



Comparison of the Results and Outcomes of the Different Modalities (closed v/s open) of the Treatment of the Proximal Humerus Fractures

KEYWORDS

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ABSTRACT We reviewed 60 patients prospective as well as retrospectively. We compared the results of various modalities of treatment in proximal humerus fracture. Patients with fracture of proximal humerus [Neer's classification [3, 11, 12, 13]: grade 2, grade 3 & grade 4] were included. Medically unfit patients, patients with open physis, shaft humerus fractures with proximal extension, Neer's one part fracture, open fractures, neurovascular injuries were excluded. Results were compared in terms of functional and radiological results. Four part and three part fractures constituted the commonest types. 9 (60%) patients with 2 part fractures had been treated with ORIF. Among 3 part fractures, 11 (50%) patients had been treated with percutaneous method and rest 11 (50%) had been treated with open methods. 17 (74%) patients of the 4 part fractures had been treated with HRA. Total of 82.46% fractures showed radiological union between 8-12 weeks period. The restriction of ROM was more commonly seen in closed method due to prolonged period of immobilization. Overhead abduction was mainly affected in HRA group and percutaneous group showed intermediate results. Mean constant score in percutaneous method is 79.2, ORIF method is 84.7 and HRA method is 77.35. The final score obtained by all the treatment modalities showed comparable results and they were not statistically significant.

Background:

Proximal humerus fractures account for approximately 4 – 5% of the fracture attendance at the hospital^[1]. The female and male ratio is 2:1^[2]. They occur more commonly in elderly patients, after cancellous bone of the humeral neck has been weakened by senility; but these fractures are seen in patients of all ages. These fractures can be extremely disabling and their management often demands experienced surgical skills. Because of increasing incidence of vehicular accidents, complicated fracture patterns in proximal humerus are becoming increasingly common. The preferred treatment depends on various factors including the patient's age, bone quality, the patterns of fracture and the patients' expectations and physical demands. In this study, we have studied the results of different modalities of operative treatment, their advantages & disadvantages, complications & outcomes in terms of functional and radiological results.

MATERIALS AND METHODS

This is a prospective as well as retrospective study of 60 consecutive patients with fracture of proximal humerus, treated in our department between time period of May, 2011 and December, 2013. All the patients with fracture of proximal humerus [Neer's classification^[3, 11, 12, 13]: grade 2, grade 3 & grade 4] were included in the study. Exclusion criteria used were medically unfit patients, patients with open physis, shaft humerus fractures with proximal extension, Neer's one part fracture, open fractures, neurovascular injuries. After primary management, all patients having proximal humerus fractures were assessed clinically and radiologically. Radiographic evaluation included Anteroposterior (AP) view and Axillary view. Following factors were taken into consideration while deciding the modality of treatment to be used.

- Age of the patient
- Bone quality e.g. Osteoporosis^[8, 9, 10, 14]
- Fracture patterns according to Neer's classification including head split fracture and dislocation^[4], valgus impaction and metaphyseal extension

Fractures were classified according to the Neer's classification. The patients were randomized for different modalities of management i.e. Percutaneous method (K wire & K wire fixator) and Open methods (Locking Plates & Hemiarthroplasty) accordingly.

After operative management, appropriate rehabilitation was started according to the modality used. In the Closed group (K wire & K wire fixator) patients were kept immobilized for 6 wks period and then started with gradual mobilization with shoulder pendulum exercises and subsequently gradual active and passive ROM exercises were started. In the ORIF group patients were mobilized after stitch removal with shoulder pendulum exercise and gradually active and passive ROM exercises were started.

OBSERVATION AND RESULTS:

Age variation in the series was from 20 to 80 years. Proximal humerus fractures were found to have high incidence in the 20 to 30 (25%) and 51 to 60 (26.67%) years age group. Mean age was 47.65 (Range 20-80). Higher incidence was found in 20 to 30 years age group; which may be due to high velocity injuries which are more common in younger active population and in 51 to 60 years age group may be due to osteoporosis. From 60 cases there were 37 (61.67%) males and 23 (38.33%) females. Male to female ratio was 1.60:1. Males predominated over females in our study, due to higher incidence of high velocity trauma and more outdoor activities among male population. Four part and three part fractures constituted the commonest types with 23 (38.33%) patients of four part and 22 (36.67%) patients of three part fracture. 15 (25%) patients had two part fracture. The more complex fracture pattern was associated with the high velocity trauma.

9 (60%) patients with 2 part fractures had been treated with ORIF. Among 3 part fractures, 11 (50%) patients had been treated with percutaneous method and rest 11 (50%) had been treated with open methods. 17 (74%) patients of the 4 part fractures had been treated with HRA. Most of the patients (31 out of 45) having complex fracture pattern had been treated by open method either ORIF or HRA. Among total 13 (21.67%) head split fractures, 1 (7.69%) patient had been treated with ORIF method, 2 (15.38%) patients with percutaneous and 10 (76.92%) patients with HRA. Most of the head split fractures were associated with 4 part fractures (12 patients) and due to increase risk of osteonecrosis associated with such type of fractures, the preferred modality of the treatment is hemiarthroplasty. Total of 82.46% fractures showed radiological union between 8-12 weeks period. 3 fractures had nonunion, among which 2 fractures were treated with percutaneous method and 1 was treated with ORIF.

