

To Evaluate the Functional Outcome of Close Reduction and Percutaneous Fixation of Fracture Proximal Humerus By K Wires

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Abstract- Proximal humerus fractures are one of the common fractures occurring in the skeleton. They account for approximately 4-5% of all the fractures. 1,2 85% are minimally displaced or undisplaced and can be treated with immobilization^{3,4,5} alone. The remaining 15% of these are displaced and provide a therapeutic challenge⁶. This study was conducted to analyze displaced fractures of proximal humerus that was treated with close reduction and pinning and to document their clinical and functional outcomes as well as complications. This study was conducted in Department of Orthopedics, Santokba Durlabhji, Hospital, Jaipur. A minimum of 25 patients with fracture proximal humerus managed with percutaneous k-wires fixation were evaluated. Percutaneous k-wires fixation is recommended in young motivated patients with two and three part fracture. Complication associated with k-wires fixation were few and functional outcomes were comparable with other studies. Complication associated with open reduction can be avoided. In four part fractures had high complication rate of malunion and stiffness, so it is not recommended for percutaneous fixation. It is type of biological fixation, in the sense that it does not compromise circulation of humeral head. It decreases duration of hospital stay

I. INTRODUCTION

Proximal humerus fractures are one of the common fractures occurring in the skeleton. They account for approximately 4-5% of all the fractures. 1,2 85% are minimally displaced or undisplaced and can be treated with immobilization^{3,4,5} alone. The remaining 15% of these are displaced and provide a therapeutic challenge⁶.

Conservative management of displaced fractures predisposes to non union, mal union, and painful shoulder dysfunction^{10,11}. Surgical treatment of displaced fracture requires realignment and fixation. Open reduction and internal fixation is challenging because it requires extensive exposure, which causes substantial blood loss and predisposes to wound complications and delay in fracture healing and risk to neurovascular structures.

As Proximal humerus fractures are metaphyseal fracture, and they heal quickly and provide a unique opportunity for temporary fixation till fracture union occurs. This can be easily done by insertion of percutaneous pins, which can left in situ for 4-6 weeks to hold reduction. Normally smooth k-wires or 2.5mm

threated wires are used for this purpose. The usual site of insertion of wires are, two wires retrograde from proximal to deltoid insertion into the humeral head, one wire from greater tuberosity to the medial humeral shaft and an optional fourth wire from anterior humeral shaft into the humeral head.

This study was conducted to analyze displaced fractures of proximal humerus that was treated with close reduction and pinning and to document their clinical and functional outcomes as well as complications.

Aims and Objectives

- The goal of study was to evaluate functional outcomes of close reduction and percutaneous pinning of displaced proximal humerus fractures by k-wires.
- To Study the complications that may occur with closed reduction and percutaneous pinning of fracture proximal humerus.

Materials and methods

Study Centre - This study was conducted in Department of Orthopedics, Santokba Durlabhji, Hospital, Jaipur.

Study Design - This was hospital based prospective study.

Source of Data - All patients fulfilling the inclusion criteria were admitted during the study period.

Sample Size - A minimum of 25 patients with fracture proximal humerus managed with percutaneous k-wires fixation were evaluated.

Inclusion Criteria - Two part, three part, four part displaced proximal humerus fracture:

- Acute fractures < 7 days
- Age above 18
- Patient fit for surgery and anesthesia

Exclusion criteria

- Associated humerus shaft fracture
- Associated neurovascular injury
- Pathological fractures
- Old fractures > 7 days
- Open fracture
- Stable fractures

Pre-operative assessment and planning:

The patients were examined according to protocol, which included:

Clinical evaluation

- Detailed history, regarding name, age, sex
- Systemic examination
- Local examination of shoulder
- Examination to check for any neurovascular or associated injury

Radiological evaluation

- Done by conventional radiograph consisting of anterior - posterior and lateral view.
- A CL scan was indicated, If the amount of displacement of the humeral head or tuberosity fragments was unclear on radiographs and for complex fracture patterns.

Routine preoperative investigation

- Hb, BT, CT, Urine Blood Urea, blood sugar, Serum electrolyte, ECG, X-ray chest.
- Antibiotic prophylaxis regime were given as per treatment protocol of closed fractures.

II. OPERATIVE PROCEDURE

Surgery was done under general anaesthesia, Patient was kept in a beach position. After adequate preparation fractured limb was grasped and fracture were manipulated under fluoroscopic control to achieve a closed reduction of the fragments. Reduction checked under image intensifier system. After obtaining adequate reduction, in both AP and lateral projections, 2-3, 2-2.5mm terminally threaded k-wires were passed in a retrograde fashion from proximal shaft of humerus across the fracture into humeral head in a divergent fashion. 1-2 wires passed prograde from greater tuberosity into the medial proximal humerus across the fracture site, preventing damage to neurovascular structures. Fixation checked under image intensifier for stability

Postoperative management

Post operatively patient was immobilized in shoulder immobilizer. Appropriate antibiotics and analgesics were used. Post-op X-rays were taken.

