



COMPARATIVE STUDY SHOWING FUNCTIONAL OUTCOME OF PROXIMAL HUMERUS FRACTURE FIXATION WITH PHILOS PLATING V/S PERCUTANEOUS K-WIRE FIXATION.

Orthopaedics

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ABSTRACT

Background: There is still a lot of debate, regarding the most effective ways to treat displaced proximal humerus fractures. Numerous fixing techniques been developed for proximal humerus fractures (like percutaneous pinning, tension band wiring, screw fixation, conventional plate, T buttress plate, locking plate, prosthetic replacement). Close reduction & percutaneous k-wire fixation having advantage being minimal invasive, less soft tissue stripping, with less blood loss, hence useful in elderly patients. But implant of choice for treating displaced proximal humerus fractures is locking plate because it provides absolute anatomical fixation with angular stability. This study evaluates prospectively, the functional outcome following PHILOS vs percutaneous pinning in proximal humerus fractures. **Methods:** 30 patients were enrolled for study based on OPD & trauma centre admissions based on inclusion & exclusion criteria. Patients were grouped into two groups based on consecutive sampling. Group A (15 Patients) {ODD} includes first patients, Group B (15 Patients) {EVEN} includes second patients. Group A operated with proximal humerus internal locking system (PHILOS), & Group B with percutaneous K-wire fixation. Functional outcome was assessed by NEER's Score. **Results:** Functional outcome at end of 6 months, based on Neer's Score, in group A, came out to be excellent in 12 (80%) and satisfactory in 3 (20%). In group B, excellent in 5 (33.3%) and satisfactory in 10 (66.6%). In Group A, 2 patients developed complications i.e., 1 patient had shoulder stiffness & 1 patient had superficial infection. In Group B, 6 patients developed complications i.e., 4 patients had shoulder stiffness only, 1 patient had superficial infection only and 1 patient had both shoulder stiffness and superficial infection. **Conclusion:** PHILOS plate provides excellent functional outcome with minimal complications for displaced proximal humerus fractures compared to percutaneous k wire fixation.

KEYWORDS

Proximal humerus Fracture, PHILOS, NEER's Score, Percutaneous pinning.

INTRODUCTION

Proximal humerus fracture represents 2nd most common fracture (29.1%) in upper extremity after Colle's fracture (37.2%), constitutes 4-5 % of all fractures.¹ The head, anatomical neck, greater tuberosity, lesser tuberosity, surgical neck, and intertubercular sulcus are all part of the proximal humerus. In elderly patients due to osteoporosis, this fracture is common due to fall from standing height & less frequently in adults due to high energy trauma.² Factors deciding treatment options includes patients age, fracture pattern, bone quality, patient's requirements & physical activities, & surgeon's familiarities with procedure. There is still a lot of debate, regarding the most effective ways to treat displaced proximal humerus fractures.³ Numerous fixing techniques been developed for proximal humerus fractures (like percutaneous pinning, tension band wiring, screw fixation, conventional plate, T buttress plate, locking plate, prosthetic replacement). Although most of the proximal humerus fractures are non-displaced; displaced fracture requires anatomical reduction & stable internal fixation to enable early range of motion, resulting in excellent functional outcome. Every fixation method having its own advantage & complications. Among various methods of fixation, desired results can be achieved either by closed reduction & percutaneous pinning or open reduction and internal fixation with PHILOS plate.⁴ Closed reduction & percutaneous k-wire fixation having advantage being minimal invasive, less soft tissue stripping, with less blood loss, hence useful in elderly patients.^{5,6} Open reduction and internal fixation with pre countered PHILOS plate, providing absolute anatomical fixation with angular stability has become implant of choice for treating displaced proximal humerus fractures in younger patients.⁷ Rotator cuff tendon secured with tension band sutures through holes in PHILOS plate, provide additional stability to construct, thereby increasing functional outcome. But extensive surgical exposure can result in neurovascular damage & avascular necrosis of humeral head. Aim of this study is to evaluate functional outcome & compare results of PHILOS plating v/s percutaneous k-wire fixation for proximal humerus fractures.

