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Functional Outcome of Philos Plating in Proximal Humerus Fracture

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Abstract:-
INTRODUCTION: Proximal humeral fractures consist of 4-5% of all the fractures in human body and make up 80% of all humeral fractures.Most of these fractures results from minor trauma in old age and high velocity injury in younger.Different operative treatment modalities are available for this fracture. TheProximal Humeral Internal Locking System plate (PHILOS plate) is an internal fixation system that helps in angular stability, reduce vascular compromise and improve fixation in osteoporotic. This study was performed to evaluate the functional outcome in proximal humerus fractures treatedwithPHILOS plating.

METHODS:Aprospective observational study conducted from July2018 to Aug 2019 inNational trauma center, Bir hospital Nepal. 41 patients fulfilling the criteria were enrolled in the study and treated with open reduction and internal fixation with PHILOS plate and the outcome assessed using Constant Murley scoreat 6 weeks, 3 months and 6 monthsfollow up. The collected data were analyzed using Fisher exact test.

RESULT:The outcome in this study was good in 58.5%, fair in 24.4%, poor in 9.8% and excellent in 7.3% of the cases with mean Murley Score 80.1±6.1SD. 65.9% patients had good to excellent outcome and 97.6 % patients had achieved clinical and radiological union at 6 month.

CONCLUSIONS:Majority of the patients had good to excellent outcome with almost all had radiological union at six month periods. Open reduction and internal fixation with the PHILOS plate provides high degree of angular and axial stability and prevent fixation failure and thus helps in early joint mobilization and returns to functional activity.

Keywords:- *constant murley score;PHILOS plate;proximal humerus fracture.*

I. INTRODUCTION

Proximal humeral fractures, refers to those fractures that occurs at or proximal to the surgical neck of the humerus[1,2] andconsist of 4-5% of all the fractures in the human body and makeup 80% of all humeral fractures.[2]Most of these fractures results from minor trauma in old age and from high velocity injury in younger.[1]These fractures can be displaced or undisplaced and criterion for the displacement is 1 cm separation of the fracture segment or more than 45 degree of angulation.[3]

Different operative modalities are available for the displaced proximal humeral fractures but the choice of treatment and device to be used depends upon the patient age, fracture type and the bone quality.[4] The PHILOS plate is an internal fixation system that provides angular stability with use of divergent and convergent interlocking screws on the pre contoured plate.[5] In addition, it has advantages of reduced vascular compromise and plate failure, better screw anchorage in osteoporotic boneand good functional outcome with early joint mobilization.[6] In contrast, percutaneous k wire fixation which is being commonly used in our context for such fractures has poor anatomic reduction, stabilization and functional outcome.Theproximal humeral locking plate has drawbacks of higher failure rate with possible need of revision surgery and which could be overcome by the fixation with PHILOS plate.Among different complications that can occur in this fracture, shoulder stiffness being the most common complication.[2, 3]

With this background and no such study performed in nepal, this study aims to explore the functional outcome in proximal humerus fractures treated with PHILOS plate in our part of the country.

II. METHODS

This prospective observationalstudy was conducted between July 2018 and Aug 2019in Department of Orthopaedics, National Trauma Centre Kathmandu, Nepal. Following the ethical clearance from the Institutional Review Board, forty one patient with proximal humerus fracture fulfilling the criteria of Proximal humerus fracture with Neer's 2 part, 3 part or 4 part fractures and age greater than 18 yearswere enrolled in the study. Patients with pathological fracture, open fractures, associated neurovascular injury and humeral shaft fracture were excluded from the study .With the help of clinic-radiological evaluation, cases of proximal humerus fractures werediagnosed and classified according to the Neers classification.[3,7]The patients were explained about the purpose of study and the methods of fixation and implant to be used in their fracture treatment. Informed written consent was taken and every precaution was employed to maintain the privacy of the patients. Fractures were treated with open reduction and internal fixation with PHILOS plate using deltopectoral approach and functional outcomes was assessed at six weeks, three months and six months follow up by using Constant Murley Score.[8]The collected data were stored and analyzed with the statistical software (SPSS version 22.0 for windows) to get the final interpretation. P-value was calculated under the predetermined level of significance (0.05), and the confidence interval of 95% was

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constructed. The strength of association between two variables was measured using the Fisher exact test.

