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Study of Functional Outcome of Surgical Management of Proximal Humerus Fracture by Various Modalities

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Abstract: *Fractures of the proximal humerus are complex injuries with significant morbidity .Although various options of management available including non- operative management are present the choice of treatment depends upon the pattern of the fracture, the quality of the bone encountered, the patient's goals and the surgeon's familiarity with the techniques. The aim of this study was to review the functional, radiographic results and complications of the operative procedure in a series of twenty patients. Over a two year period we treated twenty patients with two part fractures, three part fractures, four part fractures and fracture dislocations. Initial pre operative clinical and radiological assessment was done and appropriate mode of treatment of given depending upon type of fracture according Neer's classification. Follow up of patient was done both clinically and radiologically at 2nd, 6th and 8th weeks and assessed for any complications. Final assessment was done according to Neer's shoulder scoring criteria. Eight patients were treated with Locking Compression Plate, eight patients were treated with K-wires and cancellous screws, three patient were treated by interlocking nail, remaining one underwent hemi-arthroplasty. All fractures united with an average of 17.7 weeks and no patients had signs of malunion, non-union osteonecrosis of the humeral head on the latest follow up radiographs. In the overall results analyzed in our series 70% of the patients had excellent and satisfactory results and 30% had unsatisfactory and failure outcome. There is direct relationship in displaced proximal humeral fractures between fracture severity i.e. displacement and communition, and the eventual results.That is more the initial insult, worse the prognosis. Internal fixation of fractures of proximal end of humerus produced good functional outcome and fewer complications. Rehabilitation is the key to success*

Key Words: *Proximal end of humerus, internal fixation, rehabilitation, Neer's shoulder score*

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I. Introduction

Fractures of the proximal humerus represent approximately 4% of all fractures and 26% of humerus 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. 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.

Most studies indicate that for the majority of good results of fractures of this region are obtained by conservative methods. Some studies state that operative treatment is better, depending on type of fracture and the quality of the bone. Management of these fractures is associated with some morbidity and undesirable sequelae. They include complication like avascular necrosis, malunion, non-union, infection , neurovascular injury , loss of motion of shoulder from adhesive capsulitis , chronic edema , elbow stiffness and atrophy of the soft tissues of the immobilized limb causing significant disability during healing and afterwards.

II. Aims and Objectives of Study

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

III. Materials And Methods

This study was carried out in Narayana medical college hospital, from June 2018 to October 2019, twenty 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.

INCLUSION CRITERIA

All adults patients admitted with proximal humerus fractures.[Neer's classification :grade 2 to grade 4.

EXCLUSION CRITERIA

1. Skeletally immature patients
2. Pathological fractures,
3. Patients with distal neurovascular deficit,
4. Polytrauma patients with an Injury Severity Score > 16
5. Shaft humerus fractures with proximal extension

PROCEDURE OF THE STUDY

Pre-operative

Patients admitted with proximal humerus fractures.[Neer's classification : grade 2 to grade 4]. After the admission , necessary clinical details were recorded. Radiologic evaluation of the shoulder were done according to Neer's trauma series which consists of: A true anteroposterior (AP) view of the scapula A lateral ' Y-view ' of scapula, and An axillary view. Pre – Operative Investigations Haemogram

Bleeding time, clotting time, Blood grouping and cross matching, Chest x-ray, Electrocardiogram done.

Fractures were classified according to the Neer's classification and patients were shifted to the ward after initial temporary immobilization with Universal shoulder immobilizer. All the routine investigations were done on all the patients pre- operatively with complete medical and anesthetic fitness of patient for surgery.

Following factors were taken into consideration while deciding the modality of treatment to be used:

Neer's classification two, three or four part fracture with associated displacement.

Presence of humeral head dislocation and humeral head comminution, Valgus impaction Comminution, Quality of bone, Open or compound fracture, Age of the patient, Associated general and medical condition of the patient, Other associated lesions e.g. brachial plexus palsy,etc Functional requirements of the patient.

