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A Study on Outcome of Surgical Neck Humerus Fractures Managed Operatively by Proximal Humerus Interlocking (PHILOS) Plate

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Abstract: ***Introduction: Proximal humerus fractures account for about 5% of all injuries to appendicular skeleton and among proximal humerus fractures; surgical neck humerus fractures are most common type and account for 25% of the fractures of proximal region. The treatment of these fractures ranges from the conservative management in minimally displaced fractures to primary shoulder replacement arthroplasty in more comminuted fractures. The aim of this study was to assess the outcome of surgical neck humerus fractures managed by PHILOS plating. Materials and Methods: A total of 25 patients with surgical neck humerus fractures were in included in this study after careful inclusion and exclusion criteria and were classified according to Neer's classification and were operated with PHILOS plate and were then followed at regular intervals. The final outcome was assessed based on Constant-Murley score and DASH score. Results: According to Constant-Murley score excellent results were achieved in 12(48%) patients, good results in 7(28%) patients, fair results in 5(20%) patients and poor results in 1(4%) patient. According to DASH score 23(92%) patients had excellent results and 2(8%) patients had Good results. Infection was observed in 2(8%) patients and avascular necrosis of humeral head (AVN) was observed in 1(4%) patient non-union with implant failure was observed in 1(4%) patient and screw cut out was observed in 3(12%) patients. Conclusion: PHILOS plate is a very promising implant for surgical neck humerus fracture due to its provision of giving inferomedial support by locking screws (calcar screws) which prevent the varus displacement of the proximal fragment along with the buttressing effect laterally and provides excellent to good functional outcome.***

Keywords: Surgical Neck humerus fracture, PHILOS plate, Proximal Humerus

1. Introduction

Proximal humerus fractures are common and debilitating injuries and incidence of them are increasing especially in elderly. They account for about 5% of all injuries to appendicular skeleton. They are the third most common fractures in elderly population after hip and distal radius fractures. Among proximal humerus fractures, Surgical Neck Humerus fractures are the most common type and accounts for 25% of the fractures of the proximal region. Increase in incidence is due to more geriatric population with osteoporosis in aged population and increasing incidence of higher velocity injuries, road traffic accidents, natural disaster and industrial accidents, together with assault lead to multiple fractures and higher incidence of morbidity in young patients.

The majority of Surgical Neck Humerus fractures are non-displaced or minimally displaced and do not require operative intervention. However, displaced fractures can disrupt the function of upper extremity and often necessitate operative care. The indication for fixing such fracture depends on the fracture pattern, quality of the bone and age and activity of the patient. Many surgical techniques have evolved over a period of time like percutaneous pinning, intramedullary nailing, transosseous suture fixation. But these constructs are less stable as compared to open reduction and internal fixation (ORIF) with locking plates which provides stable fixation even in osteoporotic bones due to its locking construct and this reduces screw loosening and implant failure and thus allowing for early rehabilitation. This study is conducted to evaluate the clinical and functional outcome of operatively managed surgical neck humerus fractures with PHILOS plate.

2. Materials and Methods

This is prospective, nonrandomized study with sample size of 25 patients with surgical neck humerus fractures who were operated with PHILOS plate at G.G.G. Hospital affiliated to Shri M.P. Shah Medical College, Jamnagar.

Inclusion criteria: Patients between age group of 20-70 years (mean age: 40years) who get surgery done & available for follow-up for at least 6 months postoperatively with various configuration of surgical neck humerus fractures are included in this study.

Exclusion criteria: Pathological fractures, Open fractures and those associated with neurovascular injuries and patients with associated fractures of shoulder girdle of same side which may hamper shoulder range of motion.

On admission, detailed examination after hemodynamic stabilization of patient was carried out and then standard Anteroposterior and Axillary lateral views of shoulder were taken and were classified according to Neer's classification. Prior ethical committee approval and informed consent of

the patient for surgery were taken for including in the study.

