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A study of Proximal Humerus Fractures treated by Locking Compression plating

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ABSTRACT

Background: The treatment of proximal humerus fractures is always a challenge for the Orthopedic surgeon. Proximal humeral fractures are a regular presence in clinics. In the past, the standard treatment method was conservative. The results and functional outcomes, on the other hand, were not favorable. The functional outcomes have been known to improve after the development of locking compression plates. The purpose of this study was to see how functional proximal humerus fractures were treated with locking compression plates fared.

Methods: This cross-sectional interventional prospective study was carried out in the Department of Orthopedics, Prathima Institute of Medical Sciences. The study included all adult patients with closed two-part and three-part proximal humerus fractures who were reported within a week after the incident. Based on the sample size calculations and inclusion and exclusion criteria a total of n=35 patients were included in the study. Patients were followed up for 12months after surgery using a typical surgical method with a locking compression plate.

Results: n=35 patients out of which n=19(54.2%) were males and n=16 (45.7%) were females. The distribution based on age involved in patients with fractures showed equal preponderance among 31-35 years and 20-25 years with n=9(25.71%).Neer's classification of fractures of proximal humerus was followed in this study. Most of the patients in n=25 (71.42%) cases were having Neer's Two-part fractures and three-part fractures were found in n=8(22.8%) and four-part in n=2(5.7%). The overall results in the study were 65.71% of patients had excellent results,20% had good results,8.5% had satisfactory results and 5.7% had poor results.

Conclusion: Locking plates are a preferable therapeutic choice for proximal humerus fractures, particularly when the bone quality is poor and the fracture is comminuted. Complication rates can be reduced by using good surgical techniques and selecting the right situations. Proximal humeral internal locking plates continue to provide strong overall functionality.

KEYWORDS: proximal humerus locking plates, Functional outcome, Proximal Humerus Fracture

INTRODUCTION

Proximal humerus fractures are the second most frequent upper-limb fracture, accounting for 4% to 5% of all fractures. [1] In adults, the yearly fracture rate is 63 per thousand fractures. There is an increasing trend in this type of fracture, especially in the aging population and patients with osteoporosis. [2, 3] High-energy trauma is the most common cause of proximal humerus fractures. [4] Because a large proportion of these fractures are stable and have minimal deviation, closed treatment is the preferred option. However, surgery is required in around 20% of displaced proximal humeral fractures. [5] Nonunion, malunion, and avascular necrosis are common side effects of conservative therapy, leading to painful dysfunction. [6, 7] The objective of proximal humerus fracture therapy is to return a pain-free shoulder with good function. This involves a thorough awareness of the injury, as well as knowledge of the existing fixation procedures and their limits, as well as the patient's age, expectations, medical condition, and bone quality. Displaced, unstable fractures, as well as those involving dislocations, require surgical treatment. [8] Closed or open reduction and operational fixation should be used to treat proximal humerus fractures that have displaced more than 45 degrees or 1 cm, according to current recommendations. [9, 10] When osteosynthesis is the best choice for a patient, it is used to increase stability, allow for early mobilization, and achieve proper alignment of fracture pieces. [4] Many different techniques have been used for the fixation of these fractures they include bone sutures, tension bands, cerclage wires, K-wires, T-plates, intramedullary (IM) devices, and prosthetic replacements, double tubular plates. [11–15] The selection of the type of reduction or synthesis material to be utilized depends on the pattern of the fractures, bone quality, age, and levels of activity of patients. [16] Fixed

angled locking plates have recently been designed to provide for a more robust fixation, particularly in instances when the bone quality is poor. A new generation of implant plate with a locking system is the proximal humeral internal locking system plate. It's a fixed-angle implant that's built around the architecture of the proximal humerus. [17]There is a lower risk of screws loosening and greater purchase in the humeral head, as well as a very low risk of secondary reduction loss. In light of this, the purpose of this study was to assess the functional outcomes of proximal humerus fractures treated using proximal humeral internal locking system plates.

MATERIAL AND METHODS

This prospective study was conducted in the Department of Orthopedics, Prathima Institute of Medical Sciences. Institutional Ethical committee permission was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in their local language. Estimated sample size is 31. We have included n=35 cases in the study. Inclusion criteria were all adult patients with closed two-part, three-part and four part fractures of the proximal humerus of both genders, those who have reported within a week of the injury and available for long term follow-up. Exclusion criteria were patients with open fractures, Polytrauma, critical patients, patients with pathological fractures and those who have reported after 1 week of the fractures.

