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A prospective study on functional and radiological outcome of proximal humeral fractures treated with locking compression plates

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Abstract
Fractures of proximal humerus account for about 4 to 5% of all fractures. It is the third most common fracture after hip fracture and colles fracture in elderly patients. In this study we have analysed 20 cases of proximal humeral fractures treated surgically using (PHILOS) proximal humerus locking compression plates admitted at Department of Orthopaedics and Traumatology, Government Kilpauk Medical College and Hospital, Chennai from April 2013 to November 2013. The aim of the study was to analyze the functional and radiological outcome and to assess the complications of proximal humeral fractures treated using locking compression plates. Patients with proximal humerus fractures, who are skeletally mature and age more than 18 years satisfying Neer s criteria for operative displacement were selected. The patients were operated by the standard anterior deltopectoral approach or deltoid splitting approach using proximal humerus locking plates. All the patients were reviewed at two weeks interval, for first three months and later every month, Radiological evaluation of fracture union was observed by serial X rays. Constant and Murley's score was used to assess the functional outcome of our patients. The average constant score in our study with 20 patients was 82.4. Finally we concluded that displaced proximal humeral fractures when treated surgically produce greater range of movements (ROM), less pain and less stiffness.

Keywords: Functional and radiological outcome, proximal humeral fractures treated, locking compression plates

Introduction
Fractures of Proximal humerus account for about 4 to 5% of all fractures [1-6]. It account for up to 45% of all humeral fractures7. It is the third most common fracture after hip fracture and colles fracture in elderly patients8. It is important to recognize these fractures early. Numerous authors have suggested that non-operative treatment9,10,11 may be acceptable for two, three and four part proximal humeral fractures in elderly patients but pain, stiffness, loss of function and muscle power have been reported in high percentage of patients after this conservative approach.

Fractures of Proximal Humerus have gained more attention recently. Diagnosis has been facilitated with adaptation of 3-right angled trauma series X-rays [2, 12-14] supplemented with CT or MRI. With more standard use of Neer's 4-part Classification system for fracture and fracture dislocation a protocol for management and comparison of long term outcome of similar injuries has been made possible [15-18].

There have been improvements in fixation techniques and in the understanding of the role of prosthetic replacement [19-22] to maximize anatomic restoration and minimizing immobilisation time, during which stiffness develops.

In this study we have analyzed the functional and radiological outcome of twenty (20) cases of proximal humeral fractures treated surgically using (PHILOS) proximal humerus locking compression plates.

Aim of the Study

To analyze the functional and radiological outcome of twenty patients with proximal humeral fractures treated using proximal humerus locking compression plates (PHILOS PLATES). To assess the complications of proximal humeral fractures treated using locking compression plates (PHILOS PLATEs) ximal humeral fractures treated surgically.

Materials and Methods

This prospective study is an analysis of functional outcome of 20 cases of surgically managed displaced Proximal Humeral Fractures, using proximal humerus locking compression plates undertaken at Department of Orthopaedics and Traumatology, Government Kilpauk Medical College and Hospital, Chennai from April 2013 to November 2013.

Data from the 20 patients were analyzed and presented as mean, SD and range for quantitative data and as frequency and percent for categorical variables. The association between functional outcome and baseline variables was done using Chi-square test or Mann-Whitney U test for categorical and continuous variables respectively. Spearman's rank correlation coefficient was calculated between age and functional outcome.

Methodology

Inclusion Criteria

1. Patients with proximal humerus fractures, who are skeletally mature
2. Age more than 18 years
3. Satisfy Neer s criteria for operative displacement i.e. displacement of >1 cm between the major fracture fragments or angulation of the articular surface of >45 degrees. Neer's two, three and four part fractures.

Exclusion Criteria

1. Patients with open fractures
2. Patients pathological fractures
3. Patients associated neurovascular injury
4. Patients associated head injury

The patients were operated by the standard anterior deltopectoral approach or deltoid splitting depending upon the type of fracture pattern and bone quality using proximal humerus locking plates. Proximal Humeral Fractures in older patients with osteoporosis were challenges to conventional plates and screws resulting in early loosening and failure. In order to overcome this difficulty, fixed angle locking plate was used. Locking compression plate improve torsional resistance in the stabilisation of the 3 part fractures 7, 8. In cases of irreducible fracture dislocation, the coracoid was predrilled and osteotomised and retracted with the tendon. Arm was externally rotated and blunt instrument passed between subscapularis and capsule and stay sutures applied. In all patients, the rotator interval between anterior edge of supraspinatus and superior edge of subscapularis was closed with multiple interrupted sutures. In all patients the arm was placed in an arm sling, cuff and collar or shoulder immobilizer.

