

Functional Outcome of Two Part and Three Part Proximal Humerus Fractures –A Comparative Study Between K-Wire And Plate Fixation

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I. Introduction

Proximal humerus fractures constitute 4-5% of all the fractures. These fractures are more common in the elderly people due to osteoporosis. Management of fractures of the proximal humerus still remains a challenge for surgeons. Like fractures of the hip, proximal humerus fractures are a major cause of morbidity in the elderly population. The common causes for the fractures in the young individuals are the road accidents i.e. high energy trauma. These high energy injuries usually present with more comminution and displacement.

The functional outcome after surgical management depends upon the various factors like fracture reduction, implant selection, Post-operative mobilization and quality of the fixation. Each of the surgical management provides a different functional outcome. Locking plate fixation preserves the biological integrity of the humeral head with safe anatomical reduction by using multiple fixation screws with angle stability there by allowing for an early mobilization of the limb(1). Percutaneous pinning and ORIF-plate fixation can be done in almost all the fractures (2, 3,4 part fractures) except in cases of extensive comminution which needs hemiarthroplasty procedure. Controversy exists in the ideal treatment of proximal humerus fractures

The purpose of the study is to analyse the functional outcome of two part and three part fractures of proximal humerus surgically managed with open reduction and internal fixation with plate and with percutaneous k-wire fixation.

AIM OF THE STUDY: To compare and analyse the functional outcome of the 2 part and 3 part proximal humerus fractures managed with closed reduction and percutaneous k-wire fixation and open reduction and internal fixation with angle stabilised plate.

II. Materials and methods:

The study is done between 2009 and 2012 in PSG institute of medical sciences in the department of Orthopaedics. The study is both retrospective and prospective. Data from the previously operated patients from 2009-2010 were collected and patients who presented with two part and three part fractures from 2010 to 2012 were surgically managed and included in the study if they met the inclusion and exclusion criteria.

Inclusion criteria

- Patients older than 18 yrs old.
- Displaced proximal humerus fractures 2, 3 part fractures with displacement of 1cm or 45 degree angulation.

Exclusion criteria

- Patients younger than 18 yrs.
- Proximal humerus involving shaft of humerus.
- Undisplaced fractures.
- Two part greater tuberosity and lesser tuberosity fractures.
- Fractures involving the articular surface.
- Four part fracture.
- Pathological fractures.
- Proximal humerus fracture with nerve injury.
- Fracture dislocation.

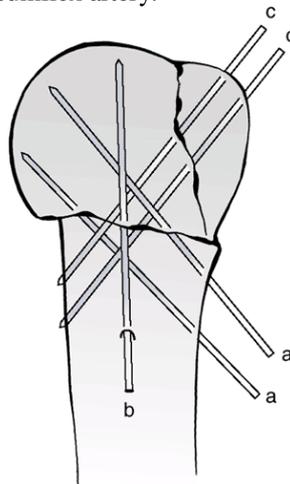
On admission in the emergency department routine anteroposterior and axillary view of the shoulder are taken. The limb is temporarily stabilized with the u-slab. The fractures are classified based on the Neers classification of proximal humerus. The fracture is considered to be displaced when the displacement is more

than 1 cm and angulation is more than 45degree. Two modes of fixation adopted here are k-wire and plate fixation.

Surgical Technique

K-wire-fixation: Fracture reduction is achieved under the c-arm fluoroscopy using a combination of closed manipulation and percutaneous introduction of instruments and pin to act as a joystick that manipulates the fragments. Once reduction is achieved, definitive fixation is achieved using threaded k-wires inserted across the key fracture fragments. Through small incision the pins are placed and a curved hemostat is used to dissect down to the periosteum and tomobilize soft tissues to avoid neurovascular injury. Two or three pins placed in the shaft to head fragments in retrograde manner. Entry point of the k-wire should be distal to the fracture line to gain adequate purchase of the intact humeral shaft cortex. Pins are passed from anterolateral to posteromedial , because of the anatomic retroversion of the humeral head.

If tuberosities are fractured they are secured with k-wires placed under c-arm guidance through greater tuberosity , approximately 1cm distal to the rotator cuff insertion, engaging the medial cortex to the shaft fragment. At this point care should be taken not to advance the pins past the medial cortex to avoid damaging the axillary nerve or posterior humeral circumflex artery.



