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Original Research Article

ANTERIOR BRIDGE PLATING FOR HUMERUS DIAPHYSEAL FRACTURES USING MINI INCISION MIPO TECHNIQUE

Naitik B. Panchal[1], Vishal M. Dindod[2], Nirav A. Patel[3], Saurav K. Padval[4]

[1]*Assistant Professor, Department of Orthopedics, Zydus Medical College and Hospital, Dahod, Gujarat, India.*
[2]*Associate Professor, Department of Orthopedics, Zydus Medical College and Hospital, Dahod, Gujarat, India.*
[3]*Senior Resident, Department of Orthopedics, Zydus Medical College and Hospital, Dahod, Gujarat, India.*
[4]*Resident, Department of Orthopedics, Zydus Medical College and Hospital, Dahod, Gujarat, India.*

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Corresponding Author:
Dr. Saurav K. Padval,
Department of Orthopedics, Zydus Medical College and Hospital, Dahod, Gujarat, India.
Email: sauravpadval99@gmail.com

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ABSTRACT

Background: From conservative cast and braces to internal fixation with nailing, plating and screw, the treatment of humeral fractures has seen significant advancements in addressing their complications. **Aim and Objective:** The study aimed to assess the practicality of using the MIPPO technique for treating fractures in the distal humeral shaft.

Materials and Methods: Patients with a midshaft humerus fracture were included in the study. The study included a total of 25 patients. The fractures were treated by using a 4.5mm narrow Dynamic compression plate (DCP) for reduction and fixation. X-rays of the humerus were taken on the first day after surgery and then at follow-up appointments at 1 month, 3 months, 6 months, and 12 months. The procedure's clinical and functional outcomes were evaluated using the MEPI score for the elbow and UCLA score for the shoulder.

Results: Among the 25 patients, it was observed that the majority of them, specifically 18 patients, had fractures on their dominant side. The average operative time was determined to be 85 minutes. At 6 months, almost all (23 out of 25) patients had an excellent MEPI score. There was no significant difference in MEPI scores over time ($p>0.05$). All patients had an excellent or good UCLA score at 6 months. The UCLA scores did not show any significant difference over time ($p>0.05$).

Conclusion: We found that anterior bridge plating through MIPO of humeral shaft fractures improved radiological, clinical, and functional outcomes (MEPI scores, UCLA scores, and range of motion). The technique is complex and takes a long time to learn, but the results are good and reproducible.

Keywords: Anterior Bridge Plating, Humerus Diaphyseal Fractures, Dynamic compression plate, Minimally invasive plate osteosynthesis.

INTRODUCTION

Humeral fractures make up approximately 7% of all fractures. Of those, about 4% affect the proximal part of the humerus, with an incidence rate of 48-142 cases per 100,000 people. Among the elderly, proximal humeral fractures is the third most common type of fracture, with a female-to-male ratio of 2:1.[1] One possible explanation for the higher prevalence of osteoporosis in the female population over 60 years is the predominance of women in this age group. In addition, fractures of the proximal humerus can be quite debilitating, as patients may experience other health issues that can affect how the fracture is managed and treated.[2,3] Conservative treatment has traditionally been the primary approach for managing humeral shaft fractures. However, there are certain situations that may require surgical intervention. These include cases where conservative treatment fails to properly align the fracture, as well as fractures that are open or associated with neurovascular damage, particularly in patients with multiple injuries. Open plating is widely regarded as the most effective

surgical method among the various options available. However, due to the extensive surgical exposure involved in open plating, there are concerns regarding the potential risks of nonunion, infection, or radial nerve palsies.[4,5]

From conservative cast and braces to internal fixation with nailing, plating and screw, the treatment of humeral fractures has seen significant advancements in addressing their complications. Ongoing studies are being conducted to determine the potential advantages of one option compared to another.[6] A minimally invasive technique for humerus shaft fracture has shown promising results in recent studies. The study aimed to assess the practicality of using the MIPPO technique for treating fractures in the distal humeral shaft.

MATERIALS AND METHODS

The study was conducted in the Department of Orthopaedics at the Medical College & Hospital. The duration of the study was 12 months. Patients with a midshaft humerus fracture were included in the study. The study included a total of 25 patients. The study followed specific criteria for including and excluding participants.

All participants included in the study were between the ages of 20 and 55 and had a mid-shaft fracture of the humerus. They willingly agreed to take part in the research. The operative procedure was conducted promptly, just 4 days after the injury.

Exclusion criteria involved the presence of fractures on both limbs, severe compounding, concurrent medical conditions like malignancy or vascular insufficiency of the upper limb, poly trauma patients with an injury severity score greater than 16 points, and patients with a history of drug addiction.