Surgical intervention: The deltopectoral approach[9]was used for the facture fixation.The patient positionedsupine in the beach chair position (elevate the table to 45°, a sandbag placed under the spine at the medial end of the scapula). Vertical skin incision was given of around 10-15 cm, starting from the coronoid process down along the deltopectoral groove to the proximal humeral shaft.The internervous plane lies between the deltoid muscle and the pectoralis major muscle. The superficial dissection done after subcutaneous dissection and cephalic vein retracted laterally followed by exposed and retracted the pectoralis major muscle medially and deltoid laterally.The deep dissectionwas done with short head of the biceps and corachobrachialis retracted medially. The endangered neurovascular structures axillary nerve, musculocutaneous nerve and the cephalic vein were saved.Fracture reduce and fixed provisionally with k wire and final fixation was done with PHILOS plate.

Fig. 1: Intraoperative photograph

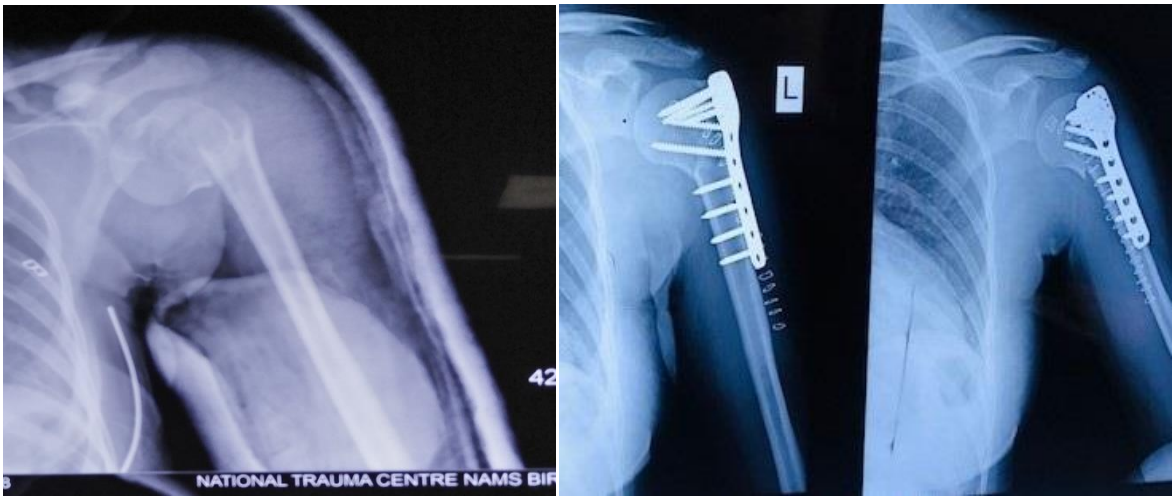

Fig. 2: Pre and postoperative operative radiograph

III. OBSERVATION AND RESULTS

Total of forty one patients of proximal humerus fracture were enrolled in this study. The minimum age of the patient was 20 years and maximum 71 years with mean age of 45.2 ±15.4. The proximal humerual fractures are more common in elderly especially in osteoporotic bone but in this study majority of the patients (75.61 %) were of age 60 years and below. Regardless of the mode of injury 61 %(25) of cases were male and 39 %(16) were female patients. Majority of the patients (56.1%) had history of road traffic accidents and 43.9% patients had sustained fall injury.In this study, right side involved in 51.2% and left side in 48.8% of the patients.The duration between the time of injury and the

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time of operation was minimum twoto maximum six days with an average duration of 3.5 days.According to the Neer's classification, the most common pattern of the fracture in tour study was Neers three part fracture (46.3%) followed by two parts (41.5%) and four parts fracture (12.2 %).

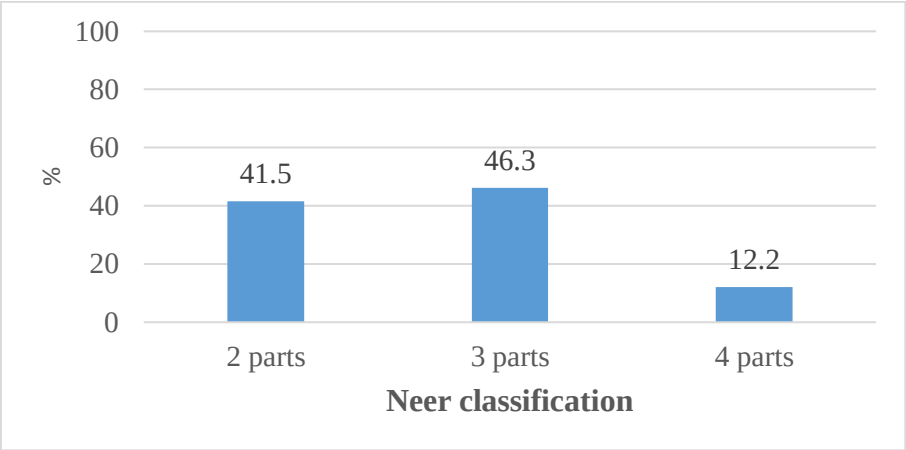

Fig. 3: Bar Diagram showing Neer's classification

There was no statistical significance found between the Neers fracture types and the outcome in this study (P =0.532)

