

Clinical and functional outcome of proximal humerus fractures treated with locking compression plate (LCP) in adults

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Abstract

Background: To evaluate the outcome of open reduction and internal fixation using locking compression plate for proximal humeral fractures. Proximal humeral fractures (PHFs) account for approximately 10 % of all fractures, and the incidence is increasing with age.

Material and Methods: This is a Prospective, observational and descriptive study conducted from March 2021 February 2022 in the Department of Orthopaedics at AKASH Institute of Medical Sciences and Research Center, Bangalore. Sampling methods: After confirmation of the proximal humerus fracture, if the patient fits into the above-said criteria was taken for study. Patients were undergone open reduction internal fixation with philos locking plating for the sustained fracture under general anaesthesia. Post-operative physiotherapy followed according to protocol, to evaluate the functional outcome. Fractures classified using Neer's classification.

Results: In the present study, the right side proximal humeral fracture occurred in 22 (55%) patients and left side proximal humeral fracture occurred in 18 (45%) patients respectively. All fractures were classified according to Neer's classification system. 17 (42.5%) patients were two-part, 13 (32.5%) were three-part and 10 (25%) were four-part. The Constant -Murley score achieved at the end of study period (6 months) was 66.32 ± 6.47 . The Constant-Murley score was significantly improved ($p < 0.0001$) over each successive follow-up period with the average improvement of around 19 scores between 1st and 2nd follow-up and around 15 score improvement between 2nd and 3rd follow-up.

Conclusions: The proximal humeral locking plate seems to be an adequate device for the fixation of displaced two-part, three part and four-part proximal humerus fractures. Due to stable fixation, early functional aftercare is possible and allows the patient to regain good shoulder function and resume normal activities much earlier.

Keywords: Neer classification, Proximal humeral fracture, Locking compression plates.

Introduction

Proximal humeral fractures (PHFs) account for approximately 10 % of all fractures, and the incidence is increasing with age.^[1] Most PHFs are low-energy osteoporotic injury occurred in the elderly and afflict two or three times as many women as men. This fracture still remains a major challenge for surgeons worldwide.^[2] It has been reported that approximately 80 to 90 % of patients with minimally displaced PHF can be managed by nonoperation.^[3] Four-part PHF is the most severe type among PHFs according to the Neer classification.^[4] Non-operative treatment for four-part PHF often results in less favorable clinical and anatomical outcomes. Shoulder hemiarthroplasty (HA) is advocated for treatment of this fracture type by prevention of varus collapse, deformity, and avascular necrosis risk.^[5] However, the functions and outcome evaluations are still controversial.

Reduction of displaced proximal humerus fractures is a challenging task as various fracture patterns can occur owing to the complex anatomy. Most of the proximal humeral fractures are nondisplaced or minimally displaced and stable. These can be treated conservatively with early rehabilitation. Conservative management may result in nonunion, malunion, and avascular necrosis (AVN), which may lead to pain and dysfunction.^[6]

Recently, locking compression plate (LCP) demonstrates satisfactory results for severely displaced PHF compared with conventional plate. The fixed-angle construct could improve the fracture stability and increase the resistance to pull out through the bone-plate interface with a single beam construct, especially useful in poor-quality cancellous bone of the proximal humerus. However, some complications, such as avascular necrosis (AVN), screw cut out, implant failure, plate impingement, head collapse, and infection, have been reported.^[7]

But severely displaced and comminuted fractures warrant surgical management for optimum shoulder function. The surgery should be carried out as soon as the patient's general condition permits. A delay of several days makes reduction more difficult and a significant delay results in absorption of bone, making secure internal fixation impossible.

For optimal treatment of displaced or unstable fractures various techniques, including open reduction and internal fixation with proximal humeral plates, intramedullary nailing, percutaneous or minimally invasive techniques with pins or screws and arthroplasty, have been described in study.^[8] Currently locking compression plate is gaining popularity. This plate combines the feature of compression of regular plate with locking into one system. It provides angular stability and act as an internal fixator.^[9] The present study was carried out to assess the functional outcome of the displaced proximal humerus fractures treated with locking compression plate.

