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Efficacy of the PHILOS plate in the management and functional outcome of proximal humerus fractures: A prospective study

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Abstract

Proximal humerus fractures management is a challenging task for orthopaedic surgeons due to the high incidence of postoperative complication. PHILOS plate is the recent advancement in locking plate fixation for proximal humerus fractures which provides angular stability and compression that lead to a speedy recovery. The present study was designed to assess the efficacy of the PHILOS plate in the management of displaced fractures to the proximal humerus. A total of 40 cases with displaced proximal humerus fractures admitted in the Department of Orthopedics were recruited. Patients were undergoing Open reduction internal fixation with PHILOS locking plating for the sustained fracture under general anaesthesia. Postoperative follow up appointments were conducted at the end of 2 weeks, 6 weeks, 3 months, 6 months and 12 months. Road traffic accidents were the commonest mode of injury in 72.5% of cases, followed by falling injuries from height (20%) and injuries by falling and slipping (7.5%). The mean constant- murley score was 66.25. The functional outcome was excellent in 20% cases, good in 30% cases, fair in 35% cases and poor in 15% cases. No severe postoperative complications observed. The proximal humerus locking plate is a good treatment option for 2, 3 and 4 part of NEER's fractures with good functional outcome, good stable fixation with minimal postoperative complications.

Keywords: Proximal humeral internal locking system (PHILOS), proximal humerus fractures, functional outcome, constant-murley score

Introduction

Proximal humerus fractures is second common fractures of the upper extremity accounts for about 5% of all injuries to the appendicular skeleton, 4% of total fractures and 26% of humerus fractures^[1]. Incidence of proximal humerus fractures is more common in women and old age people with osteoporosis. The complex fractures and dislocations are often seen in active, middle aged cases^[2, 3]. The surgical management of proximal humerus fractures is a challenging task for orthopaedician due to the high incidence of postoperative complications and a wide variety of fracture patterns. To obtain a satisfactory functional outcome, accurate anatomical reduction gains and early fracture fixation are more important than the adapted surgical procedure and type and design of implant used^[4].

There are several techniques available for fixation of proximal humerus fractures such as K-wire, bone sutures, tension band wires, cerclage wires, prosthetic replacement and intramedullary devices^[5]. The proximal humeral internal locking system (PHILOS) plate is a recent generation locking compression plates in which screws were placed in converging and diverging directions to provide stable fixation and allows early postoperative mobilization^[6, 7]. However, with the limited availability of prospective studies upon the management of proximal humerus fractures treated with PHILOS plate. The present study was designed to assess the efficacy of the PHILOS plate in the management and functional outcome of displaced proximal humerus fractures.

Materials and Methods

The present prospective study was conducted in the Department of Orthopedics, Maheshwara Medical College and Hospital, Isnapur, Telangana from March 2019 to March 2021.

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A total of 40 cases with displaced proximal humerus fractures admitted in the Department of Orthopedics were recruited. Cases with a mature skeletal framework, fractures to the proximal part of the humerus according to NEER 2 part, 3 part and 4 part fractures and cases willing to participate been included. Cases with an immature skeletal framework, open fractures, pathological fractures and cases not willing to participate in the study were excluded. Informed consent was obtained from all the study participants and the study protocol was approved by the institutional ethics committee.

All the subjects were evaluated clinically and treated accordingly. Preoperatively, all the subjects were undergone with X-ray to analyze the type of fracture with the help of NEER's classification. Few cases were undergone with CT scan, to assess the extent of articular fracture. All the study participants were operated with PHILOS plate under the guidance of C-arm. Cases were operated in the supine position on a radiolucent table under general anaesthesia through anterior deltopectoral approach.

Postoperatively, the arm was immobilized in arm pouch with a cuff and a collar sling. Drain exit was done on 2nd postoperative day. For a stable fixation, pendulum exercises and other passive ROM as tolerated were advised to the patient. Postoperative follow up appointments were conducted at the end of 2 weeks, 6 weeks, 3 months, 6 months and 12 months. During follow up, cases were evaluated clinically for status of wound, severity of pain, tenderness, swelling, range of motion and status of infection and radiological for healing of fracture, reduction and position of plate. The SPSS version 23 software was used to carry out statistical analysis relevant

to the study. Descriptive statistics were used to represent demographic and clinical characteristics in the form of frequency and percentages.

