Original Research Article

A Prospective Study to Evaluate the Effects of Performance on Patients with Proximal Humerus Fractures with a PHILOS Plate Fixation

Ramesh Kumar[1], Mahendra Kumar[2], Bharat Choudhary[3]

[1]Assistant Professor, Department of Orthopaedic, Government Medical College & Attached Groups of Hospital, Barmer, Rajasthan, India

[2]Assistant Professor, Department of Anesthesia, Government Medical College & Attached Groups of Hospital, Barmer, Rajasthan, India

[3]Senior Resident, Department of Anesthesia, Government Medical College & Attached Groups of Hospital, Barmer, Rajasthan, India

Received: 19-11-2020 / Revised: 20-12-2020 / Accepted: 31-01-2021

Abstract

Background: The proximal humerus with poor cancellous bone quality especially in older patients, results in high risk of failure of fixation with conventional plating system**.** To achieve better and more productive results, AO / ASIF has developed a special locking pressure plate (PHILOS) for fractures of the proximal humerus. **Materials& Methods:** This is a prospective study, conducted at Government Medical College and affiliated groups in Hospitals, Barmer, Rajasthan in the Department of Orthopedics and 15 patients who were admitted with displaced fracture of Proximal Humerus. The age, gender of the patient, the nature of the injury, the severity of the injury, the associated injury, the time from the injury and their functional requirement are recorded. The classification was subdivided using NEER'S classification and was organized prior to operation according to it. Intra-operative events, difficulties and complications, radiological post examination and bony union were noted. Patients were followed for 2 weeks, 6 weeks, 6 months and 1year with radiographical examination and clinical examination and outcome. All patients at their final examination, were radiated radiology and function using CONSTANT scores. **Results:** The study contained a sample of 15 patients, of whom 5 were female and 10 were male. The age distribution varied from 18years to 70 years with an average age of 45.8 yrs. Out of the 15 patients followed up, 3 patients had excellent scores, 6 had good scores, 4 had moderate scores and 2 had poor outcome scores. Mean constant score for Neer two-part fracture was 77.9 (range 55-90), for Neer's three parts fracture was 71.3 (range 38- 92). **Conclusion:** We concluded that due to early range of motion exercise which is possible with stable fixation by PHILOS, these patients experience less stiffness of nearby joint and able to live a pain-free healthy life.

Keywords: Proximal Humerus, Philos, Constant Score, Neer Classification.

Introduction

The prevalence of close humerus rupture is approximately 4% of all fractures and 26% of humerus fractures[1].The proximal humerus includes head, greater tuberosity, lesser tuberosity and one-fourth proximal on the shaft. It is most common in older patients due to osteoporosis and more often in adults due to high-strength trauma [2].These fractures challenge the orthopedic surgeon because of its osteoporotic quality in the elderly and the impaired muscle strength of the attached muscle. Most proximal fracture of humerus, small and in older patients are stable and small or have not moved anywhere, they can be treated without operation[3].Treatment of complex humeral 3- or 4-part fractures presents a challenge. The surgeon should obtain a direct reduction and a stable formation, and at the same time reduce the risk of iatrogenic penetration of the screw and avascular necrosis of the humeral head by significantly protecting the temporary soft tissues.The side effects of these complex fractures are due to the following causes:

1) Insufficient reduction of fractures especially the internal cortex
2) Unstable repair
3) Improper positioning of fixation devices.

**Correspondence*
Dr. Bharat Choudhary
Senior Resident, Department of Anesthesia, Government Medical College & Attached Groups of Hospital, Barmer, Rajasthan, India.
E-mail: patelbharat1221@gmail.com

