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Management of unstable comminuted proximal humerus fractures with percutaneous pinning: A prospective study

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Abstract

Introduction: Management of unstable comminuted proximal humeral fractures has remained controversial since ages. Open reduction and internal fixation have resulted in devastating complications like stiffness of shoulder joint, avascular necrosis, infection, etc. This study was undertaken to see the functional outcome in management of unstable comminuted proximal humerus fractures treated by a novel method of percutaneous pinning with multiple k wires.

Materials and Methods: In this prospective study conducted at MVJMC&RH, 20 patients with unstable comminuted proximal humerus fractures were treated with percutaneous pinning with multiple k wires from June 2018 to November 2020

Results: According to the Constant scoring system, two patients (10%) had an excellent score, fifteen patients (75%) had a good score, and two patients (10%) had a fair and 1 patient (5%) had poor score.

Conclusion: In view of the results obtained from our study, percutaneous pinning is a safe and novel method of management of unstable comminuted proximal humeral fractures with fewer complications.

Keywords: percutaneous pinning, unstable proximal humerus fractures, k wiring, closed reduction and fixation

Introduction

The shoulder joint was less commonly exposed to trauma before modernization, but with modernization there also came evils of increasing road traffic accidents and polytrauma, thus increasing the incidence of shoulder injuries. Proximal humeral fractures account for almost 4–5% of all fractures. These fractures have a bimodal age distribution, occurring either in young individuals following high-energy trauma or in those older than 50 years with low-velocity injuries such as a simple fall.

Various methods of osteosynthesis have been suggested for proximal humeral fractures including plate fixation, intramedullary nailing, percutaneous pinning, and external fixation. However, both plate and screw fixation require exposure of the fracture site. In addition, plate fixation is often made difficult by poor bone quality. Intramedullary nailing has the potential risk of violating the rotator cuff or elbow joint function.

Closed reduction and percutaneous pinning of proximal humerus fractures is a reliable method for fixation in certain patients. Although it is less rigid biomechanically than plate and screw constructs, percutaneous pinning may be used in unstable proximal humerus fractures. Percutaneous methods of fixation have a major advantage over open reduction and internal fixation in that there is essentially no soft tissue dissection and lower rates of avascular necrosis, decreased scar formation, and better cosmesis. We present our experience with this method^[1-4].

Materials and Methods

This is a prospective study of 20 patients with unstable comminuted proximal humeral fractures treated in MVJ medical college, Bengaluru by closed reduction and percutaneous fixation under C- arm guidance during June 2018 to November 2020.

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Inclusion criteria

- Patients above 18 years of age with unstable comminuted proximal humerus fractures.

Exclusion criteria

- Open injuries
- Pathological fractures
- Multiple/severe coexisting Medical co-morbidities.

The age of the patients ranged from 18 to 75 with an average of 42 years. Seven were females and thirteen were males. The right side was affected in twelve cases and the left in eight cases. All fractures were closed (no open fracture). Follow-up of the patients was performed weekly for the first 8 weeks and then monthly until the end of follow-up, with a mean follow-up of 6 months. The mechanism of injury was a fall on outstretched hand in 10 cases and a direct trauma to the shoulder in fifteen cases. Thirteen cases had two-part fractures and twelve had three-part fractures according to Neer^[5] classification. The diagnosis was made by clinical and radiographic examination (Anteroposterior and axillary view) and if required computed tomography, to diagnose and to classify them using Neer's classification^[5].

Surgical technique

Under general anaesthesia and under C-arm control, a trial of closed reduction was performed. If reduction was satisfactory, percutaneous pin fixation was carried out. For cases with unsatisfactory reduction, percutaneous reduction of fragments was done using k-wires / 2 mm Schantz pins as a joystick to aid in reduction.

Two or three pins were inserted through the skin from distal to proximal with special care to avoid penetrating the articular cartilage by the pins and the pins were bent just outside the skin to avoid pin migration. Additional pins were used to stabilise greater tuberosity fragments. In certain cases of gross comminution, a trans-acromial k-wire was also inserted to achieve additional stability.

Immobilization in an arm sling was done for all patients for 4 to 6 weeks. Weekly dressing of pin sites was done. Removal of the pins was performed after 4- 6 weeks depending on a case to case basis. These patients were initiated on physiotherapy 6 weeks after the operation. After 6 weeks, Pendulum exercises were performed for 1 week, followed by passive range of motion for other 2 weeks. Active range of motion was started during the sixth to eighth postoperative week under supervision. Cases in which the pins became loose or pin-tract infection was recorded, removal of the pins was performed early but not during the first 4 weeks to avoid displacement of the fracture. Active exercises for the muscles around the shoulder were started after removal of the pins until the patient recovered his/her shoulder power in comparison with the other healthy side.

Type of study: Prospective observational

Source of funding: nil

Conflict of interest: nil

Follow-up

Follow-up by plain radiographs was performed immediately postoperatively and every week (to detect displacement or pin migration) until fracture union was detected both clinically and in the radiograph.