III. FOLLOW UP AND REHABILITATION

- Patient was asked to come for follow up in OPD after seven to ten days post surgery for X-rays to check for secondary displacement of fracture and pin migration.
- Patients were started on gentle shoulder movements at three weeks from surgery as permitted by pain.
- Flexion/Abduction was permitted and rotation was restricted till fracture union.
- X-ray evaluation was done at six weeks post surgery to assess fracture union and k wires were removed in the clinic after conformation.
- Physiotherapy was continued to regain shoulder movements. Clinical checks was carried out at monthly interval till complete fracture union was achieved.
- Once radiological evidence of fracture healing was achieved, follow up exam was at three month intervals till complete shoulder range of motion was achieved. Patients were

followed up for six month post surgery or till when full ROM at shoulder was achieved if this was earlier than six months.

Methods of evaluation

Functional results were evaluated according to constant score²⁶

Observations and results

The minimum age of the patients in our series was 32 years and the maximum was 78 years with mean age of 56.60 years. Of all the 25 cases, 12 of them were in fifth and sixth decade of life comprising 48% of the total patients.

Males predominates with incidence of 68% of the total number of patients while females constituted 32% of the total number of cases.

The involvement of left and right extremity was almost equal. 16 patients had injury on right side and 9 had on left side.

Road side accidents were the mode of injury in 10 out of 25 cases. In 15 patient the mode of injury was fall.

Nineteen out of twenty five patients had no associated injury. Six patients had other injuries along with proximal humerus fracture. Out of these six patients two patients had BTC and one had BTA. One patient had HI and two patient had pelvic fracture which were managed conservatively.

In our study, six patients had hypertension, four patients had diabetes mellitus, two patients had both hypertension and diabetes mellitus. One patient had bronchial asthma.

One of total 25 patients, 9 patients had two part fracture 15 patient had 3 part fracture and 1 patient had 4 part fracture.

Out of twenty five patients, twenty patients were operated within 1-4 days of injury and five patients were operated within 5-7 days of injury due to medical problems or associated injuries.

Average union time for fracture to unite was found to be 9.5 weeks which was not very different from other modalities of treatment. The minimum time for union was six weeks and maximum time was twelve weeks.

Out of twenty five patients, three patients had superficial pin infection. Two patients had malunion. Four patients had both malunion and stiffness. Two patients had pin loosening. One patient had proximal pin migration. No patients were found to have non union or avascular necrosis of the humeral head.

2(8%) of the patients had flexion between 150 degree to 180 degree. 14 (56%) of the patients had flexion between 120 degree to 150 degree. 8 (32%) of the patients had flexion between 90 degree to 120 degree. 1 (4%) of the patient had flexion less than 90 degree.

9(36%) patients had abduction between 120 and 150 degree. 13 (52%) patients had abduction between 90 and 120 degree. 3 (12%) patients had abduction less than 90 degree.

4(16%) patients had an external rotation between 60-90 degree that is hand above head and elbow forward. 13 (52%) patients had an external rotation between 30-60 degree that is hand behind head and elbow back. 8 (32%) patients had an external rotation less than 30 degree that is hand behind head and elbow forward.

4 (16%) patients had internal rotation (dorsum of hand) up to the buttocks. 3(12%) patients had internal rotation (dorsum of hand) up to the SI Joint. 11 (44%) patients had internal rotation

(dorsum of hand) up to the waist. 7(28%) patients had internal rotation (dorsum of hand) up to the T12 level.

17 patients had no pain while 8 patients had mild pain.

Functional results were evaluated by Constant score. The Constant score was graded as poor (0% - 55%), moderate (56% - 70%), good (71% - 85%) or excellent (86% - 100%). In our study average Constant score was 73.65%. Minimum Constant score was 44% and maximum constant was 89%. Patient with Constant score 89% had two part proximal humerus fracture. K-wire fixation was done and mobilisation was started after four weeks. Patient was well educated 40 years male with great motivation. He attained range of motion up to 150° in front and lateral elevation. The only problem was mild pain while sleeping on the affected side. The union time was 1.5 months and there was no complication. Patient having minimum Constant score (44%) was a 73 years male with four part proximal humerus fracture. Front and lateral elevation was less than 90 degree. The union time in this case was eleven weeks.

In our study out of 25 patients, 9 had two part fracture with mean age of 45.55 years and average union time of 7.66 wks, with the mean constant score of 80. Out of 9 patients with 2 part fracture, 7 had union time between 6-8 wks in remaining, 2 patients union time of 9-10 wks.

