

A PROSPECTIVE COMPARATIVE STUDY TO EVALUATE THE FUNCTIONAL OUTCOME FOLLOWING PHILOS PLATING VERSUS TRANSCUTANEOUS FIXATION IN THE FRACTURES OF PROXIMAL HUMERUS IN ELDERLY PATIENTS

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Abstract

Background: Fractures of the proximal humerus represent the second most common (29.1%) fracture type in the upper extremity. The choice of treatment depends on the pattern of the fracture, the quality of the bone encountered, the patient's requirement, and the surgeon's familiarity with the procedures. Various modalities of fixations have evolved for the proximal humerus fractures (percutaneous pinning, tension band wiring, plating, inter lock nailing, and arthroplasty). The available literature is flooded with researches having equivocal results regarding use of the implants, with their various advantages and disadvantages; which prompted us to do this comparative research. **Aims:** To evaluate the functional outcome of the PHILOS plating versus transcutaneous fixation in displaced fracture of proximal humerus in elderly (> 50 years), To assess the stability of fixation in osteoporotic proximal humerus and to preserve the biological integrity of Humeral head and to secure anatomical reduction with angular stability with multiple k wires. **Material and Methods:** A total number of 30 patients were selected for this study. The first patient was selected for group A (ODD number) and the second patient for Group B (EVEN number) by fulfilling their exclusion and inclusion criteria. 15 patients (Group A) were operated on with proximal Humerus internal locking system (PHILOS) and 15 patients (Group B) with Transcutaneous K wires fixation. Out of 30 patients, 4 patients with 2-part fractures were treated with PHILOS and 4 with K-wire. 8 patients with 3-part fractures were treated with PHILOS and 9 with K-wire. 3 with Neer's 4-part were treated with PHILOS and 2 with K-wire. Regular follow up was done by using NEER SCORE at every week up to 6 weeks and After 6 weeks fortnightly up to 12 weeks was done. Statistical Analysis Used: SPSS software version 25.0. **Results:** PHILOS plating was found to be equally effective as compared to K-wire in age group 50 to 70, while percutaneous fixation was found to be better choice with statistically significant difference for age more than 70 years. Excellent scores were achieved in 01 (03%) in group A (PHILOS), and 03 (10%) patients in group B (K-wire). Functional outcome in terms of range of movement (especially abduction and external rotation) was better and statistically significant in patient treated with percutaneous fixation group as compared to PHILOS group. **Conclusion:** We concluded that transcutaneous fixation provides better functional outcome as compared to PHILOS fixation in old age group owing to excellent stable construct in osteoporotic fracture, less invasiveness, less timing of surgery and less blood loss. Patients treated with transcutaneous fixation showed significant recovery of range of motion as compared to PHILOS plating fixation at 12-weeks follow-up.



INTRODUCTION

After Colles' fracture of the wrist, fractures of the proximal humerus represent the second most common (29.1%) fracture type in the upper extremity.^[1] It constitutes 4-5% of all fractures in the body. The incidence of proximal humerus fracture in the older population is related to osteoporosis following low energy injury with the incidence of three times more often in women than in men.^[2] A younger patient typically presents with proximal humerus fracture following high energy trauma such as a motor vehicle accident. The choice of treatment depends on the pattern of the fracture, the quality of the bone encountered, the patient's requirement, and the surgeon's familiarity with the procedures. The age of the patient, physical activity, and medical fitness also largely influence the treatment options.

About 80-85% of proximal humeral fractures treated nonoperatively results in good functional outcomes, whereas in the 15% to 20% of proximal humerus fractures, it is noted that significant displacement, especially in comminuted fractures was associated with poor functional outcome with conservative treatment; hence for these types there is a general trend towards surgical fixation for better results. However, significant controversy continues regarding the best methods of treating displaced proximal humerus fractures. Over the last 30 years, various modalities of fixations have evolved for the proximal humerus fractures (percutaneous pinning, tension band wiring, plating, inter lock nailing, and arthroplasty).

Among various treatment modalities, one is closed reduction and transcutaneous K-wire fixation,^[3] and advantage of this technique is its minimal invasive, less blood loss, less dissection and soft tissue stripping and usefulness in older patients.^[4,5] Early immobilization had a detrimental effect on the mechanical properties of the native tendon.^[6,7]

Open reduction and internal fixation (ORIF) with plating is another method to achieve anatomical, stable, and secure reduction with immediate mobilization. The proximal humerus interlocking system (PHILOS) is anatomically contoured and the threaded screw heads are locked into the threaded plate holes and these plates have a low profile and hence the danger of postoperative soft tissue impingement syndrome is slight low.

