

“OPEN REDUCTION AND INTERNAL FIXATION OF HUMERAL MID-SHAFT FRACTURE: ANTERIOR VERSUS POSTERIOR PLATE FIXATION”

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ABSTRACT

OBJECTIVE: “To compare the outcome of anterior versus posterior plate fixation in open reduction and internal fixation of humeral mid-shaft fracture”.

Study design: Randomized Controlled Trial

Study place and period: Orthopedic Surgery Department, Sahiwal Teaching Hospital, Sahiwal from February 2026 to June 2026.

Methodology: All the cases were enrolled from emergency department and randomly assigned two groups. In group-I, plate fixation was done via anterior approach. In group-II, plate fixation was done via posterior approach. Operative time was noted. After 3 months, bone union and ASES score were assessed. All the data was recorded in Performa.

Results: In this trial, we observed that the mean age of patients was 40.35 ± 14.6 years in anterior approach group and 38.61 ± 14.26 years in posterior approach group. In anterior approach group, there were 55 (73.3%) males and 20 (26.7%) females. In posterior approach group, there were 41 (54.7%) males and 34 (45.3%) females. Radial nerve palsy was present in 35 (46.7%) cases in anterior approach group while in 46 (61.3%) cases in posterior approach group. The mean operative time for plate fixation via anterior approach was 123.69 ± 32.82 minutes and 143.64 ± 52.71 minutes with posterior approach and mean ASES score was 69.04 ± 11.78 vs. 77.96 ± 13.57 ($p < 0.05$). But union was noted in 90.7% vs. 98.7%, respectively ($p > 0.05$).

Conclusion: Posterior approach for plate fixation in humeral mid-shaft fracture is a better technique than anterior approach.

KEYWORDS: Anterior approach, posterior approach, plate fixation, open reduction and internal fixation, humeral mid-shaft fracture, union, American Shoulder and Elbow Surgeons Score

INTRODUCTION

About 13 out of 10,000 patients get a humeral shaft fracture each year, accounting for 1.0–3.0% of all fractures.¹ The central part of the humerus is where 60% of all humeral fractures occur.² One to five percent of all fractures are humeral shaft fractures. Patients over 50 years old account for around 60% of humeral shaft fractures. About 70% of patients under 50 with humeral shaft fractures are men, whereas women make up about 70% of patients beyond 50.³ The fractures are categorized according to where they are located, whether open or closed and the type of fracture line.⁴ A mid-shaft humerus fracture typically happens because of a direct impact to the upper arm. Trauma, such as falls, motor vehicle accidents, or motorcycle accidents, is the most common cause of fractures. In older individuals, this type of fracture can also result from falling onto an outstretched arm, with the humerus bearing the brunt of the impact instead of the wrist.^{5,6}

While opinions on the best surgical approach are divided, there have been reports of prolonged delays to fracture union and poorer percentages of good to exceptional functional results for individuals treated with intramedullary nails. Because of its dependability in treating humeral shaft fractures, many surgeons favor open reduction and internal fixation (ORIF). Internally fixing humeral shaft fractures is often accomplished by a variety of surgical techniques. Usually, the posterior technique is used to repair distal and mid-shaft fractures. However, the posterior technique necessitates lateral or prone stance, which may not be appropriate for individuals who have experienced numerous injuries, or may even be contraindicated.^{7,8} Due to its ability to adequately expose proximal-third and mid-shaft humeral fractures, the anterolateral technique is gaining

