

Study of functional outcome of multiple percutaneous pinning for proximal humerus fracture

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Abstract

Introduction: Proximal humerus fractures account for 4-5% of all fractures, it is the second most common fracture of the upper extremity, these fractures have a bimodal age distribution. Women are affected more than men. About 80% of these fractures are un-displaced according to NEER's criteria and, only 20% are displaced and require operative interference. However various methods of internal fixation have been proposed, for full functional recovery anatomical reduction, stable fixation, early mobilisation are required. The blood supply of the head of the humerus is at risk, however not only from the injury also from the dissection of soft tissues at ORIF. The incidence of mal-union, non-union and avascular necrosis (AVN) after percutaneous pinning is less and limited exposure and minimal dissection of the soft tissues at the fracture site is recommended. Our aim was to evaluate the functional outcomes of proximal humerus fractures treated with multiple percutaneous k wires.

Methods: This is a prospective study of 20 patients with proximal humerus fracture treated by percutaneous pinning with K-wires from June 2019 to June 2021 were clinically and radiographically analysed. Functional assessment of final results are noted using Neers scoring system.

Results: According to Neers score 5 had excellent results (25%), 11 had satisfactory results (55%), 3 had unsatisfactory (15%) and 1 patient had failure (5%).

Conclusion: From the present study it is concluded that the treatment of proximal humerus fracture is closed reduction with percutaneous pinning with K wire fixation, as it is least time consuming, biological fixation, easy to operate, less soft tissue damage with good functional outcome.

Keywords: Proximal humerus fracture, percutaneous pinning with k-wire

Introduction

Proximal humerus fractures are common and debilitating injuries and incidence of them are increasing especially in elderly. They accounts for about 5% of all injuries to appendicular skeleton [1]. They are the third most common fractures in elderly population after hip and distal radius fractures. Increase in incidence is due to more geriatric population with

osteoporosis in aged population and increasing incidence of higher velocity injuries, increasing incidence of road traffic accidents, natural disasters and industrial accidents, together with assault lead to multiple fractures and higher incidence of morbidity in young patients^[1].

In the past century, most of the proximal humeral fractures have been treated by non-operative methods^[2]. About 80-85% of proximal humeral fractures treated non operatively, resulting in good functional outcomes. Whereas in the 15% to 20% of displaced proximal humerus fractures it is noted that significant displacement, especially in comminuted fractures were associated with poor functional outcome, hence moving to surgical fixation for better results^[3]. However significant controversy continues regarding the best methods of treating displaced proximal humerus fractures^[4].

Over the last 3 decades, various modalities of fixations have evolved for the proximal humerus fractures (trans-osseous suturing, percutaneous pinning, tension band wiring, plating, rush nailing, arthroplasty). Of this, percutaneous pinning of proximal humerus is the implant of choice now for treatment of displaced proximal humerus fractures since they provide biological fixation without disturbing the fracture hematoma and anatomical structures, least invasive and more angular stability hence it permits early mobilization and good functional limb^[5, 6, 7, 8, 9, 10, 11, 12].

The blood supply of the head of the humerus is at risk however, not only from the injury, but also from dissection of the soft tissues at open reduction and fixation, to avoid opening of the fracture site closed reduction was done^[5].

With this background, our main aim is to evaluate the “Functional Outcome of Multiple Percutaneous Pinning for Proximal Humerus Fracture”.

Objectives

1. To study the functional outcome and time taken for union of the fracture following surgery with percutaneous fixation with k wires in proximal humeral fractures in the study subjects.
2. To achieve restoration of the anatomical alignment of the fracture and biological fixation.
3. To evaluate the effectiveness and complications of proximal humerus fractures treated with percutaneous pinning with K-wire.

Materials and Methods

Source of data

This is a prospective study of 20 patients with proximal humerus fracture treated by percutaneous pinning with K-wires from June 2019 to June 2021 at VIMS, Ballari.