3. Surgical Technique

All the patients were approached by standard Deltopectoral approach, cephalic vein is dissected and internervous plane between deltoid and pectoralis major muscle is made and fracture is exposed. It is provisionally reduced with K-wires and checked in fluoroscopy and then final fixation is done with PHILOS plate placed 1cm distal to upper end of greater tuberosity and proximal locking screws were extended to subchondral area and distal humeral screws were having bicortical purchase. Then wound is closed layerwise. Immediate postoperative radiographs were taken for maintenance of fracture reduction. Postoperatively arm was immobilized in Shoulder immobiliser

The timing of shoulder rehabilitation was determined by fracture stability, bone quality, and patient compliance. Generally pendulum exercises were began on the 3rd postop day along with active range of motion exercise of elbow, wrist and fingers. Patients were followed up on regular intervals and clinical evaluation of wound, pain, and shoulder range of movements were done and radiographs were taken for assessment of the fracture union. At final follow-up patients were critically evaluated clinically and radio graphically and results were rated according to Constant-Murley score which is categorized as Excellent result: 86-100 points, Good result: 71-85 points, Fair result: 56-70 points, Poor: < 55 points & DASH score which is categorized as Excellent result: 0-20points, Good result: 21-40 points, Fair result: 41-60points, Poor: > 60 points.

4. Results

- The study consists of 25 cases of surgical neck humerus fractures operated with PHILOS plate.
- The mean age of patient was 40 years, 19(76%) cases were males, and 6(24%) cases were females.
- Right sided involvement was more frequent in the present study 16(64%) cases.
- 15(60%) cases sustained fracture due to road traffic accident, 6(24%) cases had fall on shoulder, 2(8%) cases had fall on outstretched hand and 1(4%) cases had epileptic episode and 1(4%) had assault injury.
- As per Neer's classification; 2(8%) cases were 2 part, 12(48%) cases were 3 part, while 11(44%) cases were 4 part fractures.

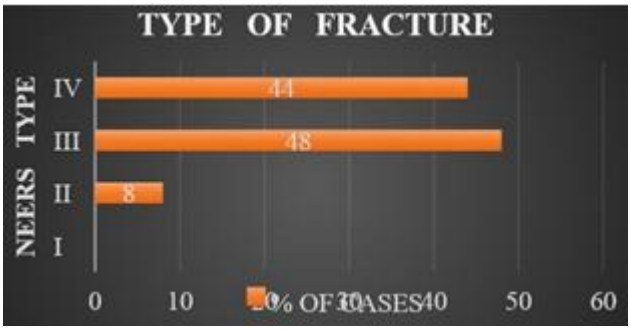

Figure 1: Showing type of fracture as per Neer's Classification

- Average admission to surgery interval in our study is 4.28 days.
- Complications in our study are as follows

Table 1: Complications

Complication	*No. Of Cases*	*% Of Cases*
Infection	2	8
Screw penetration	3	12
Non-union + Implant failure	1	4
Implant loosening	0	0
Avascular necrosis of humeral head	1	4
No Complication	18	72
Total	25	100

- Only 3 patients needed resurgery. 2 of them needed Debridement for infection and 1 patient who had Nonunion with implant failure needed bone grafting and replating. Patient with AVN was advised for replacement surgery but refused and the patients with screw penetration were advised for implant removal and they also refused for same as they were satisfied with the range of motion.
- Out of 25 patients, 1(4%) cases had achieved <90degree of abduction, 9(36%) cases 91-120 degree, and 15(60%) cases had >120 degree of abduction.

Table 2: Constant-Murley score

Constant Score Results	No. of Patients	% of Patients
Excellent(86-100)	12	48
Good(71-85)	7	28
Fair(56-70)	5	20
Poor(< 55)	1	4
Total	25	100

Table 3: DASH score

Dash Score Results	No. of Patients	% of Patients
Excellent(0-20)	23	92
Good(21-40)	2	8
Fair(41-60)	0	0
Poor(> 60)	0	0
Total	25	100

Table 4: Relation between fracture type and outcome

Constant Score Results	Neer's Type		
	2 Part	3 Part	4 Part
Excellent	1	5	6
Good	0	3	4
Fair	1	3	1
Poor	0	0	1

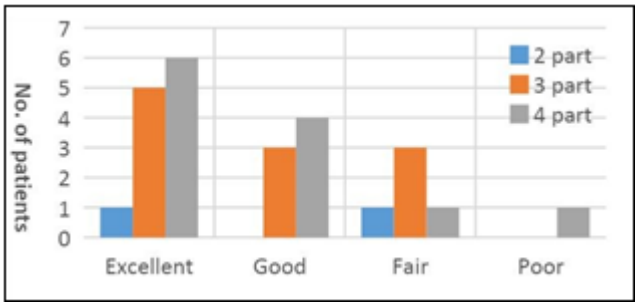

Figure 2: Showing results according to Constant-Murley Score vs Fracture type

- It is evident from the study that whenever possible even in 4 part comminuted fractures osteosynthesis should be

considered the 1st option instead of hemiarthroplasty.

