40%). Four-part fracture accounted for two of fifteen patients (13%). The fracture dislocation was observed in one patient (7%).

DISCUSSION

Proximal humeral fractures account for almost 4 to 5% of all fractures. 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,^[9] 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,^[7,11] Intramedullary nailing, plate fixation^[5,11] or Prosthetic replacement.

Due to awareness of its complexity and complications, these fractures have stimulated a growing interest in finding the optimal treatment. Most of the proximal humeral fractures are non-displaced or minimally displaced and stable. These can be treated non-operatively successfully with early rehabilitation. But severely displaced and comminuted fractures warrant surgical management for optimum shoulder function.

In our institution we managed 3 patients with fractures of proximal humerus by open reduction and internal fixation by locking compression plat, 6 were treated with percutaneous k wires, 6 patients were treated by open reduction and k wires fixation.

AGE INCIDENCE

The average age incidence in our series of 15 patients analyzed, ranging between 21 to 60 years was 42.75 yrs, which was consistent with the age incidence in studies done by Neer^[4,6] (55.3 yrs) and in other studies the average age was 52 year^[13]. Court-Brown et al.^[10] reported in their epidemiological study with an average age of 66 years, for men 56 years and for women 70 years. In our series 6 out of 15 patients were below the age of 40 years and 9 were below the age of 60 years, hence the average age incidence was 42.7 years in our series.

Table 4- Age Incidence According To Mean Age

NEER'S STUDY ^[4]	55.3
DOLFI HERSCOVICI ^[13]	52
ROLAND P.JACOB ^[14]	49.5
COURT-BROWN et al ^[11]	66
PRESENT STUDY	42.7

Table 5 – Gender Related Study Pattern

	Male: female	Male :female ratio
DOLFI HERSCOVICI ^[63]	22:18	1:0.8
KOJI YAMAMOTO ^[22]	7:9	1:1.3
ROLAND P.JACOB ^[67]	20:10	1:0.5
COURT-BROWN et al ^[11]	15:35	1:2.3
PRESENT STUDY	6:9	1:1.5

MODE OF INJURY :

The mode of injury commonly observed in our series was road traffic accidents accounting for 10 (66.66%), 4 (26%) patients had an history of fall and 01 (8%) had an history of electric shock. Thus showing high velocity injury as the main mechanism. These observations was found to be consistent with the studies in literature^[8,13], which revealed 19 (45%) road traffic accidents, 20 (50%) history of fall and 01 (5%) history of assault out of the forty cases studied. In another study 12 (75%) had road traffic accident and 04 (25%) had history of fall in a series of 16 cases studied. Comparing our study with the published series, we find that the emergence of high velocity injury due to Road traffic accidents has changed the complete out look towards these fractures.

CONCLUSION

The incidence of proximal humeral fractures has increased in last few years due to changes in life style and increase in road traffic accidents.

The best management in these injuries is still inconclusive. Studies have shown non-operative and operative treatments, both give favourable results, and the confusion remains.

Clinical evaluation, obtaining proper radiological views, age of the patient and activity levels holds the key for realistic approach and proper surgical management of these complex fractures. For complex fracture pattern 3-D CT scan was used to classify fracture according to Neer's classification and to determine the treatment of choice. In younger patients, proximal humeral fractures usually are caused by high- energy trauma (65%). In older patients with osteoporosis, even less severe trauma (fall in 35%) can produce significant injury. They occur more frequently in older patients after the cancellous bone has become weakened by senility and osteoporosis.

Fractures of the proximal humerus are complex injuries involving two articulating surfaces, the glenohumeral joint and the subacromial arch. 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.