Method of collection of data

Patients with proximal humerus fracture, admitted in Vijayanagar Institute of Medical Sciences, Ballari, were taken for the study after obtaining their consent. Present study was a prospective study. All patients with proximal humerus fracture admitted during the period, June 2019 to June 2021 were clinically evaluated and radio graphically analyzed.

Laboratory investigations with RTPCR for COVID 19 were carried out to get physical fitness for surgery.

Consent of the patients were taken for surgical management.

Patients were reviewed in outpatient department on weekly basis to look for displacement of pins, displacement of fracture fragments, loosening of pins, pin site infections and serial radiographs were taken at regular intervals to detect early backing out of the pins. When early

signs of radiographic union became visible physiotherapy could be started to regain shoulder range of motion.

Inclusion criteria

1. Age between 18-75 years.
2. Two or three or four part fracture according to Neers classification.
3. Displaced, closed fractures.

Exclusion criteria

1. Pathological fracture.
2. Open fractures.
3. One part fracture according to Neers classification.
4. Fractures with neurological deficits.

Study period

Time period of 2 years, June 2019 to June 2021.

Functional assessment evaluation

The final results were evaluated using Neers score ^[13]. This system based on 100 units. Pain is the most important consideration to the patient and is assigned 35 units. The result in any patient with significant pain is graded as failure.

Surgical procedure

- a) **Anesthesia:** Surgery performed under brachial block/scalene block.
- b) **Position of the patient:** Beach chair position or supine position, surgical site was scrubbed thoroughly, painted with povidone iodine solution and draped appropriately .
- c) **Technique:** K wire fixation used for percutaneous fixation in our technique:- K-wires (2 mm) In usual percutaneous fixation, only K-wires are used, So when we are satisfied with the position of fracture and its reduction, then we mark a line over the deltoid region about 5-7 cm from the acromial edge as a landmark of the axillary nerve.

Then small incisions are made and the track is made over lateral upper arm for k-wire traversing with the help of artery clip. It is emphasized that we get to avoid the path of the axillary nerve. Under image guidance we use two 2-mm K-wires for fixation. We use sleeves for K-wires and after making sure our trajectory we drill in the K-wires. We make a small incision over the greater tuberosity region of the humerus and use the artery clip to make a path for the insertion. Under image guidance, we pass K-wire aiming for the calcar region. Once happy with the position of K-wire the wire ends are cut as well and the tips are kept over the skin. The incisions are so small that one single mattress or simple sutures are enough for them. U slab was put and the patient is given a sling for comfort.

d) Post-operative management

For all the patients IV Cephalosporins BD for 3-5 days was administered. Post-operative pain and inflammation was managed with NSAIDs, IM Diclofenac sodium 75mg BD for 3 days. Patient was advised for active wrist and finger movements.

Check X-ray was taken on 1st post-operative day and pin tract dressing done on 2nd postoperative day. Patient was discharged with U slab on 3rd day with oral antibiotics and oral

analgesics. Patient was advised for suture removal on the 14th postoperative day (if any sutures put).

U-slab continued for 3 weeks and then slab was removed and extremity was supported with arm pouch/sling.

At fourth week of follow up detailed clinical examination was done and the patient was assessed for symptoms like pain, restriction of joint movements, tenderness, nutrition and power of arm and forearm muscles. Check X-ray was taken for radiological assessment of the fracture. Patient was advised for active assisted exercises at home like flexion, extension, internal rotation, external rotation, abduction, adduction without loading.

Patient was advised to follow up at 6 & 8 weeks and patient was clinically and radio logically evaluated for signs of union. K wires are removed once radiological union was confirmed. Patient was followed up for a period of 3 months post operatively.



