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Original Research Article

PROSPECTIVE STUDY ON THE OUTCOME ANALYSIS OF INTERNAL FIXATION OF PROXIMAL HUMERUS FRACTURES.

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ABSTRACT

Background: The aim of treatment in proximal humerus fractures is to achieve a painless and simultaneously functional shoulder. there are several techniques to treat proximal humerus fractures. The aim of the study is to analyse the outcome of proximal humerus fractures treated by internal fixation using philos plating.

Materials and Methods: This study was conducted on 50 patients with proximal humerus fractures who underwent surgical fixation with philos plate and were followed for 6 months. Surgical approach chosen as either deltopectoral or deltoid splitting approach based on fracture pattern.

Results: The mean age of the patients was 50 years and 56% were male and most of the injuries (64%) were caused by road trafffic accidents. The Functional Outcome will be assessed based on the values of Constant Murley Score obtained after Six months post-surgery and Visual Analouge Scale at six weekly intervals for Six months. The outcome were excellent in 76%, good in 20 % and moderate in 4%.

Conclusion: The results demonstrate that internal fixation can be an effective treatment option as evidenced by high union rates and positive functional outcomes. However, careful patient selection and appropriate surgical techniques are crucial for optimal results.

Keywords: Proximal humerus, fracture, philos plate

INTRODUCTION

Proximal humerus fractures are one of the commonest fractures occurring in the skeleton representing approximately 4% of all fractures and 26% of humerus fractures. Proximal humerus fractures (PHFs), also known as "proximal humerus stress fractures," are among the most common types of bone breaks that occur in adults.[1] They account for around 5.7% of all occurrences and are the third most common type of nonvertebral fracture in people over the age of 64, following femoral neck and distal radius fractures with a reported mortality rate of up to 16% in the first year after injury.[2] PHFs are more common in women than men with some studies reporting a female-to-male ratio of up to 3:1. The increased incidence of PHFs in women may be due to several factors including lower bone mineral density, increased propensity for falls and a higher prevalence of osteoporosis.[3,4] PHFs are treated in a variety of different ways, each of which is determined by the patient's overall health as well as the severity of the fracture. For fractures with limited displacement nonsurgical care may include immobilization and physical therapy is frequently adequate treatment. However, surgical intervention can be required for fractures that have been dislocated or comminuted and this is especially true for patients who are younger.

The aim of treatment in proximal humerus fractures is to achieve a painless and simultaneously functional shoulder. This result depends on the age, medical condition, bone quality, and expectations of the patient, and a good evaluation of the current fixation techniques. Traditional treatment techniques include open reduction and internal fixation with proximal humeral plates, hemiarthroplasty and percutaneous or minimally invasive techniques such as pinning, screw

osteosynthesis and the use of intramedullary nails. Loosening or failure of the implant and non-union are possible complications of surgery in humeral fractures. Still no treatment can be the golden standard in these fractures.[5-9]

The scales we used are The Constant-Murley Scale (CMS) is a standardized assessment tool that is commonly used to measure the functional ability of patients with shoulder injuries. The scale assesses a variety of functions, including pain (15points), range of motion (40points), strength (25points), and activities of daily living (20points). The CMS consists of four components: pain activities of daily living, range of motion and strength. Each component is scored on a scale from 0 to 25 points with a total score ranging from 0 to 100 points. A higher score indicates better function. The Visual Analogue Scale (VAS) on the other hand, is a subjective measure of pain intensity. Patients are asked to rate their pain on a scale of 0 to 10 with 0 indicating no pain and 10 indicating the worst possible pain. The VAS is commonly used to assess pain levels before and after treatment to evaluate the effectiveness of interventions.

While both the CMS and VAS are useful tools for assessing patient function and pain, they have different strengths and limitations. The CMS provides a more comprehensive assessment of a patient's function, while the VAS is a more specific measure of pain intensity.

