

Assessment of Functional Outcome of PHILOS Plate in Proximal Humerus Fracture

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ABSTRACT

BACKGROUND

Fracture of proximal humerus is the second most common fracture of the upper extremity, following distal forearm fractures the incidence of these fractures are increasing especially in the elderly due to osteoporosis¹. PHILOS (Proximal Humerus Internal Locking System) is part of the latest generation of locking compression plates for proximal humeral fracture fixation. The aim of this study was to evaluate the clinical and functional outcome of PHILOS plate in displaced proximal humeral fractures.

METHODS

Functional outcomes of 12 men and 18 women aged 22 to 78 (mean, 58) years who underwent PHILOS plate fixation for fracture proximal humerus under general anaesthesia were recorded. Indications for surgery were part 2 (n= 9), part 3 (n= 14) or part 4 (n= 7) closed proximal humeral fractures with angulation of more than 45 degrees or displacement of more than 1 cm. Functional outcomes and shoulder range of movement were assessed based on the constant scoring system. All patients were followed up at monthly intervals for 6 months. During this period patient were motivated for physiotherapy and gradual normal use of the affected limb. Fracture union was assessed clinically and radiologically.

RESULTS

In our study of fracture proximal humerus, union in most of the cases (24) occurred between 10-14 weeks. Range of union time was 8 to 18 weeks. One case of avascular necrosis of head occurred in our case. Out of 30 cases, results were excellent in 7 cases, good in 16 cases, satisfactory in 5 cases and poor in 2 cases.

CONCLUSIONS

PHILOS plate fixation is good treatment option for proximal humeral fractures particularly in osteoporotic bones.

KEYWORDS

PHILOS, Proximal Humerus, Osteoporosis, Plate, Fracture

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BACKGROUND

Fracture of proximal humerus is the second most common fracture of the upper extremity, following distal forearm fractures. Incidence of these fractures is increasing especially in the elderly due to osteoporosis. They account for about 5% of all injuries to the appendicular skeleton.¹ The overall prevalence is about 73 per 100,000 population per year, representing about 5% of all fractures. The prevalence rises to 405 per 100 000 population per year over the age of 70 years.² Most of these fractures occur in women over the age of 50, with the exception of isolated greater tuberosity fractures, which occur with greater frequency in younger individuals.³ The nonoperative method gives good results in stable and minimally displaced fractures,⁴ whereas Operative treatment is necessary for the management of displaced, unstable fractures and fractures associated with dislocation.⁵ Displaced and unstable fractures are difficult to manage and have a high morbidity. PHILOS (Proximal Humerus Internal Locking System) is part of the latest generation of locking compression plates for proximal humeral fracture fixation,⁶ featuring anatomically contoured shape, non-parallel locking head screws, high rigidity, locking & lcp combination holes thus it offers theoretically less chance of screw pull-out/loosening. Better purchase in the humeral head. Less secondary loss of reduction.

Complications associated with the PHILOS plate fixation include screw perforations into the glenohumeral joint or femoral head, screw loosening and backing out, secondary implant dislocations from the humeral head, avascular necrosis of the humeral head, pseudoarthrosis with a broken plate, subacromial impingement requiring plate removal, non-union, malunion due to loss of purchase in the humeral head, broken distal screws with separation of the plate from the bone, and transient axillary nerve palsies.^{7,8}

The aim of this study was to evaluate the clinical and functional outcome of management of displaced proximal humeral fractures with PHILOS plate.

METHODS

The present prospective study was carried out in the Department of Orthopaedics in ERA's Lucknow Medical College and Hospital, Lucknow. Between November 2017 and October 2019. After ethical approval from the institutional ethics committee 30 cases of fracture upper end of humerus coming to Orthopaedics department were taken up for the study.

Inclusion Criteria

- Displaced fracture of proximal humerus in which fragment displace more than one centimeter or head angulation greater than 45°.
- Ununited fracture of proximal humerus to be combined with bone grafting.
- Proximal humerus fracture with distal extension.
- Patient age above 18 years.

Exclusion Criteria

- Extensively comminuted humeral head fractures which cannot be adequately reconstructed.
- Fractures proximal humerus in paediatrics age group.
- Open fracture Gustilo grade greater than on I.
- Fracture of anatomical neck of humerus with dislocation of shoulder.

Fractures were classified according to Neer fracture classification.⁹ The Neer classification system includes 4 segments -- I, II, III, and IV -- and also rates displacement and vascular isolation. The 4 segments are as follows:

- Greater tuberosity
- Lesser tuberosity
- Humeral head
- Shaft

According to Neer, a fracture is displaced when there is more than 1 cm of displacement and 45° of angulation of any one fragment with respect to the others. Judgment of osteopenia done on the basis of BMD from distal radius and WHO criteria were used for it. Person aged seven and above, who can both read and write with understanding in any language, is treated as literate in our study.

