



Original Research Article

A Comparative Study of Anteromedial and Anterolateral Plate Osteosynthesis of Middle Third of Humeral Shaft Fractures

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ABSTRACT

Background: Humeral shaft fractures accounts for approximately 3% of all the fractures. The causes mainly includes fall from height, road traffic accidents, assault and sometimes pathological. The plate osteosynthesis is the gold standard for the treatment of humeral shaft fractures. Here in this study we compared the anteromedial and anterolateral plate osteosynthesis of humerus with respect to the incidence of iatrogenic radial nerve palsies, the mean operation time required to perform the surgeries, and also time taken for fracture to unite in both.

Methods: A retrospective study was conducted at Department of Orthopaedics, PESIMSR, Kuppam, Andhra Pradesh from July 2011 to July 2014 with a total of 86 patients were included in the study among which 39 were operated with anteromedial plate osteosynthesis and 47 were operated with anterolateral plate osteosynthesis.

Results: Among 86 patients 57(66.28%) were males and 29(33.72%) were females. Majority of the patients were with the history of road traffic accidents 64(74.41%).The mean operating time of anterolateral plate osteosynthesis was 74±9.31 minutes, and that of anteromedial osteosynthesis was 55.5±5.00minutes.Difference in its duration required in both the approaches was statistically significant ($p < 0.001$) when chi square test is applied for the independent variables. The incidence of iatrogenic radial nerve palsy in anterolateral plate osteosynthesis was 10.6% and nil with that of anteromedial plate osteosynthesis. Difference in incidence of occurrence of radial nerve palsies among these two approaches is statistically significant when Fisher Exact test is applied ($p = 0.044$).

Key words: Anteromedial plate osteosynthesis, anterolateral plate osteosynthesis, middle 3rd humeral Fracture.

INTRODUCTION

The diaphyseal fracture of humerus is defined as one occurring between the superior border of the insertion of pectoralis major and the area immediately above the supra condylar ridge of humerus. [1] The

fractures were described according to their location in the proximal, middle or distal third of the diaphysis. [2]

Humeral shaft fractures account for approximately 3% of all fractures. [3] Over 60% of fractures were in the middle third of

the humeral shaft 30% were in proximal, and 10% in the distal third. [4] There is a bimodal distribution peaking in the 3rd and 7th decade and the largest peak for male is in 3rd decade. [2]

Humeral shaft has 3 borders which separates 3 surfaces. Anterior, lateral and medial border. Antero-lateral surface is covered by deltoid, middle of this surface deltoid is inserted in to deltoid tubercle further distally the surface gives origin to the lateral fibers of brachialis. Antero-medial surface is distal to the intertuberosus sulcus and is devoid of muscular attachments. Coracobrachialis is attached to roughened strip of middle of medial border. Lower half is occupied by medial part of brachialis. Posterior surface is completely covered by triceps. The blood supply to the humeral shaft is provided by the nutrient artery branch of brachial artery that penetrates at proximal third of the humerus on medial side. [5,6]

It is generally agreed that most of humeral shaft fractures are treated best non operatively, although there are primary and secondary indications for surgical intervention. Surgical management includes plate osteosynthesis, intra medullary nailing or external fixation. Plate osteosynthesis remains the gold standard for the operative fixation of humeral shaft fractures despite advances in implant technology. It is associated with high Union rates. [7]

It is generally accepted that the best surface of a long bone for plate placement is the tension surface and theoretically this is the posterior surface of the humerus, however many authors have reported excellent results for plate osteosynthesis using an anterolateral approach and placing plate anterolateral surface of humeral shaft both situation are technically demanding and require extensive surgical dissection with risk of injury to radial nerve. The incidence of primary radial nerve palsy accounts for

11.8% [8] while iatrogenic radial nerve injury is upto 5.1 %, [9] when plates are placed on anterolateral or posterior surface of humerus.

The entire length of humeral shaft can be approached through anterolateral approach described by Henry without need of visualisation of radial nerve. The placement of plate on anterolateral surface involves potential risk to the nerve during the retraction of soft tissue or, by implant itself, especially when it placed over the middle to distal third shaft. The goal of treatment of humeral shaft fractures is to establish Union with an acceptable humeral alignment and to restore the patient pre injury level of function. [7]

The aim of our study was to find out the incidence of iatrogenic radial palsies when performing anteromedial or anterolateral plate osteosynthesis of humeral shaft fractures through an anterolateral approach, to measure the mean operation time necessary to perform both surgeries and also to compare the average time taken for fracture union between anterolateral and anteromedial plate osteosynthesis of humeral shaft fractures.