Open reduction and internal fixation of the proximal humerus.

Implant used:PHILOS plate

Deltopectoral approach

Incision- made in the deltopectoral groove

The superficial surgical dissection - between pectoralis major and the deltoid muscle, the cephalic vein is retracted medially or laterally.

Deltoid is retracted laterally and pectoralis major retracted medially to expose the lateral surface of the proximal humerus. Reduction of the fracture fragments is done in all the three planes. Varus and valgus deformities of the head can be corrected by the eccentric insertion of the k-wires, elevators, or osteotomes in to the head. These are then used as joysticks to correct the deformity. Once head has been sagittally and coronally reduced, anatomic reduction can usually be achieved by correcting any translation of the shaft under the head. The shaft is characteristically displaced anteromedially, because of the pull of the pectoralis major. Reduction is achieved by lateralizing the shaft directly by reduction forceps or indirectly by pressure in the axilla.

The tuberosity fragments are reduced temporarily with the k-wires. Plate is placed on the lateral wall of the proximal humerus. The anterior free edge of the plate should be placed just posterior to the bicipital groove to facilitate the insertion of the screws centrally or slightly posteriorly in the humeral head. The plate must be cranial enough to allow screws to be inserted centrally in to the head in the anterior projection. Three or four screws are inserted distal to the fracture, with four to six head screws proximally, depending on the bone quality. Once all the screws are fixed reduction and the position of the screws are checked under the fluoroscopy in both anteroposterior and the axial views.

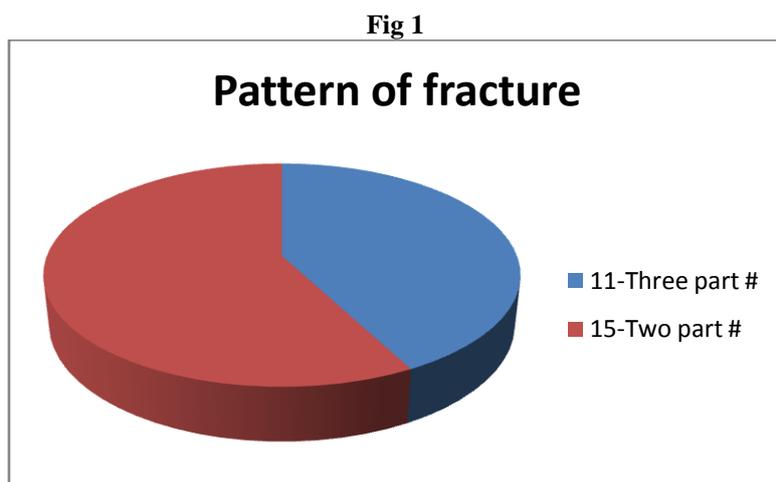
X-rays shoulder Ap view showing the proximal humerus are obtained post operatively. In plate fixation Active elbow mobilization is started immediately on the first post operative day. Active and passive Flexion , extension, abduction of about 30 degree are started after one week.. Full range of motions is started 3-4 weeks postoperatively. But in k-wire fixation mobilization are started only after 4-5 week when x-ray shows signs of union and no evidence of further collapse.Suture removal is done in the tenth post-operative day Patients are advised to review at 2 months, 6 months and 1 year duration. At each review x-rays -antero posterior view of the shoulder with proximal humerus taken and patients are assessed clinically for the range of movement.

Functional outcome of the shoulder is assessed by Constant murley scoring system usually after five or six months follow up when the patient completes the full course of physiotherapy. Total score is 100. Grading of the shoulder score is done as excellent when the score is greater than 85, good-71-85, fair 61-70 and poor less than 60 or less.

III. Result

Totally 42 patients presented with proximal humerus fractures between 2009-2012 out of which 7 patients had 2 part greater tuberosity fractures, 4 patients had fracture dislocation of the shoulder, 3 patients were conservatively managed for two part proximal humerus fracture due to multiple medical co morbidities, 1 patient died and 1 patient had associated supracondylar fracture of humerus so totally 16 patients were excluded from the study. Out of this 26 patients remained for the study.

