



International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958

P-ISSN: 2706-6630

IJOS 2021; 7(3): 500-503

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www.orthopaper.com

Received: 01-05-2021

Accepted: 03-06-2021

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Functional outcome of surgical management of proximal humerus fracture treated by various modalities

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DOI: <https://doi.org/10.22271/ortho.2021.v7.i3h.2792>

Abstract

Introduction: Fractures of the proximal humerus constitutes 7% of all fractures and approximately one-half of all humerus fractures. In the elderly population above 65 years of age, these are second most frequent upper extremity fracture and third most common non vertebral osteoporotic fractures. Management of proximal humerus fracture with various treatment modalities has always been a topic of debate and draws much controversy and confusion with it because of the complexity of these injuries with fracture displacements. Moreover, even good anatomical results achieved with operative fixation may lead to poor results unless supported by a meticulous postoperative rehabilitation.

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

Method: A prospective study comprising of 23 patients with proximal humerus fractures classified through Neer's classification. Modalities of treatment employed included (1) Closed reduction and Percutaneous K-wire fixation (2) Open reduction and Internal fixation with Locking Compression Plate (PHILOS) (3) Closed reduction and Internal fixation with Intramedullary Nail and (4) Shoulder Hemiarthroplasty. Functional outcome was evaluated using Constant Murley score and American Shoulder and Elbow Surgeons Shoulder Score (ASES) based on pain, function, strength and range of motion.

Result: Higher incidence of these fracture was seen in (61%) females as compared to males. Most of the fractures (43%) occurred in the age group 50-60 years. Fall from a standing height was the most common mode of trauma in elderly patients while in younger patients, these fractures were mostly a result of RTA or sporting injuries. Two part and three part fractures were found to be commoner of all fractures constituting 39% and 34.8% respectively. Functional outcome evaluated using Constant Murley Score shown Excellent outcome in 13% cases, Good outcome in 34.8% cases and Fair outcome in 39.1% cases while in 13% patients, outcome was poor. The unsatisfactory results in our series was seen mostly in elderly patients who were reluctant or not compatible for rigorous rehabilitation program.

Conclusion: Fractures of the proximal humerus have varied patterns and are complex injuries to manage. Reconstruction of the articular surface with restoration of the anatomy, achieving stable fixation, with minimal soft tissues damage and preservation of blood supply remains the key for attainment of optimal functional outcome.

Keywords: proximal humerus fracture, plating, intramedullary nailing, percutaneous pinning, shoulder hemiarthroplasty

1. Introduction

Fractures of the proximal humerus constitutes 7% of all fractures and approximately one-half of all humerus fractures. In the elderly population above 65 years of age, these are second most frequent upper extremity fracture and third most common non vertebral osteoporotic fractures after proximal femur and distal radius fracture. Though these fractures can occur at any age, there is an exponential rise in its incidence at a rate of over 40% every 5 years at the age of 40 years in females and 60 years in males. The risk factors for proximal humeral fractures in elderly age group are primarily associated with low bone mineral density with an increased risk of falls. Low velocity trauma as in fall over ground with an outstretched hand is a common mode of trauma in older population. However, in younger population, the mechanism is often related to high-energy trauma such as motor vehicle accidents or athletic injuries.

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These injuries may be of particular concern especially in younger and fit population where it may lead to temporary disability and social dependency. Hence, restoration of preinjury functional status of the limb is of paramount importance.

Management of proximal humerus fracture with various treatment modalities has always been a topic of debate and draws much controversy and confusion with it because of the complexity of these injuries with fracture displacements. Moreover, even good anatomical results achieved with operative fixation may lead to poor results unless supported by a meticulous postoperative rehabilitation.

2. Aims and Objectives

To assess and compare the functional outcome with different modalities of the fixations in proximal humerus fractures

3. Materials and Methods

This prospective study was carried out at Rajendra Institute of Medical Sciences, Ranchi, Jharkhand between January 2019 to December 2020. It included 23 patients who met the inclusion and exclusion criteria. Records of the patients were collected by asking the patients history and examining the patients. Essential preoperative investigations of all the patients were done. The patients were operated with various modalities of fixation. Follow up was done at regular interval.

3.1 Inclusion criteria

1. Age > 18 years
2. displaced Proximal humerus fractures 2-part, 3-part and 4-part (Neer's classification grade 2 to grade 4)

3.2 Exclusion criteria

1. Skeletally immaturity
2. Pathological fractures
3. Polytrauma patients with an Injury Severity Score > 16
4. Shaft humerus fractures with proximal extension.

Upon arrival of the patient in OPD or Emergency room, a careful history of the patient regarding mode and mechanism of trauma was elicited, careful examination of the patient was performed for associated injuries with special attention to any neurovascular injury. Radiologic evaluation of the shoulder was done as per Neer's trauma series consisting of a true anteroposterior view of the shoulder, a lateral Y-view of the scapula and an axillary view. A CT scan with 3D reconstruction was done whenever required in case of complex fractures for assessment of comminution, evaluation of articular involvement and bone quality which can greatly assist in presurgical planning.

All the fractures were classified according to the Neer's classification. Initial temporary immobilization was done with Universal shoulder immobilizer. Routine preoperative investigations were carried out with prior optimization of medical comorbidities if any.