Anaesthesia used : General Anaesthesia

Method of Treatment:

All patients were treated by one of the following methods. 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 Plate, Closed reduction and Internal fixation by Intramedullary Nail.Shoulder Hemiarthroplasty.

Post-operative care :

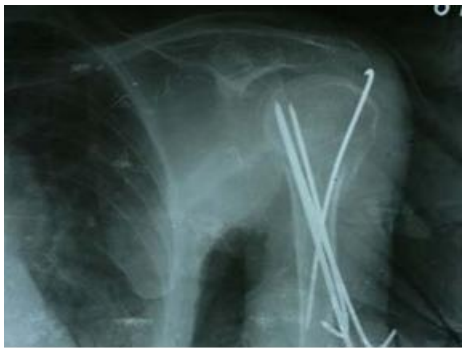
Post-operatively limb is immobilized in arm pouch, sutures were then removed and if secure fixation was achieved , mobilization was started in the second week with shoulder wheel exercises as per patient's tolerance. Immediate post-op X- Rays were done routine A-P and scapular view to assess the reduction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

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 consider 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

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:
Results Score
Excellent : > 89 units
Satisfactory : 80-89 units
Un-Satisfactory : 70-79 unitS
Failure : < 70

PRE-OP X-RAY OF TWO PART FRACTURE

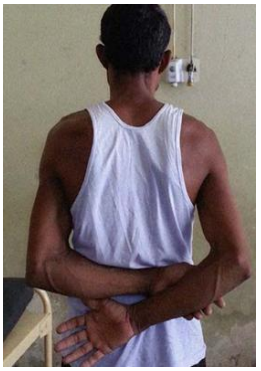


FIXATION WITH K-WIRES

FLEXION

ABDUCTION

EXTERNAL ROTATION



INTERNAL ROTATION

IV. Observations And Results

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 seven patients. One patients underwent hemiarthroplasty with Neer's prosthesis.Four patients underwent Percutaneous pinning. Two patients underwent fixation with K-wires and cancellous screws. Three patients were treated by Intramedullary nail and one patient treated by ethibond sutures.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. Per-operatively no complication was noted. Immediate post operative complications were seen as post operative infection in six patients. Late complications seen were stiffness in four patients to a marked degree and moderate stiffness in five patients.

AGE INCIDENCE OF FRACTURES

In our series of twenty patients, four were in the age group of less than 20 years (20%), four in the age group of 21-40(20%), nine in the age group of 41- 60(20%), three in the age group of greater than 60 (35%)

Table 1: Age distribution of patients studied

Age in years	Number of patients	%
<20	4	20.0
21-40	4	20.0
41-60	9	45.0
>60	3	15.0
Total	20	100.0

SEX INCIDENCE

In our study eight out of twenty (40%) were males and twelve (60%) were females

SIDE OF THE EXTREMITY

In our study most of the patient sustained injury to the right side 11(55%) and involvement of left side is 9(45%)

FRACTURE TYPE

In our study 18 cases(90%) were closed fracture and only two cases(10%) were open fracture.

TYPE OF FRACTURE

The common type of fracture observed in our series was two part fracture accounting for eight of twenty patients (40%), along with three-part fracture accounting for eight of twenty patients (40%).Four-part fracture accounted for two of twenty patients(10%).The fracture dislocation was observed in two patient (10%).

Table 5: Distribution of Neer's Type of #of patients studied

Neer's Type of #	Number of patients	%
2 part	8	40.0
3 part	8	40.0
4 part	2	10.0
Fracture with dislocation	2	10.0
Total	20	100.0

MODE OF INJURY

The most common mode of injury observed in our series was road traffic accident. It accounted for thirteen of twenty patients(65%).The next common cause was history of fall accounting for six of twenty patients (30%)and one patient had a Electric shock(5%).