There were 18 male patients and 8 female patients. Mode of injury for these patients was road traffic accidents in most of the patients (20 pts) and self-fall (6 pts) in rest of the patients.



There were 11 three part fractures and 15 two part fractures (Fig 1), out of these 11 three part fractures four underwent k-wire fixation and 7 plate fixation. Out of 15 two part fractures 7 underwent k-wire fixation and 8 plate fixation (Table1, Fig 2). Based on the pattern of fracture two fracture patterns were analysed three part greater tuberosity with surgical neck fracture and two part surgical neck fracture (Fig 3). Among 11 k-wire fixations 8 pts were operated between 2009-2010 and 3 pts operated from 2010-2012 and among 15 plate fixation all were operated after 2010.

Out of 26, 15 pts operated on the right side and 12 patients operated on the left side. Average age of the patients operated being 47.42 with highest age of 86yrs in k-wire fixation and lowest of 22yrs in plating. Average age of patients who underwent k-wire fixation was 59yrs (range being 26-86 yrs) and average age of plate fixation group was 56.66 yrs (range being 22-63 yrs)

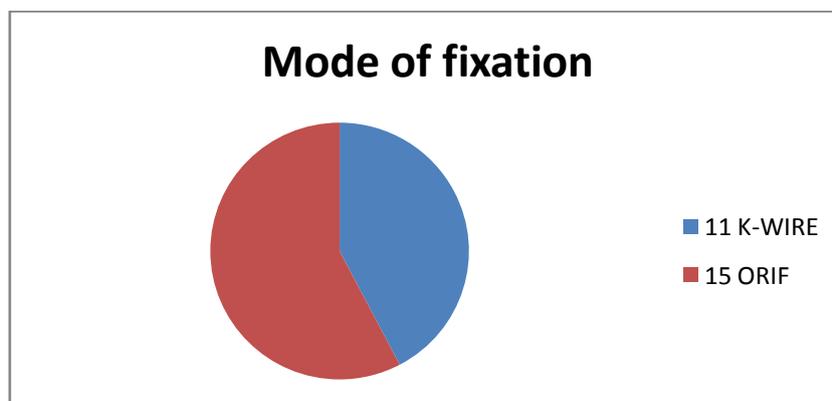
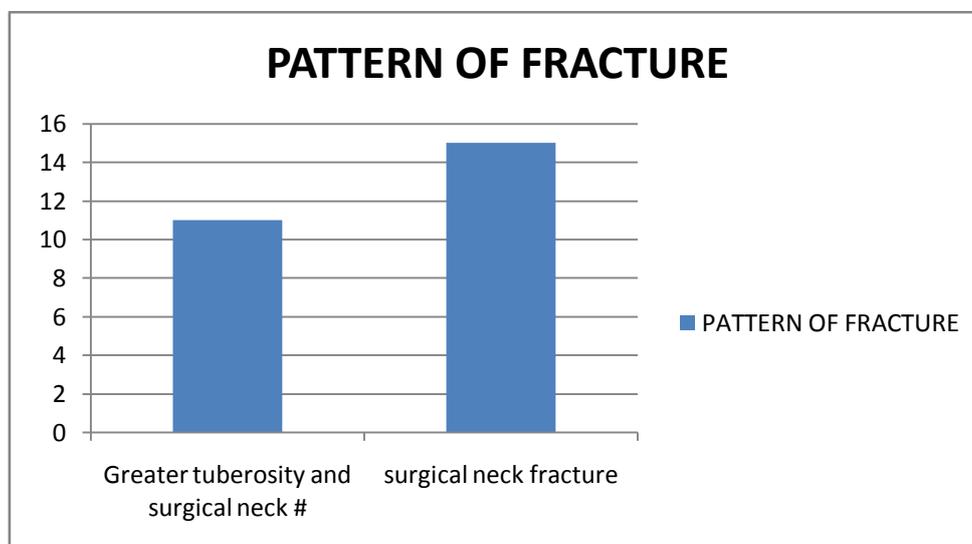


Fig2

Table 1

Fracture pattern	K-wire	ORIF
Two part #(15)	7	8
Three part #(11)	4	7



Y axis –No of patients

Fig:3

One of the patient sustained fracture in the same limb with proximal humerus fracture during follow up who was already fixed with K-wire fixation. This patient was again managed with open reduction and internal fixation with plate. One patient had implant loosening and pin site infection during follow up and the patient was managed with antibiotics and k-wire removal. No other complication was seen in k-wire fixation. No complication like avascular necrosis, non union or implant failure was seen in plate fixation.

