Original Research Article

Functional outcome of proximal humeral interlocking system plating for displaced proximal humerus fractures: A prospective study

T S Raghavendra[1], Venkatesh T[2*], Jaipalsinh Ranjeetsinh Mahida[3]

[1]Associate Professor, [2]Assistant Professor, Department of Orthopaedics, Shridevi institute of Medical Sciences and Research Hospital, NH-4, Bypass road, Tumkur
[3]Sevasharam Hospital, Paanchbatti Circle, Sevasharam Road, Bharuch, Gujarat, INDIA.
Email: hrbs2006@yahoo.co.in

Abstract

Background: Proximal humerus fracture accounts for approximately 5% of all fractures. These fractures occur primarily in older populations, many of them are osteoporotic. The most common mechanism for proximal humerus fracture is a fall on an out stretched hand from a standing height. The Neer four-part classification plays important role in categorization of fracture. PHILOS aims to correct the biological integrity of the humeral head and to secure an anatomical reduction using multiple screws with angular stability. **Materials and Method:** A prospective study of 30 cases of displaced proximal humeral fractures admitted to Sri Siddhartha Medical College and research Center, Tumkur from October 2014 to April 2016. Patients were selected according to inclusion and exclusion criteria. Patient's follow up done at 3 weeks, 6 weeks and 6 months to check for clinical and radiological union and to access the functional outcome. **Results:** In our series of 30 patients there were 18 males and 12 females, with average age of 51.23yrs side distribution was equal. 19 (63.33%) cases were admitted due to fall. 2-part fractures were more common accounting 56.67% compared to 3-part (23.33%) and 4-part (20%). Fractures united in 25 (83.33%) patients without any complications with 1 (3.33%) case going for non-union of surgical neck of humerus. Excellent functional outcome seen in 9 (30%) cases, good 10 (33.33%) cases, fair 8(26.76%) cases, poor 3(10%) cases. **Conclusion:** The functional outcome is much better in patients with 2 part and 3 part fractures, and not good in complex fractures and older the patient the functional outcome of the affected shoulder was poorer at the end of 6 months. The advantage of this fixation; is it allows early postoperative mobilization of the affected shoulder, and better functional outcome of the affected shoulder, as compared to conservative management, where patients affected shoulder is immobilized for long periods.

Key Words: Proximal humerus, PHILOS plate, 2- part, 3- part, 4 part fractures, non- union, Neer classification, Functional Outcome.

[*]**Address for Correspondence:**
Dr. Venkatesh T, Assistant Professor, Department of Orthopaedics, Shridevi institute of medical sciences and research hospital, NH-4, Bypass road, Tumkur- 572106
Email: hrbs2006@yahoo.co.in
Received Date: 30/05/2019 Revised Date: 11/07/2019 Accepted Date: 04/08/2019
DOI: https://doi.org/10.26611/10201213

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 15 October 2019

INTRODUCTION

A conservative estimate is that proximal humerus fracture accounts for approximately 5% of all fractures. These fractures occur primarily in older populations, many of them are osteoporotic. Like Hip fracture, it is the major cause of morbidity in elderly population. As the age increases complications and morbidity following fracture increases.[1,2,3,4] The most common mechanism for proximal humerus fracture is a fall on an out stretched hand from a standing height. In younger population, high

How to site this article: T S Raghavendra, Venkatesh T, Jaipalsinh Ranjeetsinh Mahida. Functional outcome of proximal humeral interlocking system plating for displaced proximal humerus fractures: A prospective study. *MedPulse International Journal of Orthopedics.* October 2019; 12(1): 10-14. https://www.medpulse.in/Orthopedics/