Hence, Proximal humerus locking plates has become the implant of choice for the treatment of displaced proximal humerus fractures in younger patient [8]. However, the available literature is flooded with researches equivocal to the use of both the implants, with their various advantages and disadvantages. Although, these studies have their own limitations. This compelled us to choose "A prospective comparative study to evaluate the functional outcome following PHILOS plating versus Transcutaneous fixation in the fracture of proximal humerus in

elderly patients" with the following Aims and Objectives

1. To evaluate the functional outcome of the PHILOS plating versus transcutaneous fixation in displaced fracture of proximal humerus in elderly (> 50 years)
2. To assess the stability of fixation in osteoporotic proximal humerus.
3. To preserve the biological integrity of Humeral head and to secure anatomical reduction with multiple k wires with angular stability.

MATERIALS AND METHODS

A cross-sectional observational study was carried out This randomized study was done prospectively in The Department of Orthopaedics and Traumatology, Gajra Raja Medical College and associated Jaya Aarogya Group of Hospitals Gwalior, M.P, India.

A total number of 30 patients were selected for this study. Before including them in this study, informed consent was obtained from them in the language in which they were well versed, and ethical committee clearance was obtained before starting the study. Since it was a time-bound study, total 30 patients were operated for fracture of the proximal humerus. and consecutive sampling were adopted for dividing patients into two groups. The first patient was selected for group A (ODD) and the second patient for Group B (EVEN) by fulfilling their exclusion and inclusion criteria. 15 patients (Group A) were operated on with proximal Humerus internal locking system (PHILOS) and 15 patients (Group B) with Transcutaneous K wires fixation.

Inclusion Criteria

- All skeletally mature patients presenting with displaced proximal humerus fracture according to NEER two, three and four parts fracture in elderly patients with or without associated dislocation of the shoulder.
- Age more than 50 years.
- Patients with complete clinical records
- Medically and surgically fit for surgery and preoperatively ambulatory patients.

Exclusion Criteria

- Pathological fracture from primary or metastatic tumor and Preexisting shoulder pathology.
- Age less than 50 years.
- Undisplaced fracture and NEER one-part fracture.
- Fracture associated with neurovascular deficit.
- Shaft humerus fracture with proximal extension.

On admission in the emergency department, age, profession, sex of the patient, mode of injury, temporality of injury, the severity of the injury, associated injuries, time since injury, and their functional demands were noted down. The limb was temporarily stabilized with the U-slab. The fracture was confirmed with radiographic evaluation including standard anteroposterior and axillary view & special views wherever needed. The intra-articular extent of fracture geometry was assessed with a thin

slice of CT scan in doubtful cases. The fracture was classified using Neer's classification and mode of fixation adopted according to the research protocol, either percutaneous k-wire fixation or ORIF with PHILOS plate fixation.

Intra-operative events, amount of blood loss, duration of surgery, difficulties and complications, post-operative radiological evaluations, and bony union were noted.

To compare the results of our study with other standard studies, we have used the t-test. By using this test, we have calculated the significance with a 'p' value. Data analysis was done using SPSS software version 25.0.

Follow Up

- Patients discharged on 3rd to 7th days of post op depending on suture line conditions.
- Regular follow up at every week up to 6 weeks.
- After 6 weeks fortnightly up to 12 weeks.
- Follow up have been done by using NEER SCORE.

Surgical Technique

1. K-wire-fixation Technique

The patient is positioned supine, on the fracture table with 30 - 45° angulation at the head end, with a sandbag behind the operating scapula. Fracture reduction is achieved under the c-arm fluoroscopy using a combination of closed manipulation and percutaneous introduction of k-wires to act as a joystick that manipulates the fragments. Once reduction is achieved, definitive fixation is done using non-threaded k-wires inserted across the key fracture fragments.

