

OUTCOMES OF ANTEROMEDIAL PLATING VERSES ANTEROLATERAL PLATING FOR FRACTURE OF MIDDLE 1/3RD OF THE HUMERUS.

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ABSTRACT

Background: Humerus shaft fracture accounts for 3-5% of all fractures commonly encountered by orthopedic surgeons. The application of plate for fracture of middle 1/3rd of Humerus is a gold standard in the presence of lot of intramedullary and extramedullary devices for these fractures.

Objectives: To compare the outcome of anterolateral plating with the anteromedial plating for fracture of middle 1/3rd of the Humerus.

Methods: It is randomized controlled trial conducted at department of Orthopedic Surgery, Services Hospital Lahore, during Jan 2018 to Jan 2019. Total number 60 patients with fracture of middle 1/3rd of shaft of the humerus were admitted through emergency department of this hospital. Subjects were randomly assigned into two equal groups. In Group A all fractures were fixed with DCP on the anterolateral surface of Humerus with anterolateral approach while in group B all 30 patients with fracture of shaft of Humerus were plated on the medial flat surface of Humerus by anterolateral technique. The radial nerve injury was also assessed in both of these groups post operatively. All these patients were followed for 6 months with weekly interval up to 03 weeks, then at 06 weeks, 03 months and thereafter at 06 months. At each follow up each patient was evaluated clinically and radiologically for fracture union range of motion at elbow and shoulder joint and post operative complications. Mean and standard deviation was calculated for quantitative variables and frequency and percentages for qualitative variables. Independent t-test was applied for numerical outcome and chi-square test was used for proportions with $p < .05$ as statistically significant.

Results: Mean age 42.2 + 5.98 years. 66.6% of the fractures were as a result of RTA Mean duration of surgery in Group A (Anterolateral surface) was 60.25 + 7.56 and in Group B (Anteromedial surface) was 52.34 + 10.29. ($p < .001$). Mean blood loss in group A was 110.17 + 12.36 and in Group B was 80.75 + 8.94 ($p < .000$). No radial nerve injury in group B while 3 (10.0%) patients had iatrogenic radial nerve palsy in group A ($p = .076$).

Conclusion: Anteromedial plating on the flat medial surface of Humerus is an excellent technique for fixation of fractures of middle 1/3rd of the Humerus as compared to anterolateral plating. It avoids the injury to the radial nerve.

Keywords: Anterolateral plating, Anterolateral approach, Anteromedial plating, fracture, Humerus, radial nerve palsy.

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INTRODUCTION

Humerus fracture accounts for 4-6% of all fractures in young and 1-3% among old population. Although these

fractures can occur at any age but the peak incidence occur between 21-30 years in males and 60-80 years in females. 60% of these fractures occur in the middle 1/3rd of shaft of Humerus.¹

Humerus is a long bone of upper limb. The proximal end articulates with the glenoid fossa forming gleno humeral joint. Distally it forms the elbow joint and articulates with the head of radius and with trochlear notch of ulna. The proximal 1/2 of Humerus is cylindrical whereas the distal 1/2 is triangular in shape. Shaft has got

anterior border, lateral border and medial border.² It has got anterolateral surface, anteromedial surface and posterior surface. Anterolateral surface is between anterior and lateral border. Proximally it is smooth and is covered largely by Deltoid muscle. Lateral portion of brachialis muscle originates from the distal end of this surface as well as from the proximal 2/3rd of lateral supracondylar ridge. Anteromedial surface is between anterior and medial border of the shaft. In the mid region it provides attachment to coracobrachialis. While, the distal half is covered with the medial part of the brachialis muscle. Posterior surface which is bonded by medial and lateral border, is covered mostly by medial border of Triceps while a ridge on the proximal 1/3rd gives attachment to lateral head of Triceps muscle.

The radial nerve, being a branch of posterior cord of Brachial plexus, courses through the spiral groove of Humerus, posterior to the brachial artery. It innervates the extensor muscles of arm, forearm, the over line skin and medial and lateral epicondyles of Humerus. Radial nerve is the most common nerve being injured following the Humerus fractures^{14, 15, 20, 21}. It is at risk at the time of injury or during the treatment procedures. Holstein-Lewis's fracture of the distal 1/3rd of shaft of Humerus is also associated with neurapraxia of radial nerve¹³. In this case there is entrapment of radial nerve at the fracture site resulting in significant functional deficit of the hand. These fractures contribute to 7.5% of shaft fracture associated with risk of injury to the radial nerve upto 22%.

Humerus shaft fractures most frequently occur as a result of a blow to the upper Humerus (transverse fractures), indirect trauma from fall or twisting of the arm particularly in wrestling usually result in spiral or oblique fractures. Direct blow to the upper arm commonly occurs as a result of fall particularly in motorcycle accidents and fall on the outstretched hand especially in elderly people²⁴.

