

A Comparative Study of Open Reduction and Internal Fixation with PHILOS Plate versus Closed Reduction and Fixation with Percutaneous K Wiring of Neer's 2-Part and 3-Part Proximal Humerus Fractures

Mahesh Gangaiah¹, Monesh Kanakappa Basavaraj², Balaraj Gowda Hanumantappa³, Girish Halasinanagenahalli Rudrappa⁴, Balakrishnan Honnapura Doppapettigama⁵, Venkata Sujith Varipy Reddy⁶

¹Department of Orthopaedics, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India. ²Department of Orthopaedics, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India. ³Department of Orthopaedics, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India. ⁴Department of Orthopaedics, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India. ⁵Department of Orthopaedics, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India. ⁶Department of Orthopaedics, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India.

ABSTRACT

BACKGROUND

We wanted to assess the clinical, functional, and radiological outcomes of two surgical treatment methods (K-wire application and PHILOS plate fixation) for proximal humerus fractures.

METHODS

A randomized prospective study was conducted between April 2017 and June 2018, 40 patients with Neer's 2-part and 3-part displaced proximal humeral fracture who underwent surgical treatment were evaluated. Twenty patients were treated with closed-reduction percutaneous pinning and 20 patients were treated with open reduction internal fixation with proximal humerus anatomical plates. The results were compared clinically using the Constant-Murley shoulder outcome score (CMS) and radiologically with x rays.

RESULTS

The CMS of the Kirschner wire (K - wire) and plate groups did not differ significantly ($p = 0.82671$). The mean CMS values were 58.5 ± 15.04 for the PHILOS group and 59.4 ± 12.04 for the K - wire group. All fractures united 100 %. One case had stiffness and the other one had impingement in the PHILOS group. In the K wire group, one case had infection.

CONCLUSIONS

The clinical and radiological results of the PHILOS plate and K-wire groups were similar. Percutaneous fixation has the advantage of minimal invasiveness, which lowers the rate of complications. But PHILOS plate has the advantage of stable fixation and early mobilization.

KEYWORDS

PHILOS Plate, Percutaneous K - Wiring, Constant Murley Score

Corresponding Author:

*Dr. Mahesh Gangaiah,
Assistant Professor,
Sapthagiri Institute of Medical Sciences
and Research Centre, Bangalore,
Karnataka, India.*

E-mail: drmaheshg85@gmail.com

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BACKGROUND

Proximal humerus fractures are one of the commonest fractures in the human body, which account for 4 to 5 %.^{1,2} The incidence of this fracture is more common in the elderly because of osteoporosis and decreased bone density. However, it can occur in a younger age group following high velocity trauma.² They can cause great morbidity. It is a challenge to treat complex unstable, displaced, comminuted fractures of proximal humerus because of various destabilising factors at fracture site. Numerous muscles attachment and paucity of space for implant fixation and osteoporosis makes fracture fixation more difficult.

Conservative treatment of displaced two and three part fractures can result in non-union or mal-union and give rise to poor functional results.³ Open reduction (OR) with internal fixation (IF) is a good method for fine reduction, but extensive soft tissue exposure during OR impairs the vasculature and doubles the risk of humeral head avascular necrosis (AVN).³ Closed reduction (CR) and IF with Kirschner wires (K - wires) or screw is another method for the treatment of proximal humeral fractures. CR with percutaneous fixation preserves the soft tissues and prevents further soft tissue damage. Four - part fractures have the worst prognosis because bone / soft tissue connections are extremely weak or completely separated and the periosteum is damaged.⁴

A wide range of treatment options for proximal humeral fractures is available. Soft tissue protection and fracture stabilization are important factors for union. With the application of K-wires, minimal soft tissue damage and fracture stabilization are possible.

With this background, we have taken up this study to compare the results of K-wire application with those of PHILOS plate fixation and provide further information to enhance the literature.

METHODS

A randomised prospective study of 30 cases was conducted in Sathagiri Institute of Medical Sciences and Hospital from April 2017 to June 2018.

Inclusion Criteria

- two part, three part proximal humeral fractures.
- acute fracture.
- age from 25 to 60 years.

Exclusion Criteria

- associated humerus shaft fracture.
- associated neurovascular injury.
- acute infection.
- pathological fractures.
- old fractures.
- compound fracture.