Based on the inclusion and exclusion criteria, a total of n=35 patients were included in the research. A radiographic examination was performed on all of the patients concerned. If intra-articular involvement, glenoid involvement, or articular comminution were suspected, a CT scan of the shoulder was conducted. In all cases, a conventional deltopectoral technique was employed. The fracture pieces were detected, and when they were reduced, a temporary fixation using K wires was used to keep the reduction in place. To avoid subacromial impingement, a pre-contoured locking plate was placed against the lateral surface of the larger tubercle and about 10mm below. The proximal humeral internal locking system plate was attached to the humeral head using proximal locking screws and distal screws placed into the humeral diaphysis, 1 cm distal to the upper end of the greater tubercle. To avoid screw penetration into the glenohumeral joint, an image intensifier was utilized to assess the reduction, plate location, and screw length. The range of motion was assessed, and the incision was then closed in layers. A shoulder sling and arm pouch were used to keep the arm immobile. On the second postoperative day, the incision was examined, and the sutures were removed on the fourteenth day. Depending on pain tolerance, limb elevation and vigorous finger motions may be recommended after surgery. For a period of 12 months, the patients were monitored. The Constant scoring system was used to evaluate functional results. Constant scores of 0 to 55 were considered low, 56 to 70 were considered moderate, 71 to 85 were considered acceptable, and 86 to 100 were considered excellent.

Statistical analysis: The data was collected and uploaded on an MS Excel spreadsheet and analyzed by SPSS version 19 (Chicago, IL, USA). Quantitative variables were expressed on mean and standard deviations and qualitative variables were expressed in proportions and percentages. Fisher's exact test has been used to find the difference between two proportions.

RESULTS

This study included n=35 patients out of which n=19(54.2%) were males and n=16 (45.7%) were females. The distribution based on age involved in patients with fractures showed equal preponderance among 31-35 years and 20-25 years with n=9(25.71%). The other distribution of the patients based on age and sex is given in Table 1

Age Group in Years	Male N (%)	Female N (%)	Total N (%)
20 – 25	5(26.31)	4(25.0)	9 (25.71)
26 – 30	4(21.05)	2(12.5)	6(17.14)
31 – 35	5(26.31)	4(25.0)	9 (25.71)
36 – 40	2(10.53	1(6.25)	3 (8.57)
41 – 45	1(5.26)	3(18.75)	3 (8.57)
46 – 50	1(5.26)	2(12.5)	3 (8.57)
> 50	1(5.26)	0(0.0)	1(2.86)
Total	19(100)	16(100)	35 (100)

Table 1: Age and sex-wise distribution of patients in the study

In our study majority of patients, n=25 (71.43%) of patients sustained an injury due to RTA, followed by falls on outstretched hands n=9 (25.71%) and assaults n=1(2.85%) cases. Most of the patients n=28(80%) were seen in the Emergency on the day of the injury and n=6(17.14%) were seen on the second-day injury and n=1(2.85%) was seen on the fourth day of the injury. Neer's classification of fractures of proximal humerus was followed in this study. Most of the patients n=25 (71.42%) was having Neer's Two-part fractures and three-part fractures were found in n=8(22.86%) and four-part in n=2(5.71%) of the patients' Table 2

The majority of the patients in the research were operated on between 1-and 4 days after the accident. The average time of follow-up was 12 months. The following criteria were used to evaluate fractures for unification: painless, unassisted motions, and no discomfort. When bridging trabeculae were observed throughout the fracture site encompassing at least 75 percent of its circumference, radiological unification requirements were met. The radiological

Neer's Classification	Male N (%)	Female N (%)	Total N (%)
One part	0(0.0)	0(0.0)	0(0.0)
Two-part	13(68.42)	12(75.0)	25 (71.42)
Three part	5(26.31)	3(18.75)	8 (22.86)
Four part	1(5.26)	1(6.25)	2 (5.71)
Total	19(100)	16(100)	35 (100)

Table 2: Classification of proximal humerus fractures as per Neer's classification

union took an average of 13.8 $\pm$ 2.5 weeks, and the patients were functionally assessed using a continuous scoring system. Excellent scores 86-100, good scores 71-85, moderate scores 56-70, and bad scores 0-55 were assigned to the procedure's end outcome, and the total functional scores are listed in Table 3.