Results

Table 1: Demographic details of study participants

Demographic parameter	Frequency	Percentage
Age (In years)		
28-40	12	30%
41-50	09	22.5%
51-60	10	25%
61-70	03	7.5%
Above 70	06	15%
Gender		
Male	23	57.5%
Female	17	42.5%
Laterality		
Unilateral right	22	55%
Unilateral left	18	45%
Bilateral	-	-
Mode of injury		
Falling injuries from height	08	20%
Falling and slipping	03	7.5%
Road traffic accidents	29	72.5%
Types of fracture (NEER's classification)		
2 part fracture	05	12.5%
3 part fracture	27	67.5%
4 part fracture	08	20%

Table 2: Average constant score in related to age and NEER's classification.

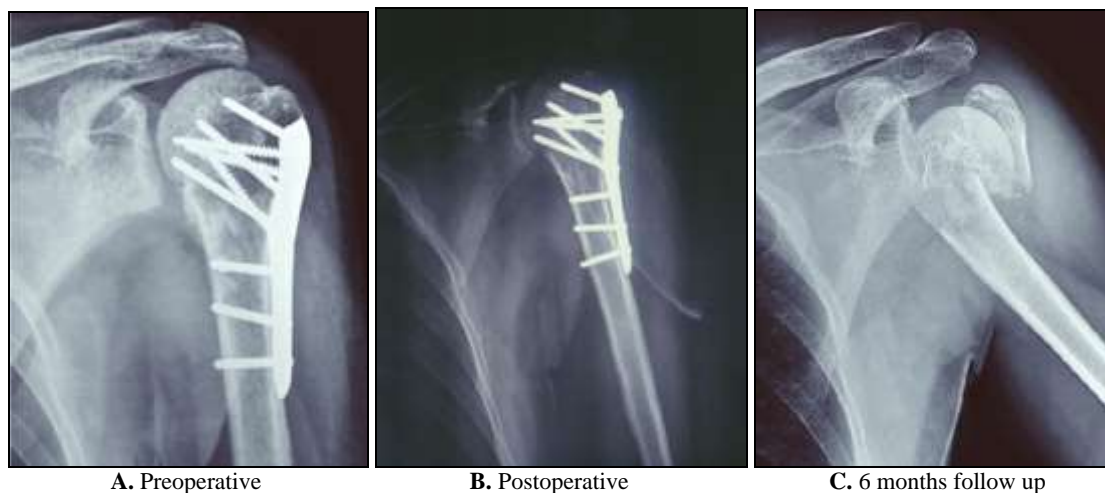
	Average constant score	Range	Frequency	Percentage
Mean constant score	66.22 (range 43-84)			
Age (In years)				
28-40	71.3	-	12	30%
41-60	63.9	-	19	47.5%
Above 60	61.06	-	09	22.5%
NEER's classification				
2 part fracture	74.8	69-80	05	12.5%
3 part fracture	65.68	45-84	27	67.5%
4 part fracture	61.24	43-76	08	20%

Table 3: Functional outcome grading in the study participants

Outcome	Frequency	Percentage
Excellent	08	20%
Good	12	30%
Moderate	14	35%
Poor	06	15%

Table 4: Postoperative complication of PHILOS plate.

Complication	Frequency	Percentage
Failure of fixation	01	2.5%
Malunion/non union	-	-
Infection	02	5%
stiffness	05	12.5%
Perforation of screw	02	5%
Implant loosening	01	2.5%
osteonecrosis	03	7.5%



A. Preoperative

B. Postoperative

C. 6 months follow up

Fig 1: Radiographs of preoperative, postoperative and end of 6th month follow-up of 42 years old male with proximal humerus fracture treated with PHILOS plate. (A. Preoperative, B. Post-operative & C. 6th month follow up)

Discussion

Proximal humerus fractures management is a challenging task for orthopaedician due to the high incidence of postoperative complication. PHILOS plate has been a widely accepted treatment modality for proximal humerus fractures. The present study was designed to assess the efficacy of PHILOS plate in the management of displaced fractures to proximal humerus. A total of 40 cases with displaced proximal humerus fractures admitted in the Department of Orthopedics were recruited. Majority cases in between 41-60 years (47.5%), followed by 28-40 years (30%) and above 60 years (22.5%). Male (57.5%) participants were more than female cases (42.5%). In this study, 55% of cases had fractures on the right humerus, 45% cases had fractures on the left humerus and none of the cases had bilateral humerus fractures. In this study, road traffic accidents were the commonest mode of injury in 72.5% cases, followed by falling injuries from height (20%) and injuries by falling and slipping (7.5%).