Total 8 patients had malunion, among which 4 had been treated with percutaneous method and 4 had been treated with ORIF. Early mobilization was started in ORIF and HRA group after stitch removal (Mean 15 days). Percutaneous group patients were kept immobilized for 6 weeks. No patient was immobilized in ORIF group for more than 40 days. All patients had started finger and elbow mobilization on 1st post operative day and pendulum exercises were started on 24th day on average. ROM exercise was started on 41st day on average in all patients.

11 (55%) patients in close method, 4 (20%) patients in open method and 7 (35%) patients in HRA showed restriction of range of motion. The restriction of ROM was more commonly seen in closed method due to prolonged period of immobilization. Restriction of ROM was mostly seen in percutaneous and HRA groups, however, the results were not statistically significant among different modalities. (p value 0.07026). Total 6 (30%) patients treated with HRA had pain at final follow up, 2 patients of percutaneous method and 1 of ORIF had pain. The observed results had no statistical significance. (p value 0.0642). Average range of motion was better in ORIF group. Overhead abduction was mainly affected in HRA group and percutaneous group showed intermediate results. The results obtained showed statistical significance among the different modalities. (F 4.58, p value 0.014, F Crit 3.15). Mean constant score in percutaneous method is 79.2, ORIF method is 84.7 and HRA method is 77.35. The final score obtained by all the treatment modalities showed comparable results and they were not statistically significant. (p value 0.149, F 1.96, F crit 3.15)

4 (20%) patients operated with percutaneous method showed poor results and 4 (20%) patients operated with open method showed poor results in terms of head shaft angle at final follow up. 20 patients those were operated with hemireplacement were not included. Among 4 patients of percutaneous method, 2 patients had fair and 2 had poor final clinical results. Among 4 patients of ORIF method, 2 had excellent and 2 had fair final clinical results. Thus only 2 patients showed poor clinical results; suggesting that poor radiological results did not necessary have poor clinical results. Thus radiological outcome does not always correlate with the clinical outcome. However, most of the radiological results were comparable with the clinical results. The observed results were also statistically correlating. (p value 0.016)

DISCUSSION:

The treatment of proximal humerus fractures remains challenging for orthopaedic surgeons even in the present day. Previous studies have indicated better results with both conservative and operative treatment, if the decision-making is appropriate. The results of the non-operative management of these injuries have historically been equivocal. The results of different modalities of operative management show insufficient evidence to establish what should be the best method of surgical treatment.

In our study, the average age of the patients was 47.65 years. Higher incidence was found in 20 to 30 years age group; which may be due to high velocity injuries which are more common in younger active population and in 51 to 60 years age group may be due to osteoporosis.

Irenberger A⁵ et al in 2006 followed up 83 patients clinically and radiologically for signs of avascular necrosis and non-union after open and percutaneous treatment of proximal humerus fractures. The reported average age of the patients in his study was 50 years. Mohamed M.H. El-Sayed⁶ in 2010 studied 59 patients who were treated with open and closed methods. Patients' age ranged between 31 and 52 years with a mean of 42 years. Smejkal K⁷ et al, in 2011 compared the medical aspects of alternative surgical methods for treatment of proximal humerus fractures in 55 patients with specific indications (two- and three- fragment fractures). Mean age was

53 years and range was between 18 to 80 years.

In our study, 61.67% of the patients were males. The studies by M H Sayed⁶, Irenberger A⁵ et al and Smejkal K⁷ et al also showed a male preponderance.

In our study, we classified the fractures according to Neer's classification system into 4 types. Four part and three part fractures constituted the commonest types with 23 (38.33%) patients of four part and 22 (36.67%) patients of three part fracture. Two part fracture was seen in 15 (25%) patients.

Irenberger A⁵ et al in their study classified fractures in 22 patients (26.5%) as two part, in 21 patients (25.3%) as three part, in 39 patients (47%) as four part, and in 1 patient (1.2%) as fracture dislocation (Neer classification). M H Sayed⁶ had 12 (20.33%) cases with three part fracture proximal humerus, 29 (49.15%) patients had four part fracture, 10 fracture dislocations (three or four parts of the fracture with dislocation of the fracture fragments from the glenoid cavity), and 8 patients with split head fractures, according to the Neer classification. Smejkal K⁷ et al used AO classification and included mainly fractures with three and four fragments which included AO fracture types A2, A3, B1 or C1.

The more complex fracture pattern is associated with the high velocity trauma.

In our study, 9 (60%) patients of 2 part fractures were treated with ORIF. Among 3 part fractures, 11 (50%) patients were treated with percutaneous method. 17 (74%) patients of the 4 part fractures were treated with HRA.