Average functional outcome in the K-wire group was 74.90 and 81.13 in ORIF. Out of all the patients functional outcome was excellent in 8 patients (30.7 %), good in 14 patients (53.84 %) and fair in 2 patients (7.69 %) poor in 2 patients (7.69%) (Fig 4, Fig 5). The average functional outcome of the Plate fixation was higher than that of the k-wire fixation. Among plate fixation 7 patients had excellent functional outcome (53.33 %), 6 patients had good functional outcome (40 %), 1 patient had poor functional outcome (6.66 %) and in k-wire fixation 1 patient had excellent functional outcome (9.09 %) and 8 patients had good functional outcome (53.33%) and 1 patient had poor functional outcome (9.09 %).

The functional outcome of the patients who underwent k-wire fixation below the age of 60 yrs (5 pts) was 81.6 and more than 60 yrs of age (6 pts) was 66.8. Similarly functional outcome of plating below sixty years (10 pts) of age was 85.3 and more than 60 yrs (5 pts) of age was 72.8 (Fig 6,7,8,9)

Table: 2

Functional outcome	K-wire	ORIF
Excellent	1	7
Good	8	6
Fair	1	1
Poor	1	1

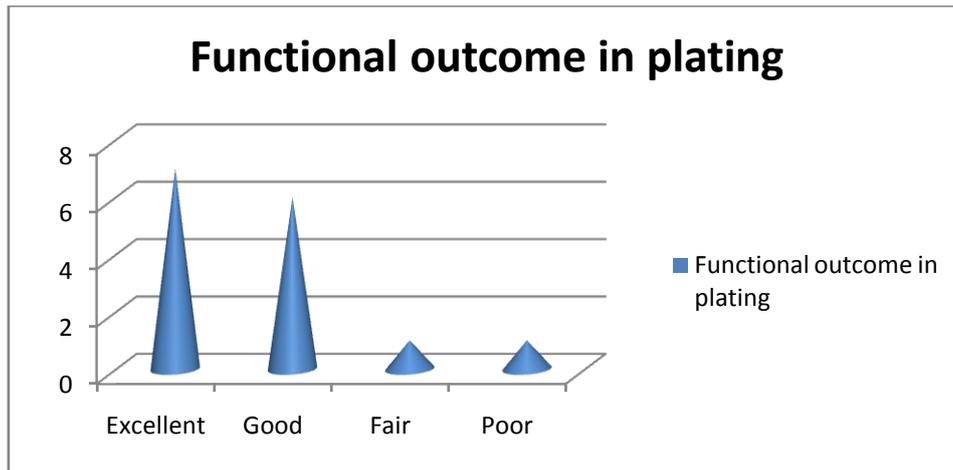


Fig:4

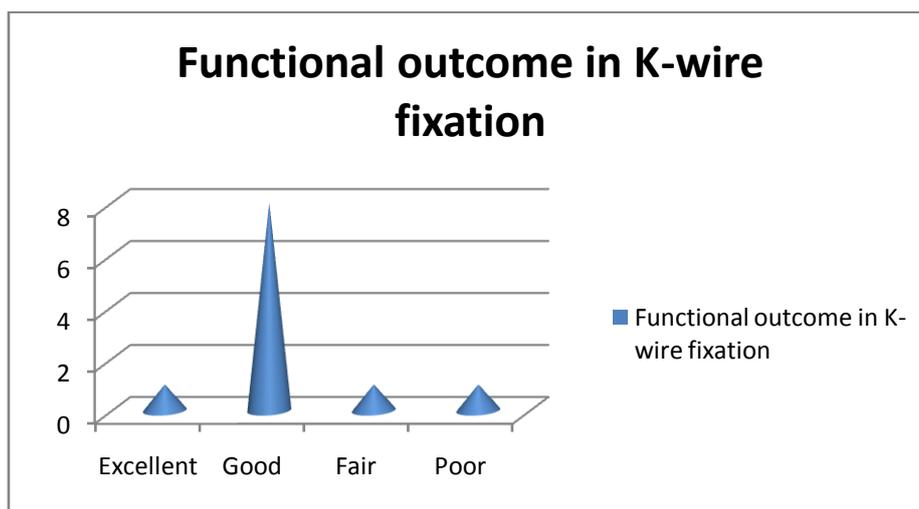
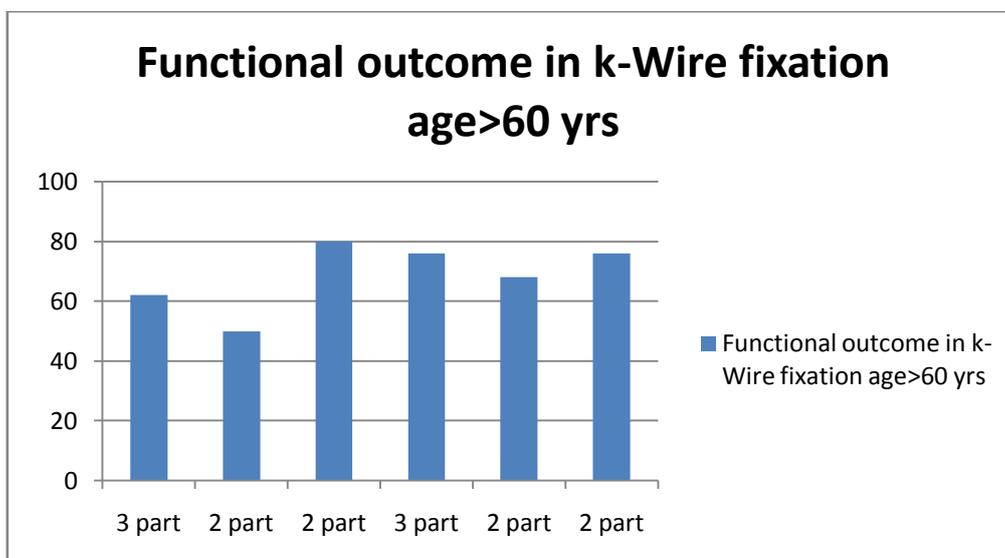
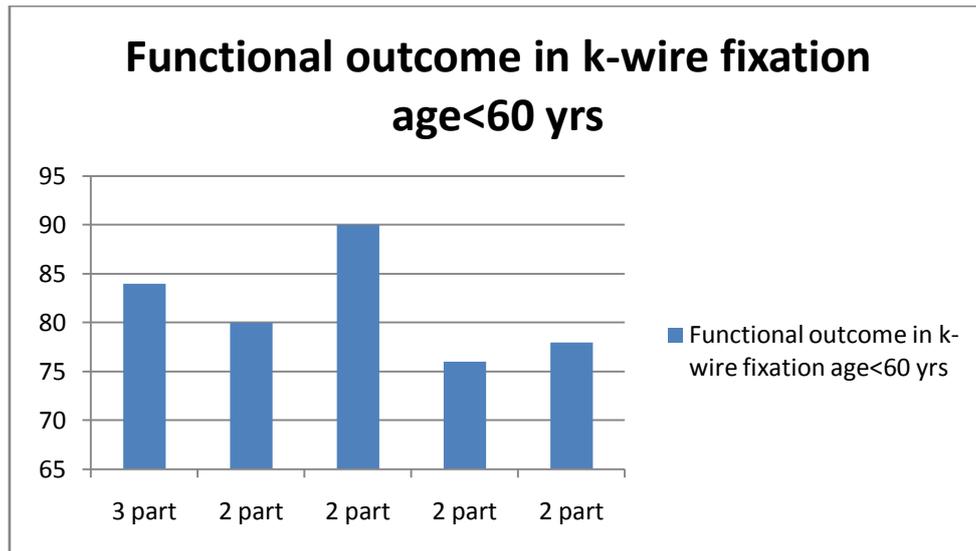


