

## Original Article

# Results of Philos Plating In Adult Proximal Humerus Fractures

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Being the most common fracture of the shoulder girdle, proximal humerus fractures occurs more common in elder age group attributing to osteoporosis. Involvement of younger age groups and complex patterns of proximal humerus fracture are more common at present in these fractures due to increased incidence of high velocity trauma and vehicular accidents. Clinical outcomes can be bothersome to patients and their daily activities of life and their management often demands high level of surgical skills. Using PHILOS plate for open reduction and internal fixation of these fractures, we have studied and evaluated the functional and radiological results. **Methods & material:** We retrospectively reviewed 20 patients who were operated for proximal humerus fracture by PHILOS plate by deltopectoral and deltoid split approaches between 2014-2017. Preoperative xrays and in some cases CT scans were done. Postoperative x-rays were evaluated and Constant shoulder score was used as a clinical tool for assessment.

**Results :** In a mean follow up period of 50 months, 55% patients showed excellent and 25% showed good outcome with improved Constant Shoulder Score. 1 patient encountered infection with resultant stitch gaping and nonunion, 2 patients had malunion, and 1 patient developed AVN of humeral head. 2 patients had to change their occupation post operatively. No patient had conversion to total or hemi arthroplasty till last follow up. **Conclusion:** 2-,3- and 4-part proximal humerus fractures and fracture dislocations by Neer's classification treated by PHILOS plate by open reduction and internal fixation give gratifying results with early mobilisation exercises and physiotherapy with low complication rates.

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**Key words :** PHILOS, Constant shoulder Score, Neer's classification, Open reduction internal fixation, Vehicular accident, Deltopectoral approach, Deltoid split approach, AVN, Early rehabilitation.

Osteoporosis and poor bone stock are usually the attributing factor for proximal humerus fractures<sup>1,2</sup> and are mostly caused by low energy trauma. There is universal agreement that most stable fractures, which often occur in frail, elderly patients, are best treated nonoperatively. Involvement of younger age groups and complex patterns of proximal humerus fracture are more common at present in these fractures due to increased incidence of high velocity trauma and vehicular accidents<sup>3</sup>. Different modalities of treatment are available and best possible treatment option depends on patient's age, quality of bone, surgical expertise, needs and expectations of the patient. These fractures affect daily activities of human life. Different treatment protocols are available with supporting as

### Editor's Comment :

- The PHILOS plate due to stable fixation allows to regain better shoulder function and early return to activities in Neer's 2-part, 3-part and 4-part fractures.
- Complication rates with this technique are low in present study.
- Early mobilization exercises and physiotherapy yielded better movements of operated shoulder.
- Present study showed gratifying results with PHILOS plating in Neer's 2-part, 3-part and 4-part fractures.
- Larger sample size with more 4-part fractures will help yield more accurate results of this treatment for more complex fracture patterns.

well as contradicting evidences of their own. Treatment modalities of wide range have been used in past ranging from percutaneous pin, wire and screw fixation, transosseous suture fixation, tension bend wiring, standard plate fixation to hemire placement arthroplasty<sup>4-6</sup>. Using PHILOS plate for open reduction and internal fixation of these fractures, we have studied and evaluated the functional and radiological results.

### MATERIALS AND METHODS

We retrospectively reviews 20 patients who were operated for proximal humerus fracture falling in Neer's classification 7 of 2-PART, 3-PART, 4-PART with

