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Comparison of functional outcome of open reduction internal fixation with proximal humerus interlocking system and close reduction and pinning with K-wire in proximal humeral fractures

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Abstract

Introduction: Fracture of the proximal humerus represents the second most common fracture type in upper extremity. Three-fourth of the proximal humerus fracture occur in the elderly with osteoporosis following low-energy injury with incidence three times more often in women than in men.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

Aims and objectives: To compare the functional outcome of displaced two-part and three-part fractures of proximal humerus managed by open reduction and internal fixation with locking plate and by close reduction and internal fixation with percutaneous K-wire fixation

Materials and methods: This study is conducted on 76 patients having fracture in surgical neck humerus (two-part and three-part) according to Neer's classification from Department of Orthopedics in Alluri Sitarama Raju Academy of Medical Sciences after taking their consent over a period of 12 months (1st October 2021 to 30th September 2022).

Results: In this study, 76 patients were divided in two groups i.e. group A and group B, each group having 38 patients. Patients of group A were treated with PHILOS plate and patients of group B were treated with Percutaneous K wire fixation. After the follow up of 6 months, 53% of patients showed excellent grade, 13% of patients had good grade, 26% exhibited fair grade and 8% patients showed poor grade after treating with PHILOS plate. In case of Percutaneous K wire fixation, 31% of patients showed excellent grade, 18% of patients had good grade, 42% patients had fair grades and 8% showed poor grade. These outcomes clearly showed that PHILOS plate is more efficient than Percutaneous K wire fixation

Conclusion: In this study primary, open reduction and internal fixation with PHILOS plate system of fresh proximal humerus fractures provides a more rigid fixation and offered a better functional outcome compared to that of the k-wire fixation in two part and three part fractures

Keywords: Neer's classification, Philos plating, closed reduction internal fixation with percutaneous K wire

Introduction

Fracture of the proximal humerus represents the second most common fracture type in upper extremity. Three-fourth of the proximal humerus fracture occurs in the elderly with osteoporosis following low-energy injury with incidence three times more often in women than in men.[1] 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 patient, physical activity, and medical fitness also largely influence the treatment options. Among various treatment options available, one is closed reduction and percutaneous K-wire fixation.[2] It has advantages of less blood loss, lower risk of neurovascular complications, and less interference with glenohumeral joint motion.[3]However, disadvantages of a prolonged immobilization which lead to the stiffness of shoulder jointand anatomical reduction are usually not achieved. 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 is anatomically contoured and the threaded screw heads are locked into the threaded plate holes to prevent screw toggle, slide and pull out, and give angular stability. These plates have a low profile and hence the danger of postoperative soft tissue impingement syndrome is very less.

Aims and objectives

To compare the functional outcome of displaced two-part and three-part fractures of proximal humerus managed by open reduction and internal fixation with locking plate and by close reduction and internal fixation with percutaneous K-wire fixation.

Materials & Methods

It is a Randomised clinical trial to compare functional outcome and complications of surgical neck humerus fracture (two-part and three-part) treated by percutaneous K-wire fixation and PHILOS plating." was conducted in Deparment of Orthopedics, Alluri Sita Rama Raju institute of medical college.

Study was conducted on 76 patients who are categorised into two groups (38 in each group), Group A were treated with Open reduction and internal fixation with PHILOS plating and Group B with Closed reduction and internal fixation with Percutanoeous K wire fixation. On the basis of inclusion criteria, patients of both genders and of age group 18-60 years were selected. Patients having there consent were included. Patients showing displaced proximal humerus fractures 2 and 3 part(according to Neer's classification) with displacement of 1 cm or 45-degree angulation were selected. Exclusion parameters include patients with age less than 18 years, patients who were not willing to participate in study, patients having pathological fractures and 4 part fracture and patients with undisplaced fractures and fracture dislocation were eliminated.

Procedure

Patients were admitted in Orthopaedics department in ASRAM hospital. They went through X-ray of shoulder AP (Anterio posterior), axial, lateral view and CT scan of shoulder joint. On the basis of X-ray shoulder joint and CT scan, patients were classified according to Neer's classification as two part and three part fracture surgical neck humerus. Then patients were randomized and taken for surgery.

Group A: Deltopectoral Approach

A standard deltopectoral approach was used for reduction and for proximal humeral locking plate application. All patients received latest generation of anatomically precontoured proximal humerus locking compression plate. The locking plate was applied to anterolateral aspect of proximal humerus 2 mm posterior to bicipital groove, approximately 0.5–1 cm below the tip of the greater tuberosity to limit subacromial plate impingement.