Fig:5

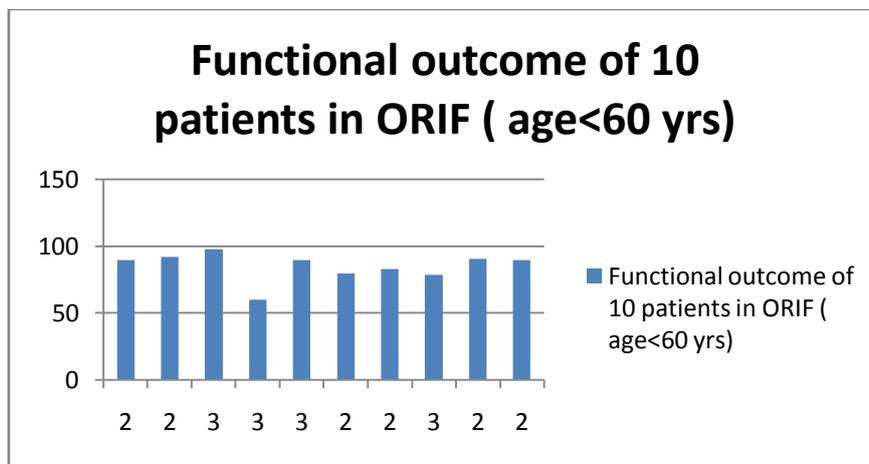


Y-axis functional outcome
Average functional outcome= 68.66

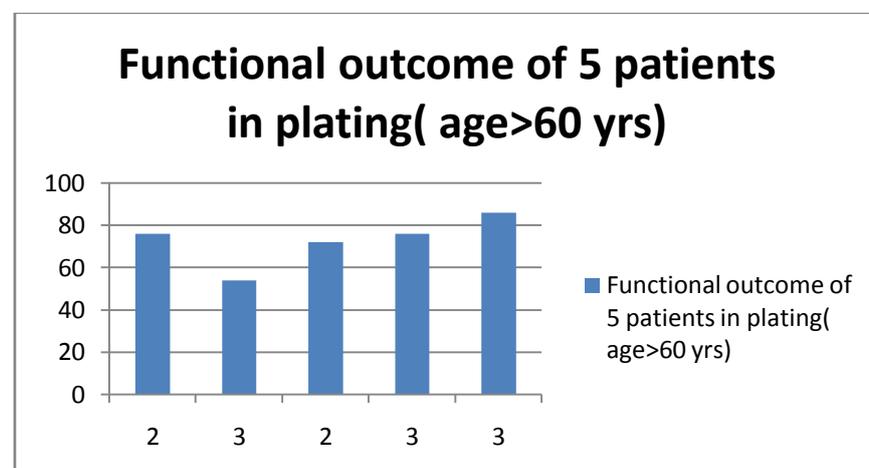
Fig : 6



Y-axis-Functional outcome
Average functional outcome=81.6
Fig: 7



X- axis Type of fracture, Y-axis Functional outcome
Average functional outcome - 85.3
Fig: 8