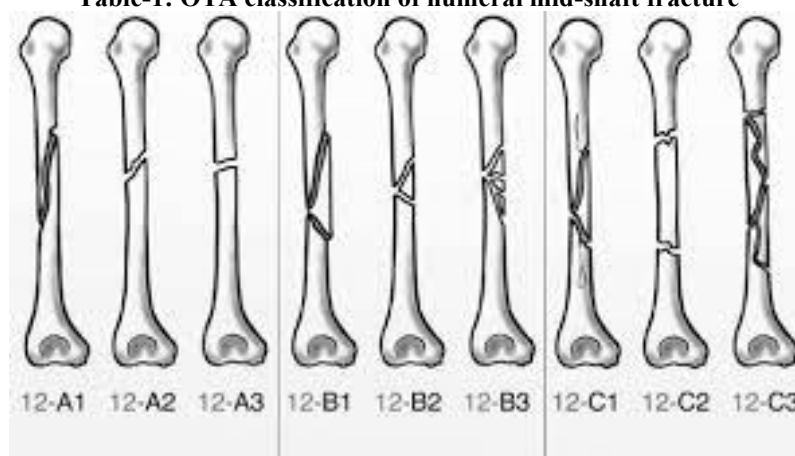
popularity.⁹ Furthermore, some publications have discovered that the iatrogenic radial nerve palsy rate following ORIF via the anterolateral method is lower than that of the posterior technique.^{10, 11} Lotzein et al., carried out a study and found that the average operating time for anterior plating was 96±30.5 minutes (with a range of 58–180 minutes). For posterior plating, the average operating time was 114±45.5 minutes (range: 56–238). There was no discernible difference in the two groups' operating times ($p = 0.19$). Union was achieved after anterior plating in 96.97% cases while in 100% cases with posterior approach ($p=0.4$).¹² Zala et al., also observed that there is no difference in both approaches in terms of operative time (posterior: 150.25±56.36 (60-300) vs. anterior 140.65±37 (60-180), p -value = 0.469) as well as for mean ASES score (80.53±8.73 (54-98) vs. 81.30±10.89 (54-98), p -value=0.762), respectively.¹³ Comparing the outcomes of internal fixation and open reduction of humeral mid-shaft fractures utilizing anterior and posterior plate fixation is the aim of this study. Literature showed that anterior plate fixation has better outcome than posterior plate fixation. But insignificant differences has been reported in previous studies in terms of operative time and union. So in routine, conventional posterior plate fixation is done due to lack of local evidence for local population. Therefore, we want to conduct this study to get evidence to confirm whether which approach is more appropriate and more successful in such fractures. Moreover, the findings of this research could profoundly influence clinical outcomes by guiding orthopedic surgeons in their decision-making for management of humeral mid-shaft fracture.

METHODOLOGY:

After getting approval from ethical review board the study was carried out at Orthopedic Surgery Department, Sahiwal Teaching Hospital, Sahiwal from February 2026 to June 2026. This Randomized Controlled Trial was registered at ClinicalTrials.gov under the identifier NCT07775690. By using openepi.com, sample size of 150 (75 in each group) is calculated with 95% confidence level, 80% power of study and mean operative time i.e. 96 ± 30.5 min with anterior plating and 114 ± 45.5 in with posterior plating.¹² All the patients who passed the inclusion and exclusion criteria, set for the researcher were include din the study by fixing Non-probability, consecutive sampling technique.

Inclusion criteria: Patients of age 16-65 years, either sexes, presenting with humeral mid-shaft fracture were enrolled. Humeral mid-shaft fracture was defined as presence of fracture in the middle part or center of humerus (table-1 below).

Table-1: OTA classification of humeral mid-shaft fracture



Exclusion criteria: Patients with pathological or open fractures, concomitant fractures or ligament or tendon ruptures of elbow or shoulder joints, presented after 14 days of injury, partial or complete disability of the elbow or shoulder joint on the affected side before injury, previous surgical procedure on same side, presence of neurovascular complications, and apparent dementia or other psychological problems were excluded from the research.

All the cases were enrolled from emergency and written consent was taken to use data for research after explaining them the pros and cons of both procedures and random division. Demographics like name, age, gender, height, weight, BMI, occupation, duration of fracture, lateral side, ASA level, mode of injury, type of fracture and presence of primary radial nerve palsy were recorded. The individuals were randomly assigned two groups using lottery method. In group A, individuals underwent ORIF by using anterior approach for plate fixation. In group B, individuals underwent ORIF by using posterior approach for plate fixation. Operative time was noted in terms of minutes required to perform surgery from time of incision given in the skin until closure of skin with stitches. After surgery, individuals were shifted to post-surgical orthopedic wards and were discharged from there. All individuals were followed-up in OPD for 3 months. After 3 months, plain x-ray was done to assess the bone union. Union was labeled if there was detectable callus bridge or at least three visible cortices on radiographs. Individuals were also examined for ASES score (<https://www.aaos.org/globalassets/quality-and-practice-resources/patient-reported-outcome-measures/upper-extremity/american-shoulder-and-elbow-surgeons-standardized-shoulder-assessment-form.pdf>) after 3 months by

researcher and presence of postoperative radial nerve palsy was also evaluated. All the data was recorded in Performa.

