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Outcome of PHILOS Plate Application in Type III and Type IV Proximal Humeral Fracture: Tertiary Level Hospital in Bangladesh

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Abstract **Original Research Article**

Background: More over 10% of all fractures in people over the age of 70 are in the proximal humerus, making it the third most commonly non-vertebral osteoporotic fracture behind proximal femur and collies' fractures. Many different methods of treatment, including closed reduction with percutaneous K-wire fixation, open reduction with subsequent fixation using Transosseous sutures, tension band wire, T plate, locking plates and screws, intramedullary nails, and prosthetic replacement, have been documented. ***Objective:*** The aim of our study was to functionally evaluate the Proximal Humerus Type II and type IV Fracture treated with PHILOS plate with early joint mobilization. To achieve maximum functional activity at shoulder joint. ***Material and Methods:*** This prospective study was conducted in the department of orthopedic surgery, Rajshahi Medical College, Bangladesh with Matricentred base Study from January June 2020 to July 2022. A total (n=176) cases of proximal humerus fracture treated by PHILLOS plate. ***Results:*** In our study of 179 cases, Male patients predominated female patients 100 (56%) males to 79 (44%) females, and the average age of patients is 39 years with the range being 25–65 years. Road traffic accident and fall from height were the commonest cause of the trauma 71 (39.66%). Neer classification system was used to classify the fractures. During the follow–up functional parameters were assessed using Constant-Murley scoring system. The study shows 60 (33.52%) excellent, 51 (28.49%) good, 24 (13.41%) satisfactory, Adequate 28 (15.64%) and 13 (7.26%) poor results on Constant Murley Score. The most common complications surgical site infection 3 (1.68%). ***Conclusion:*** A proximal humerus fracture can be stabilized with the use of a PHILOS plate.

Keywords: PHILOS, proximal humerus, Tibial plateau fracture, locking compression plate.

INTRODUCTION

The seventh most common cause of fracture in adults is proximal humerus fracture [1, 2] and the second most common cause of upper extremity fractures, accounting for approximately 5% of all fractures [3]. From 1990 to 2020, the age-adjusted incidence of this fracture type has increased by 15% annually, most likely because of the increasing prevalence of osteoporotic injuries and the mean age of the affected patients [4].

According to Neer classification of proximal humorous fracture, type III and type IV fractures are best managed by operative treatment. Surgical treatments includes use of various techniques such as intramedullary locking nail osteosynthesis, open reduction and locking plate osteosynthesis, primary hemiarthroplasty, and reverse shoulder arthroplasty [5].

Numerous surveys have suggested that angular stable implants provide sufficient fracture stabilization in older patients [6, 7]. Of these implants, the proximal humeral internal locking system (PHILOS) (Synthes, Solothurn Switzerland) is a well-established and widely reported implant with good results [8, 9]. However, no operative procedure is beyond complications. So, our aims of the study were outcome of PHILOS implant for the Type III and Type IV proximal humerus fractures in terms of functional outcome, Conostant-Murrly score [10] and determine the postoperative complications.

Inclusion Criteria

- Adult patients.
- Displaced proximal humerus fractures of type III and type IV variety.

For operative treatment outlined by Neer i.e. an angulation of articular surface of more than 45 degrees, a displacement between the major fractures fragments more than 1 cm or a fracture with valgus impaction

Exclusion Criteria

- Non-displaced proximal humerus fractures – type I and type II fractures.
- Fracture dislocations.
- Head splitting fractures.
- Infection at the site of fracture.
- Patients below age 18 years.
- Pathologic fractures.

MATERIALS AND METHODS

This prospective study was done from June 2020 to July 2022 in Rajshahi Medical College Hospital. Total PHILOS implant application was done on 179 cases for only Type III and Type IV proximal humerus fractures. For operative treatment outlined by Neer [11] i.e., an angulation of articular surface of more than 45 degrees, a displacement between the major fractures fragments more than 1 cm or a fracture with valgus impaction. Patients those who were admitted in to study place with closed proximal humorous fractures Type III and Type IV were included in this study. Patients with fractures of same sided elbow, head injury, age below 20 years, open fractures, and having primary or secondary neoplasm of humerus were excluded from the study. History of injury was taken and proper clinical examination and radiological examination were done before planning of operation and fractures were classified according to Neer's proximal humorous fracture classification.