Patients with fractures of the humerus shaft underwent treatment using the Anterior Bridge plating technique, which involved a minimally invasive approach. This study was conducted at our centre and involved a case series. The cases were tracked for at least 12 months. The fractures were treated by using a 4.5mm narrow Dynamic compression plate (DCP) for reduction and fixation. All surgeries were performed by the same orthopaedic surgeon.

An extensive preoperative clinical examination was conducted on the affected arm, thoroughly assessing for any abrasions, swelling, contusion, puckering, and neurovascular deficit. The humerus radiographs of the patient were evaluated, including both antero posterior (AP) and lateral (Lat) views. In addition, the radiographs were utilised to determine the optimal length of the implant and to assist in surgical planning.

A skin incision of approximately 3 cm was made both proximally and distally to perform MIPO surgery using the anterior approach. A tunnel was created outside the periosteum and the plate was carefully inserted after manually aligning the bones. It was then secured in position using two or three screws that went through both sides of the bone, both above and below the fracture site.

X-rays of the humerus were taken on the first day after surgery and then at follow-up appointments at 1 month, 3 months, 6 months, and 12 months. The procedure's clinical and functional outcomes were evaluated using the MEPI score for the elbow and UCLA score for the shoulder. These assessments were conducted from postoperative day 3 until the patient's discharge on postoperative day 13, as well as during each follow-up appointment. Furthermore, the length of the surgical procedure and the amount of time spent exposed to radiation were documented.

Statistical Analysis

Categorical variables are typically represented as counts and percentages, while numerical variables are usually expressed as mean values along with their corresponding standard deviations (SD). The associations among study groups were evaluated using the Fisher's test, student's t-test, and chi-square test. A p value below 0.05 was deemed significant.

RESULTS

Included in the study were a total of 25 patients. The age range of the included patients ranged from 20 to 60 years, with a mean age of 37.8 years. Among the 25 patients, it was observed that the majority of them, specifically 18 patients, had fractures on their dominant side. The average operative time was determined to be 85 minutes.

The majority of patients (18 out of 25) showed fracture union after 9-12 weeks of the postoperative period. In a few cases, union occurred earlier, with 4 patients showing union at 5-8 weeks and 1 patient at less than 4 weeks postoperative. Two patients experienced fractures that took over 12 weeks to heal, likely due to smoking and osteoporosis. [Table 1]

Postoperative MEPI score,[7]

The MEPI score was classified as follows: a score of >90 was graded as excellent,
75-89 as good,
60-74 as fair,
< 60 as poor.

At 6 months, almost all (23 out of 25) patients had an excellent MEPI score, while only two patients had a good score. There was no significant difference in MEPI scores over time ($p>0.05$).

Postoperative UCLA score,[8]

The UCLA score was classified as follows:
> 27 points was graded as excellent to good
< 27 as fair to poor.

Upon discharge, 22 patients achieved an excellent to good score, while the remaining 3 patients obtained a fair score. All patients had an excellent or good UCLA score at 6 months. The UCLA scores did not show any significant difference over time ($p>0.05$).

The shoulder function based on the UCLA score was ranging from excellent to good in 20 cases, fair in 3 cases, and 2 patients experienced an infection, resulting in the premature removal of the plate at the 5th month. The wound was carefully debrided and managed, and then treated conservatively. [Table 2]

The most common type of injury was road traffic accidents (RTAs), which were found in 22 cases. Additionally, three patients sustained injuries from a direct blow to the arm. In one case, we utilized a single lag screw for an oblique fracture. Our cases were followed up for an average of 12 months.

The average duration of radiation exposure was 167.2 ± 30.8 seconds. During the procedure, 8 patients received radiation exposure for 100-150 seconds, while a comparable number (9) received exposure for 150-200 seconds. A total of nine patients were exposed for duration of 200-250 seconds. [Table 3]

Table 1: Time to radiological union following anterior bridge plating through MIPO of humeral shaft fractures

Sr. No.	Time to radiological union	No. of patients
1	< 4	1
2	5 – 8	4
3	9 – 12	18
4	> 12	2
	Total	25

Table 2: Postoperative MEPI score at discharge and at each follow-up

MEPI score	On discharge	1 month	3 months	6 months
Excellent	18	20	22	23
Good	3	5	3	2
Fair	3	0	0	0
Poor	1	0	0	0
Total	25	25	25	25

Table 3: Posto-perative UCLA score at discharge and at each follow-up

UCLA score	On discharge	1 month	3 months	6 months
Excellent to Good	**22**	**22**	**23**	**25**
Fair to Poor	**3**	**2**	**2**	**0**
Total	**25**	**25**	**25**	**25**