In order to decrease the high complication rates of proximal humeral fractures the AO/ASIF group developed The Proximal Humeral Internal Locking Osteosynthesis (PHILOS) plate (Synthes, Stratec Medical ltd, Mezzovico Switzerland); an internal fixation system that enables angled stabilization with multiple interlocking screws. Internal fixation is a surgical technique used to stabilize and repair bone fractures.[10]

Patients who have bone fractures can often benefit from having surgery called internal fixation since the procedure can speed up the healing process and help restore function. Casting is a conventional type of immobilization that can be replaced with internal fixation which can allow for early mobilization and a faster recovery period than other treatments.[11]

The PHILOS plate is a commonly used implant for internal fixation of proximal humerus fractures. The plate is constructed so that it can offer secure fixation of the bone fragments while at the same time minimizing injury to the surrounding soft tissue and maintaining blood flow to the bone. Patients who have fractures of the proximal humerus can benefit from this in that it helps speed up the healing process and assist restore function. The PHILOS plate's adaptability is one of its benefits.[12] A variety of proximal humerus fractures, including complicated three- and four-part fractures and fractures involving the greater or lesser tuberosity can be treated with the plate. In order to increase stability, the plate can also be utilized in conjunction with other implants such as suture anchors and internal fixation since the procedure can speed up the healing process and help restore function. Casting is a conventional type of immobilization that can be replaced with internal fixation which can allow for early mobilization and a faster recovery period than other treatments.[13]

However, the PHILOS plate is a versatile and effective implant for the internal fixation of proximal humerus fractures. While it carries some risks and requires a high level of surgical skill the PHILOS plate can help promote healing and restore function for patients with challenging injuries.

The aim of this treatment is to achieve anatomical reduction, stable fixation and early functional recovery. Several studies have shown that internal fixation with the PHILOS plate is a safe and effective method for treating proximal humerus fractures with good functional outcomes and low rates of complications. However, the use of the PHILOS plate requires a high level of surgical skill and careful attention must be paid to avoid the mispositioning of the plate and to ensure proper alignment. While complications such as non-union, implant failure, and infection can occur.[14]

Additional research is required to evaluate the efficacy of hemiarthroplasty and conservative therapy versus internal fixation using the PHILOS plate. Further investigation is required to pinpoint patient-specific variables that can affect the decision about a course of therapy and the results of internal fixation using the PHILOS plate.[15]

However, few prospective studies are available that evaluate this technique's results or report on the treatment-related complications. Our aim is to investigate the outcome of internal fixation surgery in proximal humerus fractures.

MATERIAL AND METHODS

This was the prospective study that will be conducted at a single center. Fifty patients were examined with post operative follow up of six months at the Orthopaedics Department of Annapoorna Medical College and Hospitals in Salem. The study was initiated after obtaining an ethical clearance from the institutions ethical clearance committee. The indications of operative treatment were carried out according to Neer's classification. The study protocol has been approved by the institutional review board. 50 patients were included in the study after meeting inclusion criteria and a written informed consent was taken from the patient or a legal heir before recruiting the patients to the study. All of the patients either sex with age group 20 to 70 years with closed proximal fractures and without comorbidity were included in the study. Patients with open fractures, terminally ill patients with multiple medical co-morbidities and above 70 years were excluded from the study. Demographic data (age, gender and profession), mechanism of injury, the severity of the injury (NEER classification), associated injuries, initial management and time to

definitive treatment were recorded. Routine preoperative investigations will be done and patients will be taken up for surgery as soon as deemed fit. The patients will be operated on under brachial block or general anaesthesia.

Surgical approach

Surgical approach chosen as either deltopectoral or deltoid splitting approach based on fracture pattern. The patient will be positioned in either beach chair or supine position. Surgical events and difficulties faced are post-surgery local or systemic complications, time needed for fracture union and time taken to return to pre-fracture activity will be documented. The fracture fragments will be reduced and provisionally fixed with Kirschner wires. The reduction will be confirmed under image intensification. The PHILOS Plate will be positioned such that at least 5- 8 mm gap exists from the upper end of the greater tuberosity and 2 mm posterior to the bicipital groove. Presence of sufficient gap between the plate and the long head of the biceps tendon will be ensured. When the fracture reduction and probable screw positioning is deemed adequate definitive plate fixation using angular stable screws in the humeral head, calcar and other screws will be done. A final check to verify correct screw placement will be performed under c-arm guidance.

