

## Surgical management of proximal humerus fractures – Assessment of results

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### Abstract

**Introduction:** Proximal humeral fracture whether caused by trauma or related to osteoporosis, requires carefully planned individual treatment. The choice of technique and devices depends on quality of bone, soft tissue, age and reliability of patients. However the goal of proximal humerus fracture fixation should be stable reduction, allowing early motion of fracture.

**Objectives:** To analyze fractures of the proximal humerus that were treated either with the proximal humerus internal locking system (PHILOS) locking plate or percutaneous K wire and document their clinical and functional outcome.

**Materials and Method:** The study includes patients with proximal humerus fractures who underwent Open reduction and internal fixation with PHILOS locking plate or Percutaneous K-wire fixation.

Functional outcome was evaluated by Constant-Murley score. Patients were followed up at 6 weekly interval until fracture union and at once at 1 yr after the surgery

30 cases were studied, cases were selected randomly for both PHILOS and percutaneous k wire fixation, each 15 cases.

**Results:** 33.34% patients treated with open reduction and internal fixation with PHILOS plating had good to excellent results, 46.6% of patients had fair results and the remaining 20% had poor results.

40% of patients treated with closed reduction and K wire fixation had good to excellent results, 40% of patients had fair results and remaining 20% had poor results.

**Conclusion:** The results of surgical treatment of proximal humerus fractures in both the groups (percutaneous pinning and PHILOS plating) are satisfactory with good functional outcome.

**Keywords:** Proximal humerus, Constant-Murley score, PHILOS, K wire

### Introduction

Proximal humeral fractures are the second most common upper-extremity fracture and the third most common fracture after hip fractures and distal radial fractures, in patients who are older than sixty-five years of age. They account for about 5% of all injuries to appendicular skeleton.<sup>(1)</sup>

Although the overwhelming majority of proximal humeral fractures are either non-displaced or minimally displaced and can be treated with sling immobilization and physical therapy,<sup>(2)</sup> approximately 20% of displaced proximal humeral fractures may benefit from operative treatment.<sup>(3)</sup>

Many surgical techniques have been described, but no single approach is considered to be the standard of care.<sup>(4)</sup>

Over the last 3 decades, various modalities of fixations have evolved for the proximal humerus fractures (transosseous suturing, percutaneous pinning, tension band wiring, plating, rush nailing, arthroplasty). The proximal humerus locking system plate has been developed to improve screw fixation in osteoporotic bone and to minimize soft tissue dissection.

The type of fixation used depends on the patient's age, activity and bone quality, the fracture type and the surgeons technical ability. If the fracture reduction is achieved by manipulation but cannot be maintained, percutaneous K- wire fixation is performed. Recent advances in fracture fixation technologies have led to

the development of fixed-angle locked plates that maintain angular stability under load.

The treatment is more controversial for articular fractures which carry a high risk of the humeral head necrosis. In Neer's classification, these are two part, three-part and four-part fracture and those with dislocation of head of humerus. A review of published result suggests that there is no universally accepted form of treatment. Conservative management may be associated with non-union, malunion and avascular necrosis resulting in painful dysfunction.

Proximal humeral fracture whether caused by trauma or related to osteoporosis, requires carefully planned individual treatment. The choice of technique and devices depends on quality of bone, soft tissue, age and reliability of patients. However the goal of proximal humerus fracture fixation should be stable reduction, allowing early motion of fracture.

This study is conducted to analyze fractures of the proximal humerus that were treated either with the proximal humerus internal locking system (PHILOS) locking plate or percutaneous K wire and documents their clinical and functional outcome.

### Materials and Method

The study purpose to include patients with proximal humerus fractures admitted and examined according to protocol, associated injuries noted. Clinical and radiological evaluation done. Fractures

classified using Neer's classification. Routine investigations carried out to get fitness for surgery.

Patients underwent Open reduction and internal fixation with PHILOS locking plate or Percutaneous K-wire fixation under general anaesthesia/ brachial block.

Post operative physiotherapy followed according to protocol, to evaluate the functional outcome. Patients will be followed up at 6 weekly interval until fracture union and at once at 1 yr after the surgery

30 cases were studied, cases were selected randomly for both PHILOS and percutaneous k wire fixation, each 15 cases.

#### **Inclusion Criteria**

1. Patients of age above 18 yrs.
2. Two part, three part and four part fracture of proximal humerus

#### **Exclusion Criteria**

1. Children and adolescent patients less than 18yrs
2. Pathological fractures
3. Patients with compound fractures

On admission of the patient a careful history was elicited from the patients and/or attendants of injury and the severity of trauma. The patients were then assessed clinically to evaluate their general condition and the local injury.