Group B: Percutaneous K-wire fixation

At first, fracture site was verified under C-arm. Then close reduction was done by traction, abduction and external rotation confirmed under C-arm. Three K wires were passed in a triangular fashion. Finally a fourth K wire was inserted from greater tuberosity to medial humeral shaft.

Post-operative management after PHILOS plating and K wire fixation:

All patients were immobilized with shoulder immobilizer on operated limb. Appropriate antibiotics according to hospital antibiotic policy and analgesics were used as per patients' requirements. Immediate post-operative radiographs were taken to determine the bone alignment and maintenance of reduction. Sutures were removed on 14^{th} day in PHILOS plate group. In case of K-wire fixation, pin tract dressing was done on alternate day upto 14 days.

Rehabilitation after PHILOS plating and K wire fixation:

Pendulum exercises at the operated shoulder were started immediately after surgery depending on the severity of pain. Gentle range of motion exercises at the operated shoulder was started at the end of 1^{st} week. The active range of motion was started at 2-4 weeks postoperatively, depending on stability of osteosynthesis and bone quality. At the end of 4^{th} to 6^{th} week, immobilization was discontinued Active assisted movements were started upto 90 abductions without forced external rotation. Full range of movements with active exercises started by the end of 8^{th} week.

Results

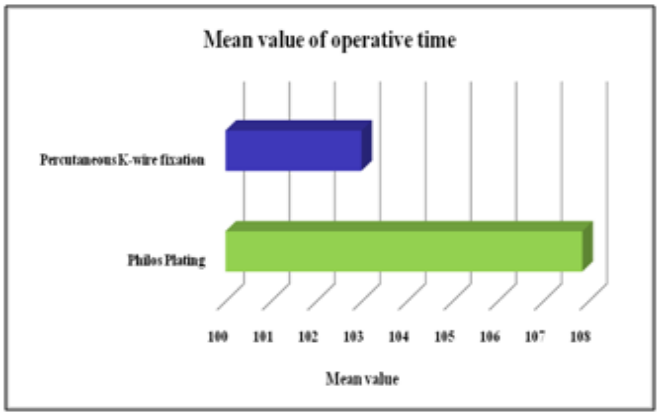
These 76 patients were divided into two groups i.e. Group A and Group B, each comprising 38 patients. Patients of group A were treated with open reduction and internal fixation (ORIF) PHILOS plating and patients of group B were treated with closed reduction and internal fixation Percutaneous K wire fixation with closed reduction and internal fixation Percutaneous K wire fixation.

Comparison of Treatment with Percutaneous K-wire Fixation and PHILOS plating

Operative Time: The mean operative time in a group of patients selected for the treatment with Percutaneous K-wire Fixation was observed to be 103 with a standard deviation of 8.431. And the mean operative time in patients selected for the treatment with PHILOS plating was observed to be 107.8684211 with a standard deviation of 9.005016778. The present data imply that there is a significant difference between the operative time of treatment with Percutaneous K-wire fixation and PHILOS plating statistically. Hence for Percutaneous k wire fixation takes less operative time as P value is 0.0126 (Table 1, Graph 1)

Operative Time	PHILOS Plating	K-wire Fixation
Mean	107.8684211	103
Standard Deviation	9.005016778	8.430959677
Standard Error	1.460806619	1.36768226
P value	0.0126	

Table 1: Comparison of operative time of treatment with Percutaneous K-wire fixation and PHILOS Plating.



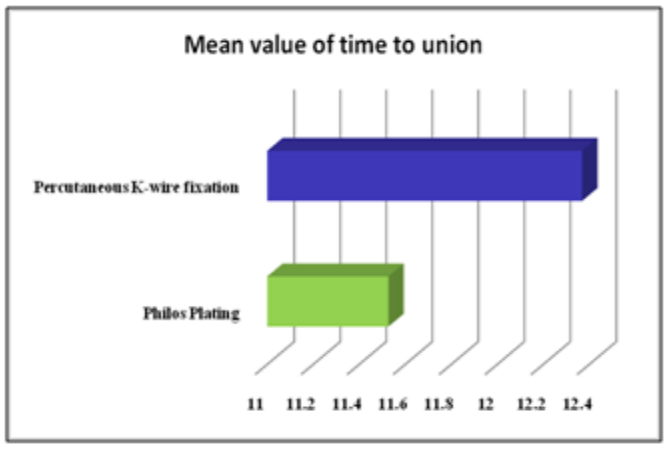
Graph 1: Comparison of operative time of treatment with Percutaneous K-wire fixation and PHILOS Plating.