Post-operative management

Preoperative and Post-operative intravenous antibiotics will be given for first three days and later will be changed to oral for next five days. Standard rehabilitation protocols will be followed and patients will be discharged on fifth post-operative day. Suture removal will be done on tenth day. Arm slings will be provided for the first 6 weeks combined with limited mobilization as follows; a) after 2 weeks pendulum exercises and active range of motion will be started subsequently after another 2 weeks active external rotation will be encouraged and initiated under the guidance of a Physiotherapist. Early passive assisted exercises help to avoid adhesion formation. Shoulder strengthening and resistance exercises will be initiated only after bony consolidation was established on plain roentgenograms. Antero-Posterior and Axillary view roentgenograms will be taken immediately post-surgery. Regular follow up radiographs will be taken six and twelve weeks post operatively.

Final outcome assessment

The Functional Outcome will be assessed based on the values of Constant Murley Score obtained after Six months post-surgery and Visual Analouge Scale at six weekly intervals for Six months. Expected Complications to be associated with the ORIF technique include screw back out, non-union of fractures, avascular necrosis of the head of humerus, post-operative shoulder stiffness and shoulder impingement. However, patient's risk of complications will be evaluated more individually and taken into consideration.

Statistical Analysis

The collection data was analyzed using SPSS software 23.0 version. P value is less than 0.05 was considered significant.

RESULTS

The study consists of 50 cases of proximal humerus fractures treated surgically at orthopaedics department of Annapoorna Medical College and Hospitals in Salem with follow up period of 6 months. Table1 illustrates patient characteristics data in which prevalent between the ages of 40 and 50; males disproportionately affected. The mean age of the patients was 50 years (SD = 15.12), and 56% were male. There were no significant differences between the two groups in terms of age, sex, mode and mechanism of injury. Most of the injuries (64%) were caused by road accidents. The most common mechanism of injury in the present study was high energy trauma or less with direct blow seen in 12% of patients. High energy trauma was younger patients (28%). Excessive rotation of the arm was seen in 24% of patients. According to Neer's classification two part fractures constituted the most common type especially surgical neck (34%) in this study. We found that postoperative shoulder stiffness is a commonest outcome of ORIF and there was no infection in surgical site among our study participants (27%). From the first to the sixth month, range of motion were tracked. The patient felt no discomfort. The obtained 'p' value >0.000 and it indicates a statistically significant difference between CMS and VAS score". No failing grades were found when the Murley value was employed as the grading criterion 4% gave a rating of "moderate," 20% gave a rating of "good"and 76% gave "excellent" with mean of 11.5± 15.60 and 6 weeks (24%), 12 weeks (36%), and 6 months (40%), with a mean of 22.33± 6.80, were the most common durations of VAS use.

Table 1: Demography, Mode of injury and Complications

Characteristics	Number of patients(%)
Age	
21-30	3(6%)
31-40	6(12%)
41-50	17(34%)
51-60	15(30%)
61-70	9(18%)
Sex	
Male	28(56%)
Female	22(44%)

Mode of injury	
Fall from height	14(28%)
Road traffic accident	32(64%)
Domestic fall	04(8%)
Mechanism of injury	
Direct blow	06(12%)
Excessive rotation of the arm in abduction	14(28%)
High energy trauma	18(36%)
Fall on outstretched hand (Minor fall)	12(24%)
Types of fracture (based on Neer's)	
1 Part	12(24%)
2 Part Surgical neck	17(34%)
2-Part Greater tuberosity	2(4%)
2 Part(Greater tuberosity)+ Anterior dislocation	4(8%)
3 Part (Greater tuberosity+ Surgical neck)	13(26%)
4 Part	2(4%)
Complication	
Infection	0
Shoulder Stiffness	3(27%)
a) Glenohumeral Arthritis	1(9%)
b) Sub-acromial impingement	2(18%)
Varus Deformity	1(9%)
Screw Pullout	2(18%)
Nil	2(18%)
Outcomes of ORIF	
Screw Backout	1(4.3%)
Non-Union	2(8.7%)
Avascular necrosis OF THE Head Of Humerus	1(4.3%)
Post-Operative Shoulder Stiffness	3(13%)
Shoulder Impingement	1(4.3%)

Table 2: Grading Outcome Scores

Constant Murley Score(CMS)		
	Frequency	**Percentage**
Poor (0-55)	0	
Moderate (56-70)	02	(04%)
Good (71-85)	10	(20%)
Excellent (86-100)	38	(76%)
Visual Analogue Scale (Vas)		
6weeks	17	(26%)
12weeks	20	(34%)
At 6month	30	(40%)