Humerus shaft fractures can be classified on the bases of fracture pattern that is transverse fractures, spiral fractures, short oblique and comminuted fractures. These can also be classified according to degree of displacement of fractures and according to soft tissue damage i.e; open or closed.³

A lot of treatment options are available to treat fracture of Humerus. A vast majority of the Humerus shaft fractures can be treated without surgery which minimize the complications rate with conservative treatment. The most common treatment for Humerus shaft fractures is fracture brace called Sarmiento Brace. An advantage of brace is that as the fractures healing progresses, the patient can use his elbow and the shoulder joint.⁴

The surgical treatment for Humerus shaft fractures has its own merits. Surgery is considered in case of open fractures, fracture with neurovascular injury, failure of

fracture to unite with non-surgical treatment. Patients with polytrauma, multiple fractures and segmental fractures etc. This can be done in the form of either plates, intramedullary fixation devices^{22, 23} or external fixator application. Moreover, the highly comminuted fractures can be treated with bridge plating^{2,5}.

Mid shaft Humerus fracture treatment by plate fixation is an accepted and well documented surgical fixation technique. Humerus diaphyseal fractures can be approached anterolaterally. Anteromedial surface of Humerus can be approached through anterolateral technique and a medial plate can be applied on the flat medial surface of Humerus^{1, 2, 3, 4}. It requires less dissection and minimal soft tissue stripping with medial plate application as compared to anterolateral plating^{6, 7, 8}. Moreover, it does not require the exposure of radial nerve and chances of radial nerve injury are diminished. The significant improvement in elbow flexion without the brachialis muscle dissection is also a potential benefit of this procedure.^{5, 9, 10}

METHODS

After approval from Hospital Ethical Review Board, this prospective, randomized controlled trial was carried out at Department of Orthopedic surgery services hospital Lahore from Jan 2018 to Jan 2019. A total number of 60 patients with fracture of Humerus were included in the study. These patients were divided into 2 equal groups A and B, each group having 30 patients. After admission a written consent was taken from each patient. Each patient underwent x-ray of Humerus with shoulder and elbow joints AP & Lat views. In group A all 30 patients with fracture of Humerus were plated by conventional anterolateral approach on the anterolateral surface of the Humerus. In group B the remaining 30 patients with mid-shaft fractures of the Humerus were plated anteromedially through standard anterolateral approach. All the patients were operated on the same day.

In the anterolateral plating the brachialis muscle was split into 2 sleeves medially and laterally. However, in the sub-brachialis approach in which the brachialis muscle was retracted laterally following the edge of brachialis muscle and isolating it from the biceps muscle, 8-9 holes 4.5 dynamic compression plate was applied. Patients with pathological fracture, infected non-union, gap-union, patients with Humerus fractures having the radial nerve palsy and patients with head injury were excluded from the study.

These patients were followed for a period of 6 months with a weekly interval for 03 weeks, at 06 weeks, 03 months and 06 months. All patients were operated under general anesthesia after fitness for anesthesia. Passive and active ROM were started at 2-3 days after the

surgery when the patient became pain free. At each follow up x-rays were done to assess the fracture union.

RESULTS

Total numbers of patients in our study were 60 which were divided into two equal groups A and B each group having 30 patients. There were 45 (75.0%) males and 15 (25.0%) females. Age range of our patients was 30-65 years with mean age 42.2 ± 5.98 years. 66.6% of the fractures were as a result of RTA followed by fall from the height 12 (20%) and 8 (14.4%) patients had fracture as a result of assault. Mostly the fracture pattern was type A2 (85.0%). Fracture exposure time was (from start of the incision up to closure on the wound) was significantly less as compared in group B to plate application in the anterolateral surface (group A) of mid-shaft of humerus ($P < 0.05$). Mean duration of surgery in

Group A (Anterolateral surface) was $60.25 + 7.56$ and in Group B (Anteromedial surface) was $52.34 + 10.29$. ($p < .001$). Mean blood loss in group A was $110.17 + 12.36$ and in Group B was $80.75 + 8.94$ ($p < .000$). No radial nerve injury in group B while 3 (10.0%) patients had iatrogenic radial nerve palsy in group A ($p = .076$). (Table no:1) Among these 3 patients it recovered after 06 weeks in one patient while in remaining 2 patients it recovered after 03 months automatically. 06 weeks after the surgery we also measured shoulder and Elbow range of motion in all patients. In group A there was flexion deficit of 10° in 3 patients while normal movements were achieved in all patients in group B. There was no case of infection reported in both of these groups except in 2 patients, 1 in each group. The infection was superficial and it resolved I/V antibiotics after 01 week in both of these patients.