energy trauma is more frequent cause and the resultant injury is more devastating. Other causes are muscle contraction following seizures or electric shock, direct blow over humerus.[5] There are various methods of treatment, mainly categorized as conservative and operative. The selection of treatment depends up on patient factor, medical history and mainly type of fracture. The Neer four-part classification plays important role in categorization of fracture. The invasive methods mainly include closed reduction with percutaneous k wire fixation, open reduction and internal fixation, humerus head replacement, reverse shoulder arthroplasty, external fixation with K wire, tension band fixation, intramedullary nailing and plating and rush nails.[2, 3] The main Aim of treatment is Pain free shoulder and restoration of normal activity in daily routine. Main challenging factor of various treatment are osteoporosis, angular fracture, failure in reduction or complex four-part fracture with bone loss. These factors may lead to treatment failure or complications in form of osteosynthesis failure, avascular necrosis of head of humerus, nonunion or mal union.6, 7, 2 In order to avoid complication and achieve the treatment goal in form of maximum shoulder function, AO/ASIF (Association for the study of internal fixation) developed new technique PHILOS (Proximal Humerus Internal Locking System), which aims to correct the biological integrity of the humeral head and to secure an anatomical reduction using multiple screws with angular stability.[2,8] The proximal humeral internal locking system (PHILOS) plate has been developed to improve screw fixation in osteoporotic bone and to minimize soft-tissue dissection. It combines the principles of fixation with a conventional plate with those of locking screws. The screw holes in the shaft can take either standard or locking screws. The plate is pre-shaped and contoured for the proximal humerus. No compression of the plate is required, which reduces the risk of loss of reduction and preserves the blood supply of the bone. Locking the screws into the plate ensures angular as well as axial stability and reduces the risk of loss of reduction. The locked interface also provides fixed stability, which helps to prevent subsidence in the metaphyseal areas [3, 4, 9]Thus the goal of this study was to assess and compare the results of PHILOS in fracture of proximal humerus both clinically and radiologically and come to conclusion about functional outcome and complications of PHILOS in proximal humerus fractures according to the pattern of fracture and patient selection.[2, 3, 4, 9]

MATERIALS AND METHODS

Randomized Prospective study was conducted from October 2014 to April 2016. Patients admitted in Sri Siddhartha Medical College Hospital and Research Centre, Tumkur, Karnataka with displaced proximal humerus fractures after obtaining consent were included. 30 patients both male and female with fresh closed displaced fractures of proximal humerus with Neer 2 part, 3 part and 4 part fractures were randomly selected and included in study. Skeletally immature patients, patients with open fractures, multiple fractures, patients with pathological fractures, patients in which time lag between injury and surgical intervention exceeded three weeks or failure of conservative treatment, patients with associated proximal forearm / shoulder injury, patients with opposite shoulder injury and limited range of movement were excluded. Standard pre and post-operative protocol were followed. All cases of displaced proximal humerus fractures were treated using proximal humerus interlocking system plating. Proximal holes of the PHILOS [PROXIMAL HUMERUS INTERLOCKING OSTEOSYNTHESIS] plate and the holes are drilled into the proximal humerus (head) up to the subchondral bone and are fixed with appropriate length LOCKING screw. Functional outcome was assessed using Constant Murley scoring system. During the follow up radiological and functional outcome were assessed. In our study monthly follow up was done every month for three months and then final at 6th month. On every follow up check X-rays (AP and Lateral view) were taken to know the position of the implant and fracture healing. Post-operative evaluation was done using Neer evaluation criteria. In a 100- point system, 35points are for pain, 25 points for range of motion (flexion, extension, abduction, internal rotation and external rotation), 30 points for function (10 activities including strength, reaching and stability) and 10 points for reconstruction of anatomy based on radiographic appearance.

RESULTS

The following observations were made from the data collected during this study of the functional outcome following fixation using PHILOS for proximal humerus fractures in Department of Orthopedics, Sri Siddhartha medical college and Hospital from October 2014 to April 2016 which included total of 30 patients.

Table 1: Overall Distribution

Age (Range)	Type of fracture by Neer's classification	No. of Cases	Gender M	Gender F	Percentage distribution of type of fracture.
28 – 75	Two parts	17	12	5	56.67%
	Three parts	7	3	4	23.33 %
	Four parts	6	3	3	20%

5 (16.67%) of the patients were aged between 20-39. 16 (53.33%) patients were between the age of 40- 59 years and 9 (30%) patients aged 60 and above. Since proximal humeral fractures are considered osteoporosis related fractures their incidence increases with age, particularly after 50. There were 18 male patients (60%) and 12 female patients (40%). 15 patients (50%) had fractured their left humerus and 15 patients (50%) had fractured their right humerus. Type of fracture based on Neer classification of proximal humerus fractures we had 17 (56.67%) cases of Neer 2 part fractures, 7 (23.33%) cases of Neer 3 part fractures and 6 (20%) cases of Neer 4 part fractures. The mode of injury was a fall in 19 (63.33%) and Road Traffic Accident in 9 (30 %) and in 2 (6.67%) the mode of injury was Assault.