According to NEER's classification of fractures, 12.5% cases had 2 part fractures, 67.5% cases had 3 part fractures and 20% cases had 4 part fractures. In this study, the mean constant score was 66.25 and the range was 43-84. A study by Uidesh Yadav *et al.* to assess the functional outcome on 34 cases with 3 and 4 part proximal humerus fractures treated with PHILOS plate noticed that all the fractures united clinically and radiologically with a mean constant score at final follow up was 85.29^[8]. A study by Vivek Bansal *et al.* included 25 cases with acute proximal humerus fractures to assess the functional outcome in these cases managed with PHILOS plate noticed a mean constant score after 6 months follow up was 57.4 and the constant score was poor in cases with 4 part fractures^[9]. A study by Goutam Kumar Satpathy and Dillip Kumar Chand recruited 31 cases with proximal humerus fractures managed with PHILOS plate noticed a mean constant murley score at the final follow up was 81 (range 57-100)^[10]. A study by Jagiasi JD *et al.* noticed average constant score was 61.8. The mean constant score for above 45 years of age was 50.53 and for below 45 years of age was 72.91^[13]. A study by P Kosala Raman *et al.* noticed average constant score after 18 months of follow up for all fractures was 67.28^[15].

In the present study, 20% of cases had excellent functional outcome, 30% cases had good functional outcome, 35% of cases had fair functional outcome and 15% cases had poor functional outcome (Table 3). A study by Vivek Bansal *et al.* found excellent outcome in 16% cases, good outcome in 44%

cases, fair in 16% cases and poor outcome in 24% cases^[9]. The functional outcome was excellent in 15 cases, good in 7 cases, fair in 5 cases and poor in 4 cases^[10]. A study by Shivaprasad S *et al.* on 30 cases with proximal humerus fractures managed with PHILOS plate noticed excellent and satisfactory constant murley score in 90% cases and unsatisfactory outcome in 10% cases^[11]. A study by Ali M and Wajid MA found the mean constant score for the operated shoulder was 62.3 as compared to 90.3 for the contralateral shoulder^[12]. The functional outcome of cases as per grading of constant score was excellent in 40% cases, very good in 6.66%, good in 30% cases, fair in 20% cases and poor in 3.33% cases^[13]. A study by Srikanth S *et al.* noticed excellent results in 66.67% cases, good results in 16.67% cases and poor results in 10% cases^[16]. A study by Rao NVN and Supradeeptha noticed an excellent constant murley score in 1 case, good score in 11 cases, moderate score in 11 cases and poor score in 2 cases^[17]. A study by Kumar V *et al.* found excellent results in 7 cases, good results in 16 cases, satisfactory results in 5 cases and poor results in 2 cases^[18]. A study by Vijay Sharma *et al.* found an excellent constant score in 50% cases, good outcome in 20% cases, moderate outcome in 20% cases and poor functional outcome in 10% cases^[19]. A study by Dhruv Pandya and Krupal Soni noticed excellent and satisfactory functional outcome in 78% of cases and poor functional outcome in 22% of cases^[20].

A study by Uidesh Yadav *et al.* concluded that proximal humerus fractures treated with PHILOS plate give better functional and radiological outcome as compared to other fixation modalities like non-locking plates, intramedullary nails, K- wire fixation and tension band wiring^[8]. A study by Vivek Bansal *et al.* concluded that management of proximal humerus fractures with PHILOS plate is associated with satisfactory functional outcomes in 2 and 3 part fractures^[9]. A study by Goutam Kumar Satpathy and Dillip Kumar Chand concluded that PHILOS plating is a safe and effective treatment modality for proximal humerus fractures^[10]. PHILOS plate is an effective modality in the management of proximal humerus fractures due to its angular stability^[11]. Open reduction and internal fixation with PHILOS plate got better functional outcome with fewer implant related complications^[12]. Management of proximal humerus fractures with PHILOS plate is a feasible modality and provides good stable fixation with the better functional outcome^[13]. A study by Akram Muhammad Aliuddin *et al.* concluded that proximal humerus fractures treated with

PHILOS plate have better functional outcome^[14]. PHILOS is a reliable procedure with good functional outcome in the treatment of proximal humerus fractures^[15]. PHILOS locking plates is a better treatment modality for proximal humerus fractures especially in cases of poor bone quality^[16, 17]. PHILOS plate fixation is an effective treatment modality for proximal humerus fractures particularly in osteoporotic bones^[18]. PHILOS plate provides good stable fixation with satisfactory functional outcome in the treatment of proximal humerus fractures^[19]. PHILOS plate fixation is a promising modality in the management of proximal humerus fractures. It provides rigid fixation, enhances axial and angular stability and allows early mobilization of the shoulder^[20, 21].

Conclusion

The proximal humerus fractures treated with PHILOS plate had excellent functional outcome in 20% cases, good in 30% cases, fair in 35% cases and poor in 15% cases by applying constant murley score. The proximal humerus locking plate is a good treatment option for 2, 3 and 4 part of NEER's fractures with good functional outcome, good stable fixation with minimal postoperative complications.

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