SPSS 26.0 was used to enter and analyze the collected data. Normality was checked by using Shapiro-Wilk test. Quantitative variables like age, height, weight, BMI, duration of fracture, operative time, and ASES score, were presented in Mean $\pm$ S.D. Qualitative variables like gender, ASA, mode of injury, type of fracture, lateral side, occupation, primary radial nerve palsy and union were presented in frequency and percentage. Both groups were compared by using Independent samples. T-test was applied to compare operative time, and ASES score and by using chi-square test for union. P-value < 0.05 was considered statistically significant.

RESULTS:

In this trial, we observed that the mean age of patients was 40.35 ± 14.6 years in anterior approach group and 38.61 ± 14.26 years in posterior approach group. In anterior approach group, there were 55 (73.3%) males and 20 (26.7%) females. In posterior approach group, there were 41 (54.7%) males and 34 (45.3%) females. Anthropometric measurements and occupation of patients in both groups are given in table below. The mean duration of fracture was 6.23 ± 3.44 days in anterior approach group while 6.56 ± 3.27 days in posterior approach group. In anterior approach group, about 29 (38.7%) patients had left side fractures, while 24 (32.0%) patients had right side fractures and 22 (29.3%) had bilateral fracture. In posterior approach group, about 31 (41.3%) patients had left side fractures, while 21 (28.0%) patients had right side fractures and 23 (30.7%) had bilateral fracture. In anterior approach group, the most common cause of fracture was road traffic accident (46.7%), followed by fall or fight (25.3% each) and few cases had other reasons for humeral bone fracture. In posterior approach group, the most common cause of fracture was fight (37.3%), followed by road traffic accident (32%), and fall (22.7% each) while few cases had other reasons for humeral bone fracture. In anterior approach group, 19 (25.3%) patients had OTA Type A fracture, 32 (42.7%) had OTA type B and 24 (32.0%) had OTA type C. In posterior approach group, 27 (36.0%) patients had OTA Type A fracture, 30 (40.0%) had OTA type B and 18 (24.0%) had OTA type C. Radial nerve palsy was present in 35 (46.7%) cases in anterior approach group while in 46 (61.3%) cases in posterior approach group. Table-I

In this trial, we observed that the mean operative time for plate fixation via anterior approach was 123.69 ± 32.82 minutes that was significantly less than posterior approach (143.64 ± 52.71 minutes, $p = 0.050!$). After 3 months, the mean ASES score in anterior approach group was calculated as 69.04 ± 11.78 , which was significantly less than posterior approach (77.96 ± 13.57 , $p < 0.001$), indicating better performance with posterior approach. Similarly, rate of union was better with posterior approach (98.7%) as compared to anterior approach (90.7%), although the difference was insignificant ($p > 0.05$). Table-II

Table-I: Demographic and clinical profile of patients undergoing open reduction and internal fixation of humeral mid-shaft fracture (n = 150)

	Group	
	Anterior approach	Posterior approach
n	75	75
Age, years	40.35 ± 14.6	38.61 ± 14.26
Gender		
Male	55 (73.3%)	41 (54.7%)
Female	20 (26.7%)	34 (45.3%)
Height (m)	1.76 ± 0.11	1.68 ± 0.11
Weight (kg)	78.23 ± 8.60	77.99 ± 9.14
BMI, kg/m ²	26.59 ± 4.47	27.85 ± 4.66
Occupation		
Business	13 (17.3%)	16 (21.3%)
Job	33 (44.0%)	23 (30.7%)
Farmer/shopkeeper	13 (17.3%)	15 (20.0%)
Retired	2 (2.7%)	2 (2.7%)
Housewife	14 (18.7%)	19 (25.3%)
Duration of fracture, days	6.23 ± 3.44	6.56 ± 3.27
Side involved		
Left	29 (38.7%)	31 (41.3%)
Right	24 (32.0%)	21 (28.0%)
Bilateral	22 (29.3%)	23 (30.7%)
ASA physical status		
I	42 (56.0%)	42 (56.0%)
II	33 (44.0%)	33 (44.0%)
Mode of fracture		
Fall	19 (25.3%)	17 (22.7%)
Fight	19 (25.3%)	28 (37.3%)
Road traffic accident	35 (46.7%)	24 (32.0%)