On arrival of a patient to the casualty thorough clinical evaluation was done and those who had injury around the shoulder was sent for x ray of shoulder. Those who had proximal humerus fractures were selected and categorised the fracture based on Neer's classifications. Only two part and three part Neer's fractures were selected for the study.

After selecting the patient for the study they were categorised into 2 group alternatively. First arrival patient was in group A, 2nd arrival patient was put into group B, 3rd arrival patient again in group A, 4th patient was in group B, similarly all patients were categorised into two groups Group A and Group B with 15 patients in each group.

After admission patient was evaluated by blood investigation, chest x ray, ECG, fitness was taken for surgery.

Group A underwent ORIF with PHILOS Plate. Group B underwent CRIF with percutaneous K wiring. Patients were evaluated clinically by Constant - Murley Score. Radiologically x rays were taken to evaluate the progress of union.

Surgical Technique

The surgery was performed under general anaesthesia with the patients in beach chair position. A standard deltopectoral approach was used for Open reduction and proximal humeral locking plate application. Following reduction, the fracture was stabilized with temporary K - wires. After the application of an anatomical proximal humerus plate, the K - wires were removed.

For percutaneous K wiring CR by manual traction and mobilisation of the arm, then confirmed the reduction using an image intensifier. An assistant maintained the reduction, and percutaneous pinning was performed. Three to five 2 – 2.5 - mm K - wires were used for fracture fixation, depending on the stability. The K-wires were left protruding from the skin.

Postoperative Period and Functional Analysis

At follow-up visits, arm pouch was applied to patients in both groups of patients. Patients in the K-wire group were advised to perform passive shoulder exercises for the first 2 weeks, active assisted exercises at 2 – 4 weeks, and active exercises after 4 weeks. K - wires were removed after 6 weeks. The plate group began passive exercises from the first postoperative day. Active assisted exercises were encouraged between 3 days and 2 weeks, and active exercises had begun by the end of 2 weeks. All patients were evaluated in the second, fourth, and sixth weeks, third, sixth, and twelfth months and then once per year during outpatient visits.

Patients were assessed by Constant Murley score. Constant Murley score is a 100 points scale composed of pain (15 points), activities of daily living (20 points), strength (25 points), range of movements (40 points). Lowest being the worst outcome and highest scores means best outcome.

- <30 poor.
- 30-39 fair.
- 40-59 good.

- 60-69 very good.
- >70 excellent.

Statistical Methods

Categorical variables are expressed as number of patients and percentage of patients and compared across the 2 groups using Pearson's Chi Square test for Independence of Attributes. Continuous variables are expressed as Mean \pm Standard Deviation and compared across the 2 groups using unpaired t test. The statistical software SPSS version 20 has been used for the analysis. An alpha level of 5% has been taken, i.e. if any p value is less than 0.05 it has been considered as significant. p value we got 0.82671 so the study was statistically insignificant and so the results were comparable.

RESULTS

Sex	Group A	Group B	Total
Male	13	11	24 (60 %)
Female	7	9	16 (40 %)
Total	20	20	40

Table 1. Sex Distribution

Neer Classification	Group A	Group B	Total
2 Part	11	12	23 (57.5 %)
3 Part	9	8	17 (42.5 %)
Total	20	20	40

Table 2. Neer Classification

Mechanism of Injury	Group A	Group B	Total
RTA	14	15	29 (72.5 %)
Fall	6	5	11 (27.5 %)
Total	20	20	40

Table 3. Mechanism of Injury

Constant Murley Score	Excellent [%]	Very Good [%]	Good [%]	Fair [%]	Poor [%]	Total
Group A	4 20 %	9 45 %	5 25 %	2 10 %	0 -	20
Group B	2 10 %	10 50 %	7 35 %	1 5 %	0 -	20
Total	6 15 %	19 47.5 %	12 30 %	3 7.5 %	0 0	40

Table 4. Constant Murley Score

Range of Movements	Normal Movements	Group A Average	Group B Average
Flexion	0 - 180	152.8 +/- 18.63	148.8 +/- 15.39
Abduction	0 - 180	146 +/- 22.96	127.8 +/- 13.42
External rotation	0 - 90	66.8 +/- 14.56	60.5 +/- 14.2
Internal rotation	0 - 90	67.5 +/- 13.33	58.3 +/- 10.47