There is consensus in the literature that, no matter how the procedure and implant is selected, the optimal effective end result depends largely on the anatomical reduction of the fracture combined with stable correction, and the initial onset of shoulder function regeneration. But in this study, the age of the patient, a small fraction of the fracture and the initial repair of the fracture, directly increases the functional outcomes.Over the past decade, internal correction of fractures has been widely used in surgical care for proximal humeral fractures.In addition to initial treatment and safe operation after surgery, it was believed that this implant would reduce the risk of second loss of osteoporotic patients.Inspite of an early and secure functional postoperative therapy, it was believed that these implants would reduce the risk of secondary reduction loss in osteoporotic patients.The proximal humerus with poor cancellous bone quality especially in older patients, results in high risk of failure of fixation with conventional plating system[4-6].The Proximal Humerus Internal Locking System (PHILOS) plate has been introduced to reduce these complications especially in older osteoporotic individual. Even minimally displaced fracture can be treated with PHILOS plate to early mobilize the fracture thereby to avoid shoulder stiffness. To achieve better and more productive results, AO / ASIF has developed a special locking pressure plate (PHILOS) for fractures of the proximal humerus[7].Patients with good bone quality were previously successfully treated with standard plate osteos-ynthesis[8].

Materials and Methods

This is a prospective study, conducted at Government Medical College and affiliated groups in Hospitals, Barmer, Rajasthan in the Department of Orthopedics and 15 patients who were admitted with displaced fracture of Proximal Humerus.

Inclusion Criteria

1. All skeletally mature patients presenting with proximal humerus fractures according to NEER two and three part fracture.
2. Patients with associated dislocation of the shoulder
3. Patients undergoing revision surgery for failure of other implants.

Exclusion Criteria

1. Pathologic fractures from primary or metastatic tumours
2. Patients age less than 18 years.
3. Open fractures
4. Poly trauma
5. Failure of conservative treatment
6. NeerFour-part fracture
7. Undisplaced fracture

Methods

The age, gender of the patient, the nature of the injury, the severity of the injury, the associated injury, the time from the injury and their functional requirement are recorded. The intra-articular scale of fracture geometry was assessed with a small piece of CT scan in questionable cases.The classification was subdivided using NEER'S classification and was organized prior to operation according to it. The patient was treated with analgesics, U-slab until surgery. Co-morbidities are treated fairly.Intra-operative events, difficulties and complications, radiological post examination and bony union were noted. Patients were followed for 2 weeks, 6 weeks, 6 months and 1year with radiographical examination and clinical examination and outcome. All patients at their final examination, were radiated radiology and function using CONSTANT scores.

Fracture Classification[9,10]

The Neer separation system is based on a 1 cm relocation process or a 45 ° fragment angulation. The type of fracture is then divided into categories. Four stages can occur, including the articular segment, the lesser tuberosity, the greater tuberosity, and the surgical neck.These four segments are separated by epiphyseal lines (bone growth plates) during the early years of development. When the proximal humerus is broken, the fracture line clearly predicts following one or more of these planes.Recently, displacement of greater tuberosity more than 5 mm is an indication of fixation.

Classification Based on Fracture Displacement

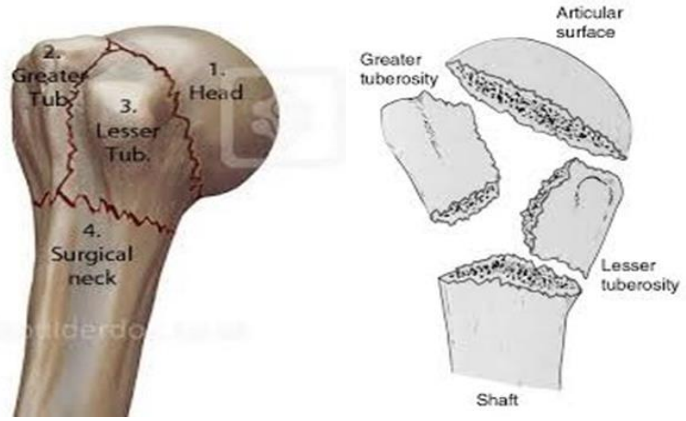

Fig 1:Depiction of bone areas

Surgical Technique for Plate Osteosynthesis – Deltopectoral Approach[11]