Table 3: Comparison of Constant Murley score (CMS) and Visual analogue score (VAS)

Scale	Excellent	Good	Moderate	P value
6weeks	8	10	2	
12weeks	17	0	0	0.000*
At 6month	13	0	0	

DISCUSSION

Patients who have fractures of the proximal humerus have been on the rise over the past several decades due to the rise in the proportion of the population affected by osteoporosis as the average age of the population has increased. It has been demonstrated through a number of studies that osteoporosis has a negative impact on the anchoring of internal fixation, which in turn leads to an increased rate of failure.[16]
This prospective study design included and collected data on Age, Sex, Mode of injury, Mechanism of injury, Type of fracture (based on Neer's), Grading value according to Murley score, Complications, Visual analogue: follow-up outcomes, Outcomes of ORIF, Comparison of constant Murley score and visual analogue scale. Comparison of the constant Murley score and Visual analogue score were statistically significant and in the excellent category there was 38 participants (76%) in our study and similar results were also present Umpathi et al study but here participants were more in the good category.[17]
In our study, we used the PHILOS plate technique which had an overall complication rate (22%) which is comparatively lower than a study by Sadowski et al., fixation with Plant Tan plates resulted in 100% complications especially in elderly osteoporotic bones with penetration of the proximal screw being the most common complication. This is because in our study majority of the patients were between 41-50 years old and in their study there were maximum elderly.[18]
Here the maximum number of participants were 41-50 age with less complications but in a retrospective analysis study the mean age was 59 years which had a mean of 3 complications occurring per patient including primary screw cutout, malunion, nonunion,

avascular necrosis, and infection.[20] Our study used the PHILOS plate technique and Neers classification as same as Mayank Vijayvargiya et al., study and also the mean age was 46 in this study similar to our study because we had maximum participants with age between 41-50.[21]

There was no infection in the patients from our study as same as Umapathi et al., study where the infection rate was low because the plate had a low profile and required less soft-tissue dissection, thus enabling stable fixation.

Fixation with PHILOS plates preserves obtained reduction and a good functional outcome may be expected in the study by Brunner et al., similar to our study we have good outcomes, which are seen in the comparison of constant Murley score and visual analogue score majority of the patients were excellent.[22] Limitations of this study include the relatively small sample size and the lack of long-term follow-up. Future studies with larger sample sizes and longer follow-up periods may be needed to further investigate the optimal management of proximal humerus fracture.

CONCLUSION

In conclusion this prospective study provides valuable insights into the efficacy and safety of internal fixation for proximal humerus fractures. The results demonstrate that internal fixation can be an effective treatment option as evidenced by high union rates and positive functional outcomes. However, careful patient selection and appropriate surgical techniques are crucial for optimal results. Complex fractures and underlying medical conditions may affect the suitability of internal fixation. These findings contribute to the existing knowledge base and inform clinical decision-making for improved patient care. Further research in this area can continue to refine treatment strategies and enhance outcomes for these challenging injuries.