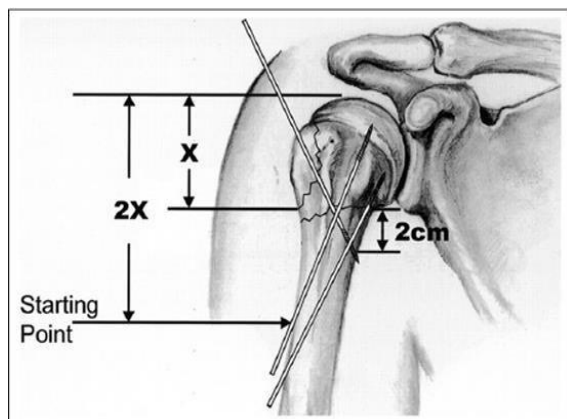


Figure 1: Diagrammatic representation of k-wire fixation technique in the proximal humerus

The ideal starting point for lateral k-wires is at least twice the distance from the top of the humeral head to the most inferior margin of the articular cartilage,^[9-11] but not distal to the deltoid tuberosity (to protect radial nerve) and the ideal angle of insertion so that the k-wires enters the centre of the head, were determined by placing the k-wire over the skin and confirming with the image (Figure 1). This also protects the axillary nerve which lies at an average distance of 5 cm distal to the acromion. The trajectory to be followed was marked on the skin, a stab incision

was given over the predetermined starting point on the lateral side of the arm, soft tissues was retracted using artery forceps, a 2.5 mm k-wire was placed directly over the bone along with a sleeve under C-arm guidance and advanced into the bone initially at a horizontal angle to prevent skating off the k wire and gradually approximating to the predetermined angle. The k-wire was oriented posteriorly to match the normal retroversion of around 20° of the humeral head and was advanced up to the subchondral bone.^[12] The k-wire placement and reduction were confirmed at this point in both AP and axillary views with the C-arm, and a second k-wire was inserted parallel to the first one so that they were separated by at least 1.5-2 cm in the head. The third k-wire was inserted from the anterior cortex through a stab incision protecting the long head of the biceps.

For three-part fractures involving the greater tuberosity (>5 mm displacement), two additional k-wires drilled in a retrograde manner through a properly reduced greater tuberosity towards a point at least 20 mm distal from the inferior extent of the humeral head to avoid injury to the axillary nerve and the posterior circumflex artery.

In cases of four-part fractures also, closed reduction was done and was accepted even with few degrees of mal-reduction of the shaft to the head segment, but all possible methods (using k-wire as a joystick, using hooks, etc.) were employed to anatomically reduce the tuberosities to avoid malunion and later blockage of motion. The k wires were bent and cut over the skin, the antiseptic dressing was applied, and the arm was supported in a broad arm sling.

2. Open reduction and internal fixation of the Proximal Humerus using Deltopectoral approach and PHILOS Plating.

Postoperative Protocol

Postoperatively, in our study, we did not use any arm pouch or sling to avoid shoulder stiffness. The drain was removed on 2nd post-operative day. The time for commencement of shoulder rehabilitation was determined by the stability of fixation, quality of bone, and compliance of the patient.

Passive ROM exercises (pendulum, passive forward elevation, external rotation) generally were begun on the first postoperative day provided that a stable reduction was achieved.

Active ROM of the elbow, wrist, and hand also began immediately after surgery. The patient then progressed through a three-phase rehabilitation program, consisting of passive assisted exercises early, active exercises starting at approximately 4 weeks postoperatively, and strengthening or resisted exercises beginning 6 to 8 weeks after surgery.

Early passive assisted exercises help to avoid adhesion formation. No limitation of exercises within the pain-free ROM was necessary during this time if a bone stock was good and medial buttressing adequate.

Shoulder strengthening and resistance exercises were initiated only after bony consolidation was confirmed

on plain radiographs and adequate coordination of the extremity had been achieved.

Follow-Up Protocol

Standard AP, axillary radiographic views were taken immediately after surgery. Routine follow-up radiographs were taken 2, 4, 6, and 12 weeks postoperatively to ensure that no pin has migrated, no loss of reduction has occurred, evidence of callus formation and consolidation of fracture. Plate removal was generally not necessary. K-wire was removed after 6-8 weeks, depending upon the radiological findings.

