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Clinico-radiological outcome of closed reduction and percutaneous fixation of proximal humerus fractures

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Abstract

Proximal humerus fracture is the commonest fracture affecting the shoulder girdle in adults and its incidence is rising. In displaced fractures, surgery is the treatment of choice in order to restore anatomical integrity, and allows early functional recovery. Several techniques were used over the years, each with specific indication. Closed reduction and percutaneous fixation reduces risk from soft-tissue dissection and may reduce the fracture indirectly, achieving provisional fixation for anatomic healing. Aim of study is to assess the clinic-radiological outcome of percutaneous pinning in proximal humerus fractures. A study group of 21 patients with Neer,s type 2 and 3 proximal humerus fracture were treated with closed reduction and percutaneous K-wire fixation and clinico-radiological assessment was done and functional outcome was assessed by Constant-Murley score in various follow ups. 17 patients were available for assessment with minimum follow up of 1 year (Range 1 to 6 year). Patients had a mean age group of 35.5 years. All patients except two showed full range of movement, radiographic healing occurred in a mean time of 10 week and K-wire removal was done at a mean interval of 12 weeks. Mean Constant-Murley score was found to be 85%. Percutaneous fixation by k-wires after closed reduction is a reliable option for management of 2-or 3-part proximal humerus fractures which also avoids plate application.

Keywords: Neer's type 2, 3, Closed reduction, Percutaneous K-wire fixation

Introduction

Proximal humerus fractures are increasing due to increased incidence of road traffic accidents which is approximately about 4-5% of all fractures and presence of associated osteoporosis makes their treatment difficult [1]. Approximately 80% of proximal humerus fractures are managed conservatively and rest of the cases present a surgical dilemma [2]. There are multiple treatment modalities are available to treat these fracture which includes conservative treatment [3], percutaneous fracture fixation [4, 5], open reduction and internal fixation with plate osteosynthesis (ORIF) [6], arthroplasty [7, 8] depending upon age of the patient, fracture pattern, and associated comorbidities. Conservative treatment has late functional recovery, but it is noninvasive, and is effective in undisplaced or mildly displaced fracture patterns however displaced fracture has higher incidence of non-union [9]. Open reduction and gives anatomical reduction, early mobilization and rehabilitation; however, it is associated with higher rates of infections, avascular necrosis of the humeral head, and neurovascular damage [10]. Complications associated with plate osteosynthesis can be avoided with percutaneous fixation if closed reduction of fracture is possible under image intensifier and it is considered to be less invasive, avoids excessive soft tissue manipulation, and preserves the residual blood supply of humeral head [11, 12, 13, 14].

This study aims to report clinic-radiological and functional results of proximal humerus fracture treated by closed reduction and percutaneous fixation with K wire in in selected patients.

Material and methods

This retrograde study was done in department of orthopaedics KGMU from 2012 and 2017. Total 21 patients of proximal humerus fracture treated with closed reduction and percutaneous fixation with K wire in this period.

17 patients were available for assessment with minimal follow up period of 1 year with inclusion criteria were: (1) adult patients with Neer's type 2 & 3 proximal humerus fracture, and (2) patients who gave consent for surgical intervention. Exclusion criteria were (1) patients with Neer's type 4 proximal humerus fracture with/without dislocation, (2) undisplaced fracture and, (3) those fractures which were not closed reduced were immediately planned for open reduction and internal fixation and excluded from study. All patients were subjected to anterior-posterior view, axial view, trans-scapular Y view of affected shoulder pre and post operatively. CT scan with 3 D reconstruction was obtained in selected patients.