Irenberger A⁵ et al treated 12 patients (14.5%) with ORIF (open reduction and internal fixation) and 71 patients (85.5%) with CRPF (closed reduction and percutaneous fixation) in their study. Smejkal K⁷ et al treated 27 (49%) patients with the Zifko method of minimally invasive osteosynthesis with intramedullary K-wire insertion (MIO group) and the other 28 (51%) patients (ORIF group) treated with open reduction with angle-stable osteosynthesis using a Philos plate (Synthes, Switzerland). M H Sayed⁶ treated most of the patients with locking plates and the rest of the patients were treated with closed methods.

Most of the patients having complex fracture pattern; are treated with open method either ORIF or HRA.

In our study, total 21 (35%) fractures had associated dislocation on presentation and most of those (14-66.67%) patients were treated with HRA. Most of dislocations were associated with four part fractures (17 patients). Among total 13 (21.67%) head split fractures, 1 (7.69%) patient was treated with ORIF method, 2 (15.38%) patients were treated with percutaneous and 10 (76.92%) patients were treated with HRA. Most of the head split fractures were associated with 4 part fractures (12 patients) and hemiarthroplasty was the preferred modality of treatment. In our study, 11 (18.33%) fractures had metaphyseal extension in proximal fragment. Among them 36.36% were treated with percutaneous method, 45.45% were treated with ORIF and 18.18% with HRA.

M H Sayed⁶ had 10 fracture dislocations (3 or 4 parts of the fracture with dislocation of the fracture fragments from the glenoid cavity). Most of them treated with locking plates. Irenberger A⁵ et al had dislocation in one patient and it was treated by open method. Smejkal K⁷ et al excluded these types of fractures.

Due to increase risk of osteonecrosis associated with such type of fractures, the preferred modality of the treatment is hemiarthroplasty.

In our study, total of 82.46% fractures showed radiological union between 8-12 weeks period. 3 fractures had non-un-

ion; among which 2 fractures were treated with percutaneous method and 1 patient was treated with ORIF. Total 8 patients had malunion; among which 4 were treated with percutaneous method and 4 were treated with ORIF. 1 patient had osteonecrosis which was treated with percutaneous method.

Irenberger A⁵ et al showed that patients suffered significantly more avascular necrosis after open treatment; five patients (50%) versus eight patients (12.7%) in the percutaneous group. M H Sayed⁶ showed 4 (6.7%) patients having partial humeral head necrosis.

In our study, 26 (43.33%) patients had excellent, 13 (21.67%) had good, 12 (20%) had fair and 9 (15%) had poor results. The results were broadly classified into favourable and unfavourable. Total 39 (65%) patients had favourable outcome and 21 (35%) had unfavourable outcome. Mean constant score in percutaneous method is 79.2, ORIF method is 84.7 and HRA method is 77.35.

M H Sayed⁶ recorded, based on the Neer scoring system; 14 excellent results (23.8%), 27 good results (45.7%), 15 fair results (25.5%), and only 3 patients had poor results (5%). Thus, 41 patients (69.5%) showed favourable results at the final follow-up visit. Smejkal K⁷ et al showed the final Constant score 86.6% (64-100%) as compared with the healthy limb and excellent and good results were achieved in 89% of the patients of ORIF group. The final Constant score was 87.5% (52-100%) in comparison with the healthy limb. Excellent and good results were achieved in 89% of the patients of MIO group. Irenberger A⁵ et al showed final constant score of 80 in percutaneous method and 86 in ORIF method. Various other authors also obtained 60-70% favourable anatomical results in patients treated operatively in recent years. The results obtained in our study are comparable to the previous study, emphasising the favourable results of the surgical treatment of these fractures.

ORIF method shows early radiological union as compared to other modalities. Malunion and nonunion are associated with poor results.

CONCLUSION

There is a paradigm shift in proximal humeral fracture epidemiology, with reduction in average age group and increase in frequency of high grade fractures.

Male preponderance is due to the pre-dominant outdoor activity and active professional behaviour. In our society, female patients are mainly involved in household activities.

As there is a substantial increase in the number motor vehicles; there is increased frequency of road traffic accidents in younger active population, which has led to complex pattern of fracture.

Most of the patients having complex fracture pattern; are treated with open method either ORIF or HRA.

Due to increased risk of osteonecrosis associated with dislocation and head split type of fractures, the preferred modality of the treatment is hemiarthroplasty.

ORIF method shows early radiological union as compared to other modalities.

Minimally displaced 3 part fracture gives better result with percutaneous methods.

Though radiological outcome (Head shaft angle) does not always correlate with the clinical outcome, most of the radiological results are comparable with the clinical results.

Varus collapse is associated with restriction of range of motion and poor functional results.

The average follow-up period was only 14 months, which is very short as compared to other studies. As these fractures are prone to develop arthrosis and osteonecrosis after a longer course of time, it is necessary to follow-up the patients for a longer period.

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