Case 1: (Group A)

ORIF with PHILOS

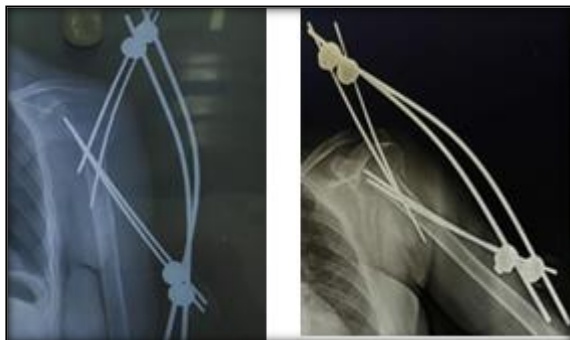
- 52 years male
- Neer’s 3-part fracture right side
- Neer’s Score 83 (Result- satisfactory)



Pre-Operative X Ray



Follow-up after 3 months



6 weeks follow up



12 weeks follow up: after k wire removal



CASE 2: (GROUP B)

Closed Reduction and Transcutaneous Fixation

- Age 70 years female
- Neer’s 3-part fracture left side
- Neer’s Score 85 (Results- satisfactory)

CASE 3: GROUP A

(ORIF with PHILOS)

- Age- 51 years female
- Neer’s 3-part fracture left side
- Neer’s Score 84 (Result- satisfactory)



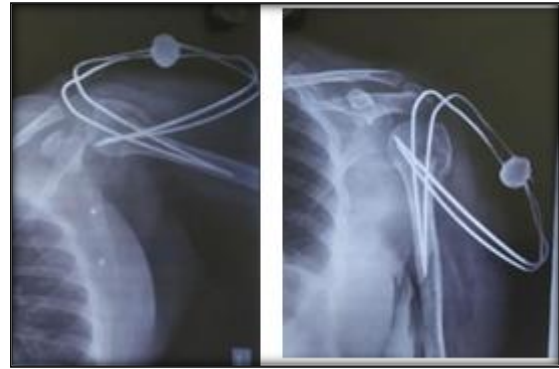
Pre-Operative X Ray



Pre-Operative X Ray



Follow Up at 12 weeks



Follow up at 6 weeks



Follow Up at 12 weeks-after K wire removal



CASE 4: (GROUP B)

Closed reduction and transcutaneous fixation

- Age 50 years female
- Neer's 2-part fracture left side
- Neer's Score- 84 (Results- satisfactory)



Pre-Operative X Ray

RESULTS

The mean age in our study was 58.13 years, with the youngest patient of 50 years and the oldest of 72 years Follow Up at 12 weeks-after K wire removal age. The mean age was 56.53 years in Group A (ORIF WITH PHILOS) and 59.73 in Group B (CLOSED REDUCTION AND TRANSCUTANEOUS K-WIRE FIXATION). The maximum number of patients was observed in the 6th decade. Out of 30 patients, 15(50%) were males and 15 (50%) were females. Slip on floor was the most common mode of injury with 21 patients (70%) followed by road traffic accident: 8 patients (27 %) and 1 patient (3%) was assaulted physically. Out of 30 patients, 14(47%) patients had a fracture of the right proximal humerus, and rest 16 (53%) patients had a fracture of the left proximal humerus. Out of 30 patients, 4 patients with 2-part fractures were treated with PHILOS and 4 with K-wire. 8 patients with 3-part fractures were treated with

PHILOS and 9 with K-wire. 3 with Neer's 4-part were treated with PHILOS and 2 with K-wire (Table 1) The average interval between fracture and operative intervention is 5.2 days in Group A and 3.8 days in Group B. The average blood loss was 81.6 ml in Group A and 18.3 ml in Group B. Blood loss was significantly less in the K-wire technique. The mean operative time was 134.3 minutes in Group A and 77.6 min in Group B. There was significant difference in time of surgery which shows group B is better in terms of time taken for surgery.

Anatomy of head and their relationship with shaft of humerus and glenoid is better restored in PHILOS plating compared to K-wire group which is statistically significant (Table 2).

PHILOS plating was found to be equally effective as compared to K-wire in age group 50 to 70 while percutaneous fixation was found to be statistically significant for age more than 70 (Table 4).

PHILOS plating was found to be equal effective as compared to K-wire with advancement of fracture comminution (Table 5)

In our study, 02 complications were seen in group A (PHILOS), one patient had shoulder stiffness, which caused restricted range of movement despite all phases of physiotherapy and superficial infection was encountered in another patient. Also, 02 complications were seen in group B (K-wire), 1 patient had shoulder stiffness and another patient had superficial infection.

Functional outcome in terms of range of movement was better and statistically significant in patient treated with percutaneous fixation group as compared to PHILOS group. Especially, range of abduction and internal rotation movements recovered much better in the patients treated with K wire from 6 to 12 weeks (Table 6).