After proper workup general anaesthesia were given in all patient. The patient is brought into the beach chair position or supine position depending on surgeon or anaesthetist choice and a deltopectoral approach is then performed. Once direct or indirect fracture reduction has been achieved provisional stabilization by K-wires may be necessary. The PHILOS plate was applied at least cm distal to the upper end of the greater tubercle and fixed to the humeral head with proximal locking screws before the distal screws were inserted into the humeral diaphysis. bone graft were used in cases where there is void either medially and in cases of establish non-union . Arm pouch sling given in all patent post operatively. All patients will be followed up at monthly intervals for 6 months. During this period patient will be motivated for physiotherapy and gradual normal use of the affected limb. Functional outcomes were assessed according to the Constant scoring system,¹⁰ the subjective variables are pain and Activity of daily living, which give a total of 35 points. The objective variables are range of motion and strength, which give a total of 65 points. Hence, total of 100 points.

Inference:

- | | |
|---------------|-----------------------|
| Excellent: | Constant score >90 |
| Good: | Constant score 75-89 |
| Satisfactory: | Constant score 60- 74 |
| Poor: | Constant score <60 |

Overall inference will be assessed as-

- | | |
|------------|--|
| Excellent: | Excellent shoulder score with healing of fracture within 3 months without complications. |
|------------|--|

- Good: Good shoulder score and healing of fracture within 3 months with minor complications
- Satisfactory: Fair shoulder score and healing of fracture in three to four months with minor problems.
- Poor: Poor shoulder score / nonunion / any major complications / any case requiring second surgical procedure.

RESULTS

This study was conducted in a total of 30 cases. In our study of proximal humerus fractures mean age of the patients was 58 years. Youngest patient was of 22 years of age and oldest patient was 78 years of age.

| Age (in Years) | Proximal Humerus Fracture | |
|----------------|---------------------------|--------|
| | No. of Cases | % |
| 20-40 | 4 | 13.33 |
| 41-60 | 12 | 40.00 |
| 61 and above | 14 | 46.66 |
| Total | 30 | 100.00 |

Table 1. Age Incidence

In this study of 30 patients with proximal humerus fractures 12 were males and 18 were females. Of the 30 patients with proximal humerus fractures 9 were from urban and 21 were from rural population. Injury due to fall were the commonest mode of trauma in this study. Overall out of 30 cases, in 19 cases the injury was due to road traffic accident. In this study 16 patients were of right side and 14 patients were of left side.

| Mode of Injury | Proximal Humerus Fracture | |
|-----------------------|---------------------------|--------|
| | No. of Cases | % |
| Road Traffic Accident | 10 | 33.33 |
| Injury due to fall | 19 | 63.33 |
| Direct blow | 1 | 3.33 |
| Total | 30 | 100.00 |

Table 2. Mode of Injury

| Associated Medical Condition | Proximal Humerus Fracture | | |
|------------------------------|---------------------------|-------|-------|
| | No. of Cases | % | |
| Absent | 19 | 66.66 | |
| Present | D.M. | 4 | 13.33 |
| | H.T. | 5 | 16.66 |
| | D.M. AND H.T. | 2 | 6.66 |
| | Total | 30 | 100 |

Table 3. Associated Medical Conditions

According to the Neer classification of proximal humerus fractures In out of 30 cases in our study there were 9 cases of type 2 fracture, 14 cases were of type 3 fracture and 7 cases were type four fracture. In the present study of 30 patients of fracture proximal humerus 13 patients were found to have osteopenia as per the radiological findings and the intra-operative findings out of which 3 patients were of type two humerus fracture, 6 patients were type three and; 4 patient were of type 4 fracture. In all 13 patients with no cases of delayed union or of implant failure were recorded. Time interval between injury and the fixation of fracture was within 7 days in most of the cases i.e. 23 out of 30. In rest of the 7 cases the delay was up to a maximum of 10 days.

In most of the cases delay were due medical problem for

which patient were take time to be fit for surgery. In our study 6 cases of early complication and 3 cases of late complication occur early complication was superficial infection, screw penetration in joint and subacromial impingement by plate two case each. while total 3 cases of delayed complication occur one case of delayed union, one case of avascular necrosis and one case of screw loosening. 2 patients had post-operative superficial wound infection, which was successfully treated with incision and drainage and antibiotics. No case of deep infection was encountered. In two cases one screw penetrated in the shoulder joint which was remove after one month.

