Comparison of Functional Outcome of Fracture Proximal Humerus Treated with Open Reduction and Plate Osteosynthesis V/S Closed Reduction and Wire Fixation

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Abstract

Introduction: Fractures of the proximal humerus constitute about 4% of all fractures and 26% of humerus fractures. Treatment of fracture proximal humerus has always been controversial. Many studies indicate that the majority of favourable results of these fractures are achieved by conservative method. Whereas some other studies suggest that surgical management is better.

Aim: The aim of this study was to compare functional outcome between Open Reduction and Plate Osteosynthesis and Closed Reduction with wire Fixation of Fracture of proximal humerus.

Method and Materials: 30 patients with fracture of proximal humerus were first categorized according to Neer's classification and were divided alternatively into Proximal Humerus Interlocking System (PHILOS) group which is named Group A and wiring group which was called Group B according to randomized control study design. These patients were then followed up for 12 months. The results were compared using Constant-Murley score.

Results: In our study, the favourable outcome was seen in 12 patients out of 15 in group A (80%) whereas in group B the favourable outcome was seen in 9 out of 15 patients (60%) which is statistically insignificant. At the final follow up after 1 year, the final mean Constant and Murley's score was 78.4 for group A while it was 70.13 for group B which is statistically significant showing better results with Philos.

Complications: Complications seen in group A were 3 shoulder stiffness, 1 varusmalunion and 1 subacromial impingement, 1 superficial infection while in group B, 5 shoulder stiffness, 2 varusmalunion, 3 superficial infection, 2 wire migration. There were no incidences of non-union & osteonecrosis of the head of proximal humerus.

Conclusion: Based on the analysis of the results, we recommend that ORIF with PHILOS is desirable for optimal outcome in patients of fracture proximal humerus. However for low demand patient, closed reduction and wire fixation is also an option.

Keywords: *Proximal humerus interlocking system, Constant-Murley score, subacromial impingement.*

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Introduction

Fractures of the proximal humerus constitute about 4% of all fractures and 26% of humerus fractures.[24] These are the second most common upper extremity fractures and the third most common fracture, after fractures in the hip and distal radius. The risk factors for proximal humerus fractures are mainly associated with

osteoporosis due to low bone mineral density and higher risk of falling. In young and middle age population, this injury is of great importance because it may cause temporary or permanent disability and therefore, loss of precious working hours. Paramount importance is given to restoration of the function of the limb and minimising disablity and pain.

The care of proximal humerus fractures has always held diversity of opinion, with regular controversies, infact achievement of some good anatomical reduction after surgical treatment may result in unfavourable outcomes unless thorough post operative rehabilitation is instituted, which is often more demanding in these fractures than the surgical technique itself.[25,26,27]

Many studies indicate that the majority of favourable results of these fractures are achieved by conservative method. Whereas some other studies suggest that surgical management is better, depending on the quality of the bone and type of fracture pattern. Operative treatment of these fractures may be associated with some morbidity and unwanted sequelae. They also include complication like avascular necrosis, non-union, malunion, infection, loss of movements of shoulder due to adhesive capsulitis, neurovascular injury, elbow stiffness and atrophy of the soft tissues due to prolonged limb immobilization causing significant disability during healing and in the rehabilitation phase.

The aim of our study was to compare functional outcome between Open Reduction and Plate Osteosynthesis and Closed Reduction with wire Fixation of Fracture of proximal humerus.

Materials and Method

It is a prospective and observational study carried out in a tertiary hospital between August 2017 and December 2019. The study was done after the clearance from Institutional Ethical Committee. 30 patients with fracture of proximal humerus were first categorized according to Neer's classification and were divided alternatively into PHILOS group which is named Group A and wiring group which was called Group B according to randomized control study design. These patients were then followed up for 12 months. Informed consent was taken from all the patients.

All the patients above 18 years of age who were admitted to this hospital with proximal humeral fractures (Neer's classification: 2 part, 3 part, 4 part) were included in the study with the exclusion of undisplaced fractures, compound fractures, pathological fractures and isolated greater tuberosity fractures.

Both the groups were compared clinically using Constant Murley score at regular follow up intervals.

All the patients were operated using delto-pectoral approach in Group A. Fractures were reduced in anatomical position and fixed with Proximal Humerus Interlocking System (PHILOS) using cortical screws of size 4.5 mm and cancellous screws of size 6.5mm for fifteen patients. Fifteen patients underwent fixation with K-wires or J-wires. Fixation rigidity was checked on table. All the patients were given Universal Shoulder Immobilizer for 1 month. Physiotherapy in the form of pendulum exercises was encouraged in all the patients in the first post-operative week. Suture removal was done on 12th day or later post operatively. Per-operatively, compatible blood was transfused as per patient's requirement.