REFERENCES

1. Patted P, Sadiq M. Functional outcome of proximal humeral interlocking system plating for displaced proximal humeral fractures: A prospective study. 2021
2. Court-Brown CM, Caesar B. Epidemiology of adult fractures: a review. Injury. 2006 Aug 1;37(8):691-7.
3. Lanting B, MacDermid J, Drosdowech D, Faber KJ. Proximal humeral fractures: a systematic review of treatment modalities. Journal of shoulder and elbow surgery. 2008 Jan 1;17(1):42-54.
4. CHARLES S NEER II. Displaced proximal humeral fractures: Part I. Classification and evaluation. JBJS. 1970 Sep 1;52(6):1077-89.
5. Scheer JH, Tillander BM, Dånmark I, Hallgren HC. Solely sutures are a reliable fixation for valgus-impacted proximal humeral fractures. Journal of Clinical Orthopaedics and Trauma. 2021 Apr 1; 15:130-5.
6. Warnhoff M, Jensen G, Hazra RO, Theruvath P, Lill H, Ellwein A. Double plating- surgical technique and good clinical results in complex and highly unstable proximal humeral fractures. Injury. 2021 Aug 1;52(8):2285-91.
7. Miquel J, Martínez R, Santana F, Marimon P, Torrens C. Surgical treatment of proximal humeral fractures with the transosseous suture fixation. Journal of Orthopaedic Surgery and Research. 2021 Dec;16(1):1-7.
8. Amin SJ, Romiyo V, Miller LS, Kleiner MT, Fedorka CJ. Displaced proximal humerus fractures in older patients: reverse total shoulder arthroplasty or nonoperative treatment? InSeminars in Arthroplasty: JSES 2022 Jun 1 (Vol. 32, No. 2, pp. 312-321). WB Saunders.
9. Chen H, Zhu ZG, Li JT, Chang ZH, Tang PF. Finite element analysis of an intramedulary anatomical strut for proximal humeral fractures with disrupted medial column instability: a cohort study. International Journal of Surgery. 2020 Jan 1; 73:50-6.
10. Olerud P, Ahrengart L, Ponzer S, Saving J, Tidermark J. Hemiarthroplasty versus nonoperative treatment of displaced 4-part proximal humeral fractures in elderly patients: a randomized controlled trial. Journal of shoulder and elbow surgery. 2011 Oct 1;20(7):1025-33.
11. Kim DY, Kim TY, Hwang JT. PHILOS plate fixation with polymethyl methacrylate cement augmentation of an osteoporotic proximal humerus fracture. Clinics in Shoulder and Elbow. 2020 Sep;23(3):156.
12. Marsh JL, Slongo TF, Agel J, Broderick JS, Creevey W, DeCoster TA, Prokuski L, Sirkin MS, Ziran B, Henley B, Audigé L. Fracture and dislocation classification compendium-2007: Orthopaedic Trauma Association classification, database and outcomes committee. Journal of orthopaedic trauma. 2007 Nov 1;21(10): S1-6.
13. Deng XY, Fan ZY, Yu BF, Ni BB, Wang W, Lu H, Shen H. Use of a locking intramedullary nail for the treatment of initial varus proximal humeral fracture: a prospective pilot study. Journal of International Medical Research. 2020 Jun;48(6):0300060520935286.
14. Ogut E, Karakas O, Aydin DD. Journal of Orthopaedic Reports.
15. Wendt KW, Jaeger M, Verbruggen J, Nijs S, Oestern HJ, Kdolsky R, Komadina R. ESTES recommendations on proximal humerus fractures in the elderly. European Journal of Trauma and Emergency Surgery. 2021 Apr; 47:381-95.
16. Barrios C, Broström LA, Stark A, Walheim G. Healing complications after internal fixation of trochanteric hip fractures: the prognostic value of osteoporosis. Journal of orthopaedic trauma. 1993 Jan 1;7(5):438-42.
17. Chowdary U, Prasad H, Subramanyam PK. Outcome of locking compression plating for proximal humeral fractures: a prospective study. Journal of orthopaedic surgery. 2014 Apr;22(1):4-8.
18. Sadowski C, Riand N, Stern R, Hoffmeyer P. Fixation of fractures of the proximal humerus with the PlantTan Humerus Fixator Plate: early experience with a new implant. Journal of shoulder and elbow surgery. 2003 Mar 1;12(2):148-51.
19. Chidambaram R, Stasch T, Mok D. Locking plate system in the treatment of displaced proximal humeral fractures. J Bone Joint Surg Br 2005;87(Suppl 2):1667.
20. Jost B, Spross C, Grehn H, Gerber C. Locking plate fixation of fractures of the proximal humerus: analysis of complications, revision strategies and outcome. Journal of shoulder and elbow surgery. 2013 Apr 1;22(4):542-9.
21. Vijayvargiya M, Pathak A, Gaur S. Outcome analysis of locking plate fixation in proximal humerus fracture. Journal of clinical and diagnostic research: JCDR. 2016 Aug;10(8):RC01.
22. Brunner F, Sommer C, Bahrs C, Heuwinkel R, Hafner C, Rillmann P, Kohut G, Ekelund A, Muller M, Audigé L, Babst R. Open reduction and internal fixation of proximal humerus fractures using a proximal humeral locked plate: a prospective multicenter analysis. Journal of orthopaedic trauma. 2009 Mar 1;23(3):163-72.