Table 1: Neers score for Pain (35 Unit) and Function (30 Unit) and Anatomy (10 Unit)

	No.	Minimum Points/units	Maximum Points/units	Mean±Std. Deviation	'P' value	Statistical significance
Pain						
Group A (PHILOS)	15	30	35	32.6±2.5	0.4	Not Significant
Group B (K Wire)	15	30	35	33.3±2.4		
FUNCTION						
Group A (PHILOS)	15	26	30	27.20±1.2	0.4	Not Significant
Group B (K Wire)	15	22	30	26.8±1.6		
ANATOMY						
Group A (PHILOS)	15	08	10	8.2±0.7	0.004	Highly Significant
Group B (K Wire)	15	06	10	7.3±0.9		

Table 2: Neer's Score at 12 Weeks

S. No.	Neer's Score	Total (30)	(Group A) PHILOS No.	(Group B) K-Wire No.
1	Excellent	4 (13%)	01 (03%)	03 (10%)
2	Satisfactory	26 (87%)	14 (47%)	12 (40%)
3	Unsatisfactory	00 (00%)	0	00 (00%)

Table 3: Neer's score Vs Age

Age Distribution	Total	Group A (PHILOS) Mean Neer's score	Group B (K-wire) Mean Neer's score
50-60 years.	21	12 (82.3±3.0)	9 (84.4±4.0)
61-70 years.	7	2 (82.5±0.7)	5 (85±2.9)
>71 years	2	1 (91)	1(85)

Table 4: Neer's Scoring Vs Neer's Fracture

S. No.	Neer's Fracture Type	Total	(Group A) PHILOS		(Group B) K-Wire	
			No.	Mean Neer's Score	No.	Mean Neer's Score
1	2 Part	7 (23%)	03	81.3±1.5	04	86±3.3
2	3 Part	18 (60%)	09	83.2±3.1	09	84.7±3.9
3	4 Part	05 (17%)	03	81±1.7	02	83.5±3.5

Table 5: Functional Outcome in Terms of Range of Movement at the End of 12 Weeks

Serial no.	Variables(degree)	Group A (ORIF with PHILOS) Mean±SD	Group B (K-WIRE) Mean±SD	P-value	Statistical Significance
1.	Abduction	124±26.6	141.15±15.5	0.0413	Significant
2.	Flexion	118.6±20	139.3±20	0.008	Significant
3.	Extension	24±13	39±7.6	0.006	Significant
4.	ER	25.3±16	27±15.9	0.7	NOT Significant
5.	IR	59.30±16	72.6±12.76	.01	Significant

DISCUSSION

Displaced proximal humerus fracture continues to be a challenge to the Orthopaedic surgeons. These fractures have been treated with wide range of options, like conservative, Percutaneous screw and/or K-wire fixation, external fixation, and internal fixation with wide range of available implants. Each modality of treatment has its own advantages and disadvantages. Choice of treatment depends on many factors including age, functional demand of the patient, associated comorbidities, and surgical expertise. However, in the present-day scenario, in order to return to activities of daily living as soon as possible and to avoid stiffness and other complication related to conservative management, internal fixation is now increasingly being accepted as the standard modality of treatment.

Among various fixation techniques, percutaneous fixation has its own limitations in the form of poor reduction of fracture fragments, pin tract infection, long period of recovery, and cosmetic issues. However, it has some advantages in terms of less soft tissue stripping, less exposure, less blood loss, and minimal invasiveness, especially in elderly population. Open reduction and internal fixation with PHILOS has the advantage of anatomical reduction, stable internal fixation, early mobilization, and better fixation in osteoporotic bones. Although it requires surgical expertise, meticulous dissection and comes with disadvantages of subacromial impingement and implant related complications like infection and implant failure etc.

In the present study, we evaluated 30 patients with displaced proximal humerus fracture (2, 3, 4-parts) according to the Neer's classification with mean age of 58.13 years. Patients were randomized to either group A which were treated with open reduction internal fixation with proximal humerus internal locking system (PHILOS) plate, and group B which were treated with closed reduction and percutaneous K-wire fixation. We analysed our results using Neer's scoring system and followed up the patients at 6 and 12 weeks.

In our study, the mean age was 56.53 years in Group A (PHILOS) and 59.73 in Group B (K-wire). The maximum number of patients was observed in the 6th decade. Also, the mean age-group of our study is comparable with similar study by Wijgman, Roolker et al,^[13] who carried out a study on fifty-two patients where mean age of patient was 48 years. In 2007, Moonot P et al,^[14] studied 32 patients where mean age is 59.9 years. In 2017, Nitin Sharma et al,^[15] had mean age of 43.64 years in 25 patients.