Fig 1: Positioning of the patient



Fig 2: K-wire insertion technique



Fig 3: Pre-operative X-ray Ap view



Fig 4: Pre-operative X-ray lateral view



Fig 5: Immediate post-op



Fig 6: 2 weeks follow up



Fig 7: 4 weeks follow up



Fig 8: After K-wire removal

Functional outcome



Fig 9: Clinical picture of touching opposite shoulder (Flexion)



Fig 10: Overhead Abduction



Fig 11: Shoulder extension



Fig 12: Shoulder abduction

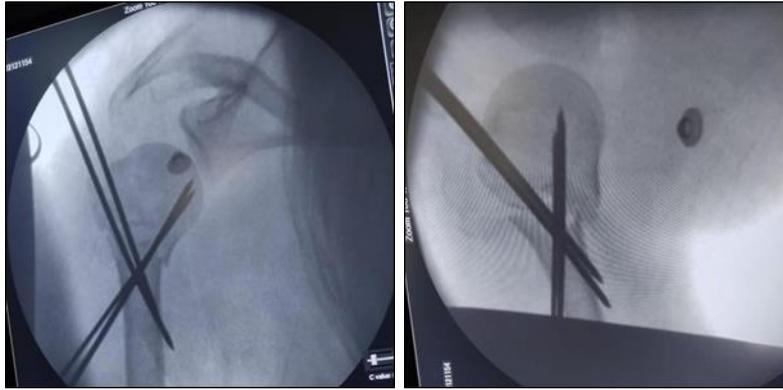


Fig 13 & 14: Intra-operative C-arm



Fig 15: Minimal incision for the insertion of K wires

Results

The present study consists of twenty cases of proximal humerus fracture treated with closed reduction and internal fixation with K wire. All cases were followed up periodically in the department of orthopedics, Vijayanagar Institute of Medical Sciences, Ballari during the study period of June 2019 to September 2021. The following are observations made and data analyzed as follows.

In our series of twenty patients 4 are in the age group of 21-30(20%), 9 are in the age group of 31-40(45%), 2 are in the age group of 41-50(10%), 3 are in the age group of 51-60(15%) and 2 are in the age group of 61-70(10%).

The youngest patient is 28 years and oldest is 70 years, the average age is 35 years.

Table 1: Age distribution

Age	No of patients	Percentage
21-30	4	20%
31-40	9	45%
41-50	2	10%
51-60	3	15%
61-70	2	10%
Total	20	100

In our study 15(75%) are male patients and 5(25%) are female patients. The ratio of Male to Female is M: F=3:1. The incidence is more in males is due to most cases in our study are young patient's sustained fracture due to RTA.

Table 2: Sex distribution

Sex	No. of cases	Percentage
Male	15	75%
Female	5	25%

The most common mode of injury observed in our series was road traffic accident. It accounted for 12 patients (60%). The next common cause was history of fall accounting for 6 patients (30%) and 2 patient had a history of assault (10%).

Table 3: Mode of injury

RTA	12	60%
Fall	6	30%
Assault	2	10%

In our study series the most common type of fracture observed was 2 part fracture accounting for 12 of 20 patients (60%).The next common being 3 part fracture accounting for 6 of 20 patients (30%). In one patient it is 4 part fracture (5%). The fracture dislocation was observed in one patient (5%).

Table 4: Type of fracture

Two part	12	60%
Three part	6	30%
Four part	1	5%
Fracture dislocation	1	5%

In our present study fracture occurred on right side in 11(55%) patients and on left side in 9(45%) patients.

Table 5: Side affected

Side	No. of cases	Percentage
Right	11	55%
Left	9	45%

In our study, we observed that the average time taken for fracture to unite is 12 weeks. In 6 of 20 patients it is 10weeks, among 8 patients it took 12 weeks, in 3 patients 14 weeks took to unite and in another 2 patients 16 weeks taken.

Table 6: Time taken for fracture union:

Time taken for union	No of cases
10 weeks	6
12 weeks	8
14 weeks	3
16 weeks	2
Non-union	1

During the follow up period two patients had shoulder stiffness (10%). Two patients had K wire back out (10%). One (5%) patient had non-union.

Table 7: Complications

Complications	No of cases	Percentage
Shoulder stiffness	2	10%
K wire back out	2	10%
nonunion	1	5%

The final results are evaluated by using NEER'S Score. In our study the minimum score was 70 and maximum of 92. The average score is 82.6. We had excellent results in 5(25%) of patients, 11(55%) had satisfactory results, 3(15%) patients had unsatisfactory, 1 had failure (5%).