Material and Method

This is a Prospective, observational and descriptive study conducted from March 2021 February 2022 in the Department of Orthopaedics at AKASH Institute of Medical Sciences and Research Center.

Inclusion criteria: Patients of either sex with more than 18 years.

Patients presenting with displaced proximal humerus fractures according to NEER two, three- and four-part fracture, with associated dislocation of the shoulder, undergoing revision surgery for failure of other implants, Failure of conservative treatment.

Exclusion criteria: Age less than 18 years, Pathologic fractures from primary or metastatic tumors, Open fractures and Poly trauma, Four-part fracture in elderly, with neurovascular deficits.

Sampling methods: After confirmation of the proximal humerus fracture, if the patient fits into the above-said criteria was taken for study. The study was approved by the institute's ethical committee. Patients were undergone open reduction internal fixation with philos locking plating for the sustained fracture under general anaesthesia. Post-operative physiotherapy followed according to protocol, to evaluate the functional outcome. Fractures classified using Neer's classification.^[10]

Data collection procedure: 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 local examination of injured shoulder was done for swelling, deformity loss of function and altered attitude. Local neurologic deficit of axillary nerve was also assessed by looking for anaesthetic patch over lateral aspect of shoulder. After confirmation of the proximal humerus fracture, if the patient fits into the above-said criteria, the patients were informed about the study following which written, and informed consent was obtained. The patient was taken for surgery after routine investigation and after obtaining physician fitness towards surgery.

Statistical analysis: Data analysis was performed by using software SPSS 22.0. Descriptive statistics such as mean, SD, frequency and percentage was used. P - value of less than 0.05 was considered to be statistically significant.

Results

All the 40 patients of displaced proximal humerus were operated by open reduction and internal fixation using locking compression plate i.e. PHILOS (Proximal Humerus Inter Locking System). Among these 24 (57.5%) were males and 16 (42.5%) were females in table 1.

Table-1: Gender distribution of patients

Gender	No. of Patients	Percentage
Males	23	57.5

Females	17	42.5
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Table-2: Age wise distribution of patients

Age in years	No of patients	Percentage
20-40	5	12.5
40-60	15	37.5
>60	20	50

Table-3: Injury related parameters.

Parameters	Number of patients	Percentage
Mode of injury		
RTA	25	62.5
Fall due to slip	15	37.5
Limb involved		
Right Side	22	55
Left Side	18	45
Co-morbidity		
None	15	37.5
Hypertension	10	25
Diabetes Mellitus	7	17.5
C.A.D	8	20

In the present study, the most common mechanism of injury was found to be road traffic accidents with a total of 25 (62.5%) patients and rest 15 (37.5%) were injured due to accidental fall on the ground. In the present study, the right side proximal humeral fracture occurred in 22 (55%) patients and left side proximal humeral fracture occurred in 18 (45%) patients respectively. Majority of the patients around 15 (37.5%) doesn't have any co-morbidities, a total of 25 patients had different comorbidities which includes; 7 (17.5%) had diabetes mellitus, 10 (25%) had hypertension, and 8 (20%) had coronary artery disease.

Table-4: Neer's classification wise distribution of fracture

Classification	Number of patients	Percentage
2 Part Fracture	17	42.5
3 Part Fracture	13	32.5

4 Part Fracture	10	25
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All fractures were classified according to Neer's classification system. 17 (42.5%) patients were two-part, 13 (32.5%) were three-part and 10 (25%) were four-part in table 4.



Table-5: Time of injury of the patients

Time of injury	Number of patients	Percentage
Valgus displacement of the head	26	65
Varus displacement	13	32.5
Normal alignment	1	2.5
Total	40	100

Table-6: Shoulder functional outcomes.

Follow-up	N	CMS (Mean±SD)	p- value
06 Weeks	40	34.39 ± 3.38	<0.0001
12 Weeks	40	56.59 ± 6.53	
06 Months	40	66.32 ± 6.47	

In table 6, the Constant -Murley score achieved at the end of study period (6months) was 66.32 ± 6.47. The Constant-Murley score was significantly improved (p<0.0001) over each successive follow-up period with the average improvement of around 19 scores between 1st and 2nd follow-up and around 15 score improvement between 2nd and 3rd follow-up.