DISCUSSION

In 1996, Tscherne and Krettek were the first to report the use of minimal invasive osteosynthesis for treating supracondylar femoral fractures. Since then, this technique has been used to treat a wide range of fractures. The MIPO technique seems to be reproducible and applicable to most shaft humeral fractures, even though it is a highly complex surgical procedure that requires a considerable amount of time to adapt to. The plate technique offers several advantages over the conventional plate technique, including a reduced risk of nerve injury, improved bone vascularity, and less damage to soft tissue.[9,10]

Plate placement and indirect reduction can be quite challenging procedures that necessitate prior experience. Nevertheless, it is possible to safely utilize plates over the humeral shaft, either in the anterior or anterior-medial position.

Studying fractures of the shaft of the humerus is crucial due to the increased risk of malunion associated with both closed and open fractures. For patients who have fractures, particularly in their extremities, the resulting functional disability can greatly impact their daily lives.[11]

The study findings demonstrated the effectiveness of anterior bridge plating through MIPO in enhancing radiological, clinical, and functional outcomes for individuals with humeral shaft fractures. Based on our research findings, it was observed that most fractures typically healed within a timeframe of nine to twelve weeks. Sharma, Vegad, Ibrahim, and Mahajan also came across a similar set of findings.[12]

Twenty-two patients achieved excellent to good UCLA scores upon discharge, while three patients had fair scores. By the six-month mark, their scores varied from excellent too good. The results from UCLA were similar ($p>0.05$). The findings of Vegad and Ibrahim align with this.

CONCLUSION

We found that anterior bridge plating through MIPO of humeral shaft fractures improved radiological, clinical, and functional outcomes (MEPI scores, UCLA scores, and range of motion). The technique is complex and takes a long time to learn, but the results are good and reproducible. However, a larger multi-centric metanalytical study with control groups will help us standardise protocol. To conclude, MIPO is a novel and acceptable treatment.

REFERENCES

1. Bassett R. Proximal humeral fractures in adults. Retrieved January. 2012;10(2012):1-30.
2. Handoll HH, Elliott J, Thillemann TM, Aluko P, Brorson S. Interventions for treating proximal humeral fractures in adults. Cochrane Database of Systematic Reviews. 2022(6).

3. Baker HP, Gutbrod J, Strelzow JA, Maassen NH, Shi L. Management of proximal humerus fractures in adults—a scoping review. Journal of Clinical Medicine. 2022;11(20):6140.
4. Orapiriyakul W, Apivatthakakul V, Theppariyapol B, Apivatthakakul T. Humerus shaft fractures, approaches and management. Journal of Clinical Orthopaedics and Trauma. 2023:102230.
5. Zavras AG, Monahan KT, Winek NC, et al. Conservative management with functional brace versus various surgical fixation techniques for humeral shaft fractures: a network meta-analysis. JBJS. 2023;105(14):1112-1122.
6. Qiu H, Liu Y, Chen Y, et al. Treatment of humeral shaft fractures with different treatment methods: a network meta-analysis of randomized controlled trials. BMC Musculoskeletal Disorders. 2023;24(1):583.
7. Mwangi ME. Functional Outcome in Conservative Management of Diaphyseal Humerus Fractures-A Comparative Assessment On the Use of U Slab Vis-À-Vis Functional Brace, University of Nairobi; 2019.
8. Abhishek Kumar RB. Prospective study of clinical, radiological and functional outcome of anterior bridge plating for shaft of humerus fracture. International Journal of Research in Orthopaedics. 2020;6(6):6.
9. Van de Wall BJ, Beeres FJ, Knobe M, Link BC, Babst R. Minimally invasive plate osteosynthesis: An update of practise. Injury. 2021;52(1):37-42.
10. Marazzi C, Wittauer M, Hirschmann MT, Testa EA. Minimally invasive plate osteosynthesis (MIPO) versus open reduction and internal fixation (ORIF) in the treatment of distal fibula Danis-Weber types B and C fractures. Journal of orthopaedic surgery and research. 2020; 15:1-9.
11. Lotzien S, Hoberg C, Rausch V, Rosteius T, Schildhauer TA, Gessmann J. Open reduction and internal fixation of humeral midshaft fractures: anterior versus posterior plate fixation. BMC musculoskeletal disorders. 2019; 20:1-9.
12. Sea JL, Zuabi N, Wray A. Adult Clavicular Fracture Case Report. Journal of Education & Teaching in Emergency Medicine. 2020;5(4): V6.