Table 2: Complications of PHILOS fixation

COMPLICATION	No. Of Cases	Percent
IMPINGEMENT	1	3.33
STIFFNESS	3	10
NON-UNION	1	3.33
NIL	25	83.33
Total	**30**	**100**

The above table shows the complication we faced during our study. 3.33 % had complication of shoulder impingement, 10% had stiffness and 1 % had nonunion, and the rest 83.33% did not face any complications. Functional outcome: In our series of 30 patient's functional outcome recorded by comparing the affected shoulder to the unaffected shoulder using constant Murley scoring system.

Table 3: Functional outcome of proximal humerus fixation using PHILOS

Inference	Number of patients	Percent
EXCELLENT	9	30
GOOD	10	33.33
FAIR	8	26.67
POOR	3	10
Total	**30**	**100**

The above table shows the functional outcome using Constant Murley scoring system at the end of 6 months following proximal humerus fixation using PHILOS.

Table 4: Distribution of Functional Outcome according to fracture Type

Fracture Type	No.of Cases	Excellent	Good	Fair	Poor
2 PART	17	6	6	4	1
3 PART	7	2	2	2	1
4 PART	6	1	2	2	1
Total	30	9	10	8	3

Table 5: The Statistics Value

	Mean	N	Std. Deviation	Paired Differences Mean	Paired Differences Std. Deviation	T	Df	P VALUE
AFFECTED SHOULDER CONSTANT SCORE	81.33	30	10.286					
UNAFFECTED SIDE CONSTANT SCORE	98.40	30	1.290	16.83	9.924	9.288	29	<0.0001

Table 6: Means of the continuous variables

Statistics				
	AGE IN YEARS	AFFECTED SHOULDER CONSTANT SCORE	UNAFFECTED SIDE	DIFFERENCE
Mean	51.23	81.33	98.40	16.83
Std. Deviation	12.241	10.286	1.290	9.924
Minimum	28	57	95	03
Maximum	75	95	100	41

DISCUSSION

In the study a total of 30 cases of displaced proximal humerus fractures were treated using proximal humerus interlocking system plating.

Age distribution

In our study all patients between the ages of 18 to 90 years were included. Mean age group patients treated with PHILOS was 51.23. Maximum age in the study was 75 and minimum was 28. The ages of patients sustaining 2, 3, and 4-part fractures were similar. This finding was similar to other studies.

Gender distribution:

In the present there was male preponderance with male female ratio being 3:2, so preponderance of fracture in male was higher by 20% where males were 18(60%) and 12(40%) females.

Side involved:

In the present study out of 30 cases, right humerus fractures were seen in 15 cases and left side were seen in 15 cases. Thus incidence of right and left side of fracture is equal.

Mode of injury:

The leading cause of injuries was fall in the present study accounting for 63.33% of cases followed by road traffic accident in 30% of cases and rest 6.67% were due to other causes. The findings in our series were similar to various other studies.

Type of fracture:

In our study we had considered displaced proximal humerus fractures-Neer 2 part, 3 part and 4part fractures. We had 17(56.67%) cases of Neer 2 part fractures, 7(23.33%) cases of Neer 3 part fractures and 6(20%) cases of Neer 4 part fractures.

Complications:

Among the 30 cases that were operated in our study, we faced complication for 5 cases. One patient was diagnosed to have non-union (3.33%). The other one patients developed shoulder impingement (3.33%) and was taken back to theatre for removal of the implant and manipulation under anaesthesia after 6 months. Other three patient developed shoulder stiffness (10%). In study of 72 patients by Bjorkenheim *et al* (2004)9 faced complication of non- union in 2 cases, AVN in 3 cases and implant failure in 2 cases. AA Martinez *et al* (2009)10 in study of 58 patients faced 5 cases of impingement complication. Shivananda *et al* (2014)12 in study of 30 patients faced stiffness in 2 cases, varus malunion in 2 cases and impingement in 3 cases.