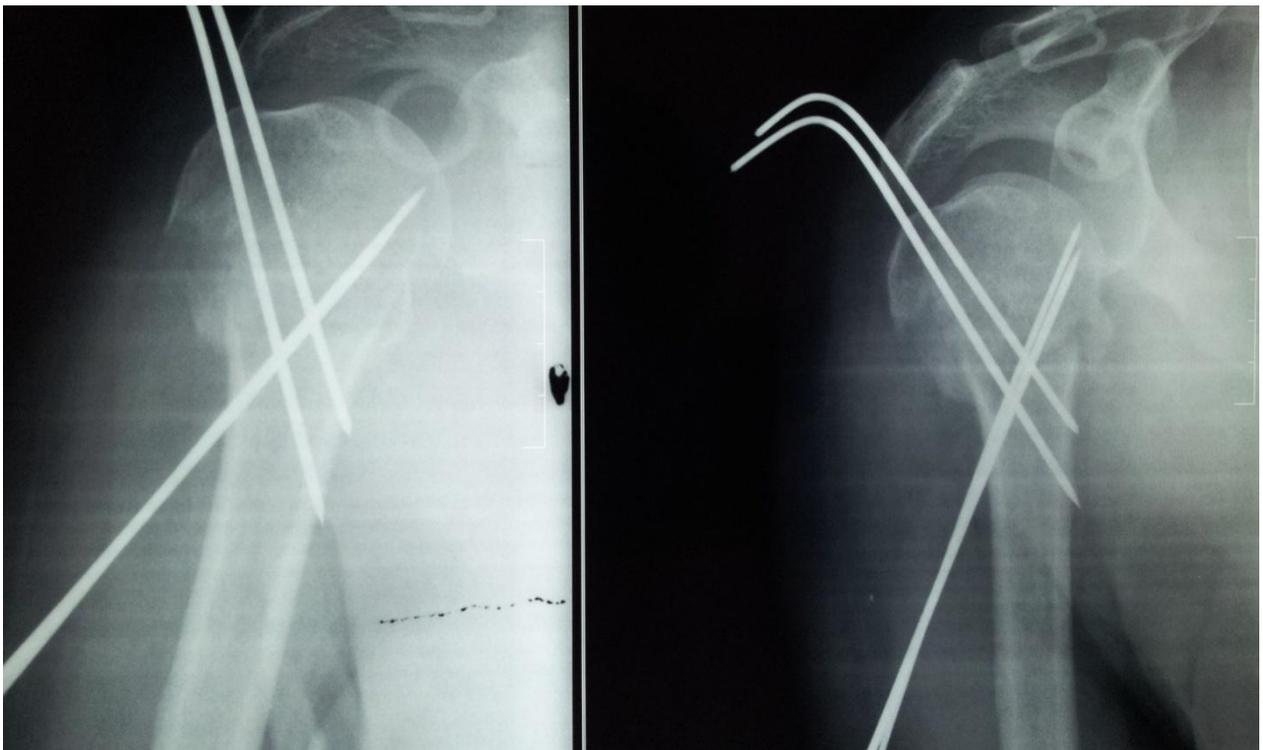
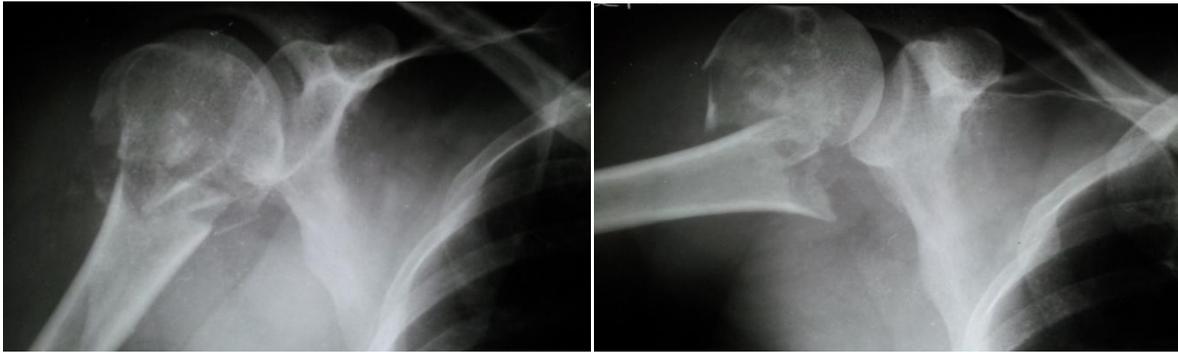


X- axis Type of fracture, Y-axis Functional outcome
Average functional outcome-72.8
Fig: 9

Patient 1



Patient 2





IV. Discussion

Proximal humerus fractures constitute about 5 % of all the fractures. The main cause being the road traffic accidents in young adults and trivial fall in the elderly people. Many treatment options are available for the proximal humerus fractures like Conservative management, k-wire fixation, percutaneous screw fixation, plating, trans osseous suture fixation, intramedullary nailing and hemiarthroplasty.

Twenty percent of the fractures of the proximal humerus are displaced and unstable (2-4). Functional results following fixation of these fractures vary with different mode of fixation. In conservative management there is long period of immobilization, the union of the fracture is relatively good but the functional results of the conservative management are unsatisfactory (5). More severe the fracture pattern i.e. four part fractures less is the functional outcome in the conservative management.