5. Discussion

The incidence of proximal humerus fractures has increased in last few years due to life style changes and increase in road traffic accidents. The best management in these injuries is still uncertain. Most of the proximal humerus fracture which are un-displaced can be treated conservatively. Even if the injury is thoroughly analyzed and the literature is understood, treatment of displaced fracture or fracture dislocation is difficult. Many studies have shown that the displaced fracture of the proximal humerus have a poor functional prognosis when left untreated because of severe displacement of fragments. However, with the aim of getting anatomically accurate reductions, rapid healing and early restoration of function, which is a demand of today's life, open reduction and internal fixation, is the preferred modality of treatment.

Many studies are conducted on the fixation of the proximal humerus fracture with plates like cloverleaf plate, T-buttress plate, blade plate, but higher failure rate was observed.

Close reduction and K-wiring gives Good results for minimally displaced fractures as it entails minimal soft tissue disruption and preserves vascular supply. However, in osteoporotic bones and in comminuted fractures it is not much useful. Fixation with intramedullary nailing has shown good results, but complications like sub acromial impingement, rotator cuff injury and nonunion are high. Thus in order to achieve stable fixation and anatomic reduction the implant used should be low profile, anatomically contoured and should provide angular and axial stability.

PHILOS plate used in our study has all the advantages to achieve stable fixation. It also has holes in its construct through which rotator cuff anatomy can be restored with sutures. There are many studies which indicate that PHILOS plate gives good result in proximal humerus fractures

The average age incidence in our study of 25 patients was 40 years, which was found consistent with the studies conducted by Gerber *et al* (44.9 years), Sharma *et al* (43.6 years) and average age incidence in Egol *et al*, study was 61 years.
As compared to other studies our study has higher Male preponderance. Gender ratio was found to be 3.12:1 and this can be explained by more labourer related work in male.

In our study most common mode of injury was Road traffic accident (60%), followed by fall on shoulder and outstretched hand (32%), assault (4%), and epileptic episode (4%).

While in past studies mainly the common mode of injury was fall on shoulder but nowadays due to increase in RTA it is the commonest mode.

The most common fracture pattern was found to be 3 part fracture (48%), followed by 4 part (44%) and then 2 part (8%) which is similar with the results of study of Rose *et al*, Siwach *et al.* By contrast, Sharma *et al*, Bjorkenheim *et al* reported a higher incidence of the 2 part fracture. In our study there was higher incidence of 3 part fracture which is due to RTA as the commonest mode of injury which leads to high velocity trauma.

No intraoperative complications were observed in any of the cases. Wound infection was observed in 2 cases which needed debridement and nonunion was observed on 1 case which needed revision plating and bone grafting. Screw penetration was observed in 3 cases.

Avascular Necrosis of Humeral head was observed in 1 case who had 4 part fracture dislocation.

Average Constant-Murley score in our series was 81.12 which is comparable to studies of Gerber *et al* (77), Ramchander *et al* (80). In our study Excellent result were observed in 48% cases, Good result in 28% cases, Fair result in 20% and Poor result in 4% cases. As per DASH score Excellent to Good result were observed in 100% cases in our study, while in Peter Helwig Bjorn Epple series it was in 81.6% cases and Patil *et al* it was in 66.67% cases.

6. Conclusion

This study concludes that in case of Neer's 2 part, 3 part, 4 part and with dislocations PHILOS plate is very effective implant due to its locking construct, convergent and divergent screw pattern which prevents the implant failure and also the screw backout in osteoporotic bones. It also prevents the varus collapse of the proximal fragment due to inferomedial screw support (calcar screw). As it gives stable fixation, early mobilization of the shoulder can be done which helps in achieving more range of motion and thus help the patient in resuming their duties as early as possible without any discomfort.

Figure 3: Pre-op and Post-op X-rays of patients having Neer's 4 part fracture dislocation s urgical neck humerus of right side

Figure 4: Showing 6 months post-operative range of motion of right shoulder of same patient.

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