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PHILOS plating between 2014-2017 of which 14 patients were operated by DELTOID SPLIT and 6 patients were operated by DELTOPECTORAL approach<sup>8</sup>. According to NEERs classification, 6(30%) patients had 2-part, 12(60%) patients had 3-part and 2(10%) patients had 4-part fracture. Patients with any of the following were excluded: medically unfit, fracture in <18 years of age, shaft humerus fracture with proximal extension, Neer's classification 1-part fracture, open fractures, associated with neurovascular injuries. Patients were explained about procedure, prognosis and informed consent was taken. Total 20 patients comprising of 15 males and 5 females with 70% patients falling in age group of 26-45 years were included with mean age found to be 41 years. One patient had early infection with resultant stitch gaping which was reoperated for debridement of wound and removal of screw and infection site. Fracture showed nonunion on follow up and was lost at follow up. One patient having 4-part fracture dislocation by Neer's classification with head split developed humeral head AVN resulting in arthritis. In 2 patients head was fixed in various and both the patient had malunion on follow up. 55% patients had RTA as mode of injury with most of the patient having age 30-45 years and 1 patient had railway accident. 40% of patients had associated injury to other limbs and systems as a result of high velocity trauma. Preoperative radiological evaluation of shoulder was done in all cases by X-ray Anteroposterior view and Axillary view and CT Scan in some of the patients. Postoperative shoulder Anteroposterior and Lateral views were obtained and Head shaft angle, nonunion, malunion, AVN of humeral head were assessed. After suture removal, follow up was done at monthly interval for 3 months, at 6 months and 6 monthly thereafter. Patient was assessed clinically and radiologically on every follow up.

#### SURGICAL APPROACHES AND PROCEDURE

14 patients were operated by deltoid split and 6 patients were operated by deltopectoral approach in supine position. The affected arm was draped to allow free motion intraoperatively. Injectable intravenous antibiotic ceftriaxone and sulbactam were administered half hour prior to surgery. Head end of patient was put on radiolucent part of the table such that standard intraoperative Anteroposterior and Lateral views were possible throughout the procedure.



Fig 1 — Provisional fixation of fracture with k wires followed by fixation with plate

#### ***Deltoid split approach*** —

The skin incision follows direction of muscle fibres along upper part of deltoid at junction of anterior and middle raphe. Starting from the acromion, deltoid muscle is split along its fibres taking care not to injure axillary nerve.

#### ***Deltopectoral approach*** —

Oblique incision 15cm starting from below clavicle passing over the coracoid. Deltopectoral groove and cephalic vein identified and conjoint tendon retracted. Biceps tendon was located. Greater and lesser tuberosity fragments were identified with their tendon attachments relative to biceps tendon.

The rest of the surgical techniques applied did not differ between both groups. Articular fractures were anatomically reduced. Greater and lesser tuberosity fractures were reduced by fixing rotator cuffs with ethibond suture. After provisional fixation with k wires, final fracture fixation was done with PHILOS plate (Fig 1).

#### POSTOPERATIVE REHABILITATION

During immediate postoperative period, shoulder and elbow were kept in immobiliser and finger, wrist mobilization exercises were allowed. Patient was kept immobilised in shoulder immobiliser till the condition required. Pendulum exercises were started as soon as the patient felt comfortable. After 3 weeks, forward flexion upto 90° and abduction upto 90° started. After 6 weeks, overhead abduction and external rotation were allowed and encouraged. Weight lifting was allowed once union was confirmed clinicoradiologically on follow up.

#### RESULTS

Our mean follow up period was 50 months comprising 15 male and 5 female patients with mean

age 41 years. The age and sex distribution of study population is given below in Table 1.

As is evident, majority of the patient belong to age group 26-45 years comprising 70% of study population.

We have used constant shoulder score (CSS)<sup>9</sup> as clinical tool to measure results in our patients. CSS is measured at 3 months postoperatively and thereafter at interval of 6 months. The given table features CSS (difference between normal and abnormal side) in follow up patients (Table 2).

As is evident, in age group 26-45 years 11 out of 14 patients and in age group 46-65 years 5 out of 6 patients had excellent to good CSS.

Only 1 patient had non union and in all the united fractures, clinical union preceded radiological union with clinical and radiological union seen at mean 9 and 10 months respectively (Tables 3&4).

As is evident, 1 patient had infection with resultant stitch gaping which was treated by antibiotics and regular dressing and required delayed suture removal. This patient was then re-operated for debridement of wound and removal of one screw at the infection site. The fracture had head split and showed nonunion on follow up. This patient was lost at follow up.

One patient developed humeral head avascular necrosis which further caused arthritis. The fracture pattern was 4 part fracture dislocation by Neer's classification with head split. In 2 patients humeral head was in various fixation and had malunion on

follow up. These complex patterns of fractures could be the reason for the radiological complications. These patients had restriction in

movements and overhead abduction was not possible.