Functional outcome:

It was assessed using Constant Murley Scoring system. Among the 30 patients 9(30%) patients had an excellent outcome, 10(33.3%) patients had a good outcome, 8(26.67%) patients had a fair outcome, and 3(10%) patients had a poor outcome.

As displayed in table, among the 30 patients in our study, the 17 patients had Neer 2-part fracture with an average constant score of 17.89 which was good, and 1 complications. 7 patients had Neer 3-part fracture with an average constant score of 18.14, which was good; and 6 patients had Neer 4-part fracture with an average constant score of 19.83, which was good. This correlation indicated that, more complex the fracture, the function outcome was affected with increased rate of complications, and simple fracture had better functional outcome.

As shown in table, among the 30 patients in our study, the 5 patients were below 40 years or below, 16 patients between 40 and 60 years of age, and 8 patients above the age of 60 years. We observed that the average constant Murley score had decreased as the average age of the patient in the study increased. These findings are comparable to earlier studies.

CONCLUSION

In our study of 30 patients with displaced proximal humerus fractures treated with proximal humeral interlocking system plating we conclude that the functional outcome is much better in patients with Neer 2 part and 3 part fractures, and not good in complex fractures. The advantage of this fixation is it allows early postoperative mobilization of the affected shoulder, and better functional outcome of the affected shoulder, as compared to conservative management, where patient's affected shoulder is immobilized for long periods. Among the 30 patients only (16.66%) had complications, one of which was non-union, three cases of shoulder stiffness

and the other one patient had shoulder impingement for which they underwent plate removal and manipulation under general anesthesia at the end of 6 months. Our study also concluded that older the patient the functional outcome of the affected shoulder was poorer at the end of 6 months.

REFERENCES

1. Anil Solanki, Ruchir Patel. Study of philos plate osteosynthesis in proximal humerus fractures in adult. Iosr journal of dental and medical sciences March 2016; 15(3): 08-10.
2. P Moonot NA, M. Hamlet. Early results for treatment of three- and four part fractures of the proximal humerus using the PHILOS plate system. The journal of bone and joint surgery September 2007; 89(9).
3. J. M. Muthuuri. Outcome of plate osteosynthesis in the management of proximal humeral fractures in adults. East Africa Orthopaedic journal. September 2010; 4.
4. Rizwan Shahid AM, Julian Northover, Mohammad Maqsood. Outcome of proximal humerus fractures treated by PHILOS plate internal fixation. Acta Orthop Belg 2008; 74(5): 602-608.
5. Neeraj Mahajan, Arti Khurana. Fixation of proximal humerus fractures using philos plate. International journal of current research March 2016; 8(3): 27752-27757.
6. Ma Fazal, Fs Haddad. Philos plate fixation for displaced proximal humeral fractures. Journal of orthopaedic surgery 2009; 17(1):15-8.
7. R Sahu. Philos locking plates in proximal humerus fractures. The internet journal of health 11 (1): 1-9.
8. Burkhead WJ, Scheinberg RBG. Surgical anatomy of the axillary nerve. J Shoulder Elbow Surg 1992; 1: 31-36.
9. Björkenheim J-M, Pajarinen J, Savolainen V. Internal fixation of proximal humeral fractures with a locking compression plate. Acta Orthopaedica 2004; 75(6): 741-5.
10. Aa Martinez, J cuenca, A Herrera. Philos plate fixation for proximal humeral fractures. Journal of orthopaedic surgery 2009; 17(1):10-4.
11. Ananthula krishna reddy, V Prashant; A study of functional outcome of fractures of upper end humerus treated by philos plate. J of evidence based med and hlthcare 2015; 2(14): 7961-7966.
12. Shivananda S, Radhakrishna AM, Kumar M. "Management of proximal humerus fracture with locking compression plate". Journal of evolution of medical and dental sciences 2014; 3(14): 3714-3720.

Source of Support: None Declared
Conflict of Interest: None Declared