

Evaluation of Functional Outcome Following Open Reduction and Internal Fixation of Proximal Humerus Fractures Using Philos Plate: A Prospective Study

Dr. Govind Kumar Gupta¹, Dr. Sudha Rani², Dr. Vinit Vivek³, Dr. Umashanker Prasad Keshri^{4*}

¹Associate Professor, Department of Orthopaedics, RIMS Ranchi, Rims Cir, Indraprasth Colony, Bariatu, Ranchi, Jharkhand 834009, India

²Assistant Professor & HOD, Department of Anatomy, Hazaribag Medical College, Kolghatti, Hazaribagh, Jharkhand 825301, India

³Senior Resident, Department of Orthopaedics, Palamu Medical College, Panki, Road, Daltonganj, Jharkhand 822101, India

⁴Professor, Department of Pharmacology, RIMS, Ranchi, Rims Cir, Indraprasth Colony, Bariatu, Ranchi, Jharkhand 834009, India

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*Corresponding author: Dr. Umashanker Prasad Keshri

Abstract

Original Research Article

Proximal humeral fractures are the second most common fractures of the upper extremity and 20% of them require surgical fixation either because they need better shoulder mobility or because their fracture is more severe. PHILOS plate promises to provide good fixation and stability. This prospective study aims to evaluate the functional outcome in the subjects following surgery. After obtaining due ethical clearance, a prospective study was conducted from January 2017 to September 2018. Thirty patients were selected. Fracture was classified using NEER'S Classification. All the fractures were approached by Delto pectoral approach and fixation done under fluoroscopic guidance. Patients were followed up at 6 weeks, 3, 6 and 12 months with radiographical evaluation and clinical examination and outcome. All patients at their final assessment underwent radiological and functional evaluation using the CONSTANT score. Based on NEER'S classification, 8 patients (26.7%) had 2 part fracture, 12 patients (40.0%) had 3 part fracture and 10 patients (33.3%) had 4 part fracture. 1 patient had delayed union, 1 patient had non union, 2 patients developed stiffness of shoulder, 1 patient had a superficial infection and 1 patient had varus malunion. We assessed the final functional outcome with CONSTANT-MURLEY score and found that 7(20.0%) patients had excellent, 11(36.7%) patients had good, 7(23.3%) patients had moderate and 5(16.7%) patients had poor outcome. The mean constant score (mean± s.d.) of patients was 70.1000± 13.0816. Surgical management of fracture proximal humerus with PHILOS plating has a good functional outcome. However, proper patient selection, thorough knowledge of the anatomy and biomechanical principles are the pre-requisites for a successful surgery.

Keywords: PHILOS, CONSTANT Score, Proximal humerus, Neer's classification.

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INTRODUCTION

Proximal humeral fractures are the second most common fractures of the upper extremity accounting for 4% to 5% of all fractures [1]. The incidence of proximal fractures is 26% of all humerus fractures, are the commonest fractures in elderly population, which ranks the third and the first and second being, hip and distal radius fractures respectively. Proximal humerus involves head, greater tuberosity, lesser tuberosity and proximal one fourth of the shaft. Fracture of proximal humerus occurs most commonly in elderly patients due to osteoporosis and less frequently in young adults due to high energy trauma [2].

Most of the proximal humerus fractures, in younger as well as in the elderly patients, are stable & slightly or non-displaced, can be treated non operatively [3]. These comprise nearly 80% of the proximal humerus fractures. The rest of 20% requires surgical fixation either because they need better shoulder mobility or because their fracture is more severe. Neer's classification distinguishes between the number of displaced fragments with displacement defined as greater than 45° of angulation or > 1 cm of separation. These type of fractures require stable fixation.

Difficulties have been multifactorial, including osteoporotic bone, angular instability, implant impingement, loss of reduction and backing out of

screws. The indication for fixing such a fracture depends on the fracture pattern, quality of bone and age and activity of the patient.

Conservative treatment is usually associated with nonunion, malunion and avascular necrosis resulting in a painful dysfunction [4].

The goal is to achieve near anatomical reduction and stabilization so as to achieve early mobilization.

The surgical modalities used are transosseous suture fixation, closed reduction and percutaneous fixation, open reduction and internal fixation with conventional plates, locking plate fixation, intramedullary fixation and hemiarthroplasty which have shown to have mixed results [3-6]. Complications of these techniques include cutout or backout of screws and plates, avascular necrosis, non-union, malunion, nail migration, impingement of rotator cuff and impingement syndrome. Insufficient anchorage from conventional implant may lead to early loosening and failure, especially in osteoporotic bones. Every fixation has its own complication. The proximal humerus with poor cancellous bone quality especially in older patients, results in high risk of failure of fixation with conventional plating system [4, 5, 6]. Pre-contoured locking compression plates are fixed angled devices which prevent subsidence in the metaphyseal areas [7-9]. These plates alleviate the risk of malreduction and preserve the blood supply to the bone.