MODE OF INTERNAL FIXATION

In our study , seven patients (35%) were treated by open reduction and internal fixation with Locking compression plate, four patients (20%) were treated by Percutaneous pinning, three patients (15%) were treated by closed reduction and internal fixation with Intramedullary nail, two patients (10%) were treated by open reduction and fixation with k-wires, two patients (10%) were treated by open reduction and fixation with k-wires and cancellous screws, one patients (5%) undergone ethibond suturing and one patient (5%) treated with shoulder Hemiarthroplasty.

Table 7: Distribution of Surgical Treatment of patients studied

Surgical Treatment	Number of patients (n=20)	%
1.ORIF with LCP	7	35.0
2.Percutaneous pinning	4	20.0
3.CRIF with I.M nail	3	15.0
4.ORIF with k-wires	2	10.0
5.ORIF with k-wires and cancellous screws	2	10.0
6.Shoulder Hemiarthroplasty	1	5.0
7.ORIF with Ethibond Suture	1	5.0

CLINICAL AND RADIOLOGICAL EVALUATION

The average time taken for clinical union was 13.4 weeks (11-16weeks) and for radiological union17.65 weeks (16 to 22 weeks).

Table 9: Distribution of Clinical union in weeks of patients studied

Clinical union in weeks	Number of patients	%
11 weeks	1	5.0
12 weeks	8	40.0
13 weeks	1	5.0
14 weeks	6	30.0
15 weeks	4	20.0
Total	20	100.0

Neer's Score Study

In our study Neers score study was done on patient every 1st week ,fourth week, eight week and finally at fourteen week. Study shows that out of twenty patients studied twenty patients(100%) had Neers score below 70, at fourth week seventeen patient (85%) had score below 70 and three patients(15%) had score in between 70-79, at eight week five patients(25%) were below 70 ,twelve patients(60%) were in between 70-79 and three patients(15%) were in range 80-89. Final Neers score showed one patient(5%) below 70 which went for failure outcome, five patients (25%) were in the range of 70-79 showing unsatisfactory outcome, ten patient (10%) were between 80-89 score showing satisfactory outcome and four patients(20%) had score above 90 showing excellent results.

Table 11: Distribution of Neer's Score of patients studied

Neer's Score	1st week	4th week	8th week	Final
<70	20(100.0%)	17(85.0%)	5(25.0%)	1(5.0%)
70-79	0	3(15.0%)	12(60.0%)	5(25.0%)
80-89	0	0	3(15.0%)	10(50.0%)
90& above	0	0	0	4(20.0%)
Total	20(100.0%)	20(100.0%)	20(100.0%)	20(100.0%)
Mean ± SD	52.10±6.50	62.00±7.23	71.95±7.82	80.95±8.41

RANGE OF MOTION

At the end of full functional recovery all patients assessed by Neer's shoulder score had restriction of abduction, forward flexion and external rotation. The average loss of abduction was 54°, forward flexion 46°, external rotation was 28°, internal rotation 31.5°, extension 7°. The average range of movements observed was abduction 126°, forward flexion 180°, extension 45°, external rotation 32°, internal rotation 58.5º.

Table 13: Average of range of motion of patients studied

MOTION	Maximum ROM	Observed ROM
ABDUCTION	180	126
FORWARD FLEXION	180	134
EXTENSION	45	38
EXTERNAL ROTATION	60	32
INTERNAL ROTATION	90	58.5

EVALUATION OF RESULTS BY NEERS SHOULDER SCORE

At the end of clinical and radiological union and full functional recovery the results were evaluated by Neer's score. Of the twenty patients four (20%) had excellent results, ten patients (50%) had satisfactory results, five (25%) had unsatisfactory results and one (5%) was a failure The mean scores

observed on Neer's score was pain (34.25units), function (23.25units), range of motion (15.55units), anatomy(7.9units) and the total Neer's score was 80.95.