Results

The mean age incidence in our study of 30 patients analyzed, ranging between 27 to 85 years is 52.3 years and the gender ratio is 1:0.57, 19 of 30 patients were males. The most commonly seen mode of injury in our study was simple fall on ground accounting for 46.67% of all the cases. Many among them were over 50 years old depicting the role of osteoporosis in these fractures. 26.67% patients had road traffic accident which was the second most common cause in our study and other causes included blunt trauma, fall from height and history of electric shock. Types of fracture in our study revealed 15(50 percent) were 2-part fractures, 09(36.67 percent) were 3-part fractures and 04 (13.33 percent) were 4-part fractures of proximal humerus. In our study, the favourable outcome was seen in 12 patients out of 15 in group A (80%) whereas in group B the favourable outcome was seen in 9 out of 15 patients (60%) which is statistically insignificant.

	Group A	Group B	Total
Excellent	2	1	3
Good	10	8	18
Moderate	2	4	6
Poor	1	2	3
Total	15	15	30

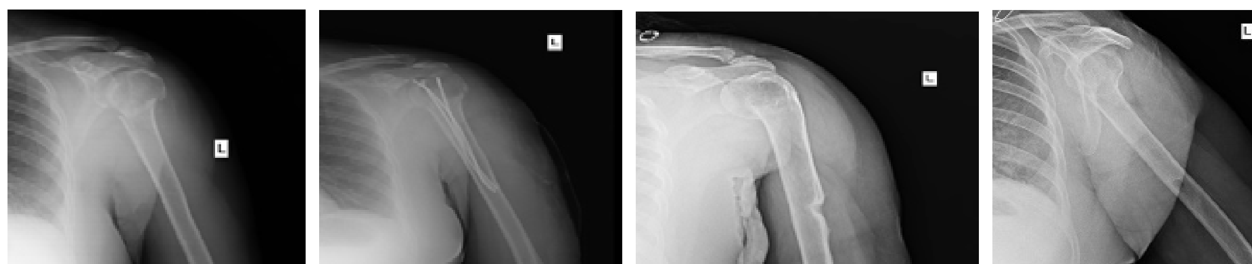
At the final follow up after 1 year, the final mean Constant and Murley's score was 78.4 for group A while it was 70.13 for group B. The p-value using unpaired t-test comes out to be 0.04 between Group A and B which is statistically significant showing better results with PHILOS.

In ages less than 50 years, all the 14 patients had favourable outcome where as in age group more than 50 years of age, favourable outcome was seen in only 7 out of 16 patients. The result is better in group A as 3 out of 6 patients (50%) showed favourable results while in Group B, 4 out of 10 patients showed favourable outcomes. This may be because open reduction helps in better restoration of anatomy and thus helps in early physiotherapy of elder patients.

The results showed insignificant statistical results when these procedures were compared among groups of 2-part, 3-part and 4-part fracture. This may be because the study was done on a smaller scale as significant difference was seen clinically in favour of Group A among 3 and 4 part fractures.

	2 Part		3 Part		4 Part	
	Group A	Group B	Group A	Group B	Group A	Group B
Excellent	1	1	1	0	0	0
Good	5	5	4	3	1	0
Moderate	1	1	1	2	0	1
Poor	0	0	0	1	1	1
Total	7	7	6	6	2	2

Case 1: Radiographs and clinical pictures of patient managed with PHILOS



Case 2: Radiographs and clinical pictures of patient managed with wiring

During the period of follow up, in group A, 3 patients developed shoulder stiffness out of which 1 patient developed varusmalunion and subacromial impingement and screw perforation was seen in 1 patient each. 1 patient had superficial infection which was treated with iv antibiotics only and implant removal was not required. While in group B, shoulder stiffness was present in 5 patients and 2 went into varusmalunion, 3 patients developed superficial infection. I.V. antibiotics were started and k-wires were removed after the union. 2 patients developed the complication of wire migration. There were no incidences of non-union & osteonecrosis of the head of proximal humerus.

Complication	Group A	Group B
Stiffness	3	5
Malunion	1	2
Superficial Infection	1	3
Wire Migration	-	2
Impingement	1	-
Screw Perforation	1	-