The general condition of the patient and the vital signs were recorded. The local examination of injured shoulder was done for swelling, deformity, loss of function and altered attitude. Any nerve injury was also looked for and noted. Axillary nerve assessed by looking for anaesthetic patch over lateral aspect of shoulder.

Radiograph of proximal humerus i.e., antero-posterior view and axillary view taken and fractures were classified according to Neer's classification. Next the limb was immobilized in U slab and arm-pouch. The patient was taken for surgery after routine investigation and after obtaining physician fitness towards surgery. The investigations are as follows. Hb%, RBS, blood urea, serum creatinine, HIV, HBsAg and ECG.

The consent for surgery was also taken from the patient and attendants after explaining the procedure and possible complications.

#### **Postoperative management:**

- All patients are immobilized in arm pouch with cuff and collar sling.
- Appropriate antibiotics and analgesics were used.
- Immediate post operative radiographs were taken to determine the bone alignment and maintainance of reduction.
- Passive range of motion and pendulum exercises are begun immediately depending on pain from third week.
- K-wires are removed at about 6-8 weeks.

#### **Follow up:**

All patents were followed every week in first month and every 2-3 weeks for 6months.

- The active range of motion were started at 1-2 weeks. postoperatively, depending on stability of osteosynthesis and bone quality.
- The sling is discontinued by 8-12 weeks depending upon fracture stability.
- Further follow ups were at 8 weeks and 12 weeks and 24 weeks.
- The patients were examined clinically and radiologically. Assessed for range of motion and bony union and complication.
- The patient with shoulder stiffness given physiotherapy for 1 week to 15 days on outpatient basis.

**Functional results:** The final result were evaluated using Constant-Murley score.

This system base on 100 point score composed of a number of individual parameters. The subjective parameters assess the degree of pain the patient experiences and the ability to perform normal tasks of daily living as they apply to him or her in both activity and position related terms. Both of these assessments are subjective and are carried out independently prior to objective testing of active motion range and shoulder power.

#### **Results**

In our study most of the patients 40% belong to the age group of >50yrs. 30% patients belong to the age group 41-50. The average age of the patient was 47.93 years. Sex distribution was comparable between males and females corresponding to 53.33% and 46.6% respectively. Male: Female sex ratio is 1.14:1.

Most of the patients were affected on the right humerus corresponding to 53.33% and on left side in 46.6% patients. 56.66% of our patients had suffered a domestic fall and 43.3% were involved in motor vehicle accidents.

Fall resulted in three part fracture in 6 patients; Road Traffic Accident resulted in two part fracture in 7 cases. The association of type of fracture and mode of injury is insignificant. In our study, in the age group >50yrs the commonest mode of injury is by fall (domestic). In the age group 19-30yrs the commonest mode of injury is by RTA. There is significant association of mode of injury and age.  $p < 0.05$  which shows significant association.

In our study we had 46.66% of patients with 2 part fracture and 36.66% of patients had 3 part fractures. 16.66% of patients had 4 part fracture. 71.4% patients with two part fractures were treated using closed reduction and k- wire fixation. 63% of patients with three part fractures are treated with open reduction and internal fixation with PHILOS plating. 80% of patients with four part fractures are treated with open reduction and internal fixation with PHILOS plating. The patients treated with open reduction and internal fixation with PHILOS plating, Impingement of the implant with

restriction of movements was present in 2 cases and Varus malunion is seen in 1 patient.

In patients treated with percutaneous pinning the complications noted are pin tract infection in 3 of patient and varus malunion in 2 patients.

The mean constant Murley score for patients treated with open reduction and internal fixation with PHILOS plating is 68.13% compared to Percutaneous pinning which is 71.9%.  $p > 0.05$ , which refers that comparison between two groups is insignificant.

In the present study 33.34% patients treated with open reduction and internal fixation with PHILOS plating had good to excellent results, 46.6% of patients had fair results and the remaining 20% had poor results.

40% of patients treated with closed reduction and K wire fixation had good to excellent results, 40% of patients had fair results and remaining 20% had poor results.

## Discussion

The operative treatment of proximal humeral fractures is a therapeutic challenge for orthopaedic surgeons. 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.

The result is related to restoration of anatomical alignment, and if the fracture is treated conservatively, a functional deficit will certainly develop and may be associated with pain. The external support is difficult to apply effectively because fracture site is adjacent to trunk.

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.<sup>(1-5)</sup>

Numerous investigators have described the various surgical treatments for displaced proximal humerus fracture. There is no consensus on optimal treatment of displaced proximal humerus fractures which account for about 20% of fractures. In some studies, the objective functional results of conservative treatment have been unsatisfactory. The fractures are defined by variety of classification systems. The difficulty in accurately classifying the fracture creates problems in reporting outcome and also none of the system gives clear prognosis and direction of treatment.