Neer's classification	Murley score at 6months				Total	**P=0.532**
	Excellent n (%)	Good n (%)	Fair n (%)	Poor n (%)		
2 parts	2 (4.88 %)	10 (24.39%)	4 (9.75%)	1(2.44%)	17	
3 parts	1 (2.44%)	12 (29.27%)	5 (12.19%)	1(2.44%)	19	
4 parts	0	2 (4.88%)	1 (2.44%)	2(4.88%)	5	

Table 1: Association between Neer's part and functional outcome

At 6 month follow up, 97.6%(40)of patient had radiological union, one patient had not united and the mean time for the radiological union was 12.6 weeks (12.6±4.86 SD). The functional outcome based on Constant Murley score have found to be good in 58.5%, fair in 24.4%, poor in 9.8 % and excellent outcome in 7.3% of the patients with an average Constant Murley score of 80.1 (ranging from 68 to 91). The majority of the patients had good to excellent outcome (65.9%).

Outcome	At 6 weeks n (%)	At 3 months n (%)	At 6 months n (%)
Excellent to good	0(0)	6(14.6)	27(65.9)
Fair to poor	41(100)	35(85.4)	14(34.1)
Total	41(100)	41(100)	41(100)

Table 2: Outcome based on Constant Murley Score

The outcome in patients with less than 60 years of age had good to excellent as compared to the patients with age more than 60 years had fair to poor outcome. There was statistical significance seen in outcome in age group of less than and more than 60 years age (P=<0.001).

Outcome at 6 month	Age group		P value
	< 60 years n (%)	>= 60 years n (%)	
Excellent	3(7.32)	0(0)	<0.001
Good	24(58.53)	0(0)	
Fair	3(7.31)	7(17.07)	
Poor	1(2.44)	3(7.32)	
Total	31(75.61)	10(24.39)	

Table 3: Final outcome based on age group

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The statistical association had also observed between the mode of injury and functional outcomeof proximal humeral fractures in this study (P=0.002).

MOI	Murley score at 6 months				Total	P=0.002
	Excellent	Good	Fair	Poor		
Fall	2 (4.88%)	5(12.19%)	7(17.07%)	4(9.76%)	18(43.9%)	
RTA	1(2.44%)	19(46.34%)	3(7.32%)	0	23(65.10%)	

Table 4: Association between mode of injury and outcome

- **Complications**

In our study, a few patients had developed the postoperative complications like shoulder stiffness in 6 cases, varus malunion in 1 case andnon union in 1 case at six months follow up.

Complications	Frequency	Percentage
Stiffness	6	14.6
Varus malunion	1	2.4
Non union	1	2.4
Total	8	19.4

Table 5: Complications at 6 months follow up

IV. DISCUSSION

The proximal humerus fracture are more common in elderly population with underlying osteoporosis but with increasing trend of road traffic accidents these fractures have also become common problem among young individuals. The anatomical reduction and stable or rigid fixation can only be achieved by open reduction and internal fixation. Fixation with PHILOS plate offers the good functional outcome in proximal humerus fracture.

Numbers of literature have described the different implants device and operative techniques to treat these fractures, but it is difficult to compare these studies due to variations in age of the patients, type of fractures, duration of follow up, surgeons expertize, outcome parameters and the evaluation systems.[10]This study was performed to assess the functional outcome following open reduction and internal fixation for proximal humerus fractures with PHILOS plate. Total of 41 patients with proximal humerus fractures fulfilled the inclusion criteria were enrolled in the study.

The mean age of the patients in this study was 45.2(20-71) years which is almost similar to the study done by Sohal et al. on PHILOS plate in Proximal Humerus Fracture. The more numbers of the young patients could possibly due to the increasing incidence of sustaining road traffic accident among young individuals in both studies.

In this study most of the fracture cases were of male (61%) in compared to the female (39%). This finding is similar to the finding in a prospective study done by S N Patil et al. in which 53.3 % are male 46.7 % are female[11] ; however there was no change in the outcome in relation to gender involved.