Complication	Number	Percentage
Early Infection	1	5%
Stitch Gaping	1	5%
Malunion	2	10%
Nonunion	1	5%
Avn	1	5%

#### DISCUSSION

Non operative treatment of Neer's 3 and 4 part fractures of the proximal humerus is associated with poor outcome due to intraarticular fracture geography and inherent instability of fracture fragments<sup>10,11</sup>. Screw loosening, fracture redisplacement, fixation failure are more common in comminuted fractures. Careful assessment of the patient in terms of age, bone quality, fracture type, comminution, activity level and patient's needs is required before deciding the type of treatment in particular patient. Good bone quality, minimal comminution of fracture, compliance of patient and expertise n skills are required for better results with percutaneous pinning<sup>6,12-14</sup>. Complications like loosening of screws, subacromial impingement or humeral head avascular necrosis<sup>15-18</sup>. Extensive stripping of soft tissues are needed during open reduction of these fractures which further compromises vascular supply of humeral head. Chances of axillary nerve and vascular damage are more with minimal invasive methods of osteosynthesis plating of proximal humerus fracture<sup>19,20</sup> PHILOS provides better angular stability. Multiplanar placement of screws in humeral head with locking of screws with plate at fixed angle gives advantage of high resistance to back out. Shorter period of immobilization and early beginning of rehabilitation are other advantages of PHILOS plate attributable to initial better stability with fixation<sup>21,22</sup>. In our study 80%(n=16) of the patient had excellent to good outcome. Functional outcome was better in 2- and 3- part fracture. With 50.85% patients of 2-part and 3-part fracture and 49.15% patients of 4-part fractures and mean age of 42 years, Mohammed M.H. El-Sayed in their study showed 69.5% excellent to good results<sup>23</sup>. 31.8% 3-part and 4-part fractures in mean age of 63 years Parmaksizoglu et al found 68.7% excellent to good result<sup>24</sup>. Epidemiology of proximal humerus fracture shows younger age group of patients with increase in frequency of more complex fracture patterns due to increased frequency of vehicular accidents and high velocity trauma in younger active population<sup>3</sup>. Even with satisfactory shoulder function the functional outcome may be lower than expected

Age Group (in Years)	Male	Female	Percentage
26-35	10	1	55%
36-45	2	1	15%
46-55	2	1	15%
56-65	1	2	15%
Total	15	05	100%

Score Rating	26-45 Years	46-65 Years	Percentage
Excellent (<11)	8	3	55%
Good (11-20)	3	2	25%
Fair (21-30)	1	0	5%
Poor (>30)	2	1	15%

Weeks	Radiological Union		Clinical Union	
	Number	Percentage	Number	Percentage
8	0	0%	13	65%
10	16	80%	5	25%
12	3	15%	1	5%
14	0	0%	0	0%
16	0	0%	0	0%
18	0	0%	0	0%
20	0	0%	0	0%

due to associated injuries. Varus collapse is associated with restriction of range of motion and poor functional results. This study showed lower complication rates. Early rehabilitation and physiotherapy of operated shoulders gave better range of motion.

**Limitation of our study :** It was limited number of patients and even less 4-part fractures. Technical expertise, adequate exposure to complex fracture patterns and high level of surgical skills give more promising results.