With the patient in a supine position at the fracture table with a 30-45 ° angulation at the end of the head, and a sandbag behind the operating scapula, a deltopectoral method was used. Start the incision at coracoid process, then extend farther away from the deltopectoral canal until the deltoid is about 15 cm long.Improve the skins to reveal a deeper fascia. Open the fascia above the deltopectoral groove with dull scissors, facing the cephalic artery. This artery serves as an important sign of the avascular interval between the deltoid and pectoralis muscles. Bluntly develop this interval, and retract the deltoid laterally and the pectoralis major medially. The vein can be ligated or retracted with the deltoid laterally.The anterior circumflex artery lies in the middle of the wound, just as high as the pectoralis muscle; they may need to be isolated, clamped, and coagulated.Wider exposure is possible if the muscle origins from the coracoid are transected. If more proximal exposure is needed, it may be necessary to transect the origin of the pectoralis minor muscle. In such cases, release the origins of the coracobrachialis and the short head of the biceps from the tip of the coracoid, leaving a cuff on the tip of the coracoid for repair.It is better to avoid devascularization of the fracture fragment by meticulous dissection of tendino osseous attachments. The osseous attachments of the rotator cuff are pull together to reduce the fracture.If the lowering is difficult, insert the k-wire as a play stick on the humeral head to rotate the head into a reduced position. or placing sutures under the rotator cuff (supraspinatus) tender can also help to stimulate and reduce. For 3-part fractures or osteoporotic fragments, place sutures into the rotator cuff tendons attached to fractured fragments to aid in reduction.Place the plate onto the greater tuberosity, just posterior to the biceps tendon, and temporarily fix it with Kirschner wires; confirm correct plate position in c-arm both in ap view in adduction and abduction. If plate placement is too proximally, it may cause impingement and If plate placement too close to the biceps tendon may damage the anterior humeral circumflex artery.If there is fractures with medial comminution, first fix the plate to the head with screws, and reduce the shaft segment to the plate. This helps avoid varus malposition, which is associated with higher failure rates. Screw insertion into the inferomedial humeral head adds stability for fractures without medial calcar support.Confirmation with c-arm on anteroposterior and lateral views is necessary for reduction and screw placement.

Post-Operative Protocol[12,13]

Postoperatively, the arm was immobilized in a sling. The drain was removed on 2nd post operative day. The time for commencement of shoulder rehabilitation was determined by stability of fixation, quality of bone, and compliance of patient. Passive ROM exercises (ie, pendulums, passive forward elevation, external rotation) generally were begun on the first postoperative day provided that a stable reduction was achieved. Active ROM of the elbow, wrist, and hand was also begun immediately after surgery. The patient then

progressed through a three-phase rehabilitation program, consisting of passive assisted exercises early, active exercises starting at approximately 6 weeks postoperatively, and strengthening or resisted exercises beginning 10 to 12 weeks after surgery. Early passive assisted exercises help to avoid adhesion formation. No limitation of exercises within the pain-free ROM was necessary during this time provided that bone stock was good and medial buttressing adequate. Shoulder strengthening and resistance exercises were initiated only after bony consolidation was confirmed on plain radiographs and adequate coordination of the extremity had been achieved.

Standard AP, axillary, and scapular Y radiographic views were taken immediately after surgery. Routine follow-up radiographs were taken 2, 6 weeks, 6 months & 1 year postoperatively to ensure that no screw has migrated, no loss of reduction has occurred, evidence of callus formation and consolidation of fracture. Plate removal was generally not necessary.

Evaluation

A physical examination was performed, the Constant score was calculated, and radiographs of the proximal part of the humerus were made and evaluated for bony healing, signs of malunion, nonunion or avascular necrosis.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[14]

Results

The study contained a sample of 15 patients, of whom 5 were female and 10 were male. The age distribution varied from 18years to 70 years with an average age of 45.8 yrs. Of the 15 patients, 8 patients fell victim to a road accident, four patients fell, 2 patients fell from a height (minimum of 10 meters) and one became the victim of an animal attack. The longest follow-up period was 20 months with an average follow-up of 12 months. 11 patients had a fracture of the right proximal humerus and 4 patients had a fracture of the left proximal humerus (Table 1).

The fracture of all 15 patients were classified using NEER'S Classification. Out of 15 patients, 11 were had Neer's3-part fracture, 4 were had Neer's2-part fracture in which 3 had surgical neck fracture and one had greater tuberosity fracture (table 1).