Factors taken into consideration while deciding the modality of treatment to be used included:

1. Neer's classification two, three or four-part fracture with amount of displacement
2. Presence of humeral head dislocation and humeral head comminution
3. Valgus impaction
4. Comminution
5. Quality of bone
6. Open or compound fracture

7. Age of the patient
8. Associated general and medical condition of the patient.
9. Other associated lesions e.g. brachial plexus palsy etc.
10. Functional requirements of the patient.

3.3 Method of Treatment

One of the following modality of treatment was employed

1. Closed reduction and Percutaneous K-wire fixation
2. Open reduction and Internal fixation with Locking Compression Plate (PHILOS)
3. Closed reduction and Internal fixation with Intramedullary Nail
4. Shoulder Hemiarthroplasty

Postoperatively limb was immobilized in arm pouch and an early rehabilitation was begun with active-assisted range of motion exercises starting from next day if the fixation was found to be secure as per patient's tolerance. In case of severe osteoporosis and if fixation was less than rigid, mobilization was delayed for the fear of displacement of fracture fragments.

Regular follow up of the patients was done at 2 weeks, 4 weeks and monthly thereafter up to 1 Year. In every visit, clinical evaluation of wound healing, pain, shoulder function and range of movements were assessed and recorded. Functional outcome was evaluated using Constant Murley score and American Shoulder and Elbow Surgeons Shoulder Score (ASES) based on pain, function, strength and range of motion.



Fig 1: Pre and Postoperative radiograph of Closed reduction and percutaneous pinning



Fig 2: Pre and Postoperative radiograph of proximal humerus Plating



Fig 3: Pre and Postoperative radiograph of Intramedullary Nailing



Fig 4: Pre and Postoperative radiograph of Hemiarthroplasty Shoulder

4. Result & Discussion

Proximal humerus fracture are increasing in incidence over last two decades. The preferred management for these injuries is still not conclusive. Nonoperative and operative, both treatments modalities have been claimed to yield favorable outcome by several researchers. Hence the best method for management of these fractures remains unanswered. Clinical evaluation, age of the patient and quality of the bone and level of activity holds the key for the optimum surgical management of these complex injuries.

We included a total of 23 cases of proximal humerus fractures in this study who were managed surgically by means of above mentioned different techniques with the goal of achieving rigid fixation. 61% of the study population were females indicating higher incidence of these fracture in females as compared to males. Most of the fractures (43%) occurred in the age group 50-60 years. Fall from a standing height was the most common mode of trauma in elderly patients while in younger patients, these fractures were mostly a result of RTA or sporting injuries. All the fractures were classified as per Neer's classification. 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. Two part and three part fractures were found to be commoner of all fractures constituting 39% and 34.8% respectively. Four-part fracture was seen in 17.4% cases while fracture with dislocation was least common seen only in 8.7% cases.

Osteosynthesis with open reduction and internal fixation with Locking Compression Plate (PHILOS) done in 11 patients (47.8%) was seen to yield good to fair outcome especially in younger patients with fewer complications. These patients

responded well to the rehabilitation program as compared to their older counterparts. However, in elderly patients, plating was poorly tolerated and was associated with more complications. This can be explained by poor bone quality in older individuals with a thin and ruptured rotator cuff that predisposes to unpredictable clinical outcome in them. Patients having metaphyseal comminution are more appropriate candidate for treatment by Osteosynthesis using plate. Plating method also appears a rational option for three-part fracture with significant displacement of the greater tuberosity.

Fixation by closed reduction and percutaneous pinning using K wire was done in 5 patients (21.7%). 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 undisplaced 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 duration of surgery.

Displaced anatomical neck fractures seen in 0.54% of proximal humerus fractures causes complete disruption of blood supply to the articular segment. Risk of avascular necrosis of humeral head in these type of fractures has been reported to be very high. The only preferred treatment for displaced anatomical neck fracture is primary hemiarthroplasty. Neer's primary hemiarthroplasty is also a preferred choice for four part fractures and 4-part fracture dislocation.

Functional outcome evaluated using Constant Murley Score shown Excellent outcome in 13% cases, Good outcome in 34.8% cases and Fair outcome in 39.1% cases while in 13% patients, outcome was poor. The unsatisfactory results in our series was seen mostly in elderly patients who were reluctant or not compatible for rigorous rehabilitation program. Decreased immunity status lead to infection in few of these patients resulting in unsatisfactory and poor outcome.

Early open reduction and internal fixation prevents complications like Frozen shoulder, malunion and late osteoarthritis. Complexity of the fracture with greater displacement have been shown to be directly related to eventual poor outcome. Rehabilitation is the key to success. After the fracture is stabilized by whatever means, continuous active followed by passive motion should be started as soon as the construct is found stable and pain of the patient permits.

5. Conclusion

Fractures of the proximal humerus have varied patterns and are complex injuries to manage. The options as to the management modality used depend on the pattern of the fracture, age of the patient, the quality of the bone encountered, the patient's goals and the surgeon's familiarity with the techniques. Reconstruction of the articular surface with restoration of the anatomy, achieving stable fixation, with minimal soft tissues damage and preservation of blood supply remains the key for attainment of optimal functional outcome.

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