

COMPARISON OF OUTCOMES OF CONVENTIONAL POSTERIOR PLATING VS ANTERIOR MINIMALLY INVASIVE LOCKED PLATE FIXATION FOR HUMERUS SHAFT FRACTURES

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Abstract

Background: Humerus shaft fracture can be treated with non-operative methods, and operative methods like posterior open plating or anterior minimally invasive locked plate osteosynthesis (MIPO). No study shows superiority of any method. In this retrospective cohort study we are comparing outcomes of posterior plating vs anterior MIPO in humerus shaft fracture. **Materials and Methods:** Patients operated between January 2019 and December 2022 for humerus shaft fracture, either treated with posterior plating or anterior minimally invasive locked plating were included in the study. Scores used for functional outcomes were ASES (American Shoulder and Elbow Surgeons) shoulder score, UCLA (University of California- Los Angeles) shoulder scale and VAS (visual analogue scale) pain score. Union time, operative duration and complications were recorded. Minimum follow up was 1 year after surgery. **Result:** Out of 62 patients included, 39 were in group 1 (posterior plating group), while 23 were in group 2 (anterior MIPO group). Iatrogenic radial nerve palsy was observed in 2 patients in group 1, and 1 patient in group 2. All palsies recovered within 1 year. Malunion was slightly more common in group 2. There was no statistically significant difference in union time, complication rate or revision surgery rate. **Conclusion:** There was no significant difference in outcomes of anterior MIPO plating as compared to posterior conventional plating for shaft of humerus fracture.

INTRODUCTION

Humerus shaft fractures were historically treated with functional bracing with low rate of complications.^[1] Improvement in the fixation methods along with more importance given to early mobilization and over all functional outcome, rather than union of fracture, led to various fixation strategies for fixation.^[2] While many fractures united with conservative treatment alone, there were more incidences of nonunion than operated patients. Humerus nail (antegrade and retrograde), posterior compression plating and anterior minimally invasive plating are currently used for humeral shaft fractures.^[3,4] While humerus nail is a technically demanding procedure, and the rotator cuff has to be violated for the insertion of nail, many surgeons prefer plating of humerus.^[4] Advances in development of locking plate technology have increased popularity of minimally invasive approach in fracture fixation. There is no

strong evidence for superiority of any method of fixation in humerus shaft fracture. In this retrospective cohort study we are comparing outcomes of two methods of fracture fixation of humerus shaft, namely posterior conventional plating and anterior minimally invasive plate osteosynthesis (MIPO) with locked plate.

MATERIALS AND METHODS

This study was approved by institutional ethics committee. Patients operated between January 2019 and December 2022 for humerus shaft fracture, either treated with posterior plating or anterior minimally invasive locked plating were included in the study. Data were retrieved from the operation theater register of our hospital. Indoor case details and pre and post-operative radiographs were examined to collect relevant data. Patients follow up details were collected from hospital records. Patients were called for final follow up and were examined

for functional and radiological outcomes. Scores used for functional outcomes were ASES (American Shoulder and Elbow Surgeons) shoulder score,^[5,6] UCLA (University of California- Los Angeles) shoulder scale and VAS (visual analogue scale) pain score. Union was decided using AP and lateral radiographs of the fracture, and union in more than 3 cortices was considered as a union of the fracture.

Surgical Technique

Posterior Plating

Patient was positioned in a lateral decubitus position with arm rest under the humerus. General or regional anesthesia was given. Fracture was exposed using posterior midline incision over the arm, centered over the fracture. Triceps was split between two heads, and radial nerve was identified and isolated along its course. After getting adequate exposure, reduction was achieved and fracture was fixed using plate and screws.

Anterior minimally invasive plating

Patient was positioned supine with C-arm compatible arm rest over affected side. Proximal incision was made in the delto-pectoral interval, and distal incision was made in the center of the front of arm, and biceps was retracted medially along with the profunda brachii artery. Epi periosteal dissection of the plane was done, and locking plate was introduced under c-arm guidance. Fixation was done using minimum 2 locking screws on each side of fracture. Other screws were inserted whenever required with percutaneous approach.

Post-Operative Protocol

All patients were given U shaped arm splint and triangular shoulder pouch. Stitches were removed at 12 days after surgery. Pendulum exercise of the shoulder and passive elbow movements were started as soon as the patient is pain free. After discharge patients were called for follow up on 1 week, 4 weeks, 8 weeks, 3 months, 6 months and 1 year duration after the surgery. Xrays were taken immediately after surgery, then 4 weeks, 8 weeks, 3 month, 6 month and 1 year interval after the surgery. UCLA shoulder scores, ASES shoulder scores and VAS (visual analogue scale) was recorded at each

follow up visit. Once included in study, patients were called for final follow up and xrays and examination were done.

Statistical Analysis

Mean and range were calculated for categorical variables. P value was obtained between two groups using unpaired t test and chi squared test. P value <0.05 was considered as statistically significant. Epicollect 5 v 5.1.52 (Center for Genomic Pathogen Surveillance) was used for data collection.