Table 8: Functional Assessment

Grading	No of cases
Excellent	5
Satisfactory	11
Unsatisfactory	3
Failure	1

Discussion

Proximal humeral fractures constitute 4-5% of all fractures of long bones. Now a days, its incidence is increasing because of increase in geriatric population with osteoporosis and increased RTA in young population. 80-85% of these fractures are amenable to conservative treatment remaining 15-20% are significantly displaced and require some type of fixation.

In recent years, biological fixation without disturbing the fracture hematoma and without disturbing the soft tissues, proximal humeral fractures can be fixed with K wires.

Patient can be mobilized early, no post-operative wound infections, and very less chance of implant back outs particularly in osteoporotic bone.

The benefit of this technique (percutaneous pinning) is that firstly it is less invasive. The integrity of skin and tissues is respected. Secondly, this is cost effective. Thirdly, less chances of injuring adjacent neurovascular structures. Lastly, the common problem of screw cutout is not an issue in this technique, thus for proximal humerus fracture, fixation with k wire is better option when compared to other modalities of treatment.^{10,11}

The results of our study are comparable with the various prospective studies conducted in other parts of the world and the same are shown below.

1. Age incidence

The average age incidence in our series of 20 patients analyzed, ranging between 18 to 75 years was 35 years, which was consistent with the age incidence in studies done in other studies. In our series 15 out of 20 Patients were below the age of 50 years and hence the average age incidence was 35 years in our series.

Table 9: Comparison of Age

Study	Average age in yrs.
Kenneth A. Egol <i>et al.</i> ^[14]	61
Gerber C <i>et al.</i> ^[15]	44.9
A. Kocalkowski & W. angus Wallace ^[10]	61
Shakeel ahmad qidwai ^[11]	34.04
Khan sm <i>et al.</i> ^[12]	66.66
Our study	35

2. Sex incidence

Regarding sex incidence study of literature reveals predominance of proximal humeral fractures in females in an elderly age group. Studies also reveal that male to female ratio being 1:0.8, in our series the male to female ratio is 3:1. The reason for high incidence of males in our series being that the majority of the cases, 15 out of 20 were within the age of 50 years and 13 among them were

less than 40 years of age and maximum cases are because of RTA. These fractures of proximal humerus have bimodal presentation with adolescents and younger middle age who are more prone for high velocity injuries most common among males forming one group and later these fractures are seen in elderly patients (>50 years) in which cases they are osteoporosis related and most often seen in females.

Table 10: Comparison of Gender

Study	Male : Female	Ratio (M: F)
Kenneth A. Egol <i>et al.</i> ^[14]	18:33	0.5:1
Ash wood N <i>et al.</i> ^[16]	9:23	0.4:1
Shakeel Ahmad Qidwai ^[11]	27:14	2:1
A. Kocialkowski & W. angus Wallace ^[10]	7:15	0.5:1
Our study	15:5	3:1

3. Mode of injury

The mode of injury commonly observed in our series was road traffic accidents accounting for 12(60%), 6 (30%) patients had a history of fall and 02(10%) had a history of assault.

These observations were found to be consistent with the studies in literature. The high incidence of RTA is more in our study because 13 of 20 patients are below 40 years. The most common mode of injury in young patients is RTA and in elderly it is DOMESTIC FALL, which is consistent with world literature.

Table 11: Comparison of Mode of injury

Study	RTA	Fall	Assault
Shakeel Ahmad Qidwai ^[11]	24(58%)	16(39%)	1(3%)
Khan SM <i>et al.</i> ^[12]	63.33%	23.33%	13.33%
Our study	12(60%)	6(30%)	2(10%)

4. Type of fracture

The study of type of fracture in our series revealed 11 (55%) were 2 part fractures, 7 (35%) were 3 part fractures, 01 (5%) was a 4 part fracture and 01 (5%) was fracture dislocation.