Operative Procedure

Surgery was performed in beach chair position on a radiolucent table under general anesthesia using the anterior deltopectoral approach. The greater and lesser tuberosity fragments were tagged with non-absorbable sutures. The tuberosity fragments were reduced to the lateral cortex of the shaft. Reduction of the tuberosities may indirectly reduce the head fragment; alternatively, to restore the medial calcar of the proximal humerus, an elevator was inserted to dis-impact the head fragment. If required, the fracture was reduced and provisionally fixed into position using 1.5 mm Kirschner wires, sutures were passed through the rotator cuff and attached to the plate through the suture eyelets before permanent fixation with the contoured proximal humerus locking plate will be performed. On the anteroposterior view, the plate was ideally placed 8-10 mm distal to the superior tip of the greater tuberosity; from the lateral view, the plate was centered against the lateral aspect of the greater tuberosity.

An adequate gap was left between the plate and the biceps tendon to prevent disruption of the anterior humeral circumflex artery or entrapment of the tendon. The initial screw was then placed in the elongated hole in the humeral shaft (in classic 3- or 4-part fractures), so that the height of the plate could be adjusted. After achieving the appropriate fracture reduction and plate position, the locked screws were inserted into the humeral head using the insertion guide and sleeve assembly. At least three distal shaft screws were inserted. A final fluoroscopic image was taken to ensure adequate reduction and proper medical support. Rotator cuff, capsule and subscapularis muscle tears/avulsions were repaired meticulously. The wound was closed in layers and a suction drain will be inserted.

Follow up Schedule

Follow up appointments were at 2 weeks, 6 weeks, 3 months, 6 months, and 9 months postoperatively. Radiographs were taken regularly to check the position of the plate and the progress of fracture healing. The patient's shoulder ROM was recorded. The patients were evaluated using the Constant shoulder score4 at 3 and 6 months postoperatively when the fracture theoretically had healed and the patients had completed the rehabilitation program.

RESULTS

Among 179, 100 (56%) were male and 79 (44%) were female. Age distribution was shown in Table-1. Most of cases presented with road traffic accident 71 (39.66%). Evaluation of results were done on basis of scoring system given by Constant and Murley score, the scoring system of which comprises four parts: pain, power, activities of daily living and range of movement. More score indicates well to excellent outcome. Mean score was 77.40 ±12.03 categorically 60 (33.52%) were in excellent and 51 (28.49%) were in good outcome (Table 4).

Table 1: Distribution of age (n= 179)

Age	**Frequency**	**%**
20-40	57	31.84
40-60	88	49.16
60-70	34	18.99
Gender		
Male	100	56
Female	79	44

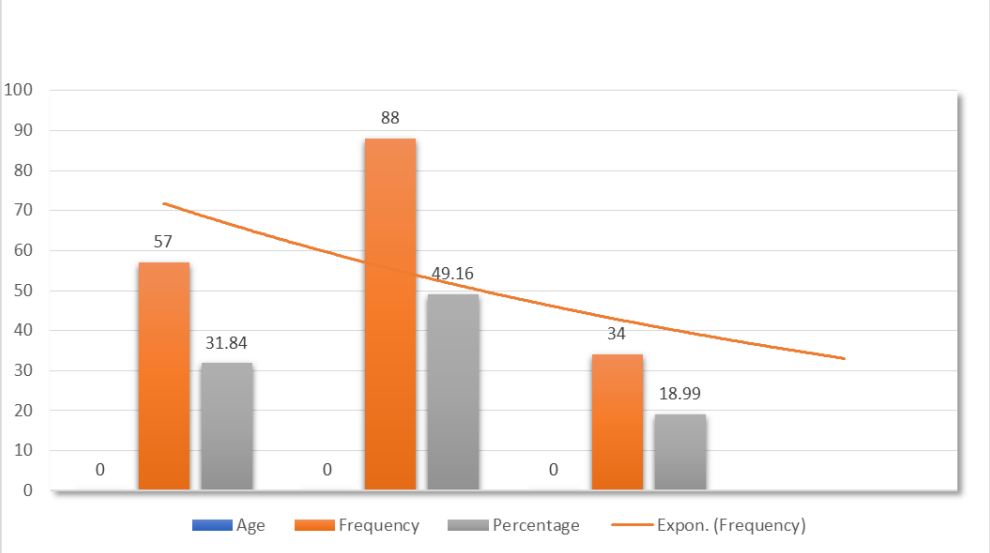

Fig. 1: Distribution of age (n= 179)

Table 2: Distribution of age (n= 179) Frequency Table

Statistics					
			Age	**Frequency**	**Percentage**
N	Valid	0	3	3	3
	Missing	0	0	0	0
Mean				59.67	33.3300
Std. Deviation				27.099	15.14009
Minimum				34	18.99
Maximum				88	49.16
Percentiles	25			34.00	18.9900
	50			57.00	31.8400
	75			.	.