Phase I exercises consisting of pendulum exercises were started from the first week. Gentle passive forward flexion, internal and external rotation exercises were initiated by third week. Phase II exercises consisting of active range of motion exercises and resistive exercises were started by 4-6 weeks. Phase III exercises consisting of advanced stretching and strengthening exercises were started by 3 months. Lifting of light weight objects were started after 3 months.

Results and Observation

Age of the twenty patients included in the study ranged from 20 to 65 with a mean (SD) of 47.9 (11.9) years. Majority were females (60%). Major occupation of subjects was housework (35%) followed by laborers (25%). Free fall at ground level was the most common mode of injury of 50% followed by RTA (30%). One patient had a post-epileptic fall causing the fracture. No bilateral fractures were reported. All patients had unilateral involvement with 75% fractures were on the right side. Eight patients had associated injuries. These details are presented in Table 1.

Table 1: Details of the injury

Characteristics	No. of individuals	percent
Mode of Injury:		
Fall at ground level	10	50.0
Road traffic accident (RTA)	6	30.0
Fall from height	3	15.0
Epilepsy	1	5.0
Duration from injury to reporting		
Same day	5	25.0
2 – 3 days	5	25.0
4 - 5 days	5	25.0
> 5 days	5	25.0
Previous treatment:		
Massage	2	10.0
Splinting	1	5.0
Attempted reduction with splinting	1	5.0
POP	1	5.0
Side:		
Right	15	75.0
Left	5	25.0
Associated injuries:		
Fracture metacarpal	2	10.0
Fracture patella	1	5.0
Fracture distal radius	2	10.0
Fracture SOH	1	5.0
Fracture NOF	1	5.0
Fracture BB Forearm	1	5.0

Two part fracture is the most common type in 60% patients. Greater Tuberosity fractures were the predominant type in 2 part fracture. Fracture dislocations were present in 2 patients (10%) and both had 3 part fractures. 4 part fractures accounted for only 5% of patients.

Table 2: Type of Fracture

Neer's type	No. of individuals	percent
2 part	12	60.0
3 part	7	35.0
4 part	1	5.0
Dislocation	2	10.0

Fourteen (70%) patients were operated by the standard anterior deltopectoral approach and the remaining deltoid splitting approach. Locking compression plates were used for all patients. Patients were then followed up for an average of 6.8 months. Range of motion was evaluated at baseline and after follow-up visit. Functional outcome of the treatment was evaluated using Constant and Murley's score. After follow-up the score ranged from 68 to 88 with a mean (SD) of 81.7 (6.1) for 20 patients. Table 3.

Table 3: Range of Motion

Motion	Range in degrees	Mean ± SD
Elevation	90-165	140.0±25.9
Abduction	70-150	125.75±22.4
ER	35-55	48.25±6.1
Extension	30-50	45.0±6.5
Flexion	80-110	96.0±9.7

The grading according to the score for the 20 patients are presented in Table 4. 90% had good to excellent function and no patient was reported to have poor function.

Table 4: Functional outcome according to Constant and Murley's score

Grading of functional outcome	No. of patients	Percent
Excellent (>86)	7	35.0
Good (71 – 85)	11	55.0
Moderate (56-70)	2	10.0

The functional outcome score was not associated with age (spearman's rank correlation coefficient was 0.121; p=0.612), sex (p=0.076), mode of injury (p=0.952) or surgical approach (p=0.353). Type of fracture was significantly associated with functional outcome as 2 part fractures having 58.3% excellent function (p=0.003).

Fig 1: Instruments and implants used

1. Kirschner 'K' wire (1.5mm)
2. Kirschner 'K' wire (1.8mm)
3. Drill Sleeve (4mm)
4. Drill Bit (3mm)
5. Screw Driver (3.5mm)
6. Cortical Locking Screw (4mm)
7. Cancellous Locking Screw (4mm)
8. Philos Plates

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