Table 14: Average of score of pain , function, ROM and Anatomy of patients studied

Modalities	Min-Max	Mean	Median	SD
Pain	30-35	34.25	35.00	1.83
Function	13-30	23.25	22.00	4.44
ROM	12-19	15.55	15.00	1.90
ANATOMY	4-10	7.90	8.00	1.52
Total	59-92	80.95	81.00	8.41

Table 15 : Distribution of Results of patients studied

Results	Number of patients	%
Excellent	4	20.0
Satisfactory	10	50.0
Unsatisfactory	5	25.0
Failure	1	5.0
Total	20	100.0

V. Discussion

Our study was conducted in Narayana medical college hospital. The cases with proximal humerus fracture were initially examined in out patient department or casualty. Different studies, which have used the Neer's scoring system for assessment of results, demonstrate a fairly similar pattern of results with 70 - 80% patients having satisfactory to excellent results and 20 - 30% having un-satisfactory to failure results. In our series 12 cases of two part ,three part and four part fractures and fracture dislocation treated with open reduction and internal fixation, 1 (05%) excellent results, 07 (35%) had satisfactory results, 03 (15%) had unsatisfactory results and 1(05%) was a failure. When compared with other studies in case of Neer's, (63.3%) had excellent and satisfactory results.[4,20] and in other study of 3 part fracture (93.3%) had excellent and satisfactory results all of them had underwent OR & IF with K wires/cancellous screws and one failure in this series was fixation with AO buttress plate. This implies that our results with OR& IF almost correlated with the studies in literature but improved results are seen in minimal fixation techniques.

Table 22 - Results Of OR&IF In Proximal Humerus Fractures

	Excellent	Satisfactory	Unsatisfactory	Failure
NEER'S	10(33.3%)	09(30%)	00	11(36.7%)
RICHARD J,HAWKINS	08(53.3%)	06(40%)	00	01(6.7%)
PRESENT STUDY	01(05%)	07(35%)	03(15%)	01(5%)

Studies reveal that results of percutaneous pinning are more superior to OR & IF regarding functional outcome. Jaberg and associates study shows, 91.6% of the cases had excellent (70.8%) and satisfactory (20.8%) results with 04 (8.3%) failures . In our series four patients underwent percutaneous pinning two had excellent results one satisfactory and one unsatisfactory.

Results pertaining to prosthetic replacement were studied studies reveal that prosthetic replacement is of chores in 4 part fracture and selected 3 part fracture in elderly. Neer study shows (11.6%) had excellent (79%) had satisfactory results only (9.4%) had unsatisfactory and failure. In another study (44.3%) had excellent results, (31.4%) had satisfactory results and (24.3%) had unsatisfactory results. In our series of 20 patients, 01 underwent prosthetic replacement for four part fracture with dislocation which showed satisfactory result. In the overall results analyzed in our series 70% of the patients had excellent and satisfactory results and 30% had unsatisfactory and failure outcome. This was observed to be on par with the studies in literatures

Table 25 - Overall Results

	Excellent	Satisfactory	Unsatisfactory	Failure
NEER'S	15(17.4%)	43(50%)	02(2.3%)	26(30%)
RICHARD J HAWKINS	08(53.3%)	06(40%)	00	01(6.7%)

PRESENT STUDY	04(20%)	10(50%)	05(25%)	01(05%)

VI. 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. Early open reduction and internal fixation prevents complications like Frozen shoulder, malunion and late osteoarthritis.There is direct relationship between displaced proximal humeral fractures, between fractures severity (i.e. greater displacement, communition) and eventual results. The more the initial insult, worse the prognosis.

Rehabilitation is the key to success. After the fracture is stabilized by whatever means, continuous active followed by passive motion should be started. On discharge, the patients must be instructed regarding physiotheraphy exercises to be done several times a day.Results assessed with standard shoulder scoring system of Neer's we have achieved 70% of excellent and satisfactory results,25% unsatisfactory and 5% failure outcome.

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