Out of the 15 patients followed up, 3 patients had excellent scores, 6 had good scores, 4 had moderate scores and 2 had poor outcome scores (table 2). Mean constant score for Neertwo-part fracture was 77.9 (range 55-90), for Neer's three parts fracture was 71.3 (range 38-92) (table 3).

Table 1: Parameters of Patients

Parameters	No. of patients (N=15)	Percentage
Age (yrs)		
18-40 yrs	4	26.66%
41-60 yrs	10	66.66%
>60 yrs	1	6.66%
Gender		
Male	10	66.66%
Female	5	33.33%
Side involvement		
Right	11	73.33%
Left	4	26.66%
Mode of Injury		
Road traffic accident	8	53.33%
Self fall	4	26.66%
Fall from height	2	13.33%
Animal attack	1	6.66%
Type of Fracture (Neer's Classification)		
Two part - surgical neck	3	20%
Two part - greater tuberosity	1	6.66%
Three Part Fracture	11	73.33%

Table 2: Evaluation

Result – Outcome	Numbers (N=15)	Percentage (%)
Excellent	3	20%
Good	6	40%
Moderate	4	26.66%
Poorer	2	13.33%

Table 3: Constant Score v/s Neer's parts of Fracture

Neer's Classification	Constant Score	Number
Two Part	77.9 (range 55 – 90)	4
Three Part	71.3 (range 38 – 92)	11

Table 4: Complication of Philos Plate

Complications	No. of Patients
Perforation of screw	1
Chronic Osteomyelitis	1
Failure of Fixation	1
Osteonecrosis	1
Malunion/Non union	0

Complications

One with Neer3-part fracture later leads to osteonecrosis of the humeral head. One who with 3-part fracture encountered backing out of screw with failure of fixation and finally leads to Osteonecrosis who undergone implant exit and planned for hemiarthroplasty of shoulder. Unfortunately, patient not willing for further procedure.

Avascular necrosis is not in itself a clinical problem. However, it may end up in partial or total collapse of the humeral head with incongruency. This may result in malfunction and pain, although the x- ray appearance frequently does not correlate with the clinical picture.Postoperative wound or bone infection is one of the common complications. It can be classified as acute (<21 days), intermediate (between 21 and 56 days) or chronic (>56 days). Once the purpose of implant is over, it can be removed.One patient with Neer 3 parts open fracture leads to chronic osteomyelitis for which iv antibiotic followed by oral antibiotic according to culture & sensitivity, waited till bone union and finally undergone for implant exit.

Discussion

Open loops and internal adjustments (ORIF) provide features for the reduction of fractures, solid correction and the possibility of bone grafting. In the growing humerus fracture, the PHILOS plate provides a good performance and context effect on the initial integration and strong fracture repair.In the very old age group with osteoporosis, functional outcome after conventional plate osteosynthesis was poor[15]In order to obtain better and reproducible results, the AO/ASIF has developed a special locking compression plate (PHILOS) for fractures of the proximal humerus[7].Patients with good bone quality have previously been treated successfully with the conventional plate osteosynthesis[8].This study comprises the sample of 15 patients, in which 5 were females and 10 were males. The age distribution was varied from 18 years to 70 years with an average age of 45.8 years. These findings consistent with Jacob TT et al[16] founded that 42 patients age group range between 20 and 80 years 61.9% are male and 38.1% are female treated with philos plate.The fracture of all 15 patients were classified using NEER'S Classification. Out of 15 patients, 11 were had Neer's3-part fracture, 4 were had Neer's2-part fracture in which 3 had surgical neck fracture and one had greater tuberosity fracture. Jacob TT et al[16] founded 21 patients (50%) were two-part fracture 15 patients (35.7%) were three-part fracture, 6 patients (14.3%) were four-part fracture.Out of the 15 patients followed up, 3 patients had excellent scores, 6 had good scores, 4 had moderate scores and 2 had poor outcome scores. Jacob TT et al[16]founded excellent 1 (2.4%), good 13 (31%), fair 19 (45.2%) outcome and 9 (21.4%) poor outcome noted.