Discussion

Due to changes in lifestyle and an increase in motor vehicle accidents, the incidence of fractures of proximal humerus have increased in recent years. In these fractures, the optimal treatment is still not conclusive. Studies show that conservative and operative treatments, both give positive outcomes and hence, the uncertainty remains. Most of the undisplaced fractures can be managed non-operatively. However, displaced proximal humerus fractures do not show good results with conservative treatment, hence they require surgical management for better outcome. The goal of the treatment should be to achieve pain free shoulder with full Range of movements. Different techniques of fixation are used for these complex fractures like tension band, non-absorbable bone sutures, T-plate, K-wire, Intramedullary nailing and hemiarthroplasty. Every technique has its own advantages and disadvantages and has a constant rate of mechanical failure[5,6]. Proximal humerus fractures occur mostly in patients with older age group, showing osteoporosis as a cause of these fractures. In the fractures of proximal humerus, union occurs in almost all the patients due to cancellous nature of the bone in proximal humerus unless the articular part or anatomical neck is involved as it compromises the blood supply[7]. In our study, there were no cases of delayed or nonunion. Open Reduction and Internal Fixation with PHILOS provides better reduction anatomically with rigid fixation to the metaphysis, thus consequently allowing for early mobilization. Another advantage of PHILOS is that it provides better reduction of greater tuberosity fracture fragment. Hence, there were more favourable results in plating group as compared to wiring group. The Neer's score and Constant-Murley score was also higher and better range of movements were seen in plating group due to same reasons. Two part fractures showed good results in both the groups but for three and four part fractures, better results were seen in plating group as compared to the wiring group. In the patients with age more than 50 years, PHILOS showed better results as compared to wiring whereas in patients less than 50 years of age, both groups showed significant results. The proximal locking screws produce angular stable construct with PHILOS and enhance the gripping in osteoporotic bones in elderly patients and in patients with multi-fragmentary fractures[8]. The purchase in head of proximal humerus improves with alternate diverging and converging screws and it also increases the pullout strength. Impingement can be prevented by proper reduction of all the fragments in anatomical position before applying the plate. Acceptable fracture reduction with proper placement of plate and perforation

of screws should be checked intra-operatively using image intensifier for better results. Medial comminution should be fixed properly using additional inferomedial screws. To prevent stiffness and obtain good range of movements, early physiotherapy is of paramount importance. Careful surgical dissection and medial periosteal hinge prevent damage to posteromedial vessels present at the posteromedial aspect of the neck of humerus, thus the incidence of Avascular Necrosis can be reduced. The results of K-wires or J-wires was not appreciable in our study in patients with 3-part and 4-part fractures. This is likely to be due to poor bone quality in elderly and comminution at the fracture site along with less stable fixation which could lead to wire migration and loss of reduction. Furthermore, threaded k-wires, terminally threaded Schanz screws, transosseuos sutures and cannulated cancellous screws were not used in our study which could have helped in better reduction of the tuberosities when used along with wiring and thus providing a better outcome. The advantages of wiring is that it helps in retaining the vascularity of the head of humerus. It can be used in two and some three part fractures in young adults without comminution. In older population, this technique can be considered if the bone quality is good and there is less comminution to shorten the time duration of the surgery. In this study, the follow up of the patients was taken for 1 year but longer duration follow up helps in providing the broader spectrum of complication rates like secondary osteoarthritis and avascular necrosis of proximal humerus which appear late after surgical intervention.

Conclusion

We recommend that ORIF with PHILOS is desirable for optimal outcome in patients of fracture proximal humerus. However for low demand patient, closed reduction and wire fixation is also an option.

Limitations and Recommendations:

1. Surgeon related bias due to surgeries performed by various surgeons.
2. Sample size was small.
3. Follow up duration was shorter.

Ethical Clearance: Taken from institutional ethics committee.

Source of Funding: Self.

Conflict of Interest: Nil.

References

1. Court-Brown C et al. The epidemiology of proximal humeral fractures. Actaorthopaedica Scandinavica. 2001;72(4):365-71.
2. Canale Set al. Campbell's Operative Orthopaedics. 9th ed. St. Louis: Mosby-Year Book; 1998. p 2286-96.
3. Marsh Jet al. Rockwood and Green's fractures in adults. 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2001. p 1055-107.
4. Neer CS. Displaced proximal humeral fractures. Part I. Classification and evaluation. J Bone Joint Surg. 1970;52(6):1077–89.
5. Kulkarni V et al. Comparison between antegrade intramedullary nailing (IMN), open reduction plate osteosynthesis (ORPO) and minimally invasive plate osteosynthesis (MIPO) in treatment of humerusdiaphyseal fractures. Injury. 2017; 48(2): S8-S13.
6. Siwach R et al. Internal fixation of proximal humeral fractures with locking proximal humeral plate (LPHP) in elderly patients with osteoporosis. Journal of Orthopaedics and Traumatology. 2008; 9:149–153.
7. Akshat V et al. Comparison of open reduction internal fixation with proximal humerus interlocking system and close reduction and pinning with K-wire in proximal humeral fracture. 2017; 9(2): 99-105.
8. Jain R et al. Pre-contoured locking plates vs conventional reconstruction plates in AO type C Distal humerus fractures: A prospective randomised study. 2018;24(2):73-7.