There were 15 males and 15 females in our study, in which 8 males and 7 females were in group A, on contrary 7 males and 8 females were in group B. so ongoing study cannot predict which sex is more vulnerable to slip on floor. Similar study by Nitin Sharma et al,^[15] carried out study on 25 patients with

proximal humerus fracture showed significant male preponderance accounting to 76%.

Slip on floor was the most common mode of injury in our study accounting to 70% of the cases. Old age patients suffered this fracture due to trivial trauma like slip in the bathroom. Study performed by Kumar et al,^[16] had maximum number of patients due to road traffic accident. On the contrary, MA Fazal et al,^[17] in his study on 27 patients encountered majority from fall on ground followed by road traffic accident.

In our study, 47% patients had a fracture on the right side, which is like the findings of Jan Magnus Bjorkenheim et al.^[18]

The average interval between fracture and operative intervention was 5.2 days in Group A and 3.8 days in group B. This delay of 3-4 days in the operative intervention can be accounted to the delayed reporting of patient after trauma and time taken for obtaining fitness for surgery. Similar study by Nitin Sharma, Mohit Dhingra, Deepak Sharma et al,^[15] showed average delay of 3.28 days between fracture and operative intervention.

The average blood loss was 81.6 ml in Group A and 18.3 ml in Group B. Blood loss was significantly less in the K-wire technique as it was percutaneous procedure, and PHILOS being an open procedure with significant soft tissue dissection, had a comparative more blood loss. Study by Kumar et al,^[16] had mean blood loss in the PHILOS group of 710±105.56 ml and in K-wire group was 127±18.23 ml which is statistically significant. Chander Mohan Singh et al,^[19] did a study where they found mean blood loss was 600 ml in group A and 100 ml in group B which is almost like our results.

In our present study, the mean operative time was 134.3 minutes in Group A and 77.3 min in Group B. There is significant difference in time of surgery which shows group B is better in terms of time taken for surgery. This can be attributed to the technique of close reduction and percutaneous fixation. Study by Kumar et al,^[16] had mean time of surgery as 102±9.22 min in the PHILOS group compared to 60.67±23.06 min in K-wire fixation group. Jura et al stated that mean operation time was 100 min in PHILOS group and 50 min in K-wire fixation group. Shaleen Sreen et al,^[19] had similar study where they found mean operative time was 100 min in group A and 50 min in group B.

In our study, functional outcome at 12 weeks revealed excellent scores in 1 (3%) patient in group A (PHILOS), and 3 (10%) patients in group B (K-wire). 14 (47%) had satisfactory score in Group A and 12 (40%) in Group B. None of the patients had unsatisfactory results/failure score in both groups. Both the procedures gave equivocal results at 12 weeks follow-up, with statistically insignificant difference (p value-0.137). Study by Akshat Vijay et al,^[20] found seven patient scored excellent results in group A (treated with PHILOS plate) and 5 have excellent in group B (treated with K-wire fixation), and 13 were satisfactory in group A and 7 in group B. Similar study by Chander Mohan Singh et

al63,^[19] showed 7 patients (28%) in group 1 (treated with K-wire fixation) had excellent results, 12 patients (48%) had satisfactory results, 2 patients (8%) had unsatisfactory results while 4 patients (16%) had poor outcome. For Group 2 (treated with PHILOS plate), as per Neer's scoring system, 12 patients (48%) had excellent results, 9 patients (36%) had satisfactory results, 2 patients (8%) had unsatisfactory results while 2 patients (8%) had a poor outcome. Study by Addanki Vijayanand et al,^[21] on 30 cases showed 23 cases to have excellent results, 4 cases satisfactory, 2 cases unsatisfactory, and one case had a failure. Study by Pappu Marandi et al,^[22] comprised of 5 (26%) excellent, 6 (31.6%) satisfactory, 3 (15.8%) unsatisfactory and 5 (26.3%) failure cases in total 19 patients treated with PHILOS. The mean Neer's score for the age group (50-60) was 82.3 in Group A compared to 84.4 in Group B, for the age group (61-70) was 82.5 in group A compared to 85 in group B, for the age group (>71 yrs) was 91 in group A compared to 85 in Group B. PHILOS plating was found to be equal effective as compared to K-wire and was found to be statistically insignificant as age increases. Study by Shiva et al,^[23] observed that the functional outcome of patient who underwent K-wire fixation below the age of 60 years was 81.6 and more than 60 years old of age was 66.8 and similarly, functional outcome of plating below 60 years of age was 85.3 and after 60 years 72.

