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Study of outcomes of the proximal humerus fractures treated by various modalities

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Abstract
Introduction: The proximal humerus fracture is of great importance when it affects the young and middle age groups of the population as it leads to temporary disability and loss of working hours. Restoration of the function of the limb becomes the primary goal of its treatment. 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. The present study was conducted to analyze the occurrence, mechanism of injury and displacement of various types of proximal humerus fractures and further evaluate the functional outcome of different modalities of its management.
Methods: The following study was conducted at C U Shah Medical College and Hospital, Surendranagar, Gujarat during the period of June 2012 to June 2014. Total 50 patients, 22 males and 28 females with proximal humerus fractures treated with different modalities were selected for the study and assessed by Constant and Murley scoring system with at least 1 year follow up.
Results: The average age of patients was 55.6 years out of which 56% were female. Domestic fall was the most common mode of injury (64% patients). Two part surgical neck fractures (Neer's) accounted maximum number of the patients (34%). All One parts and most of the two part fractures treated conservatively. Most of the three part fracture treated with Open reduction and proximal humerus anatomical locking plates. Most common complication was malunion whereas one patient had implant loosening as complication. The average constant score at final follow up for all conservatively treated patients was 75.69, for patients treated by close reduction and percutaneous K wire fixation was 82.79 and for patients treated by open reduction and internal fixation with anatomical locking plate was 73.6.
Conclusion: Early Open Reduction and Internal fixation prevents complications like shoulder stiffness, malunion, and late osteoarthritis. Open reduction and rigid internal fixation with proximal humerus plates becomes the choice of treatment for young adults with displaced fractures, whereas fractures in old aged patients with osteoporosis gave good outcome with conservative modality of management. There is also a direct relationship between displaced proximal humerus fractures, fracture severity and eventual results.

Keyword: Proximal humerus fractures, Neer's classification, Proximal humerus anatomical plates, Constant and Murley score

Introduction
The fracture of proximal humerus is a relatively common fracture type that one comes across, accounting to about 10% of major fractures encountered. The incidence of this fracture is increasing in present era due to increased frequency of road traffic accidents. They are common in elderly patients with osteoporosis after trivial trauma and in young patients following high energy trauma. 80 percent of these fractures are osteoporosis related, more common in females as compared to males [1, 2].

Controversies exists between various types of surgical modalities, some advocating the use of minimally invasive method while others pressing upon use of open reduction and rigid fixation. These fractures are associated with complications like shoulder stiffness, avascular necrosis, malunion, nonunion and others. Further, the role of rehabilitation in form of physiotherapy has emerged as significant factor affecting overall prognosis. Therefore, in order to get better understanding of management in these types of fracture, we carried out this study. The aim of the study was to analyze different modalities of the fixations in proximal humerus fractures and to study clinical, radiological and functional outcome of management of

proximal humerus fractures by conservative and surgical treatment.

Method and material

The following study was conducted at C U Shah Medical College and Hospital, Surendranagar, Gujarat during the period of June 2012 to June 2014. 50 patients were included in our study, 22 males and 28 females. All patients with proximal humerus fractures, giving consent for the study, were included. After eliciting detailed history and thorough clinical examination, antero-posterior and axillary radiographs were obtained. 3D CT reconstruction of affected limb was done in fractures with displacement and communition. The fractures were classified according to NEER'S classification. [3, 4] After confirming the diagnosis, a shoulder immobilizer and analgesic was given and further line of management was decided by senior orthopaedic surgeon depending on various factors. All undisplaced or minimally displaced fractures were treated conservatively. Fractures with displacement more than 1 centimetre or angulation more than 45 degree of angulation were treated with closed reduction and percutaneous fixation with K wire or cancellous screws or open reduction and internal fixation with Proximal Humerus Anatomical Locking Plate depending on age of patient, occupation, fracture geometry and bone quality. Post operatively, each patient was subjected to appropriate physiotherapy by trained therapists. All patients were called for follow-up at 1 month, 3 months, 6 months, 9 months and 1 year for evaluation using Constant and Murley scoring system and appropriate radiographs.

Results

The most common type of fracture encountered in the present study was 2 part surgical neck fracture (17 patients, 34%), next most common was 1 part fracture (14 patients, 28%). 4 (8%) patients had 2 part fracture (Greater tuberosity with Anterior dislocation, while 2 (4%) patients had isolated 2 part greater tuberosity fracture. 3 part fracture of greater tuberosity with surgical neck was encountered in 13 patients (26%).

All one part fracture patients (14) were treated conservatively by shoulder immobilizer application. Out of 17 patients with 2 part surgical neck fracture, 11 (64.7%) had conservative treatment, 3 (17.6%) had closed reduction and percutaneous K wire fixation, while 3 (17.6%) had undergone open reduction and fixation with anatomical locking plate. 2 patients of 2 part isolated Greater tuberosity were treated conservatively. 4 patients of 2 part (Greater tuberosity + Anterior dislocation) had undergone closed reduction and shoulder immobilizer application. Out of 13 patients with 3 part (surgical neck + greater tuberosity) fracture, 4 (30.7%) had conservative treatment in form of shoulder immobilizer application, 2 (15.3%) had closed reduction and percutaneous K wire fixation, while 7 (53.38%) had Open reduction and fixation with anatomical locking plate as treatment. The average duration of follow up was 13.1 months (range 12-16 months). The average time taken for clinical union was 11.6 weeks (8-16weeks) and for radiological union 15.2 weeks (12 to 20 weeks).