The PROXIMAL HUMERUS INTERNAL LOCKING SYSTEM (PHILOS) plate has been introduced to reduce these complications especially in older osteoporotic individual. PHILOS plate provides rigid fixation and greater angular stability than do conventional implants. It works as a locked internal fixator and provides better anchorage of screws in osteoporotic bones, with good functional outcomes. Even minimally displaced fracture can be treated with PHILOS plate to early mobilise the fracture thereby to avoid shoulder stiffness. Highly communitied 3 & 4 parts fractures can be reconstructed with rotator cuff sutural ties with plate and thereby enhance the functional outcome. This study enlightens the functional outcome of management of the fracture of humerus involving the proximal part, with PHILOS plate [10].

MATERIALS & METHODS

After obtaining due ethical clearance, a prospective study was conducted from January 2017 to September 2018. Thirty patients were selected based on the following criteria.

Inclusion Criteria

1. Patients with displaced proximal humerus fracture, (Neer's two, three and four part fractures.)
2. Patients undergoing revision surgery for failure implants.
3. Patients who have given consent to this study.

Exclusion Criteria

1. Pathological fractures from primary or metastatic tumours
2. Patients age less than 18 years
3. Open fractures
4. Polytrauma
5. Failure of conservative treatment
6. Patient who did not give consent for study

Age, profession and sex of the patient, mode of injury, severity of the injury, associated injuries, time since injury and their function demands were noted down. Diagnosis was confirmed with plain radiographs. Intra-articular extent of fracture geometry was assessed with thin slice of CT scan in doubtful cases. Fracture was classified using NEER'S Classification and planned pre-operatively according to it. Patients were treated with analgesics, U- slab till surgery. Co-morbidities were treated accordingly. Routine investigations were carried out in order to get fitness for surgery. Consent of the patient was taken.

All the fractures were approached by Deltopectoral approach and fixation done under fluoroscopic guidance. Intra-operative events, difficulties and complications, post-operative radiological evaluations and bony union were noted. Post-operatively limb was immobilized in arm pouch; mobilization was started in the second week with pendulum exercises as per patient's tolerance.

Immediate post-op X-Rays were done routine A-P and axillary view to assess the reduction of fracture and stability of fixation. Most of the suture removal was done on 10th day. Patients were discharged with arm pouch and advise to continue pendulum exercises.

Patients were followed up at 6 weeks, 3, 6 and 12 months with radiographical evaluation and clinical examination and outcome. All patients at their final assessment underwent radiological and functional evaluation using the CONSTANT score.

The Constant score assigns points for Pain, Range of movements, Power and Activities of daily living. Muscle strength was measured with use of a 1 kg weight in the patient's hand and the shoulder in 90° of abduction, or, if 90° could not be reached, in maximum active abduction as described by Constant.

The Constant score was graded as
 Poor (0 to 55points),
 Moderate (56to 70points),
 Good (71to 85points),
 Excellent (86to 100points).

RESULTS

Of the thirty patients, 4 belonged to the age group of 21-30years, 7 were inthe age group of 31-40 years, 9 were in the age group of 40-50 years, and those belonging to the age group of 51-60 and 61-70 years were 8 and 2 respectively. The mean age was 44.0333 ± 11.2449 years. 21 patients (70%) were male whereas 9(30%) were female patients. The ratio of Male to Female was 2.3:1.

Three patients (10.0%) had assault as mode of injury , 9 patients (30.0%) had sustained fall and 18 patients (60.0%) had met with road traffic accident (RTA).RTA was the most common mode of injury observed in our series.10 patients had sustained a fracture on the left, as compared to 20 patients with the involvement of right side.

Based on NEER’S classification, 8 patients (26.7%) had 2 part fracture, 12patients (40.0%) had 3 part fracture and 10patients (33.3%) had 4 part fracture.

The mean duration of surgery (mean± s.d.) was 112.6667 ± 24.7656 minutes. The mean blood loss (mean± s.d.) of patients was 178.3333 ± 65.2361 ml. The mean duration of stay at hospital (mean± s.d.) of patients was 10.4333 ± 1.2780 days.

1 patient had delayed union, 1 patient had non union, 2 patients developed stiffness of shoulder, 1 patient had a superficial infection and 1 patient had varusmalunion. Association of complication and outcome was statistically significant (p=0.0127) which implies that patents who suffered complications reported an overall poor functional outcomes.

Table-1: Distribution of Complication

COMPLICATION	Frequency	Percent
DELAYED UNION	1	3.3%
PLATE IMPINGEMENT	1	3.3%
STIFFNESS OF SHOULDER	2	6.7%
SUPERFICIAL INFECTION	1	3.3%
VARUS MALUNION	1	3.3%



In the present study the time taken for radiological union was 10 weeks in 4(13.3%) patients, 11 weeks in 3(10.0%) patients, 12 weeks in 12(43.3%) patients, 13 weeks in 6(20.0%) patients, 14 weeks in 2(6.7%) patients, 15 weeks in 1(3.3%) patients, and 18 weeks in 1(3.3%) patients. However, the mean union time didn't significantly affect the final outcome ($p=0.0501$).