The mean Neer's score for Neer's two-part fracture was 81.3 in Group A in comparison to 86 in Group B, for Neer's three parts fracture was 83.2 in Group A compared to 84.37 in Group B, and for Neer's four parts fracture was 81 compared to 83.5 in Group B. PHILOS plating was found to be equal effective as compared to K-wire with advancement of fracture comminution.

The mean Neer's score for pain was observed as 32.6 in group A compared to 33.3 in group B. which was statistically insignificant. The mean Neer's score function in group A was 27.2 compared to 26.8 in group B. The mean Neer's score anatomy in group A was 8.2 compared to 7.3 in group B. Anatomy of head and their relationship with shaft of humerus and glenoid is better restored with better results in PHILOS plating compared to K-wire group which is statistically significant. Similar study by Addanki et al,^[21] performed their study on 30 cases, they observed Neer's score for pain (33.5 units), Function (23.5 units), range of motion (16.55 units), and anatomy (6.9 units).

In our study, 2 complications were seen in group A (PHILOS), 1 patient had shoulder stiffness, which caused restricted range of movement despite all phases of physiotherapy. Superficial infection was encountered in one patient. 2 complications were seen in group B (K-wire), 1 patient had shoulder stiffness and other had superficial infection. Similar study by Sameer Aggarwal et al,^[24] found complication like screw perforation of head, AVN, subacromial impingement, loss of fixation in patients treated with locking compression plate. A varus

malalignment is strong predictor of loss of fixation. Akshat Vijay et al,^[20] 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. Study in 2011 by Georg Osterhoff et al,^[25] found humeral head necrosis occurred in 6 patients in (c+, 15.4%) and 3 in (c-, 14.3%). Cut out of the proximal screw were observed in 3(c+, 7.7%) and 1(c-, 4.8%) cases. In each group, 1 patient showed a delayed union. Study by Adithya C Pawaskar et al,^[26] found mean loss in neck-shaft angle in the first 3 months was 3.8° as compared to 1.3° in the p period between 3 months and final follow up.

Most of the complications that we came across in our study were related to the technique. The precise surgical technique, stable fracture fixation, and restoration of the correct neck-shaft angle are necessary for improved outcomes. Meticulous preoperative surgical planning is a must. Minimal dissection, proper placement of plate, judicious use of aiming block with k wire sleeves to judge the correct placement and order of locking and nonlocking screws under image intensifier especially play an important role. Incorporation of sutures through the rotator cuff into the plate is a critical step and should not be skipped, because it allows the deforming forces of the rotator cuff to be counterbalanced and neutralized.

Functional outcome in terms of range of movement (in all planes) was equal and statistically insignificant in patient treated with PHILOS as compared to K-wire at the end of 6 weeks follow-up but at the end of 12 weeks all movements except external rotation were improved in group B. Also, early mobilization becomes more feasible with PHILOS plating. Similar study conducted upon 20 patients with PHILOS plating by Younes Akel et al,^[27] showed stable fixation, enabled an early range of motion exercise to achieve acceptable functional result. Study conducted by Chander Mohan Singh et al,^[19] found that PHILOS plate provides stable fixation even in Comminuted multi-fragmented osteoporotic proximal humerus fracture with advantage of anatomical reduction and early rehabilitation.

Our study represents a short-term follow-up of 12 weeks, which is the limitation of our study. A longer follow-up with a greater number of cases is recommended to evaluate the long-term functional outcome of the cases.

CONCLUSION

- In our present study, we concluded that transcutaneous fixation provides better functional outcome as compared to PHILOS fixation in old age group owing to excellent stable construct in

osteoporotic fracture, less invasiveness, less timing of surgery and less blood loss.

- Functional outcome was equivocal in both the treatment modality in older age group, if less comminution associated.
- Patients treated with transcutaneous fixation showed significant recovery of range of motion as compared to PHILOS plating fixation at 12-weeks follow-up.
- Better anatomical outcome with PHILOS group is attributable to stable fixation & early mobilization, although K-wire fixation has less blood loss & less invasiveness.

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