Table no: 1 outcome of anterolateral and anteromedial surface plating

Variables	GroupA (n=30) Anterolateral surface	Group B (n=30) Anteromedial surface	t-test / Chi-square p value
Duration of surgery (min)	60.25 ± 7.56	52.34 ± 10.29	$t = 3.39$ $P = 0.001$
Blood loss (ml)	110.17 ± 12.36	80.75 ± 8.94	$t = 10.56$ $P = 0.000$
Radial nerve palsy	3 (10.0 %)	0 (0.0%)	chi-square= 3.158 P = 0.076

Data was analyzed and evaluated using SPSS version 19. Blood loss and operative duration were measured by using Student t-test. Complications including radial nerve injury and infection assessment was done using Fisher's Exact Test. A p-value of 0.05 was considered as significant

DISCUSSION

Fractures of mid-shaft or Humerus are mostly treated by conservative means with good functional and radiological outcomes^{2, 24}. Even though there are various primary and secondary indications for surgical fixation of mid-shaft of Humerus fractures^{22, 23}. Lot of options are available to treat these fractures. Dynamic compression plate is a gold standard for fixation of fractures of shaft of Humerus. Mostly the Humerus shaft fractures are fixed by anterolateral approach described by Henry. The entire shaft can be approached by this technique. This approach is best for fractures at the proximal and midshaft of Humerus. The application of plate on the anterolateral surface carries the risk of iatrogenic radial nerve⁵ injury and splitting of brachialis muscle. Incidence of nerve injury is 0-12%. To avoid

this problem plate can be applied on the flat medial surface of Humerus¹⁰.

In our study we compared the results of anterolateral plating with anteromedial plating through anterolateral approach⁸. No radial nerve palsy was noted in our study with medial plating. Moreover, the elbow movement were better in group B than in group A. Surgery duration and blood loss was also less with medial plating group than in anterolateral group.

Currently available literature confirms our findings that anteromedial plating is safe and effective treatment option for humeral shaft fractures. A lot of studies confirm that medial plating done for fracture of shaft of the Humerus are comparable to our study.

In his study Mohammed A et al. In 2019 carried out his study regarding the application of medial plating for fracture of mid-shaft of the Humerus¹. He came to the conclusion that anteromedial plating through anterolateral approach is a safe and effective technique. The release of deltoid insertion and the injury to the radial nerve can be avoided by applying plate on the flat medial surface of Humerus.

In another study conducted by Mattam Sanjay also revealed that application of medial plating through anterolateral approach had excellent results with less

gapping, good fracture fixation, reduced time for surgery and has fewer complications per rate³.

In views of Romeith ME, the medial plating is an effective and a safe option for fixation of mid-shaft Humerus fractures⁴. It is associated with better outcomes.

In another study Dr. Munish Sood et al. Came to the conclusion that both anteromedial and anterolateral plating have similar functional and radiological outcomes. However, the medial plate application is associated with lower incidence of radial nerve palsy. The elbow range of movements were also better in his study.

M. Sunil et al. Is also of the view that anteromedial plating on the flat medial surface of Humerus using anterolateral exposure has good functional outcomes with less incidence of nerve injury⁶.

Kubsad S et al. Has concluded from his study that for treatment of displaced Humeral shaft fractures, open reduction and internal fixation with anteromedial plating is an effective and safe technique for fixation of fracture of middle 1/3rd of Humerus⁷. His patients also had better functional outcomes.

N. Prabin et al. Concluded from his study on the anteromedial plating through anterolateral approach that anteromedial plating provides a safe form of fixation of humeral shaft fractures⁹. Union rate was good with less surgical time and incidence of radial nerve palsy was less. Functional outcome and ROM of elbow joint were good in his study in comparison to anteromedial plating in anterolateral plating the radial nerve is strained. It requires the meticulous dissection to protect the radial nerve and to reduce the incidence of its damage.

All these studies confirmed our study that application of medial plating for fracture of middle 1/3rd of Humerus is safe and effective technique as compared to anterolateral plating. It resulted in reduced surgical exposure time and reduced blood loss. Moreover, the ROM of shoulder and elbow joint were good.

It is associated with good union rate and is without radial nerve palsy^{14, 15, 20, 21}. This technique can be done through anterolateral approach safely. Medial surface of Humerus is a flat surface and does not require any contouring of the plate. Duration of surgery and blood loss is less in group B as compared to group A.

CONCLUSION

Anteromedial plating on the flat medial surface of Humerus is an excellent technique for fixation of fractures of middle 1/3rd of the Humerus as compared to anterolateral plating. It carries the less risk of damage to the radial nerve. Moreover, the blood loss and surgical duration with medial plating is also less as compared to anterolateral plating.

LIMITATION OF THE STUDY

Although no long-term complication occurred in our study, primary and secondary outcomes were addressed significantly in the follow up. Even though this study shows that with medial plating there is minimal or no risk of radial nerve injury. Number of patients in our study were small. It requires large number of patients with longer duration for assessment. The experience of researchers also has affected the outcomes which were not considered in the study.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest regarding the study.

FUNDING

No internal or external fundings have been received for this study.

ETHICAL APPROVAL

Ethical approval for this study was obtained from the Institutional Review Board of Services Institute of Medical Sciences / Services Hospital Lahore vide Ref. No. 20/2018 dated January 9, 2018.

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