MATERIALS AND METHODS

This retrospective study was conducted at the department of Orthopaedics in PES Institute of Medical Science and Research (PESIMSR) Kuppam, Andhra Pradesh from July 2011 to July 2014. Records of consecutive patients with acute middle 3rd humeral fractures treated by anteromedial or anterolateral plate osteosynthesis with anterolateral approach were included in study. Patients less than 18 years, preoperative radial nerve palsy, pathological fracture, patients with associated injuries in same limb and patients with follow up less than 9 months were excluded from study.

The required data was collected and entered in a predesigned data collection sheet after obtaining permission from hospital medical record department. The data sheet predesigned and contained information on demographics, side of injury, fracture type, mechanism of injury, type of treatment, duration of surgery, time taken to unite, and complications. After data collection patients were categorised into two groups depending on the treatment approach. Group A with anteromedial plate osteosynthesis 39 patients and Group B with anterolateral plate osteosynthesis 47 patients.

Statistical Analysis: Statistical tests like mean, proportion and Chi square were applied by using SPSS 16 version package

Surgical Technique: The patients were placed on supine position on an operating table with arm in abduction on the arm board. The entire limb was prepared with exposing both shoulder and elbow. The humerus middle third was exposed by standard Henry's approach. The incision was made along the lateral border of biceps (Fig.1) with sufficient length to allow 8 to 10 hole LCP (Locking Compression Plate) or LCDCP (Limited Contact Dynamic Compression Plate). The space between biceps and brachialis was identified; the musculocutaneous nerve was visualized and protected. The biceps retracted medially, the brachialis muscle was split longitudinally to expose the humerus. The arm was externally rotated to facilitate the visualization of antero-medial surface of humerus (Fig.2). Fractures were reduced and fixed with 4.5 mm lcp or lcdcp with AO (Arbeitsgemeinschaft fur Osetosynthesefragen) principles. Active Shoulder and elbow range of motion started on 2nd post-operative day and after 10 days sutures were removed and patient was discharged. Patients were advised to continue movements with arm pouch support and to follow up every month till

fracture unites. During each follow up, each case was examined for pain, functional recovery and course of fracture healing was radiologically documented (Fig.4a and 4b).



Fig 1.Position of skin incision along the lateral border of biceps.



Fig 2.Intra operative position of plate on anteromedial surface of humerus.

RESULTS

A total number of 86 patients were included in the study among which, 57 (66.28%) were males and remaining 29(33.72%) were females. The age group of the patients in our study ranges from 18 to 65 years, among which most of the patients belong to the age group of 36 - 50 years i.e., 37(43.02%) as shown in the Table1.

Table 1: Age wise distribution of patients.

Age group of patients (in years)	Number of patients	%
<20	2	2.32
21-35	28	32.56
36-50	37	43.02
52-65	17	19.76
>65	2	2.32

Majority (74.41%) of the patients were with the history of road traffic accidents followed by fall from height (18.6%) and assault (6.98%). The most common fracture pattern identified in this study is A3 type which accounts for 56.97% (Figure:3)

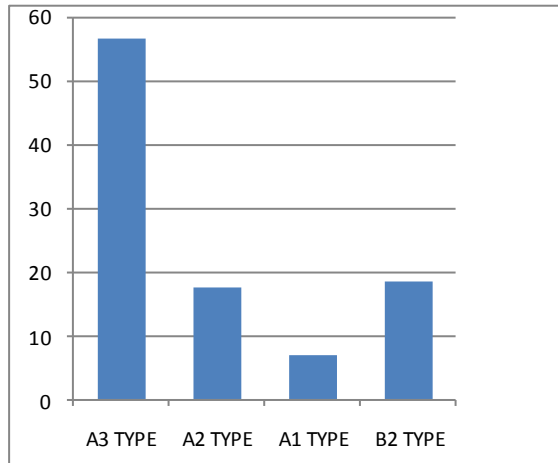


Fig 3: Distribution of patients according to type of fracture.

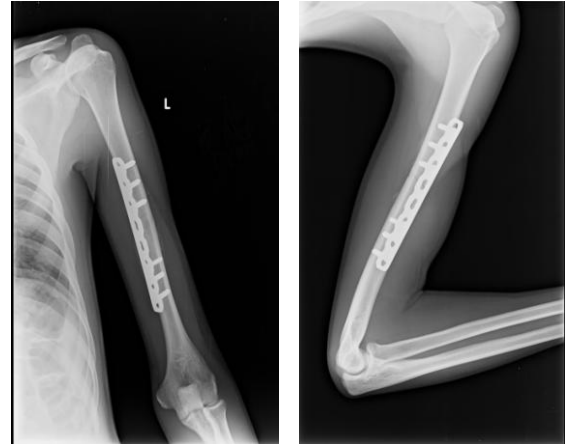


Fig 4a and 4b: Anteroposterior and Lateral x ray showing Plate position on anteromedial surface of humerus.