Hemiarthroplasty are usually indicated for severely comminuted fractures like four part fractures and fracture dislocations. Closed reduction and percutaneous fixation of unstable fractures of the proximal part of the humerus involves less soft tissue dissection and may reduce operative morbidity (6-10). Complications encountered in the percutaneous k-wire fixation are pin tract infection, pin migration and improper reduction because of closed reduction manoeuvre.

Baldev et al studied functional outcome of patients managed with k-wire fixation. The study group consisted of twenty patients with three and four part fractures. The minimum follow up of the patients was 12 months. All the three part and the four part fractures were managed with k-wire fixation. Out of all these patients four patients had pin site infection, four patients had mal-union, one patient had non-union and no patients had avascular necrosis of the humeral head. From his study the average constant score was 73.65 % out of these 10 % had excellent functional outcome, 55 % had good functional outcome, 20 % had moderate and 15 % had poor results (11).

Open reduction and internal fixation offers anatomical reduction with rigid fixation of the fracture fragments and early mobilization of the shoulder (12). Burke et al in their study on open reduction and internal fixation of the proximal humerus fractures with the locking plate had higher complication rate with 7.9 %

avascular necrosis, 11.7 % screw cut out and 13.7 % needed revision surgery. These complications of the locking plate can be prevented by good surgical technique (13). Geiger Ev et al studied on 28 patients with two part, three part and four part proximal humerus fractures managed with the philos plate fixation. The complication included avascular necrosis in 7.2 % of the patients, sub acromial impingement in 21.4 % of patients, loosening of the locking head screw in 3.6%, decreased radial nerve sensation in 7.2 %.

In our series of 26 patients the overall functional outcome of all the patients are good either in k-wire fixation or in plate fixation. 30.76 % of the patients have excellent functional outcome, 53.84 % have good functional outcome and 7.69 % have fair functional outcome, 7.69 % of the patients have poor functional outcome. Among this 7 patients had excellent functional outcome in plating compared to that of 1 patient in k-wire fixation. Only 2 patients presented with poor functional outcome one in k-wire fixation and another one in plate fixation. The average functional outcome is higher in case of the plating 81 than with 71.54 in k-wire fixation. The functional outcome of the patients who underwent k-wire fixation below the age of 60 yrs (5 pts) was 81.6 and more than 60 yrs of age (6 pts) was 66.8. Similarly functional outcome of plating below sixty years (10 pts) of age was 85.3 and more than 60 yrs (5 pts) of age was 72.8. So patients who were less than 60 yrs of age had only a marginally better functional outcome than patients who were more than 60 yrs of age.

The probable reason suggested for the higher functional outcome in group would be rigid fixation and early post-operative mobilization.

This study consisted of only two part surgical neck fractures and 3 part surgical neck and greater tuberosity fractures. so the complication like AVN commonly seen in four part fracture were not encountered in these patients. In k-wire group only one patient had pin loosening and infection which necessitated pin removal. In plate fixation no major complications were seen.

Operating time and morbidity is less in k-wire fixation when compared to plate fixation but the disadvantage is closed reduction may be sometimes difficult especially in three part fracture and problems of loosening and migration. Another complication is k-wire fixation offers less rigid fixation and active mobilization are started after 4.5 weeks when union is evident. Compared to k-wire fixation the main advantage of the plate fixation is even though morbidity of the surgery is more, early mobilization can be started as early as one week. The problem of the screw loosening seen in older buttress plate is not encountered with locking plates. Edelmann K et in their study osteosynthesis of three part and four part fractures found functional results of k-wire was poor compared to angle stable implants and recommended not to use k-wires osteosynthesis (14) but in our study only two part and three part fractures were included and functional outcome of fractures managed by k-wire is marginally low when compared with the plating.

The main limitation of the study is the less number of the patients for the comparative study between both the groups. We need large number of the patients to find out significant difference in functional outcome between two groups

V. Conclusion:

Plate fixation offered a better functional outcome compared to that of the k-wire fixation in two part and three part fractures. Plating (angle stabilized plate) can be better choice of management in 2 part and 3 part fractures in terms of functional outcome. But people with multiple co morbidities who may not be fit for prolonged anaesthesia k-wire fixation is still be an option.

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