Table-7: Constant-Murley score grading.

CMS Grading	Number of patients	Percentage
Poor (0-55)	0	0
Moderate (56-70)	17	42.5
Good (71-85)	19	47.5
Excellent (86-100)	4	10.0
Total	40	100

In table 7, at six months follow up out of 40 patients, 0 patients had poor (constant score 0-55), 17 had moderate (constant score 56-70), 19 had good (constant score 71-85) and 4 had excellent (constant score 86-100) outcome.

Discussion

The overall incidence of humeral diaphysis fractures is increasing worldwide in both developed and developing countries. Our experience with the locking plate has given favorable results. Early mobilization and rehabilitation played a significant role in achieving optimal functional outcome, especially when dominant upper limb was involved.

In the present study, it was observed that road traffic accident was the most common mode of injury (62.5%) followed by simple falls (37.5%). This is in contrast to the earlier epidemiological studies which state fall as the most common mode of injury.^[11] Gregory TM et al. study reported fall (53.8%) is the predominant mode of injury followed by road traffic accidents (46.2%).^[12]

In the present study at the time of injury majority of fracture 26 (65%) showed valgus displacement of the head followed by 13 (32.5%) showed varus displacement and 1 (2.5%) shows normal alignment. The average head-shaft angle of proximal humeral fracture after injury is 133.63 ± 53.81 .

Most of the patients had two-part (42.5%) followed by three-part (32.5%) and four-part (25%) are Neer's Fracture Type. This is in accordance with the results of epidemiological studies conducted by Jordan RW et al. who stated that the most common displaced fracture pattern was 2-part fractures followed by 3 parts and 4 parts respectively.^[13] But this is in contrast to the findings of Burkhart KJ, et al., most of the fractures observed are three-part (46.1%) followed by four- part (34.7%) and least number are two-part (19.2%) proximal humerus fractures.^[14] Similarly, Buecking B et al. observed a higher number of three-part fractures (40), compared to four- part (35) and two-part (2) among a total number of 81 patients with 82 proximal humeral humerus fractures.^[15]

In the present study, 04 of the patient (10%) had excellent (constant score 86-100) 19 patients (47.5%) had good (constant score 71-85), 17 patients (44%) had moderate (constant score 56-70) functional outcome. These results are consistent with result found in other studies. Vijayvargiya et al. study reported 8 patients with the good score, 10 patients with the moderate score, 6 patients with excellent outcome and 2 patients with poor outcome.^[16] Similarly, Azar FM et al study with 82 patients of proximal humerus fractures with an average follow-up of 32 months reported excellent scores for 8 patients, good for 52, moderate for 17 and poor for 5 patients.^[17] However, Pinkowsky GJ et al. study reported excellent to good results in 16patients, moderate in 1 patient and poor in 11 patients.^[18]

In the present study, average Constant-Murley score observed among all 19 patients were good (score 71-85). The reported Constant-Murley score is varied among according to Manek V et al., studies reported less mean Constant-Murley score (<70) compared to the present study.^[19] Arumugam S et al., study reported mean Constant-Murley score of 70 as equivalent to the present study.^[20] The variations in reported Constant-Murley score among different studies attribute to a multitude of reasons like the average age of patients, various follow up periods and as most of the studies are Western studies with the difference in physical characteristics of patients with individual race. The high Constant-Murley score reported in this compared to the present study may be due to the younger age of participants (mean age of 38 years) and longer follow-up period.

Conclusion

In conclusion, the proximal humeral locking plate seems to be an adequate device for the fixation of displaced two parts, three-part and four-part proximal humerus fractures as 92% of the present study population had “excellent to moderate” functional outcomes. Due to stable fixation, early functional aftercare is possible and allows the patient to regain good shoulder function and resume normal activities much earlier.

Proximal humerus locking plate is an effective system for stabilizing these fractures, but the surgeon should be aware of potential complications. Additional studies with larger cohorts and longer follow-ups are necessary to better define the appropriate indications and expected outcomes of this technology.

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