Majority of the patients in our study presented with the history of RTA (56.1%) followed by fall injury (43.9%). This finding was similar to a study done by Ananthula Krishna Reddy et al. in which the majority of the cases had sustained road traffic accidents.[12] In another similar study by S N Patil et al. had 70 % of the cases sustained the injury by RTA. In their study, the majority of patient were young individuals who had a history of road traffic accidents.[11] In contrast to our study, a study by Juan Agudelo et al. on the Analysis of efficacy and failure in proximal humerus fracture had found the fall injury as common mechanism of injury (n = 99, 65%) among the total of 153 evaluated patients. Fall injury as a major mechanism in their study could be due to most of the patients are elderly who are vulnerable to fall.[13]

Right sided limb was found to be involved in 51.2% of patient and 48.8% in the left side in this study. This finding was comparable with a similar study by Chintan Doshi et al. wherein the majority of cases (58.49%) had right sided involvement .[14] The average duration between the time of injury and the time of operation was 3.5 days (SD 1.3) with minimum duration of two days and maximum of 6 days in this study. Since none of the patients in our study had avascular necrosis of the humeral head on radiographic evaluation, the duration between the time of injury and time of operation seems to have no influence in outcome of the patient.

Observing the type of fracture pattern according to the Neer's classification system, we found that the most common pattern was three part fractures (46.3%) followed by two part (41.5 %) and four part fractures (12.2 %). Our result was similar to a study done by Leah M. Schulte et al. wherein 50% of the patent had three part fracture followed by 43.18% had two part and 6.81% had four part fracture.[15]In contrast to our finding, in a study by Jeung Tak Suh et al. in Korea had maximum cases with two part fracture (52.6%), followed by three part in 23.7%, four part 5.3% and 6.6% had head splitting fracture among total of 76

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enrolled patients.[16]

We observed that there was no significant statistical association between the Neers types and the functional outcome while measuring the association between constant Murley score and Neers Part fractures (P=0.532). Among all the two part fracture 4.88% had excellent, 24.39% had good 9.75% had fair results, similarly in three part fractures majority of patients had good result (29.29%) and excellent in2.44%. Among 5 cases of four part fractures 7.32% had satisfactory to good results.

A similar result of no functional outcome had altered by the Neers different types of part fracture in a retrospective review study conducted at five different level-one trauma centers by Juan Agudelo Et al. between 2001 and 2005.[13]

In other hand, a systematic review of locking plate fixation of proximal humerus fractures by Robert C. Sproul et al. had observed with no significant findings in an outcome in two part or three part fractures whereas the outcome difference was seen between the three part and four part fractures.[17]

While evaluating the outcome based on the Constant Murley score at 6 month follow up, the average Constant Murley score was found 80.1 ranging from 68 to 91 and the majority of patients had good functional outcome (58.5%) in our study. It was also observed that the 65.9% of the patients have good to excellent outcome at six month and 24 (58.5%) patients have Constant Murley score between 80 and 89. It was found that the 3(7.3%) patients had excellent result, 10(24.4%) had fair or satisfactory and 4(9.8 %) patients had poor results. A similar finding was noticed in a study by SN Patil on A prospective study of 30 cases of PHILOS plating for displaced proximal humeral fractures had good to excellent result in 60.67% patients whereas in our study it was 65.9% as a good to excellent result. The fair to poor result was in 33.33% patients in their study and 34.2 %. in our study.[11]

The average time for radiological union in our study was 12.6 weeks (±4.86 SD) on six month follow up with overall 97.56% union rate. A study by Awal Hakeem et al. on outcome of the PHILOS plating in proximal humerus fractures had similar result as found in our study. The average time for radiological union in their study was 12 weeks.[18]Another similar study on 30 patients of the proximal humerus fractures by Ch. Venkateswarlu et al had the mean time for the radiological union of all the fractures was 11.4 weeks (8-20 weeks).[4]

A few complications that were noted in our study are nonunion of 1 case(2.4%), stiffness of 6 cases(14.6%), and the varus malunion of 1case (2.4%). The most common complication observed in our was stiffness which could be due noncompliance to the rehabilitation. There was no single infection noted in our study. A similar study on fractures and fracture-dislocations of the proximal humerusdone by Rocco Erasmo et al. in contrast had shown the secondary screw penetration in 3.6 % cases and the plate breakage in 1 case which complications are not seen in our study. They had also observed 2 cases with nonunion, 4.8 % cases varus positioning and in 3.6% had impingement syndrome because of cranial position of the plate.[10]

V. CONCLUSION

Majority of the patients had good to excellent outcome with almost all had radiological union at six month periods. Among operative modalities open reduction and internal fixation with PHILOS plate provides high degreeof angular & axial stability thushelps in early joint mobilization and returns to the functional activity.The accessible and regular rehabilitationservice to allthe patients is key to achieve the excellent outcome which is most challenging in Nepal due to its geographic constrains.

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