We assessed the final functional outcome with CONSTANT-MURLEY score and found that 7(20.0%) patients had excellent, 11(36.7%) patients had good, 7(23.3%) patients had moderate and 5(16.7%) patients had poor outcome. The mean constant score (mean \pm s.d.) of patients was 70.1000 \pm 13.0816.

Patients reporting a poor outcome, had delayed union (1 patient), 2(60%) with stiff shoulder and 1(20%) patient had varus malunion. Association of complication vs. outcome was statistically significant ($p=0.0127$).

Excellent outcome was found to be associated with 2 part fractures, the mean being 2.8571 \pm .6901 parts. Poor outcome was frequently associated with 4 part fractures (mean \pm s.d. = 3.8000 \pm .4472). The association of mean Neer's type and outcome was statistically significant ($p=0.0384$).

DISCUSSION

The mean age (mean \pm s.d.) of patients in this study was 44.0333 \pm 11.2449 years, range (21-65 years). The average age incidence was 54.3 \pm 5.8 years in the study done by Doshi C *et al.*, [11] and 38 years (range 24-68) in the study done by Kumar GK *et al.*, [12] 58 years (range 22-78) in the study done by Sreen S *et al.*, [13] 49.24 years in the study done by Bansal V *et al.*, [15].

Literature reveals predominance of proximal humeral fractures in females in an elderly age group 40. However, in the present study, 9(30.0%) patients were females and 21(70.0%) patients were males with male to female ratio being 2.3: 1.

The mean duration of surgery (mean \pm s.d.) of patients was 112.6667 \pm 24.7656 min which was consistent with the mean duration of surgery in the study done by Doshi C *et al.*, [11] was 94 \pm 10.2 minutes.

The incidence of complications were comparable to the previous studies as depicted in the underlying table.

Table-2: Comparison of complication rates among similar studies

COMPLICATION	Kumar GK <i>et al.</i> , [12]	Bansal V <i>et al.</i> , [15]	OUR STUDY
STIFFNESS OF SHOULDER	00	8%	2(6.7%)
PLATE IMPINGEMENT	1	4%	1(3.3%)
POST-OP INFECTION	1	12%	1(3.3%)
DELAYED UNION	00	00	1(3.3%)
VARUS MALUNION	4	20%	1(3.3%)
OSTEONECROSIS OF HEAD OF HUMERUS	00	8%	00
SCREW PERFORATION	1	16%	00
PULL OUT OF SCREWS	00	4%	00

The mean union time (mean \pm s.d.) was 12.2666 \pm 1.6174 weeks which is consistent with the mean union time in other studies as shown in the table below:

Table-3: Mean union time

STUDY	UNION TIME (WEEKS)
Doshi C <i>et al.</i> , [11]	12 \pm 4.6
Kumar GK <i>et al.</i> , [12]	12
Sreen S <i>et al.</i> , [13]	Range (8-12)
Our study	12.2666 \pm 1.6174(range 10-18)

We assessed the final functional outcome with CONSTANT-MURLEY score and found that according to outcome, 7(20.0%) patients had excellent, 11(36.7%) patients had good, 7(23.3%) patients had moderate and 5(16.7%) patients had poor outcome. We found that the mean constant score (mean \pm s.d.) of patients was 70.1000 \pm 13.0816.

In the study by Kumar GK *et al.*, [12], at the final follow-up the mean Constant-Murley score was 79 (range 50-100) and the results were excellent in 25 patients, good in 13 patients, fair in 6 patients and poor in 5 patient. Out of 30 cases, excellent result in 7 cases, Good in 16 cases Satisfactory in 5 cases and Poor in 2 cases were reported by Sreen S *et al.*, [13] and outcomes were excellent in 16%, good in 44%, fair in 16% while poor in 24% in the study done by Bansal V *et al.*, [15].

Rao TV *et al.*, [16] found that excellent and satisfactory results were found in 80% of patients with unsatisfactory results in 20% according to Neer's criteria. Sharma V *et al.*, [14] found functional outcome based on the Constant scoring system showed excellent results in 20 (50%), good in eight (20%), and moderate in eight (20%) patients. Four (10%) patients had poor functional results.

CONCLUSION

Surgical management of fracture proximal humerus with PHILOS plating has a good functional outcome. However, proper patient selection, thorough knowledge of the anatomy and biomechanical principles are the pre-requisites for a successful surgery. From our study, it can be safely recommended that for proximal humerus fractures PHILOS plating is a good choice of surgical treatment.

Conflict of Interest: None.

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