Surgical technique

Patient lying supine on OT table with 30 degree head end elevated and general anesthesia administered. All aseptic precautions were taken. We positioned the image intensifier at head end in such a manner that it allows the AP and axial views intraoperatively. First closed reduction achieved by correcting varus of humeral head by abducting the distal fragment, and in type 3 fracture if greater tuberosity was not reduced closely we do the minimally invasive manipulation of greater tuberosity to achieve anatomical reduction. 5 to 6 K-wires of 2.5mm thickness were inserted percutaneously after achieving satisfactory reduction. 2 K-wires from lateral to medial direction in humeral head, 2 K-wires anterior to posterior and rest of the 2-K wires were inserted from greater tuberosity just lateral to acromioan into calcar region. K-wire positions were checked in image intensifier. In initial 3 cases K-wires were left outside the skin and in remaining 14 cases K-wires were buried under the skin. Aseptic dressing was done and immobilization was achieved by a standard shoulder immobilization brace in immediate post-operative period. Patients were encouraged to start active mobilization of elbow and wrist on the first postoperative day and pendulum exercises as on comfort of patient. Patients were asked to self-remove their braces several times during the day to allow passive mobilization of the shoulder for 4 weeks, active assisted exercise for another 4 weeks followed by active mobilization allowed depending upon radiological healing and subjected to hardware removal. In some patients we removed the GT K wires at 6 weeks for unrestricted mobilization of shoulder.

Follow up visits were conducted at 2week, 4 week, 6 week, 12 week, 24 weeks and later on yearly basis after surgery. Patients were followed with clinical examination including ROM and complications, radiological assessment with x rays and radiographic healing was considered when cortical continuity was visible. Functional status was assessed by Constant-Murley score [15]. A total of 17 patients were followed over a minimal follow up period of 1 year. Mean follow up was 3.5 years (Range=1-6year). Patient demographic data is shown in Table 1. Out of 17 patients, 15 patients had complete range of motion (ROM) at 12 month follow up and rest 2 patient had terminal restriction of shoulder range of motion (Fig. 1). Terminal abduction and forward flexion movement was affected the most. The mean duration for radiological healing was found 10 week (Range=8-12 week) (Fig. 2). Radiological healing was considered complete when bridging callus was seen on x-rays in 3 out of 4 cortices. Functional outcome was recorded by Constant-Murley score which was found to be mean of 85 (Range=80-95) at final follow up. K-wires were removed at mean duration of 12 week (Range=10 to 20week). Pin

loosening was seen in 2 patients out of which 1 patient had varus malunion and pin tract infection was reported in 2 patients however it didn't affect the union of proximal humerus. None of the cases developed nonunion.

Table 1: Demographic data-

Age	
Mean=35.5 years	Range 18-70 year
Sex	
Male=12	Female=5
Mode of injury	
Road traffic accidents=13	Slip on ground=4
Injury-surgery interval	
Mean=6days	Range=3 to 14 days
Fracture configuration	
Neer's type 2=9	Neer's type 3=8

Discussion

Much controversy exists on various modalities of treatment by surgical procedures in proximal humerus fractures. Open reduction and internal fixation with plate osteosynthesis provides stable fixation in Neer's type 4 fractures with/without dislocation and is a reliable method to treatment in these type of injuries. However this plate osteosynthesis can be avoided in Neer's type 2 and 3 where closed reduction can be achieved with relative ease and percutaneous K-wire fixation can be done as plate osteosynthesis is associated with various complications [10, 16, 17].

In current study all except two patients had full range of movement of affected shoulder. 2 patients had terminal restriction of abduction and forward flexion. In study by Francisco Munibi *et al* 22 out of 41 cases had range of motion similar to pretraumatic pattern and rest of the patients had significant range of motion [18].

In present study union was achieved in all patients with mean duration for radiological healing of 10 week (Range=8-12 week). Similar results were found in study conducted by Francisco Munibi *et al* treated 41 cases with with percutaneous fixation and found radiological union achieved in all patients with a mean duration of 12 weeks [18] and Keener *et al* treated 35 patients with percutaneous fixation found complete healing in all patients [19] (Table 2).

In our study we found mean Constant-Murley score 85 (Range 70-95). Francisco Munibi *et al* found Constant-Murley score 87.1 in their study [18]. Keener *et al* treated 35 patients with percutaneous fixation and found Constant Murley score of 87 [19] and Resh *et al* found mean Constant Murley score of 91 in 3 part fractures and score of 87 in four part fractures [10]. In present study pin tract infection was reported in 2 patients however it didn't affect the union of proximal humerus. Infection was managed with local dressings and prolonged antibiotic course. In one of these cases, infected and loose K wire was removed and rest k wires were removed only after the radiological healing was achieved. Jaberg *et al* treated 48 patients and they found pin tract infection in 4 patients and deep infection in 1 patient [20].