MATERIAL & METHODS:

This study was done prospectively and randomised, in the Department of Orthopaedics and Trauma Centre in Jaya Arogya Group of Hospitals, Gwalior (M.P.). 30 patients were enrolled for study based on OPD & trauma centre admissions based on inclusion & exclusion criteria. (Table1)

Table 1: Inclusion & Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Neer's two, three, or four parts fractures (displaced proximal humerus fractures).	Neer's one-part fractures (undisplaced proximal humerus fractures).
Associated dislocated shoulder.	Pathological fractures from primary or metastatic tumours
Proximal humerus fractures, both open and closed.	Proximal humerus fracture in skeletally immature patients.
Proximal humerus fracture in skeletally mature patients.	Fractures associated with neurovascular deficits.
Failure of conservative treatment.	Medically & surgically unfit for surgery.
Patients with complete clinical records.	Shaft humerus fractures with proximal extension.
Medically and surgically fit for surgery.	Pre-existing Shoulder pathology.
Preoperative ambulatory patient.	Significant cognitive impairment.
Patients who have given consent to this study.	Refusal to consent.

Patients were grouped into two groups based on consecutive sampling. Group A (15 Patients) (ODD) includes first patients, Group B (15 Patients) (EVEN) includes second patients. Group A operated with proximal humerus internal locking system (PHILOS), & Group B with percutaneous K-wire fixation. All these 30 patients were followed for mean duration of 6 months. Functional outcome was assessed by NEER's Score.

Fracture was classified based on Neer's Classification. Pre-operatively AP, Lateral & Axillary views were taken. 3D-CT scan was done to evaluate fracture configuration. Shoulder was immobilized pre-operatively with shoulder immobilizer. Surgery was done in beach chair position under general anesthesia. Prophylactically all patients received, intravenous antibiotics preoperatively.

Group A Operative Technique Proximal humerus fracture was treated with open reduction and internal fixation with PHILOS plate, under aseptic precautions, by deltopectoral approach. Fracture reduction done under C-Arm guidance & provisional fixation with K-wire was done. Definitive fixation with PHILOS plate was done. Plate was

aligned properly along the shaft of humerus, about 5-8 mm distal to tip of greater tuberosity, slightly posterior to bicipital groove (2-4 mm). Calcar screw providing inferomedial support, prevent secondary loss of fracture reduction. Rotator cuff tendon sutures were passed through their tendon insertion to the plate holes, improves stability of construct. After all screw fixation, fracture reduction & screw position was checked under C-Arm in AP, Lateral & Axial views. Shoulder range of motion and impingement was checked. Closure was done in layers with suction drain.

Group B Operative Technique For deciding, safe starting point for greater tuberosity & proximal lateral pins, we followed the criteria from millet et al⁷ and Rowles⁷. Under fluoroscopy, 1 k-wire of size 3.5 mm can be used as a joystick for fracture reduction then 3-4 threaded K-wire of size 2.5 mm were passed, depending upon number of fracture fragments. During pin placement care was taken to avoid injury to anterior circumflex humeral artery, axillary nerve & radial nerve. Extra part of K-wire was cut & bend, which prevents its proximal migration. Pin tract dressing was done. Wrist & elbow active ROM exercise started on 2nd postoperative day.

Post-Operative Protocol: Active ROM of elbow, wrist, hand started immediately after surgery. Passive ROM exercise (Pendulum, passive forward elevation, external rotation) begun on 1st postoperative day. Patients progressively passed through three phase rehabilitation program, passive assisted exercise early which helps to avoid adhesion formation, active exercise 4 weeks post operatively, then strengthening or resisted exercise 6 to 8 weeks post operatively. Immediate post operative shoulder anteroposterior, lateral, & axillary view were taken. Follow up radiograph were taken at 1st week, 2nd week, then every month, till fracture union or up to 6 months and to access fracture reduction, consolidation evidence of callus formation & status of pin. K-wire removal done after 6-8 weeks, depending upon radiographic finding.