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#### REFERENCES

- 1 CourtBrown CM, Caesar B — Epidemiology of adult fractures: a review. *Injury* 2006; **37**: 691-7.
- 2 Lind T, Kroner K, Jensen J — The epidemiology of fractures of the proximal humerus. *Arch orthop Trauma Surg* 1989; **108**: 285-7.
- 3 Irenberger A — *J Bone Joint Surg Br* 2004 Mar; **86(2)**:217-9.
- 4 Bell JE, Leung BC, Spratt KF, Koval KJ, Weinstein JD, Goodman DC, *et al* — Trends and variation in incidence, surgical treatment, and repeat surgery of proximal humerus fractures in the elderly. *J Bone Joint Surg Am* 2011; **93**: 121-31
- 5 Park MC, Murthi AM, Roth NS, Blaine TA, Levine WN, Bigliani LU — Two-part and three-part fractures of the proximal humerus treated with suture fixation. *J Orthop Trauma* 2003; **17**: 319-25.
- 6 Resch H, Povacz P, Frohlich R, Wambacher M — Percutaneous fixation of three- and four-part fractures of the proximal humerus. *J Bone Joint Surg Br* 1997; **79**: 295-300.
- 7 Neer CS — Displaced proximal humerus fractures classification and evaluation, *JBJS* 1970; 52A: No6, September, 1077-89.
- 8 Wu CH, Ma CH, Yeh JJ, Yen CY, Yu SW, Tu YK — Locked plating for proximal humeral fractures: differences between the deltopectoral and deltoid split approaches. *J Trauma* 2011; **71**: 1364-70.
- 9 Constant CR, Murley AH — A clinical method of functional assessment of the shoulder. *Clin Orthop Relat Res* 1987; **(214)**: 160-4.
- 10 Nho SJ, Brophy RH, Barker JU, Cornell SJ, MacGillivray JD — Management of proximal humeral fractures based on current literature. *J Bone Joint Surg Am* 2007; **89(Suppl 3)**: 44-58.
- 11 Friess DM, Attia A — Locking plate fixation for proximal humerus fractures: a comparison with other fixation techniques. *Orthopedics* 2008; **31(12)**:
- 12 Jaberg H, Warner JJ, Jacob RP — percutaneous stabilization of unstable fracture of Humerus. *J Bone Joint Surg Am* 1992; **74**: 508 -15.
- 13 Resch H, Hubner C, Schwaiger R — Minimally invasive reduction and osteosynthesis of articular fractures of the humeral head. *Injury* 2001; **32(Suppl 1)**: SA25-32.
- 14 Herscovici D Jr, Saunders DT, Johnson MP, Sanders R, DiPasquale T — Percutaneous fixation of proximal humeral fractures. *Clin Orthop Relat Res* 2000; **375**: 97-104.
- 15 Esser RD — ORIF of three & four part fractures of proximal humerus. *Clin Orthop Relat Res*; **No.299**, 244-51
- 16 Hawkins RJ — Three part fractures of proximal humerus, *JBJS* 1986; **Vol 68A**: 1410-4.
- 17 Kristiansen B, Christensen SW — Plate fixation of proximal humeral fractures. *Acta Orthop Scand* 1986; **57**: 320-3.
- 18 Wijnman AJ, Roolker W, Patt TW, Raaymakers EL, Marti RK — Open reduction and internal fixation of three and four-part fractures of the proximal part of the humerus. *J Bone Joint Surg Am* 2002; **84**: 1919-25.
- 19 Gardener MJ, Griffith MH, Lorch DG — Helical plating of the proximal humerus. *Injury* 2005; **36**: 1197-200.
- 20 Lau TW, Leung F, Chan CF, Chow SP — Minimally invasive plate osteosynthesis in the treatment of proximal humeral fractures. *Int Orthop* 2006; **31**: 657-64
- 21 O'Toole RV, Anderson RC, Vesnovsky O, Alexander M, Topoleski LD, *et al* — Are locking screws advantageous with plate fixation of humeral shaft fractures? A biomechanical analysis of synthetic and cadaveric bone. *J Orthop Trauma* 2008; **22(10)**: 709-15.
- 22 Thalhammer G, Platzer P, Oberleitner G, Fialka C, Greitbauer M, *et al* — Angular stable FIXATION OF proximal humeral fractures. *J Orthop Trauma* 2009; **66(1)**: 204-10.
- 23 Mohamed MH — El-Sayed, *Orthopedic Reviews* 2010; **2**: e14 doi:10.4081
- 24 Parmaksizoglu AS, Sokucu S, Ozkaya U, Kabukcuoglu Y, Gul M — Locking plate fixation of three- and four-part proximal humerus fractures. *Acta Orthop Traumatol Turc* 2010; **44**: 97-104.