Evaluation

Every patient was evaluated at the end of the follow up period

according to the Constant score, which is a 100-point score system developed by Constant and Murley^[6]. This scoring system (Table 1) consists of four variables that are used to assess the function of the shoulder. The right and left shoulders are assessed separately. The subjective variables are pain and activity of daily living (sleep, work, recreation, and sport), which yield a total of 35 points. The objective variables are range of motion and strength, which yield a total of 65 points. The score was graded according to the total points obtained by the patient taking the normal side for every patient as a standard (100 points). A score between 90 and 100 points was graded excellent. A score between 80 and 89 points was graded good. A score between 70 and 79 points was graded fair and a score less than 70 points was graded (poor)^[7].

Table 1: Constant score

Subjective	
Pain	15 points
ADL (sleep, work, recreation/sport)	20 points
Objective	
Range of motion	40 points
Strength	25 points

(ADL, activity of daily living)

Pre-operative, intra-operative and post-operative x-rays:

**Fig 1:** Pre-op x-ray showing comminuted proximal humerus fracture**Fig 2.** Intra-op fluroscopy image**Fig 3.** Intra-op fluroscopy image showing multiple percutaneous pinning

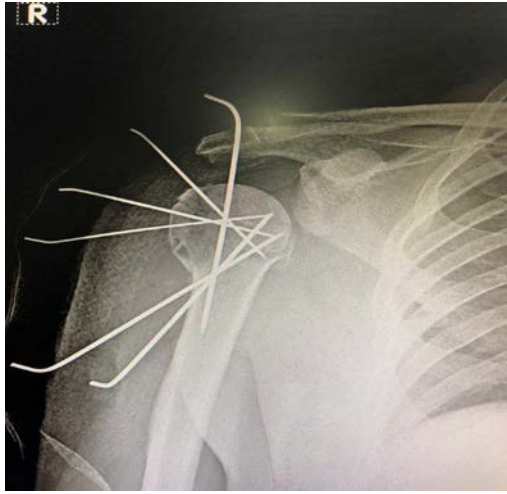


Fig 4: Post-op x-ray

Results

Every patient was evaluated at the end of the follow up period according to the constant murley score. The following observations were made from data collected during study.

Total patients – 20

Age range – 18 - 75 years

Average age – 42 years

Male/female – 13/7

Right side – 12

Left side – 8

Table 2: Sex distribution

Sex	Number of cases	Percentage
Male	13	65
Female	7	35

Table 3: Side affected

Side affected	Number of cases	Percentage
Right	12	60
Left	8	40

Table 4: Complications

Complications	Number of cases	Percentage
Pin site infection	1	5
Stiffness	5	25
Avascular necrosis	1	5
Nil	13	65

Table 5: Constant Murley score results

Points	Percutaneous pinning	Percentage (%)
<70	1	5
70-79	2	10
80-89	15	75
90-100	2	10
Total	20	100

We followed up all the patients until union of fractures ranged from 16-24 weeks.

We had total 3 complications include 1 pin site infection; 5 post traumatic stiffness & 1 case of avascular necrosis.

Discussion

Closed reduction and percutaneous pinning of unstable comminuted proximal humeral fractures has the advantage of being both a less invasive and a simple procedure. Recent trends are shifting away from open reduction and internal

fixation (by plates and screws) toward closed reduction and percutaneous fixation as this method is less invasive and causes less soft tissue damage. Another complication associated with open reduction and fixation is the risk for avascular necrosis of the humeral head because of impairment of the anterior circumflex humeral artery and consecutive devascularization of the fracture fragments, which causes significant functional impairment [8]. Percutaneous pinning seems to be a suitable alternative to other operative techniques such as intramedullary nailing or open reduction and internal fixation using plates [9].

Although percutaneous pinning may be biomechanically less stable, but certain methods may enhance this stability. These are using pins with larger diameter and terminally threaded pins which have a strong hold on opposite cortices and configurations with biplanar fixation [10] Pin configuration has also been studied. Parallel pin configuration was biomechanically superior to convergent pins.

At the end of our study, 85% of the patients had excellent and good scores, and they were satisfied with the method of treatment because there was no permanent hardware (plates or nails) in their shoulders and there was no need for a second operation to remove the hardware. The healing time in patients treated by closed reduction was better than that in patients treated by open reduction. Only 2 patients had fair scores and 1 patient with poor constant score.

The results of the current study are comparable with the results of Fenichel *et al.* [11] using threaded pins for two-part fractures as they achieved an average Constant score of 86 points (range 78–100 points) and also for the range of motion. Rosa *et al.* [12] reported a Constant score between 33 and 84 points using two elastic smooth pins inserted through the head at the level of the physis.

The common complications reported in the literature are pin site infection, stiffness, loss of fixation, axillary nerve injury, secondary displacement, and deep infection [13–15]. In the present study, We had total 3 complications include 1 pin site infection; 5 post traumatic stiffness & 1 case of avascular necrosis.

Thus, all unstable comminuted proximal humerus fractures deserve a trial of this technique, only absolute contraindication could be a head splitting fracture, and proximal humeral fracture with vascular injuries.

Conclusion

Unstable comminuted proximal humerus fractures treated with percutaneous pinning give excellent to good functional results in 85% patients. Patient age, injury-surgery interval, rehabilitation time and condition of rotator cuff affect functional outcome. In conclusion, percutaneous pinning is an excellent treatment modality for unstable comminuted proximal humerus fractures with early mobilization, shortened hospital stay and improved rate of union.

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