Constant Score	Two-part	Three-part	Four-part	Total (%)
Excellent (86-100)	19	4	0	23 (65.71)
Good (71 - 85)	3	3	1	7 (20.0)
Satisfactory (56 – 70)	2	1	0	3 (8.57)
Poor (0 – 55)	1	0	1	2 (5.71)
Total	25	8	2	35 (100)

Table 3: The functional outcomes of patients based on constant scores

Superficial infection was found in 2(5.71%) cases, and they were managed successfully by antibiotics. AVN was seen in one case in a male. The male patient had AVN of the head along with nonunion of the fragment with the shaft. Hardware failure in the form of loosening screws was not seen in any patient and secondary varus 8°-11° was found in n=1 case. Pseudoarthrosis was found in one female patient shown in Table 4

Complications	Male	Female	Total N (%)
Superficial Infection	2	0	2(5.71)
Wound dehiscence	0	0	0(0.00)
AVN of the humeral head	1	0	1(2.86)
Hardware failure	0	0	0(0.00)
Secondary varus	0	1	1(2.86)
Pseudoarthrosis	0	0	0(0.0)
Total	3	1	4(11.43)

Table 4: Surgical complications in patients

DISCUSSION

The introduction of locking plates for the treatment of proximal humerus fractures has added a new dimension to therapy, particularly in the treatment of three-part, four-part, epiphyseal fractures in young patients and fractures in the brittle bone. [18] The mechanical benefit of locking plates is that they provide enough stability without requiring plate-bone contact. Because the locking screws give stability, greater outcomes are obtained in porous bones. [19] The AO-ASIF group created the PHILOS (Proximal Humerus Internal Locked System), which is the most recent generation of locking compression plates. [20, 21] The major goal of surgical therapy for displaced proximal humerus fractures is to return the patient's functional condition as close to pre-fracture as feasible. The fractures were categorized radiologically according to Neer's classification in this investigation. The bulk of the cases (71.42%) were two-part fractures, and previous investigations have shown comparable results. [22–25] The patients in this research ranged in age from 20 to 58, with a mean age of 31.5 $\pm$ 5.5 years. Because the majority of the fractures in this study (n=25; 71.43%) cases were caused by Road Traffic Accidents, the mean age of the patients in this study was lower. According to the findings, males were more impacted than females in this study. In our study, we found the right side was involved in the n=22 (62.86%) and the left side in n=13(37.14%). The average time lag between injury and surgery was 3.25 days, whereas S Vijay et al., [26] reported the average time lag to be 6.24 days, and Resch H et al., [27] discovered the period to be between 2 and 10 days. In the current study, the average time for the radiological union was 13.8 $\pm$ 2.5 weeks, which was consistent with earlier studies by Ebraheim NA et al., [28] Klitscher D, et al., [29] and Kilic B et al., [9] In this study, 65.71 percent of the participants got excellent outcomes, while 20.0 percent achieved good results. Hirschmann et al., [30] conducted a study with n=64 patients who were treated with a locking plate and had a minimum follow-up of four years. They found 75 percent excellent and good outcomes. They also discovered that the results improved for another year following the procedure. Rose et al., [22] discovered a consolidation rate of 75% and good outcomes. Because our patients were relatively young and the bone quality and surgical skills were both good, one of the possible explanations for the improved results of this study is that our patients were younger. The minimum follow-up period in our study was 12 months, during which time n=25 (83.33 percent) of patients reported no discomfort while the

remainder n=5 (16.67 percent) had minor shoulder pain on occasion after extended exercise. After one year of follow-up, Fankhauser et al., [31] observed excellent pain reduction with an average continuous pain score of 13.9. In two of the instances in this investigation, secondary varus 8°-11° displacement of the proximal fragment was seen. Using the identical implant, Acklin et al., [32] detected subsequent varus displacement in just one out of 29 patients. This is in line with the findings of the current investigation. In a study of n=29 patients, Fankhauser et al., [31] found three incidences of subsequent varus displacement of the proximal fragment. One of the recognized consequences of the proximal humeral fracture, which is typical in 4 component fractures, is avascular necrosis of the humeral head. In the current investigation, one AVN complication was discovered in a patient with a four-part fracture. Kilic B et al., [9] employed PHILOS for proximal humeral fracture treatment and found AVN in just one of their 22 patients. Our findings were similar to those previously published in the literature. Because of conventional surgical intervention, overall complication rates were lower in this research, and more fractures were two-part fractures.

Limitations of the current study: The study was conducted in a single hospital with a limited number of cases. The duration of the follow-up was short. Therefore, these limitations must be kept in mind before applying conclusions obtained in the current study. A large scale multicentric study with long follow up is desirable to obtain the correct picture

CONCLUSION

Within the constraints of the current study, it can be stated that locking plates are a preferable therapeutic choice for proximal humerus fractures, particularly when the bone quality is poor and the fracture is comminuted. Complication rates can be reduced by using good surgical techniques and selecting the right situations. proximal humeral internal locking plates continue to provide strong overall functionality.

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