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# FUNCTIONAL OUTCOME OF PROXIMAL HUMERUS FRACTURE WITH PHILOS PLATING

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**Abstract:**

**Background:** Fractures of the proximal humerus represent approximately 4% of all fractures and 26% of humerus fractures. Three and four-part fractures of Neer's Classification (13-16% of proximal humerus fractures) have been a challenge to achieve stable fixation. Difficulties have been multifactorial, including osteoporotic bone, angular instability, implant impingement, loss of reduction and backing out of screws.

**Aim:** The aim of the study is to provide a pain free shoulder and restoration of activities of daily living as early as possible in patients with proximal humerus fracture.

**Materials & Methods:** In a prospective study, 22 patients with proximal humeral fractures were treated with the Locking Proximal Humerus Plate from July 2014- Dec 2015. All patients were evaluated with radiographs in anteroposterior, lateral & axillary views and 3DCT scan. Most of these fractures were closed except one which was open with relative frequency of 2 parts fractures-4; 3 parts fractures - 8 & 4 parts fractures - 10, according to the Neer's classification. All fractures were treated surgically with proximal humerus locking plate. Follow ups included radiographs, clinical examinations, and recording Constant scores.

**Results:** After 18 months of follow up, the average Constant score for all fractures was 67.28 (2 parts-75; 3 parts 66.71; 4 parts - 60.14). Complications like deep infection (6.6%) was associated with open fracture, loss of reduction of fracture (6.6%) in one patient & osteonecrosis (6.6%) in one patient. There were no non-unions and implant breakage.

**Conclusion:** Our data shows that using the Proximal Humerus interlocking system Plate for treatment of proximal humeral fractures of all types is a

reliable procedure, with good results being obtained with careful planning and familiarity with the special features of the operative technique.

**Key-words:** Proximal Humerus fracture, Philos Plating, Functional Outcome

**Introduction:**

Fractures of the proximal humerus account for 4% of all fractures & 26% of humerus fractures.<sup>1,2</sup> Mostly common in elderly patients due to osteoporosis and less frequently in young adults due to high energy trauma. Usually high energy trauma associated with dislocation. These fractures challenge the treating orthopaedician because of its osteoporotic quality in the elderly people and the deforming forces of the muscles attached. Most are stable and minimally displaced and can be treated non-operatively with good results.<sup>3</sup> Displaced fractures (Neer’s classification) of two, three and four-part fractures (13-16% of proximal humerus fractures) have been a challenge to achieve stable fixation. The treatment goal is to achieve a painless shoulder with full function. Various methods of fixation have been used, including Kirschner wire fixation, suture fixation, external fixation, tension band fixation, Rush pin fixation, intramedullary nailing, and prosthetic replacement with plating.<sup>4-11</sup>

The proximal humeral internal locking system (PHILOS) plate has been developed to overcome the above difficulties and to improve screw fixation in osteoporotic bone and to minimise 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 preshaped and contoured for the proximal humerus. No compression of the plate is required, which reduces the risk of loss of reduction and preserves the periosteal blood supply of the bone. Locking the screws into the plate ensures angular as well as axial stability and reduces the risk of screw

toggle, pull out and loss of reduction. Divergent or convergent locking screws improve the pull out resistance of the whole construct.<sup>12</sup> The locked interface also provides fixed stability, which helps to prevent subsidence in the metaphyseal areas.<sup>13</sup>

This prospective study was undertaken to highlight our experience in treating proximal humerus fracture with PHILOS plating.

**Materials & Methods:**

Between July 2014 and December 2015, a total of 22 patients with displaced/angulated/rotated two, three and four part fractures cum dislocation of proximal humerus were treated with open reduction with internal fixation

using philos plating. The study includes 16 men and 6 women in the age range from 18 years to 66 years (mean = 49.8). Out of 22 patients, 10 patients were victim of road traffic accident in which one associated with fracture neck of femur on ipsilateral hip, 7 patients had self fall, 4 patients had fall from height and one was victim of an animal attack. Inclusion criteria in this study were patients with displaced proximal humerus fracture on basis of Neer’s classification, Open and closed fractures of proximal humerus and failure of conservative treatment. Exclusion criteria were pathologic fractures from primary or metastatic tumours and skeletally immature patients.

Neer’s Classification							
S.N.	Age In years	2 part		3 part		4 part	
		M	F	M	F	M	F
1	18-30	1	-	1	-	1	-
2	31-40	1	-	1	-	-	-
3	41-50	1	-	3	-	3	2
4	51-60	1	-	1	1	1	2
5	>60	-	-	-	1	1	-
		4	0	6	2	6	4
		4		8		10	

**Table 1: Age, sex and Fracture pattern**

Anteroposterior, lateral and axillary radiographs were taken preoperatively to determine the Neer’s classification [classified as 2-part (n=4), 3-part (n=8), and 4-part (n=10)].<sup>14</sup> In selected cases CT scan was done in order to know the extent of articular surface involvement and architecture of the fracture. The fracture pattern was also confirmed intraoperatively.



**Fig 1. Pre op AP Xray**



**Fig 2. 3D CT SCan**

The functional outcome of patients was assessed by using the Shoulder CONSTANT scoring system.<sup>15</sup> Post operative radiographs were reviewed for evidence of bony union or complications (non-union, avascular necrosis, implant failure, etc.).