Other	2 (2.7%)	6 (8.0%)
Type of fracture		
A	19 (25.3%)	27 (36.0%)
B	32 (42.7%)	30 (40.0%)
C	24 (32.0%)	18 (24.0%)
Radial nerve palsy	35 (46.7%)	46 (61.3%)

Table-II: Comparison of intraoperative and postoperative outcomes between anterior and posterior approach (n = 150)

	Group		p-value
	Anterior approach	Posterior approach	
n	75	75	
Operative time, minutes	123.69 ± 32.82	143.64 ± 52.71	0.050!
ASES score after 3 months	69.04 ± 11.78	77.96 ± 13.57	<0.001!
Union achieved	68 (90.7%)	74 (98.7%)	0.063*

Note: ! = Independent samples t-test; * = Fischer Exact test

DISCUSSION:

In this trial, we found that mean operative time for plate fixation via anterior approach was 123.69 ± 32.82 minutes and 143.64 ± 52.71 minutes with posterior approach and mean ASES score was 69.04 ± 11.78 vs. 77.96 ± 13.57 (p<0.05). But union was noted in 90.7% vs. 98.7%, respectively (p>0.05).

Lotzein et al., carried out a study and found that the average operating time for anterior plating was 96±30.5 minutes (with a range of 58–180 minutes). For posterior plating, the average operating time was 114±45.5 minutes (range: 56–238). There was no discernible difference in the two groups' operating times (p = 0.19). Union was achieved after anterior plating in 96.97% cases while in 100% cases with posterior approach (p=0.4).¹² Zala et al., also observed that there is no difference in both approaches in terms of operative time (posterior: 150.25±56.36 (60-300) vs. anterior 140.65±37 (60-180), p-value = 0.469) as well as for mean ASES score (80.53±8.73 (54-98) vs. 81.30±10.89 (54-98), p-value=0.762), respectively.¹³

To the best of our knowledge, no prospective randomized studies comparing the healing rate and clinical effects of anterior and posterior plate fixation have been conducted.¹⁴ However, our conclusion that an anterior surgical approach with plating is a safe and effective treatment option for humeral mid-shaft fractures is supported by the literature now in publication.^{15, 16} In terms of bone union and iatrogenic neurovascular damage, one biomechanical investigation and one retrospective clinical study for antero-medial plating for upper extremity mid-shaft fractures have produced reliable findings.^{17, 18} Although 20% of the fractures in one retrospective analysis of 96 humeral fractures treated with antero-medial plating were open fractures, the union rate was 97%.¹⁹

Boschi et al. reported another retrospective study that examined the results of using ORIF to repair 280 humeral mid-shaft fractures in terms of the technique and plate position. There was no discernible variation in the approach or plate position, and the overall healing rate was 98.2%. There was no discernible difference in the operative time between the two groups in our investigation, which is consistent with the results published by Boschi et al.²⁰ According to a research by Ring et al., patients using functional braces had a non-union rate of about 15%.²¹ In a similar vein, non-operative treatment is associated with higher incidence of non-union than surgical intervention, according to Matsunaga et al.'s meta-analysis.²²

CONCLUSION:

Posterior approach for plate fixation in humeral mid-shaft fracture is a better technique than anterior approach. Now, in future, we will implement use of posterior approach as it is associated with better outcomes and patients satisfaction as compared to anterior approach for management of humeral mid-shaft fracture.

CONFLICT OF INTEREST:

None.

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