These observations were found consistent with other studies.

Table 12: Comparison of Type of fracture

	2 Part #	3 Part #	4 Part #	# Dislocation
Shakeel Ahmad Qidwai ^[11]	18(44%)	11(27%)	12(29%)	00
A. Kocialkowski & W. Angus Wallace ^[10]	18(81%)	2(10%)	2(10%)	00
Our study	12(60%)	6(30%)	01(5%)	01(5%)

5. Complications

- 2 cases developed stiffness of shoulder.

- 2 cases had k wire back out.
- 1 case developed nonunion as she was suffering from systemic disease (b/l ovarian cyst) of 20 cases in our study.

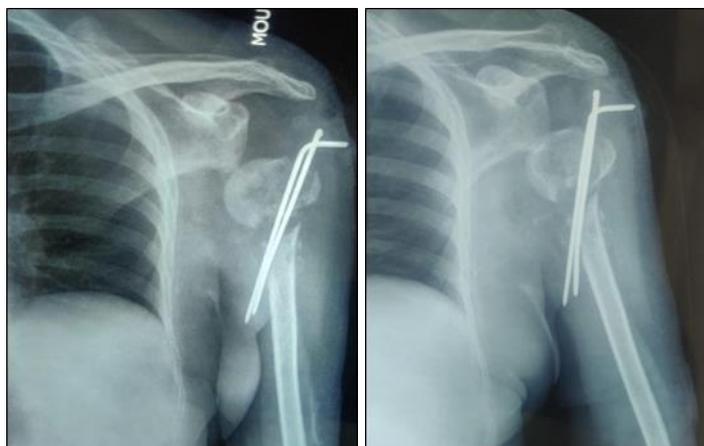


Fig 16 & 17: One of the case developing NON-UNION with subluxation with one of the k wire removed due to back-out

Table 13: Comparison of Complications

	Khan SM <i>et al.</i> [12]	A Kocialkoki & W Anguswalce [10]	Shakeel Ahmad Qidwai [11]	Our Study
Stiffness	09	11	06	02
Pin Tract Infection	01	05	00	00
K-Wire Back out	00	09	00	02
Malunion	04	00	00	00
Non Union	00	02	00	01
Avn	00	02	1	00

6. Results

In our study final functional outcome is assessed with NEER'S score. 5 (25%) of 20 patients had excellent results, 11(55%) had satisfactory results and 3(15%) had unsatisfactory results, 1(5%) had failure.

All cases of unsatisfactory results were had complication and elderly patients. 1 had failure because of systemic disease (bilateral complex ovarian cyst with Diabetes and Hypertension) these results are consistent with other studies too.

Table 14: Comparison of Results

	Excellent	Satisfactory	Unsatisfactory	Failure
Shakeel ahmad qidwai [11]	20(49%)	18(44%)	03(7%)	00
A.kocialkows ki & w.angus Wallace [10]	7(33%)	1(5%)	2(9%)	11(52%)
Khan sm <i>et al.</i> [12]	14(46.66%)	13(43.33%)	3(10%)	00
Our study	5(25%)	11(55%)	3(15%)	1(5%)

Conclusion

Fracture of the proximal humerus is still a debatable and controversial subject in Orthopaedics. Clinical evaluation, obtaining proper radiological views, age of the patient and activity levels holds the key for realistic approach and proper surgical management of these

complex fractures.

The common mode of injury in these fractures is fall on shoulder in elderly and RTA in young population, FIXATION without disturbing the fracture hematoma is essential and determines the outcome in surgical treatment of these fractures, closed reduction and internal fixation with percutaneous pinning with K wires has given good results and it is the implant of choice now a days.

The present study was undertaken to evaluate the functional and radiological outcome of surgical management of proximal humerus fractures.

From the present study it is concluded that the treatment of proximal humerus fracture is closed reduction with percutaneous pinning with K wire fixation as it is least time consuming, easy to operate, less soft tissue damage with good functional outcome.

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