Table 3: Etiological factors

A etiological factors	**Frequency**	**%**
Fall from height	14	7.82
RTA	71	39.66
Machinery injury	67	37.43
Physical assault	27	15.08
Total	**179**	**100**

Parameter	**Score**
Pain	15
Activities of daily living	20
Range of motion	40
Power	15
Total	100
Valuation	**Score**
Excellent	91-100
Good	81-90
Satisfactory	71-80
Adequate	61-70
Poor	<60

Fig. 2: Constant and Murley score system

Table 4: Functional Outcome of PHILOS plate application

Outcome	Frequency	%
Excellent	60	33.52
Good	51	28.49
Satisfactory	24	13.41
Adequate	28	15.64
Poor	13	7.26
Surgical site infection	3	1.68
Total	**179**	**100**

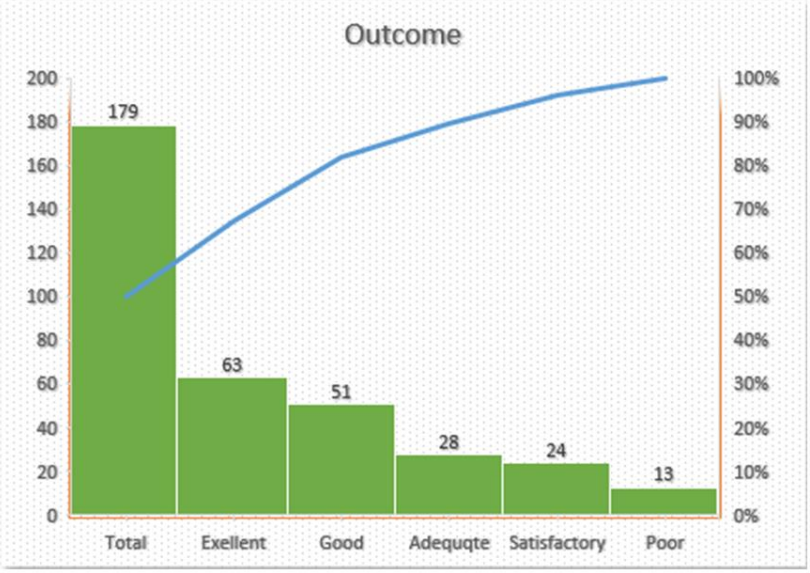

Fig. 3: Functional Outcome of PHILOS plate application

DISCUSSION

Open reduction and internal fixation (ORIF) of proximal humeral fractures with a plate and screws has been associated with complications such as screw loosening from the insufficient holding power of screws in osteoporotic bone, subacromial impingement, and avascular necrosis from excessive periosteal and soft tissue stripping [13, 14]. In 1986, Kristiansen and Christensen9 reported satisfactory or excellent results in only nine of 20 patients who had fixation of proximal humerus fracture with T-buttress plate. There was a high occurrence of fixation failure [13]. New techniques have been introduced such as the Polarus nail, the Plan Tan Humerus Fixator Plate, and the PHILOS plate. Among all those fixation method, PHILOS plate has less complications and better functional outcome [15].

In our study according to Constant and Murley scoring system, mean score of this study was 77.40 ±12.03 which was similar to Patil SR [12] *et al.*, mean 79.81±16.03; Thanasias *et al.*, [16] mean 74.3 and Chen CY [1] *et al.*, 73.2 ± 15.2. Most common complications of this study were screw perforation and varus malunion. Same type of complications was shown in Patil SR [12] *et al.*, Thanasias *et al.*, [12]; and Chen CY *et al.*, studies. To overcome this problem, different screw size and larger length of buttress might be solution.

In exposing the tendon in the bicipital groove, the anterolateral branch of the anterior humeral circumflex artery, which is the primary blood supply to the proximal humerus [16] may be damaged. This jeopardizes the blood supply to the humeral head and increases the risk of osteonecrosis. Though in our study only 5.68% cases developed such problem, but incidence became almost zero due to development of our expertise. In Chen CY *et al.*, study its incidence less than 5% and Patil SR *et al.*, had only 5%. 8 cases developed surgical site infection and among them 5 had Diabetes mellitus and rest 3 cases had sever soft tissue injury and muscle injury. Among 8 cases, 3 cases developed implant failure and all were more than 65 years old and were advised for shoulder arthroplasty.

CONCLUSION

PHILOS has better functional outcome than other plate and screw fixation. Not only that complications rate is also minimum, so, PHILOS is the good option for Type III and Type IV proximal humorous fractures.

CONFLICT OF INTEREST

None.

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