In the present study 9 patients had shoulder stiffness (18%) who were treated with rigorous physiotherapy, while 2 (4%) patients had impingement of implant managed by revision surgery. One(2%) had screw perforation into humeral head , whereas one patient(2%) had implant loosening(failure of implant); both underwent second surgery with change of implants and lastly 12 (24%) patients had malunion. There were no incidences of non-union, osteonecrosis of humeral head, infection, myositis ossificans or neurovascular deficit.

Case 1: one part fracture treated conservatively

Case 2: 2 part surgical neck fracture treated with closed reduction and K wire

Case 3: 2 part fracture surgical neck, treated with open reduction and internal fixation

As per the final outcome decided by the Constant and Murley score [6], the functional outcome of all the treated patients were graded into excellent (score 86-100), good (score 71-85), fair (score 56-70) and poor (0-55). The average Constant score of for conservatively treated patients at final follow up was 75.69, for patients treated by closed reduction and percutaneous K wire fixation was 82.79 and for patients with open reduction and internal fixation with anatomical plates was 73.6.

Out of 35 patients treated conservatively, 11 (31.42%) had excellent outcome, 16 (45.71%) had good outcome, 5 (14.28%) patients had fair outcome and 3 (8.57%) had poor outcome. Out of 5 patients treated by closed reduction and percutaneous K wire fixation, 1 (20%) had excellent outcome, 3 (60%) had good outcome and 1 (20%) had poor outcome. Out of 10 patients treated by open reduction and internal fixation with plate, 3 (30%) had excellent outcome, 4 (40%) had good outcome, 2 (20%) patients had fair outcome and 1 (10%) had poor outcome.

Discussion

The treatment of displaced proximal humeral fractures is complex and requires careful assessment of patient factors (such as age and activity level) and fracture-related factor (such as bone quality, fracture pattern, degree of comminution, and vascular status). The goal of treatment is a pain-free shoulder with restoration of pre-injury function. 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 the present study, 32 (64%) patients were injured by domestic fall, 6 (12%) patients had history of fall from height while 12(24%) patients had Road traffic accident as mode of injury. This finding corresponded with the incidence rate in literature like Koval *et al.* [17], Canbora *et al*. [9], Resch *et al.* [10], Aggarwal *et al.* [15] and M. EI Sayed *et al.* [14].

Out of 35 patients treated conservatively, 11 (31.42%) had excellent outcome, 16 (45.71%) had good outcome, 5 (14.28%) patients had fair outcome and 3 (8.57%) had poor outcome. Similar results have been noted in literature by Young and collegues [7], Gaebler *et al.* [8], Canbora *et al.* [9] and others. Most of fractures proximal humerus, found to be undisplaced and conservative modality was treatment of choice in such patients.

Out of 5 patients with displaced two and three part fractures treated by closed reduction and percutaneous K wire fixation, 1 (20%) had excellent outcome, 3 (60%) had good outcome and 1 (20%) had poor outcome. The final follow up mean Constant Score was found to be 82.79. The above results are comparable with results in literature, Resch *et al.* [10], Francesco *et al.* [11], Fenichel *et al.* [12], emphasizing the fact that minimally invasive fixation procedure can deliver best results and optimal functional outcome with least damage to soft tissue anatomy.

Out of 10 patients treated by Open Reduction and Internal Fixation with anatomical locking plate, 3 (30%) had excellent outcome, 4 (40%) had good outcome, 2 (20%) patients had fair outcome and 1 (10%) had poor outcome. The mean Constant score at final follow up was 73.6. These results are comparable to results available in literature, Atilla *et al.* [13], Moonot *et al.* [14], M El Sayed *et al.* [15], Aggarwal *et al.* [16] and Rajinder *et al.* [17]. And implies that in displaced 2, 3 and 4 part fracture this modality provides good outcome if anatomical reduction and stable fixation is achieved, along with appropriate post-operative rehabilitation.

In the present study during the follow up period 9 patients had shoulder stiffness (18%), 2(4%) patients had impingement of implant, one (2%) had screw perforation into humeral head, one patient (2%) had implant loosening (failure of implant) and 12 (24%) patients had malunion. Most cases of stiffness were elderly patients who were unwilling to undergo rigorous rehabilitation program. Literature dictates high incidence of osteonecrosis, but most of these patients have good functional outcome. [3, 4, 10]

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. Studies have shown non-operative and operative treatments, both give favorable results, and the confusion remains regarding the optimal management. Clinical evaluation, obtaining proper radiological views, age of the patient and activity level holds the key for realistic approach and proper surgical management of these complex fractures. 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. 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 have 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. 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. Neer's four part fractures and 4-part fracture dislocation are rare compared to other fractures of proximal humerus, chances of avascular necrosis is very high. Neer's primary hemiarthroplasty is preferred treatment in such cases as per various literature [3, 4]. Rehabilitation is the key to success. After the fracture is stabilized by whatever means, continuous passive followed by active assisted and strengthening exercise should be instructed by trained physiotherapist.

Thus, this study does give an insight and improved our experience on treatment of this complex fracture, however further larger volume studies shall be required to further streamline the management of proximal humerus fractures.

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