In one case 2 screw loosening occur, however no adverse effect occurs on healing due to this. In one case of type four fracture avascular necrosis of humeral head occur for which patient have to go replacement arthroplasty. In two cases subacromial impingement occur due to higher placement of plate. No case of malunion/non-union, and implant failure were recorded. One case of delayed union occurred.

In our study of fracture proximal humerus union in most of the cases (24) occurring between 10-14 weeks. Range of union time was 8 to 18 weeks. One case of avascular necrosis of head occur in our case.

| Osteopenia | Proximal Humerus | | |
|------------|------------------|-------|--------|
| | No. of Cases | % | |
| Absent | 17 | 56.66 | |
| Present | Type two | 3 | 13.33 |
| | Type three | 6 | 20.00 |
| | Type four | 4 | 10.00 |
| | Total | 30 | 100.00 |

Table 4. Presence of Osteopenia

In our study evaluation of osteopenia done on the basis of x-ray and intraoperative finding. Out of a total of 30 cases osteopenia was present in 13 cases. Out of 30 cases excellent result in 7 cases, Good in 16 cases, Satisfactory in 5 cases and Poor in 2 cases were obtained.

| Grade | Fracture Proximal Humerus | |
|--------------|---------------------------|-------|
| | No. of Cases | % |
| Excellent | 7 | 23.33 |
| Good | 16 | 53.33 |
| Satisfactory | 5 | 16.66 |
| Poor | 2 | 6.67 |
| Total | 30 | 100 |

Table 5. Grading of Results

DISCUSSION

Some authors have reported excellent results after conventional plate osteosynthesis of proximal humeral fractures, however this method of plating with conventional plate has also been associated with a high complication rate, namely: avascular necrosis, subacromial impingement, or screw loosening in osteoporotic bone particularly in elderly patients with comminuted fractures. In order to obtain better and reproducible results, the AO/ASIF has developed a special locking compression plate (PHILOS).¹¹ in the present study in case of PROXIMAL HUMERUS fractures, the patients age was in the range of 22 to 78 years, with mean

being 58 years. This mean age in the present study is comparable with Kilic B et al.¹² (2008). This mean age in our series was probably due to higher incidence of this fracture in osteoporotic bone, as incidence of osteoporosis increases with age.

In our study 17 patient were literate and 13 patient were illiterate, so in our study literate patient were slightly out number than illiterate patients. This ratio of illiterate and literate is of accordance with the official literacy rate of dist. Patiala and its neighbouring villages. In the present study 63.33% of upper end humerus fractures were due to LOW ENERGY TRAUMA (i.e. 19 out of 30 cases); whereas in 10 patients, mode of trauma was road traffic accident and in one patient mode of injury was direct blow.

The results are comparable to the study of Geiger EV (2010)¹³ in which out of a total of 30 patients, the injury was due an accident 7 patients (33%) and fall from height in 21 patient. In out of 30 cases in our study there were 9 cases of type 2 fracture, 14 cases were of type 3 fracture and 7 cases were type 4 fracture. In the study of Geiger EV et al.¹³ OUT OF 28 CASES there were 8 cases of type 2 fracture, 12 cases of type 3 fracture and 8 cases of type 4 fracture. In the study of David S et al. (2009)¹⁴ OUT OF 30 CASES there were 6 cases of type 2 fracture, 14 cases of type 3 fracture and 10 cases of type 4 fracture. In the present study in 30 cases of proximal humerus fractures, radiological union was seen between 8 to 22 weeks with union in most of the cases (24) occurring between 10-14 weeks. In one case avascular necrosis seen. Bone grafting required in none of the cases.

In the study of Kilic B et al.¹² the average time for proximal humerus fracture healing treated PHILOS in 20 cases. In the study of Moonat P et al.¹⁵ Mean duration for union was 10 weeks with range of 8 to 24 weeks. One case was showing non- union. Out of a total of 30 cases result is as follows- excellent: 7 cases, good: 16 cases, satisfactory: 5 cases and poor: 2 cases.

Average constant score in our study is 76 (range 56 to 96) with male having slightly better result constant score 78 while in case of female score was 72. Parmaksizogio AS et al.¹⁶ mean constant score was in his study was 88.3 (69-100), in his study male were showing slightly better result.

Limitations

The limitations of this study include small no. of cases (n=25). Another limitation of study is that there is no control group in the present study; therefore, we cannot determine if another method of treatment would have led to different results. Longer follow up would help to determine the long-term outcome and complications using these locking plates for fixation of proximal humerus.

CONCLUSIONS

Treatment of displaced proximal humeral fractures can be quite challenging and the management options have been

controversial as several modalities of treatment exist. PHILOS plate allows stable fixation for proximal humerus fracture and dislocation of proximal humerus. Satisfactory reduction of the fracture and optimal positioning of the plate under image-control is of paramount importance for obtaining good results.

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