Table 5. Range of Movements

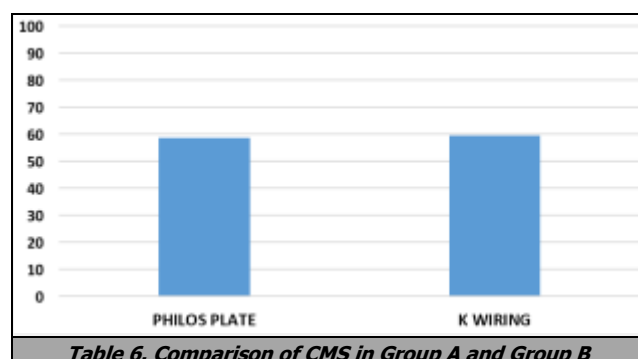


Table 6. Comparison of CMS in Group A and Group B

In our study, majority of patients were male (60 %), with history of RTA (72.5 %) or history of fall (27.5 %). Fracture united in all cases (100 %). Excellent (20 %), Very good (45 %), Good (25 %), Fair (10 %) PHILOS Plate (Group A). Excellent (10 %), Very good (50 %), Good (35 %), Fair (5 %) in K wiring (Group B).

Complications

We had one stiffness and one impingement in Group A that is PHILOS plate application. And we had one infection in Group B that is in K wiring.

DISCUSSION

Proximal humerus fracture is one of the most common fracture of the body. It is the second most common site of fracture in the upper limb after distal radius. These fractures have many options of treatment like non operative, ORIF, percutaneous screw / pin fixation and external fixation. Fractures of proximal humerus are common with high - velocity trauma in young age and simple fall in older people with osteoporosis. These patients also have comorbidities which makes the treatment of these patients even more challenging.

Zyto and colleagues reported mean constant score of 65 points and no complications with conservative treatment compared with surgical approach, resulting in mean value of 60 points and with complications (avascular necrosis, infection).⁵ Magovern, Kenner, and Nho found good constant scores with surgery and relatively few complications, with better functional scores for percutaneous fixation.^{6,7,8}

Percutaneous fixation has its limitations of poor reduction of fracture fragments, pin tract infection and long period of recovery.^{5,7} But it has the advantages of less soft tissue stripping with less exposure, less blood loss and minimal invasiveness.

In cases where there is loss of reduction due to pin loosening, ORIF can be performed.⁸ ORIF with PHILOS plate for treatment of proximal humerus fractures has the advantages of accurate reduction, early fractures has the advantages of accurate reduction, early mobilization, better fixation in osteoporotic bones and ease of reconstruction of comminuted irreducible fractures. On the other hand it has the disadvantages of excessive soft tissue dissection and blood loss, risks of injury to the neurovascular structures and increased risk of avascular necrosis of humeral head.^{9,10} However, recent studies have shown good long term results of proximal humerus fractures managed by the PHILOS plate.^{11,12}

In a study conducted by Fazalet al. it was seen that PHILOS plate fixation provided stable fixation with minimal implant problems and enabled early range of motion exercises to achieve acceptable functional results.¹³

In the present study it was concluded that PHILOS plate provides an excellent stable construct even in multi

fragmented osteoporotic proximal humerus fractures with the advantages of accurate reduction and early mobilization. Fixation with percutaneous K - wires may present an efficient treatment option for 2 or 3 part proximal humerus fractures with its advantages of minimal invasiveness and less soft tissue dissection. Better functional results were seen in patients treated with PHILOS plate than those treated with percutaneous K - wire fixation.

CONCLUSIONS

Our study showed that in elderly population, comminuted proximal humerus fracture can be successfully treated with percutaneous K - wire fixation, as well as with open reduction and internal fixation with PHILOS and both were equally successful. Although the radiological results are slightly better with the PHILOS than percutaneous K-wire fixation, there is no difference in functional outcome. In elderly population, both the modalities of treatments give comparable results, K-wire fixation is preferred as it requires less intra-operative time, less blood loss, less trauma to soft tissues, less cost but it requires C-arm control. As other medical comorbidities accompany the elderly patients and as fitness for anaesthesia is sometimes in question, K-wire fixation is preferred. Both modalities of treatment were associated with complications. They were more severe in K-wire fixation group than PHILOS group due pin loosening in osteoporotic bones in the elderly.

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