RESULTS

Mean age was 57.23 years, youngest being 45 years and the oldest being 68 years. Mean age in group A 55.45 years, in group B 58.68 years. Maximum patients being in 6th decade. In group A, 9(60%) were male, 6 (40%) were female; while in group B, 8(53.33%) were male and 7(46.66%) were female. Most common mode of injury was slip on floor i.e., 23 (76.66%), followed by road traffic accident in 6 patients (20%) and physical assault in 1 (3.33%) patient. 18 (60%) patients had right proximal humerus fracture and 12 (40%) patients had left proximal humerus fracture. According to Neer's fracture pattern, 3 patients with 2 parts, 7 patients with 3 parts, 5 patients with 4 parts were in group A treated with PHILOS plating. 6 patients with 2 parts, 7 patients with 3 parts, 2 patients with 4 parts were in group B treated with percutaneous K-wire fixation. The average time between fracture & operative intervention was 4.3 days in group A, 2.6 days in group B. Average blood loss was 83.2 ml in group A, 15.8 ml in group B. Percutaneous pinning technique results in significant less blood loss in group B. Mean operative time was 121.6 minutes in group A, 61.5 minutes in group B. Group B showing less surgery time attributed to close reduction & percutaneous pinning. Neer's Score at end of 6 month, in group A excellent in 12(80%), satisfactory in 3 (20%). In group B, excellent in 5 (33.3%), satisfactory in 10 (66.6%). In Group A, 2 patients developed complications i.e., 1 had shoulder stiffness & 1 had superficial infection. In Group B, 6 patients developed complications i.e., 4 had shoulder stiffness only & 1 had superficial infection only, 1 had both shoulder stiffness with superficial infection. (Table 2-3)

Table 2: Patients Demographic Data's

Mean Age	57.23 Years	
Youngest	45 years	
Oldest	68 years	
Male: Female	1:1	
Mode of Injury	Slip on floor	23 (76.66%)
	Road Traffic accident	6 (20%)
	Physical assault	1 (3.33%)
Fracture Side	Right	18 (60%)
	Left	12 (40%)

Table 3: Study Results

Parameters	Group A	Group B
Mean Age (Years)	55.45	58.68
Males	9 (60%)	8 (53.33%)

Females	6 (40%)	7 (46.66%)	
Time interval between Fracture & operative intervention	4.3 days	2.6 days	
Average blood loss (ml)	83.2	15.8	
Mean operative time (Minutes)	121.6	61.5	
Neer's Fracture Pattern	2 parts	3	6
	3 parts	7	7
	4 parts	5	2
Neer's Score (At 6-month end)	Excellent	12 (80%)	5 (33.3%)
	Satisfactory	3 (20%)	10 (66.6%)
Complications	Shoulder stiffness	1	4
	Superficial infection	1	1
	Shoulder stiffness with Superficial infection	0	1

DISCUSSION

Displaced proximal humerus fracture requires surgical management for better functional outcome. Most of proximal humerus fracture occurs at home, by falling on level ground.^{2,10,11} In ≥60 years, ≥90% cases results from fall from standing height.¹² In Young, high incidence due to outdoor activities like sports, assaults, high energy trauma (RTA).^{2,11,13,14} Numerous fixing techniques been developed for proximal humerus fractures (like percutaneous pinning, tension band wiring, screw fixation, conventional plate, T buttress plate, locking plate, prosthetic replacement). In current scenario, to regain early range of motion, simultaneously avoiding complication related to conservative management like shoulder stiffness, internal fixation is considered as standard treatment.

Closed reduction & percutaneous pinning having advantage of being minimal invasive, less soft tissue stripping, with less blood loss, hence useful in elderly patients, but its limitations are cosmetic issue, poor fracture reduction, pin tract infection, longer recovery time. Open reduction & internal fixation with PHILOS plate, advantages being absolute anatomical reduction, providing 3-dimensional stable internal fixation and with adequate surgical technique & intensive rehabilitation programme we have decreased the complications to minimal, ensuring excellent functional outcome.

Mean age in group A 55.45 years, in group B 58.68 years, with maximum patients in 6th decade, was comparable with study done by Wjgman, Roolker et al¹⁵ in 52 patients, with mean age of 48 years. Moonot P, Ashwood N et al¹⁶ studied 32 patients, with mean age of 59.9 years. Sharma et al¹⁷ studied 25 patients with mean age of 43.64 patients.

Group A include 9 males, 6 females. Group B includes 8 males & 7 females. Our study can't predict which sex is more vulnerable to slip on floor. Sharma et al¹⁷ studied 25 patients, showing significant male preponderance 76% for proximal humerus fractures.

Most common mode of injury was slip on floor accounting for 23 cases (76.66%). Kumar et al¹⁸ study showing RTA being most common mode of injury. Kumar et al¹⁸ study showing maximum patients were due to RTA. MA Fazal et al¹⁹ studied 27 patients, in which fall on ground most common cause followed by RTA.