Time to union

The mean time to union in a group of patients selected for the treatment with Percutaneous K-wire Fixation was observed to be 12.3684 with a standard deviation of 1.6833. And the mean time to union in patients selected for the treatment with PHILOS plating was observed to be 11.5263with a standard deviation of 1.4655. The present data imply that there is a significant difference between the time of union of treatment with Percutaneous K-wire fixation and PHILOS plating statistically. Hence, PHILOS plating takes less time union as p value is 0.0198. (Table 2, Graph 2)

Time to union	Philos Plating	PercutaneousK-wire fixation
Mean	11.5263	12.3684
Standard Deviation	1.4655	1.6833
Standard Error	0.2377	0.273
P value	0.0198	

Table 2: Comparison of time to union for treatment with Percutaneous K wire fixation and PHILOS Plating



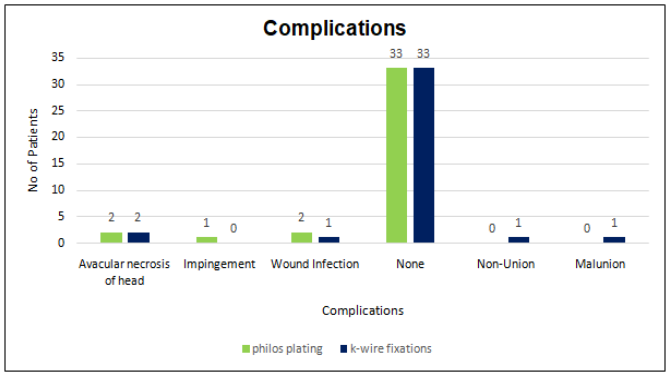
Graph 2: Comparison of time to union for treatment with Percutaneous K-wire fixation and PHILOS Plating

Comparison of complications after PHILOS plating and Percutaneous K wire fixation:

Various complications were observed among patients after treatment by PHILOS plating and Percutaneous K wire fixation. In case of PHILOS plating, out of total 38 patients, 2(5%) patients had avascular necrosis which was same in case of Percutaneous K wire fixation. Impingement wasobserved in 1(2%) patients after PHILOS plating whereas in case of K wire fixation, no impingement was observed. 2(5%) and 1(2%) patients had wound infection after PHILOS plating and Percutaneous K wire fixation respectively. No complications were observed in 33(87%) patients in case of both treatments. In case of PHILOS plating there was not any patient withnon union while in case of Percutaneous K wire fixation 1(2%) patient had non union. Malunion was not observed after PHILOS plating. 1(2%) patient showed malunion after Percutaneous K wire fixation. (Table 3, Graph 3)

Table 3: Comparison of complications

Complications	Philos plating	K-Wire fixations	P-Value
A vascular necrosis of head	2	2	0.648742
Impingement	1	0	
Wound Infection	2	1	
None	33	33	
Non-Union	0	1	
Malunion	0	1	



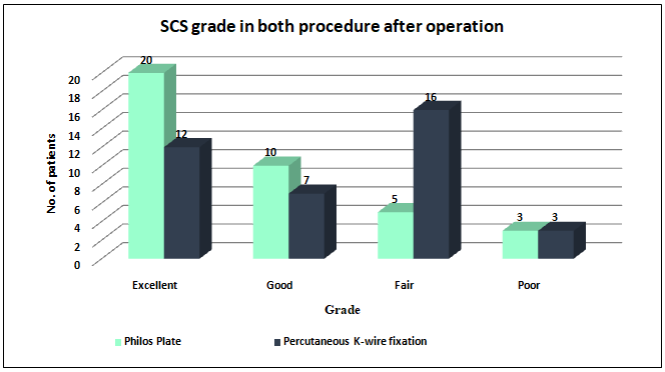
Graph 3: Comparison of complications

Shoulder Constant Score

Four different grades of shoulder constant score were observed after operating on patients with Percutaneous K-wire Fixation and PHILOS plating. After treatment by PHILOS plating, out of total 38 patients, 20(26%) patients showed excellent grade of SCS, 10(13%) patients exhibited good grade, 5(6%) patients had fair grade and 3(4%) patients displayed poor grade. Whereas after treatment by Percutaneous K wire fixation, out of 38 patients, 12(16%) patients showed excellent grade, 7(9%) patients had good grade, 16(21%) patients exhibited fair grade and 3(4%) patients showed poor grade. After comparing both the treatments, p value was found be 0.0403 which shows PHILOS plating was more efficientthan Percutaneous K wire fixation. **(Table 4, Graph 4).**

Grade	Philos Plate	Percutaneous K-wire fixation	P-value
Excellent	20	12	0.0403 (Significant)
Good	10	7	
Fair	5	16	
Poor	3	3	

Table 4: Comparison of grades of Shoulder constant Score observed in the patients.