RESULTS

Total 62 patients who were operated for humeral shaft fracture with either anterior MIPPO or posterior plating were included in study. There were 39 patients in group 1, who underwent posterior plating. In group 2 there were 23 patients who underwent anterior MIPPO plating. Average age of patient was 41.7 years (range 17-87 years). There were 16 females and 46 males included in the study. In group 1, there were 30 males and 9 females with mean age of 39.35 years. In group 2, there were 16 males and 7 females with, mean age of 45.65 years. Other variables of both groups were as mentioned in Table-1. There was no significant difference in both the groups in any demographic variable.

Union was achieved in 59 out of 62 patients. Among group 1, 2 patients had nonunion, and among group 2, 1 patient had nonunion. All 3 patients had revision surgery in form of bone grafting and revision plating and achieved union thereafter. There was no significant difference in union time or complication rates in both groups as shown. Iatrogenic radial nerve palsy was seen in 2 patients in group 1, and 1 patient in group 2. All radial nerve palsies were recovered at final follow up. 2 patients had rotational deformity in group 2, while only 1 patient had coronal plane deformity in group 1. There was no functional disability associated with these deformities.

Table 1: Geographic data

	Group 1 Posterior plate	Group 2 MIPPO	P value
Number	39	23	
Age	39.35±14.65 (17-75)	45.65±16.15(22-87)	0.12
Gender (M:F)	30:9	16:7	0.522
Hospital Stay	4.69±1.06	4.78±1.24	0.76
Compound fracture (GA type 1)	1	1	0.7
Neurological deficit (pre op)	1	1	0.7
Injured side (Dominant, non-dominant)	45% dominant side	48% dominant side	0.67
Follow up months	15.43±2.6(12-24)	16.08±3.15(12-24)	0.385

Table 2: Outcome

	Group 1	Group 2	P value
UCLA (max 35)	28.56±4.14(15-35)	28.47±4.21(16-35)	0.937
VAS (max 10)	1.53±1.21 (0-6)	1.34±1.27(0-5)	0.558
ASES score (max 100)	80.53±8.73 (54-98)	81.30±10.89 (54-98)	0.762
Operation time	150.25±56.36 (60-300)	140.65±37 (60-180)	0.469
Union time in weeks	16.64±2.88 (12-24)	17.56±3.62(12-26)	0.28

Complications:			
Iatrogenic palsy	2	1	0.88
Loosening of screw	0	0	-
Implant failure	0	0	-
Infection	1	1	0.71
Non union	2	1	0.88
Mal-union (Angulation, Rotation & shortening)	1	2	0.25
Revision surgery	2	1	0.88

DISCUSSION

Sarmiento et al described conservative treatment of shaft of humerus fracture in a case series with good rate of union and functional outcomes.^[1] After progression in methods of internal fixation, recent studies showed high nonunion rates in type A fractures of humeral shaft, and worse outcome of patients undergoing surgery for nonunion after the conservative treatment.^[2] A detailed meta-analysis conducted in 2012 by Gosler et al showed a deficiency of conclusive evidence for superiority of any of the method of treatment for humeral shaft fracture.^[7] Plating of these fractures was having lower rates of shoulder complications.^[4] Apivatthakakul et al in 2005 published a cadaveric study describing the approach of minimally invasive plate osteosynthesis of the shaft of humerus.^[8] He also followed up with similar studies describing a danger to the neurovascular bundle while inserting percutaneous anterior screws.^[9] One more cadaveric study published in 2016 showed superiority of anterior minimally invasive plating approach in preserving the vascularity of the fracture site.^[10] A 2019 study by Lotzien et al described anterior open plating of shaft humerus fracture having equivalent outcomes with posterior plating, and added advantages of avoiding dissection near the radial nerve, and ease of positioning patient in the supine position.^[11] As development in locking plate technology and understanding of biological healing of fracture improved, minimally invasive anterior plating was an attractive option to the posterior plating.

An et al published in 2009 that the anterior MIPO technique was associated with lower incidence of iatrogenic radial nerve palsy and enhanced union time as compared to posterior plating.^[12] Similarly Oh et al in 2012 described lower complication rate, lesser operative duration and similar outcomes of anterior MIPO plating in comparison to posterior open plating of humerus shaft.^[13] Anterior MIPO plating requires intra operative x-ray imaging with c- arm, and rotational and longitudinal alignment may be compromised due to indirect reduction of the fracture. In 2015 study by Wang et al, MIPO technique was associated with increased incidence of post operative malrotation, which is associated with future shoulder arthritis, while the outcomes at 1 year and muscle strength at final follow up were not superior to the conventional posterior plating.^[14] Rellan et al in 2021 published that time of union

was significantly shorter in patients treated with absolute stability fixation of humerus shaft.^[15] In our study, there was no significant difference in union time, UCLA, ASES and VAS scores (Table 2). While complication rates were low in both the groups, only 2 patients with radial nerve iatrogenic palsy was found in conventional posterior plating group, while 1 in anterior MIPO group. All patients had complete recovery at 1 year follow up.

CONCLUSION

There was no significant difference in outcomes of anterior MIPO plating as compared to posterior conventional plating for shaft of humerus fracture. Randomized controlled trials with larger population would be needed for proving superiority of any of the method over the other.

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