In present study pin loosening was seen in 2 patients. Out of 17 patients we found 1 case of varus malunion as we included Neer,s type 2 & 3 proximal humerus fractures which has less chance of loss reduction and here this 1 varus malunion was found which have occurred due to pin loosening. In study done by Keerner *et al* in 35 patients, malunion was seen in 4 cases in Neer,s type 3 & 4 proximal humerus fractures [19]. Francisco Munibi *et al* included 41 patients of Neer's type 2, 3 and 4 fractures and found no loss of reduction in various

follow up visits [18].

Limitations

Limitation of our study is being retrospective in nature with less sample size.

Conclusion

Percutaneous pinning of proximal humerus fracture in type 2 & type 3 fractures is a reliable option for treatment if closed reduction is achieved under image intensifier and this can avoid plate osteosynthesis.

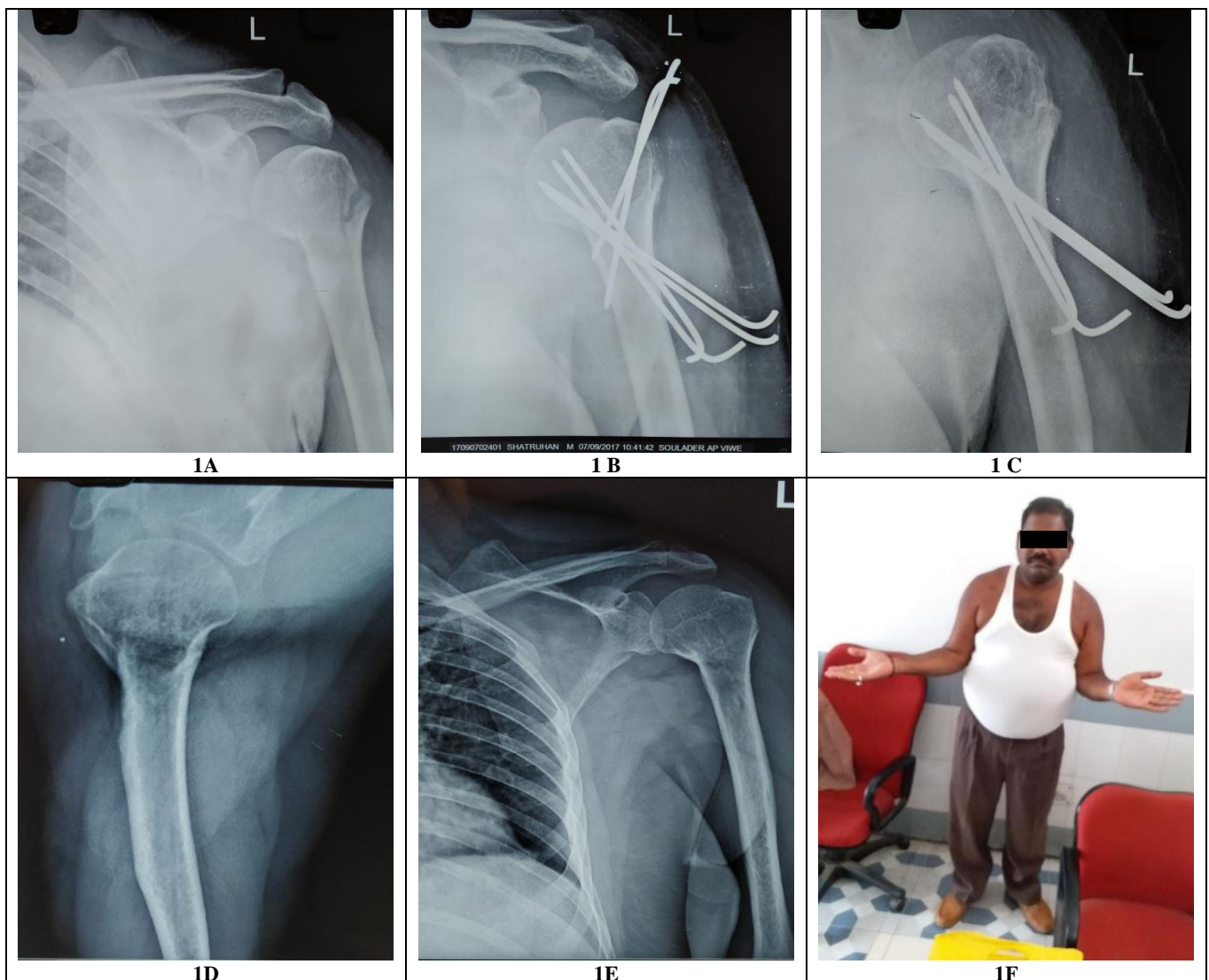
Table 2

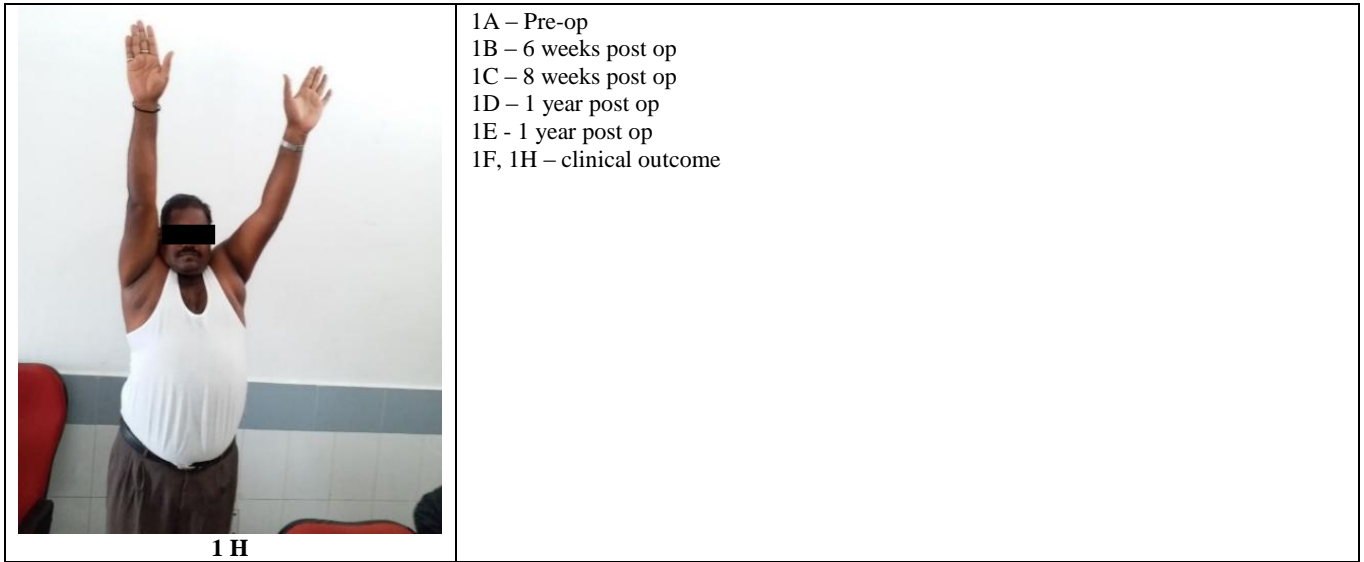
Study	Cases (no.)	Procedure performed	Union (radiologically)	Constant-murley score	Complication	Follow up period
Present study	17	Closed reduction and percutaneous k-wire fixation	All patients	85	Pin tract infection-2 Varus Malunion-1	1-6 year
Francesco Muncibi <i>et al</i>	41	Percutaneous k-wire fixation	All patients	87.6	Nonunion-1	2 years
Jaberg and associates	48	Percutaneous fixation	Union achieved in 46 patients	-	Loss of fixation-4 Pin tract infection-4 Deep infection-1 Malunion-1 Osteonecrosis-2 Partial osteonecrosis – 8	2-7 years
Resch <i>et al</i>	27	Percutaneous fixation	All patients	For 3 part fracture= 91 For 4 part fracture= 87	Osteonecrosis – 11% in 4 part fracture	2 years
Keener <i>et al</i>	35	Percutaneous fixation	All patients	73.9	Malunion-4 Early glenohumeral osteoarthritis-4	35 months