Fazal et al concluded PHILOS plate fixation provided stable fixation, minimal metal work problem and enabled early range of motion exercises to achieve acceptable functional[17].The average clinical result obtained in our study, with a mean Constant-Murley score of 74.3 points is satisfactory. A meticulous anatomical reduction with appropriate plate positioning led to a significantly better result. The Constant-Murley score was significantly lower if anatomical reconstruction did not succeed or a nonanatomical reconstruction was accepted intraoperatively, and/or when the plate was not correctly positioned on the shaft at the proper height to avoid subacromial impingement. Jacob TT et al[16] founded after 1 year, a mean constant score of 72 points (87% of the contralateral non-injured side), a mean Neer's score of 76 points, and mean disabilities of the arm, shoulder, and hand score of 16 points were achieved.In a study Koukakiset al[18] founded the plate design provides stable fixation with a good functional outcome and eliminates most hardware problems such as failure and impingement.The functional results after rigid fixation of two and three part fractures using a locking plate were shown to be better than conservative treatment or semi-rigid fixation without anatomical reduction of the head fragment. Shoulder function continued to improve as the strength and function of the muscles increased.

Conflict of Interest: Nil

Source of support:Nil

Conclusion

We concluded that due to early range of motion exercise which is possible with stable fixation by PHILOS, these patients experience less stiffness of nearby joint and able to live a pain-free healthy life.

References

1. Court-Brown CM, Garg A, McQueen M. The epidemiology of proximal humeral fractures. Acta Orthop Sc and. 2001;72:365-71.
2. Flatow EL. Fractures of the proximal humerus. In: Bucholz RW, Heckman JD, eds. Rockwood and Greens fractures in adults. Vol. 1. Philadelphia: Lippincott, Williams and Wilkins, 2001, 997-1035.
3. Young TB, Wallace WA. Conservative treatment of fractures and fracture-dislocations of the upper end of the humerus. J Bone Joint Surg [Br]. 1985;67-B:373-7.
4. Hall MC, Rosser M. The structure of the upper end of the humerus with reference to osteoporotic changes in senescence leading to fractures. Can Med Assoc J. 1963;88:290-4.
5. Hawkins RJ, Bell RH, Gurr K. The three-part fracture of the proximal part of the humerus. Operative treatment. J Bone Joint Surg. 1986;68-A:1410-14.
6. Kristiansen B, Christensen SW. Plate fixation of proximal humeral fractures. Acta Orthop Sc and. 1986; 57:320-3.
7. Frigg R. Development of the locking compression plate. Injury (Suppl 2). 2003;34:6-10.
8. Wijgman 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.
9. Neer CS II. Displaced proximal humeral fractures. Part II. Treatment of three-part and four-part displacement. J Bone Joint Surg [Am]. 1970;52-A:1090-103.
10. Neer CS 2nd. Displaced proximal humeral fractures. I. Classification and evaluation. J Bone Joint Surg Am. 1970;52 (6):1077-89.
11. Hoppenfeld. Surgical Exposures in Orthopaedics: The Anatomic Approach, 3rd Edition.
12. Hodgson S. Proximal humerus fracture rehabilitation. Clin Orthop Relat Res. 2006, 131-8.
13. Bertoft ES, Lundh I, Ringqvist I. Physiotherapy after fracture of the proximal end of the humerus. Comparison between two methods. Scand J Rehabil Med. 1984;16:11-1
14. Constant C, Murley A.A clinical method of functional assessment of the shoulder. ClinOrthopRelat Res. 1987, 160-4.
15. Cordasco FA, Bigliani LU. Complications of proximal humerus fractures. Tech Orthop. 1997; 12:50.
16. Jacob TT, Nayak M. Functional outcome of patients treated with proximal humeral internal locking osteosynthesis plate in proximal humeral fractures. Int J Res Orthop. 2020;6:1182-5.
17. Fazal MA, Haddad FS. Philos plate fixation for displaced proximal humeral fractures. J OrthopSurg (Hong Kong). 2009;17(l):15-8.
18. Koukakis A, Apostolou CD, Taneja T, Korres DS, Amini A. Fixation of proximal humerus fractures using the PHILOS plate: early experience. Clin Orthop Relat Res. 2006;442:115-20.