Graph 4: Comparison of SCS grades observed in the patients

Discussion

The present study was conducted on 76 patients in Department of Orthopedics, ASRAM hospital. Patients were selected on the basis of inclusion and exclusion criteria. In the present study, an attempt was done to understand the efficacy achieved by treatment with Percutaneous K-wire fixation and PHILOS plating on patients **Varyani A (2021)**[4] carried out a study on 20 patients the average union time was 22 weeks; the mean constant Murley's score was 82 points. Only 3 post-operative complications were noted among all the 20 patients; these were, one mal-union and two cases of pin tract infection. The results of their study were extremely in favor of K-wire fixation of such fractures. K-wire fixation of proximal humerus [3rd part] fractures provide stable fixation of such fractures, with negligible post-operative complications and at an extremely cheap cost, easily affordable to average and low-income group patients with early discharge from the hospital, with very low intra operative blood loss and very low operative time, and exposure to C-arm machine. having two-part and three-part fractures **Dwivedi, Atul &Maravi, Lakhan *et al.* (2021)**[5] objective of this study was to comparatively examine the functional outcome of ORIF with Proximal Humerus Internal Locking System (PHILOS) and Close Reduction and Percutaneous Fixation with K-wires in proximal humerus fractures. 50 cases were admitted with proximal humerus fractures as per inclusion criteria. 25 cases were treated with PHILOS plate in group A and 25 patients were treated with Closed Reduction and Percutaneous Fixation with K-wires in group B. Post operative follow-up was done at 6 weeks and 12 weeks and functional outcome were evaluated by Neer's scoring criteria. Out of total cases, excellent scores was obtained in 88% of cases treated with PHILOS in group A, and 72% of cases treated with k-wire fixation in group B, satisfactory score was obtained in 12% in Group A and 24% in Group B. They found that PHILOS provides secure fixation with better functional outcomes in terms of range of motion. Fixation with Percutaneous K-wires is likewise an efficient treatment option with intraoperative advantage in terms of intrusiveness, blood loss and time taken for surgery with least tissue dissection than PHILOS plating. **Maalouly *Jet al*(2020)**[6]presented this case to show management of proximal humerus fracture and the ensure excellent results on follow-up. Fracture dislocation of the proximal humerus is a rare entity that was very challenging technically in young patients. It was vital to do the surgery as soon as possible after the initial trauma for the best results. Intraoperatively careful manipulation of the humeral head is key for proper alignment and reduction with minimal disruption of vascularity while achieving rigid fixation

Baig M, Diack M, Murphy B, *et al.* (2020)[7]depicted the percutaneous fixation of the proximal humerus which is not widely used but is cost-effective, less invasive and comparable to other techniques with respect to results. The surgical techniques are evolving with the progress of time. It is preferred to adopt the minimalist approach in surgery as it has multiple benefits. The pre-states of any successful advancements in surgical procedures are that they should be less invasive, more faithful, cost-effective, quick rehabilitation and help in the early resumption of maximum functional capacity. Like any other technique, their technique has advantages and disadvantages as well, but they just wanted to introduce their technique as something which offers, lesser complication, cost-effective and successful technique.

Conclusion

Proximal humerus fractures are usually treated conservatively but there are specific indications for which operative treatment is needed like two andreduction and internalthree-part displaced proximal humerus fractures. In this study primary, open fixation with PHILOS plate system of fresh proximal humerus fractures provides a more rigid fixation and does not require immobilization for longer periods (2 weeks) whereas in patients treated with K-wire required immobilization at least for four weeks. PHILOS Plate fixation offered a better functional outcome compared to that of the k-wire fixation in two part and three part fractures. PHILOS plate fixation provided stable fixation with minimal metal work problems and enabled early range-of-motion exercises to achieve acceptable functional results. PHILOS Plating (angle stabilized plate) can be the better choice of management in 2 part and 3 part fractures in terms of functional outcome.

Fig 1: A 43 year old male patient a) Radiograph b) Clinical Photograph

Fig 2: A 36 year old male patient a) Radiograph b) Clinical photograph

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