18 patients (60%) having right side fracture in our study, was comparable to findings of Bjorkenheim et al.²⁰

Time gap between fracture & operative intervention, in group A 4.3 days, in group B 2.6 days. This gap was due to delay in reporting of patients after trauma & taking surgical fitness. Sharma et al¹⁷ in their study showed similar average delay of 3.28 days between fracture & operative intervention.

Average blood loss 83.2 ml in group A, 15.8 ml in group B. Significant less blood loss in group B pertaining to close reduction & percutaneous pinning technique. Group B being open procedure, with soft tissue dissection, resulting in comparatively more blood loss. Kumar et al¹⁸ study showed mean blood loss of 710±105.56 in PHILOS group, 127±18.23 ml in K-wire group, was statistically significant. Sreen et al²¹ study showing mean blood loss of 600 ml in PHILOS group, 100 ml in K-wire group.

Mean operative time was 121.6 minutes in group A, 61.5 minutes in group B. Significant less time in group B pertaining to close reduction

& percutaneous pinning technique. Kumar et al¹⁸ study showing mean operative time of 102±9.22 min in PHILOS group, 60.67±23.06 min in K-wire group. Sreen et al²¹ study showed mean operative time of 100 min in PHILOS group and 50 min in k-wire group. Functional outcome based on Neer's Score at end of 6 month, in group A excellent in 12 (80%), satisfactory in 3 (20%). In group B, excellent in 5 (33.3%), satisfactory in 10 (66.6%). No patients were unsatisfactory/failure in any group. At follow up period of 6 month PHILOS clearly performed better than percutaneous pinning in terms of final functional outcome and complications. Akshat Vijay et al²² study results show, in group A (treated with PHILOS group) excellent in 7, satisfactory in 13, In group B (treated with K-wire) excellent in 5, satisfactory in 7. Singh et al²¹ study results show, in group A (treated with K-wire fixation) excellent in 7(28%), satisfactory in 12 (48%), unsatisfactory in 2(8%), poor outcome in 4 (16%), in group B (treated with PHILOS plate) excellent in 12(48%), satisfactory in 9(36%), unsatisfactory in 2(8%), poor outcome in 4 (16%).

In our study group A, 1 patient developed shoulder stiffness, in spite all phases of physiotherapy & 1 patient developed superficial infection. 6 complications were seen in group B (K-wire), 4 had shoulder stiffness only & 1 had superficial infection only, 1 had both shoulder stiffness with superficial infection. Infection was treated with daily dressing, & intravenous antibiotics after getting culture sensitivity reports. Vijay et al²² carried out a study on 48 cases and found ten complications (subacromial impingement-1, screw perforation-1, infection-1, malunion-2, stiff shoulder-3, and pain in shoulder-2) were seen in six patients (25%) treated with PHILOS and 17 complications (K-wire migration-2, infection-2, malunion-4, stiff shoulder-6, and pain in shoulder-3) were seen in 10 patients (41.1%) fixed with K-wire. Pawaskar et al²³ found mean loss in neck-shaft angle in the first 3 months was 3.8° as compared to 1.3° in the period between 3 months and final follow up. (Figure 1,2 Case illustration).



Figure 1: Case illustration: Group A (PHILOS Plating)



Figure 2: Case illustration: Group B (Percutaneous K-Wire fixation)

CONCLUSION

Our study concluded that, PHILOS plate provide, excellent stable fixation, even in comminuted proximal humerus fractures, owing to its

angular stability, better biomechanical properties, adequate buttressing, enhanced anchorage, load sharing support preventing secondary loss of reduction, less stiffness, less pain, enabling greater range of motion, to early regain function activities. By adequate surgical exposure, complications were decreased to minimum, & with intensive rehabilitation programme, it provides excellent outcomes. Functional outcome in terms of range of movement (in all planes) was better in patient treated with PHILOS as compared to K-wire at the end of 6 month follow-up. Similar study conducted upon 20 patients with PHILOS plating by Akel et al²⁴ showed stable fixation, enabled an early range of motion exercise to achieve acceptable functional result. Study conducted by Singh et al²¹ found that PHILOS plate provide stable fixation even in comminuted multi-fragmented osteoporotic proximal humerus fracture with advantage of anatomical reduction and early rehabilitation.

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