**Operative Technique:**

All surgeries were performed under general anaesthesia and supraclavicular block with the patient in the supine position with ‘bump’ under affected shoulder. Patients received 1.5 grams of Cefuroxime intravenously at the induction of anaesthesia. A deltopectoral approach was used for 3 and 4 part fractures and deltoid splitting approach for 2 part fractures. In deltopectoral approach, cephalic vein was identified and retracted laterally and the subscapularis was retracted medially.



**Fig 3. Intraop Image**



**Fig 4. Post op AP Xray**

The fragments were indirectly reduced and provisionally fixed with K-wires under image intensifier control. After obtaining acceptable reduction, the PHILOS plate was placed laterally at least 8 mm distal to the tip of the greater tuberosity . The long head of the biceps tendon in the bicipital groove was identified and preserved. The plate was then placed lateral to the long head of the biceps without compromising its function. The humeral head fragment as well as the metaphyseal shaft fracture was fixed with locking head screws. The length of the screw was measured with depth guage. The corresponding length locking screw was then inserted. Minimum 4 screws were inserted in the head. The final position of the implant was checked with the image intensifier in multiple planes to assess fracture reduction, glenohumeral congruence and intra articular screw perforation. The shoulder was checked clinically for stability of fixation, range of movements and absence of impingement. One of our patients required bone grafting that was harvested from the ipsilateral iliac crest.

Closure was done with 2/0 vicryl to muscle, fascia and subcutaneous tissue and 1/0 Ethilon to the skin after perfect hemostasis. The post

operative protocol includes pouch arm sling immediately after surgery. IV antibiotic was continued for 5 days with cefuroxime. All patients started early passive and active assisted mobilisation of shoulder and elbow within the first 72 hours under close supervision. They were discharged within one week postoperatively unless there were any other associated co-morbidities. Sutures were removed on 14th post operative day.

Patients were followed up at 2 weeks, 6 weeks, 3, 6 and 12 months. Radiological examination was performed at the six-week to assess bony union and was repeated at three months if union had not been achieved. Patients were assessed functionally using the Constant shoulder score.

**Results**

The average Constant shoulder score was 67.28 (range, 38–92). 9 patients had a score exceeding 75, 10 were scored between 50 and 75, and 3 were below 50. Constant scores in 2-, 3-, and 4-part fractures were compared below in the table. Complications like deep infection(6.6%) was seen in one open fracture, loss of reduction of fracture(6.6%) in one patient & avascular necrosis of humeral head(6.6%) in one patient. There were no non-unions and implant breakage.

Constant Score	No . (%) Of Patients		
	2 Part Fracture (n=4 )	3 part Fracture (n=6)	4 part Fracture (n=5)
Mean (range)	75 (56 - 92)	66.71(38-91)	60.14 (40-71)
≥ 75 (Excellent)	2 (91)	3 (50)	4 (78)
50 - 75 (Average)	2 (59)	4 (59)	4 (80)
<50 (Poor)	-	1(16.6)	2 (20)

**Table 2: Comparison of Constant scores**



**Fig 5. Functional Outcome - Clinical Picture**

### Discussion:

Comminuted fractures of the proximal humerus are at risk of fracture displacement, screw loosening, and fixation failure.<sup>16</sup> Open reduction and internal fixation with commonly used AO T-plate and other plate and screws has been associated with a high rate of complications, such as subacromial impingement, screw loosening in osteoporotic bone or avascular necrosis.<sup>17-20</sup> The surgical technique requires extensive soft tissue stripping, compromising the vascular supply to the humeral head. Minimally invasive methods of plate osteosynthesis may increase the risk of neurovascular damage.<sup>21,22</sup> Percutaneous pinning requires advanced skills, good bone quality, minimal fracture comminution, and a cooperative patient during rehabilitation.<sup>23</sup> Every

fourth patient fixed with a blade plate is at risk of blade perforation into the glenohumeral joint.<sup>24</sup> In an *in vitro* model of a reconstructed 3-part proximal humeral fracture, the locking plate provided better torsional fatigue resistance and stiffness than did the blade plate.<sup>25</sup> The bulky PlantTan plate requires wide surgical exposure and has high rates of infection and fixation failure in patients with osteoporosis.<sup>26</sup>

Intramedullary nails are biomechanically stronger than plates.<sup>27-29</sup> 80% of patients treated with Polarus nails reported satisfactory results; most of them had 2-part fractures.<sup>30</sup> However, a failure rate of 45% was also reported.<sup>31</sup> With antegrade nailing, shoulder function can be impaired because of subacromial impingement or rotator cuff injury at the nail entry point.<sup>32</sup>

In our study, the Philos plate fixation was suitable for 2-, 3- and 4-part proximal humeral fractures. Its complication rate was low, probably because our patients were relatively young, and both the bone quality and the surgical technique were good. During dissection and head penetration with proximal locking screws, care should be taken to avoid damage of the anterior humeral circumflex artery and the axillary nerve. The screw position must be checked intra-operatively with image intensification. In elderly patients with poor bone stock, the humeral head and shaft should be packed with bone grafts or substitutes to prevent fixation failure of the screws.<sup>33</sup>

### Conclusion:

The results of management of proximal humeral fractures with the PHILOS plate was found to be better than the other known methods with less complication rate. The functional

outcome was found to be better in younger than older patients. Delay in the surgical treatment as well as post operative rehabilitation and increasing complexity of fracture pattern affected the final functional outcome.

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