**Age Incidence:** The average age incidence in present series of 30 patients analyzed, was 47.93 years, which was consistent with the age incidence in studies done by Kenneth A. Egol et al,<sup>(29)</sup> (61 years) and the average age incidence in C. Gerber et al,<sup>(23)</sup> study was 44.9 years. In present series 12 (40%) out of 30 Patients were age group of > 50 years and 9 (30%) patients in 41-50 age group. Majority of the patient in our group are elderly in our study.

In present study the association between age and mode of injury shows that the common mode of injury in the age group 50yrs is by fall (domestic). The common mode of injury in the age group between 19-30yrs is road traffic accidents.

**Sex Incidence:** Further as compared with other studies, present study showed a higher incidence of fractures in men than in women. The gender ration was 1.14:1. this higher ration can be explained by a higher involvement of male in day to day activities in compare to female.

**Mode of Injury:** Motor vehicle accidents constitute a major cause of musculoskeletal trauma worldwide. In our country too, it happens to be very common and is reflected in present study, the second most common cause after the domestic fall.

Rose SH et al, in their study of proximal humerus fracture, have reported 80% of cases the mode of injury was minor fall in a patients aged above 40 years and especially in osteoporotic females.<sup>(4)</sup>

Herbert Resch et al in their study 27 patients with three part and four part fracture, 24 patients had history of high energy trauma.<sup>(32)</sup>

Fall resulted in three part fractures in 6 cases, road traffic accident resulted in two part fractures in 6 cases and three part fracture in 5 cases and four part fractures in 2 cases.

**Side Afeected:** In our present study fracture occurred on right side in 16 patients and on left side in 14 patients. C. Gerber reported, in their series of 34 fractures 16 were on left side and 18 were on right side.<sup>(23)</sup>

**Period between injury and time of Surgery:** The average interval between fracture and surgery was 3.63 days in our study. Average interval between fracture and surgery was 3.2 days in Gerber C. et al Study.<sup>(23)</sup>

**Type of Fracture:** The study of type of fracture in present series revealed, 14 (46.66%) were two part fractures, 11 (36.66%) were three part fractures, 05 (16.66%) was four part fracture. In studies done by Rizwan Shahid et al,<sup>(28)</sup> in a series of 50 patients studied 11 (22%) were two part fractures, 21 (42%) were three part fractures and 18 (36%) were four part fractures. In another study by MA Fazal et al,<sup>(32)</sup> Of 27 cases 13 (48%) were two part fractures, 12 (44.5%) were three part fractures and 2 (7.5%) were four part fractures indicating that the incidence of type of fracture is nearly consistent with the studies in literature.

## Complications

Secondary displacement and malunion occurred in three cases at surgical neck. It usually involves to anterior angulation and varus deformity, decreasing neck shaft angle  $< 120^\circ$ . It was probably due to comminution of underlying osteoporotic bone which may go impaction at the fracture site after reduction leading to varus malunion.

Two patients in PHILOS group had plate impingement and limitation of abduction, its hardware

related complication, improper plate positioning may have lead to impingement.

Three patients had pin track infection in percutaneous K- Wire fixation series which are treated with appropriate antibiotics and it didn't result in any loosening of k-wire. Pin track infection is the commonly encountered complication in percutaneous pinning.

- Both complications in PHILOS group i.e. varus malunion and impingement lead to poor results.
- In percutaneous group pin track infection is commonest complication where 66% of patients had fair to excellent result and the remaining 33% had poor results.

### Comparison of results in studies treated with PHILOS plating

Study	Constant Murley Score
Gerber., et al. <sup>(9)</sup>	78
Monnot et al. <sup>(19)</sup>	66.5
Felix Brunner et al. <sup>(38)</sup>	72
Present study	68.13

### Comparison of results in studies treated percutaneous K-Wire fixation

Study	Constant Murley Scores
Jay D. keener MD et al. <sup>(52)</sup>	73.9
Bruner. A et al. <sup>(53)</sup>	73.6
Present study	71.9

### Conclusion

In both the groups of percutaneous pinning and plate fixation, comparatively minor differences were detected with regard to functional outcome. The results of surgical treatment of proximal humerus fractures in both the groups (percutaneous pinning and PHILOS plating) are satisfactory with good functional outcome. The most common complication in open reduction and plate fixation is plate impingement, leading to limitation of abduction.

Closed reduction and percutaneous pinning have advantage in retaining the vascularity of the humeral head.

- It can be used for Un-displaced two, three or four part fracture of the proximal humerus without comminution, in the younger age groups.
- Elderly who are unfit for major surgery. Complication faced are pin track infections and loss of reduction.

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