Source of Support: Nil

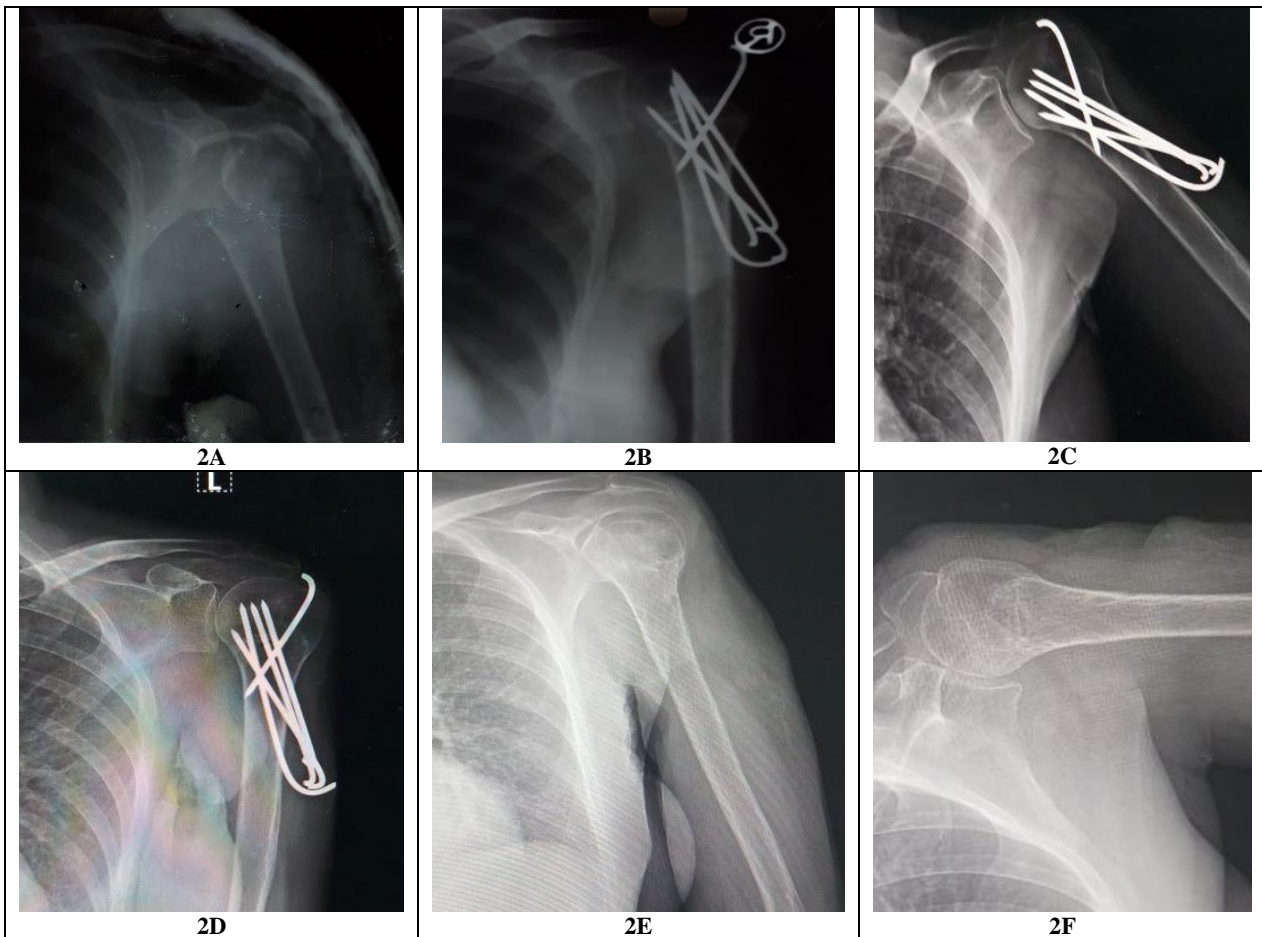
Conflict of Interest: None.

Case 1





Case 2



2A-Preoperative Xray; 2B-6 week Postop Xray; 2C & 2D-5 month postop; 2E & 2F- 2 year post op after implant removal.

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