Biologically the technique of closed reduction and percutaneous pinning is good from the standpoint of retaining the vascularity of the humeral head. It can be used for un-displaced or displaced two, three or four part fracture of the proximal humerus without comminution, in the younger age groups with good bone quality. In older individuals it is good to fix with percutaneous 'K' wires, keeping in mind about quality of bone (osteoporosis) and also to shorten the period of surgery. Patients who has two part greater tuberosity avulsion fracture can be treated by closed reduction and percutaneous screws fixation or open reduction and internal fixation with ethibond sutures. Patients who have metaphyseal comminution are more appropriately treated by open reduction and Internal fixation with a plate (35% cases). In patients who have a three-part fracture with appreciable displacement of the greater tuberosity, open reduction, limited dissection and internal fixation should be performed. Literature says anatomical neck fractures of proximal humerus account for only 0.54% of proximal humeral fractures. Displaced anatomical neck fractures cause complete disruption of blood supply to the articular segment. The success rate of closed pinning and headless screw fixation is very less. The chance of avascular necrosis of humeral head increases by 5 times in these type of fractures. The only preferred treatment for displaced anatomical neck fracture is primary hemiarthroplasty. The Neer's four part fractures and 4-part fracture dislocation are rare compared to other fractures of proximal humerus. The chances of avascular necrosis is very high. The Neer's primary hemiarthroplasty is preferred treatment.

REFERENCES

- 1) Court-Brown CM, Garg A, McQueen M, et al. The epidemiology of proximal humeral fractures. *Acta Orthop Scand* 2001 ; 72 : 365-371.
- 2) Terry Canale's Campbell's Operative Orthopaedics , Vol-3: 9th edition, 1998 Mosby Publishers, USA Pg 2286-2296
- 3) Bucholz and Hecman's Rockwood and Green Fractures in Adults Vol-1: 5th Ed 2001, Lippincott Williams and Wilkins Company, USA Pg 10055-1107
- 4) Neer C.S: Displaced Proximal humeral fractures Part –I Classification and Evaluation JBJS (am) 1970;52:1077-1089
- 5) Dimakopoulos P, Potamitis N, Lambiris E, et al. Hemiarthroplasty in the treatment of comminuted intraarticular fractures of the proximal humerus. *Clin Orthop*. Aug 1997;(341):7-11.
- 6) Neer C.S: Displaced proximal humeral fractures Part-II Treatment of three and four part displacement JBJS (am) 1970;52:1090-1101.
- 7) M Pritsch, A. Greental, "Closed pinning for humeral fractures" JBJS 1997; 79B: Supp III.
- 8) Koji, Yamamoto R: Surgical Treatment of complex fractures of the proximal humerus. *Clin.Orthop*-1996:327:225-237.
- 9) G. Tytherleigh strong, "The Epidemiology of Humeral shaft fracture" JBJS 1998; March Vol. 80B, No. 2.
- 10) Richard F Kyle, "Current techniques in proximal fractures" JBJS 1997; 79B: Supp IV.
- 11) Herbert Resch, "Percutaneous pinning of 3-4 part fractures of the proximal humerus. JBJS March 1997.
- 12) 12 C. Michael Robinson, Richard S. Page, "Hemiarthroplasty for treatment of proximal humeral fractures" JBJS Am 2003;85: 1215-23.
- 13) 13 Dolfi Herscovici Jr, Darrick T, Saunders, Marie P. Johnson, et al : Per-cutaneous fixation of proximal humeral fractures Clin. Orthop2000:375:97-104.
- 14) 14 Roland P. Jakob, et al: Four part valgus impacted fractures of the proximal humerus. JBJS Br. March 1991 ; 73-B:295-297.
- 15) Jaberg H, Warner JJ, Jakob RP, et al. Percutaneous stabilization of unstable fractures of the humerus. *J Bone Joint Surg Am* 1992;74:508-515.
- 16) Koji, Yamamoto R: Surgical Treatment of complex fractures of the proximal humerus. *Clin.Orthop*-1996:327:225-237.
- 17) Terry Canale's Campbell's Operative Orthopaedics , Vol-3: 11th edition, 2007 Mosby Publishers, USA Pg 2601-2602.
- 18) Helfet DL, Shonnard PY, Levine D, Borrelli J Jr. Minimally invasive plate osteosynthesis of distal fractures of the tibia. *Injury*. 1997; 28(suppl 1):A42-A48.

- 19) Collinge CA, Sanders RW. Percutaneous plating in the lower extremity. *J Am Acad Orthop Surg.* 2000; 8(4):211-216.
- 20) Bono CM, Grossman MG, Hochwald N, Tornetta P III. Radial and axillary nerves. Anatomic considerations for humeral fixation. *Clin Orthop Relat Res.* 2000; (373):259-264.