The mean duration of surgery for anterolateral humerus plating was 74.2 ± 9.31 minutes, and that for anteromedial humerus plating was 55.5 ± 5.00 minutes. Difference in its duration required for anterolateral and anteromedial humerus plating determined by applying χ^2 test for independent samples was statistically significant ($\chi^2 = 53.611$; $p < 0.001$). Difference in the time of union of fracture for anteromedial and anterolateral plating determined by applying χ^2 test for independent variables, shows ($\chi^2 = 0$; $p = 1$) which was not statistically significant. (Table: 2)

Table:2 Comparison between anterolateral and anteromedial humeral plating.

Characteristics	Anterolateral approach	Anteromedial approach	χ^2	p value
Time of union:				
< 16 weeks	43 (91.5%)	35 (84.7%)	0	1
≥ 16 weeks	4 (8.5%)	4 (16.3%)		
Duration of Surgery			53.611	<0.01
≤ 60 mins	5 (10.6%)	35 (84.7%)		
>60 mins	42(89.4%)	4 (16.3%)		

Iatrogenic lesions of radial nerve occurred in 5 of 47 patients (10.6%) who had position of the plate on anterolateral humeral surface, while anteromedial plating performed in 39 patients resulted in 0% of radial nerve palsies. The non union rates among the patients who underwent

anterolateral humeral plating was 4.3% which was almost similar to that of anteromedial humeral plating 5.1% which was also not statistically significant when Fisher Exact test is applied.

Difference in Incidence of occurrence of radial nerve palsies among

anterolateral and anteromedial humeral plating is done by applying Fisher Exact test shows statistically significant p value (p=0.044) (Table3)

Table: 3 Incidence of occurrence of Radial nerve palsy.

Surgical approach	Radial nerve palsy		Total
	Present	Absent	
Anterolateral	5 (10.6%)	42 (89.4%)	47
Anteromedial	0 (0%)	39 (100%)	39
Total	5	81	86

DISCUSSION

Most of middle third of humerus fractures best treated by conservatively with good union rates and acceptable functional outcomes, even-though there are various primary and secondary indications for surgical fixation. The plate osteosynthesis remains the gold standard fixation for humeral shaft fractures.^[7]

The most surgical approaches used for humerus are anterolateral approach described by Henry and posterior approach. Antero-lateral approach best suited for middle third and proximal third fractures. Posterior approach best suited for distal third fractures. The entire length of humerus shaft can be approached by anterolateral approach. The placement of plate on antero-lateral surface of humerus carries potential damage to radial nerve either by traction injury by fracture reduction, compression by retractors or bone levers of by implant itself.

The global incidence of post surgical radial nerve palsy varies from 0 to 12 percent .The anterolateral approach with placement of plate on anteromedial surface prevents the unnecessary dissection at lateral side of humerus and avoids injury to the radial by the retractors and the implant. In our study the incidence of post surgical radial palsy in anterolateral plating is 10.6% and we didn't see any post surgery radial palsy in antero medial group. A study conducted by Ivan Kirin et al comparing antero-medial and antero-lateral plating of

humerus also reports no post operative radial nerve palsy in antero-medial approach.^[10] In terms of neurologic sequelae, injury to the radial nerve with neuropraxia is most frequently encountered nerve deficit associated with humeral fracture.^[11] Spontaneous recovery over a period of 4 months occurs in 70% to 92% of all the patients managed with observation.^(12,13) So, the patients with radial nerve palsy were not re-explored as surgeon was confident that the radial nerve was free and intact intra operatively. All cases are followed showed full recovery of radial nerve at the end of six months.

The main concern regarding plate placement on anteromedial surface of humerus is damage to nutrient artery of humerus as decried by many authors.^(5,6) As described by Laing,⁽¹⁴⁾ the displaced fractures at junction of middle and lower third humerus shaft will probably destroy the main nutrient artery and open reduction of middle third humerus fractures damages the nutrient artery greatest .The blood supply to upper end of distal fragment depends on periosteal vessels and ascending branches from the epicondyles. The proximal fragment supplied by accessory nutrient arteries and periosteum. Antero lateral plate placement needs more soft tissue stripping compared to anteromedial plate placement as anteromedial surface relatively free of muscle attachments

In our study the incidence of delayed union in both the surgical approaches remains almost same. Our study also shows that the mean time duration required for antero-medial plating is much lesser when compared to that of antero-lateral plating.

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