In our study, 15 patients had 3 part fracture with man age of 60.73, union time of 8.6 wks, and mean constant score of 65.86. out of these, three patients had poor results with restriction of movements and persistent mild pain and varus malunion. Two patient had malunion with satisfactory range of movements.

Correlation time of scores of age, union time and results for four part fracture

Age	Union time	Complication	Constant score	Result
73	11	Mal & ST	44	Poor

This patient had severe restriction of movements and malunion, decreasing neck shaft angle less than 120 degree, probably due to comminution of bone which got impacted after reduction, leading to varus malunion.

Results

Results	No. of cases	Percentage (%)
Excellent	4	16
Good	11	44
Moderate	6	24
Poor	4	16

Out of twenty five patients of two or three and four part fracture proximal humerus, managed with percutaneous k-wires in our study, 16% had excellent, 44% had good, 24% had moderate and 16% had poor results.

Summary

A total of 25 patients with two, three or four part fracture proximal humerus managed with percutaneous k-wires fixation were evaluated.

The minimum age of the patients in our series was 32 years and the maximum was 78 years with mean age of 56.60 years.

Males predominated with incidence of 68% of the total number of patients while females constituted only 32% of the total number of cases.

64% patients had injury on right side and 36% had injury on left side.

Road side accidents were the mode of injury in 10 out of 25 cases. In 15 patient the mode of injury was fall.

The average time from injury to surgery was 3.08 days. While most of cases operated within four days, one patient (4%) took six days to operate, as he had associated head injury and was managed for the same.

Of the total 25 patients, 9 patients had two part fracture 15 patients had 3 part fracture and 1 patient had 4 part fracture.

Nineteen out of twenty five patients had no associated injury. Six patients had other injuries along with proximal humerus fracture. Out of these six patients two patients had BTC and one had BTA. One patient had HI and two patients had pelvic fracture which were managed conservatively.

In our study hypertension was the most common medical history. Hypertension present in 6 patients (24%). In two patients hypertension associated with diabetes mellitus. Diabetes mellitus was present in total 4 patients (16%). Bronchial asthma is present in 1 patient (4%).

Average union time for fractures to unite was found to be 9.5 weeks which was not very different from other modalities of treatment. The minimum time for union was six weeks and maximum time was twelve weeks.

Two patients had malunion. Four patients had both malunion and stiffness (forward and lateral elevation less than 120 degree, external rotation with hand behind head and elbow forward and back, and internal rotation with dorsum of hand up to buttock or S.I. joint). Three patients had superficial infection. Two patients had proximal pin migration. No patients found to have nonunion or avascular necrosis of the humeral head.

In our study average Constant score was 70.04%. Minimum Constant score was 44% and maximum Constant was 89%.

Out of twenty five patients 16% had excellent, 44% had good, 24% had moderate and 16 % had poor results.

Our results are similar to or better than the results reported in literature when k-wire fixation was done in two, three or four part fracture proximal humerus.

In conclusion, fixation of two, three part fracture proximal humerus with percutaneous k-wire after stabilization of the patient gives good functional results in terms of final range of movement achieved and acceptable rate of complications, but four part fracture has high complication rate of malunion and stiffness.

IV. CONCLUSION

The advantage of close reduction and percutaneous pinning include avoidance of devascularization of fracture fragment, decreasing risk of injury to soft tissue and blood vessels.

As Proximal humerus fractures are metaphyseal fracture so heals quickly and

- provide a unique opportunity for temporary fixation till fracture union occurs. This can be easily done by temporary insertion of percutaneous pins for two and three part fractures.
- Comparable results with fair to good functional outcomes can be obtained with close reduction percutaneous pinning of proximal humerus fracture.
- Isolated greater tuberosity fractures and displaced four part fractures are less amiable to treatment with this modality and are more likely to heal in some amount of malunion.
- Despite some degree of malunion and stiffness patients are not significantly compromised in their activities of daily living.
- Complications though present are not with lasting sequel and can be managed easily.
- This is an easy technique and particularly attractive because of the minimally invasive approach and predictably favourable outcomes in majority of patients.
- The fixation method is more biologic and reduces cost and hospital stay, and allows for early fracture healing.

V. RECOMMENDATIONS

- Percutaneous k- wires fixation is recommended in young motivated patients with two and three part fracture.
- Complication associated with k-wires fixation were few and functional outcomes were comparable with other studies. Complication associated with open reduction can be avoided.
- Four part fractures had high complication rate of malunion and stiffness, so it is not recommended for percutaneous fixation.
- It is type of biological fixation, in the sense that it does not compromise circulation of humeral head.
- It decreases duration of hospital stay.

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