Outcome of Dynamic Compression Plating of Humerus Shaft Fracture In Adults

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ABSTRACT

Objective — *To determine the outcome of dynamic compression plating in humerus shaft fracture in adults.*

Study design — *Cross sectional study.*

Place & Duration of study — *Department of Orthopedic Surgery, Jinnah Postgraduate Medical Centre (JPMC) Karachi, from November 2017 to May 2018.*

Methodology — *Patients with isolated, close humeral shaft fractures between 21 to 60 years, of either gender presented within four weeks of injury. Patients with radial nerve injury due to trauma (pre-surgery), open fractures, multiple or pathological fractures were ruled out from the study. Brief history regarding fracture duration and comobids such as diabetes, hypertension were obtained. Open reduction and internal fixation was done and dynamic compression plate was applied on lateral surface of humerus through anterolateral approach. Postoperatively radial nerve assessment was done and patients were followed up at monthly intervals with clinical and radiological evaluation. Final outcome was determined at the end of six months using Rommens grading.*

Results — *A total of 65 patients with humeral shaft fracture were managed. There were 36 (55.4%) males and 29 (44.6%) females. Mean age of patients was 36.29±11.17 years. Average duration of fracture was 6.27±4.70 days. The mean BMI was 26.08±4.12 kg/m^2. Most of the patients were noted in the age group between 31-45 year (n=30 - 46.2%). Fracture location was on left side in 45 (69.2%) and right in 20 (30.8%) patients. The most frequent mechanism of injury was motor vehicle accidents (n=47 - 72.3%) followed by assault (n=12 - 18.5%).*

According to Rommens criteria, excellent results were seen in 30 (46.2%) cases, good in 26 (40%) and poor results in 9 (13.8%) patients. Excellent and good results considered satisfactory were found in 56(86.2%) patients. Poor results were related to aseptic non union in seven patients (10.7%) and septic non union in two (3.1%) patients. Radial nerve palsy was found in five (7.6%) patients out of which three recovered well in three months period whereas remaining two (3.0%) required further procedures of tendon transfer.

Conclusion — *Plating of humeral shaft fracture was found to be satisfactory method of treatment with high fracture union rates, good movements at shoulder and elbow joints and low complication rate.*

Key words — *Dynamic compression plating, Fracture shaft Humerus, Intramedullary nailing.*

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INTRODUCTION:

Humeral shaft fractures comprise nearly 3% of all fractures. Many of these fractures occur in older age group with weak osteoporotic bones and occur due to fall. However, in young patients these fractures may result from high-velocity trauma due to motor vehicle accidents or assaults.[1]

The humeral shaft extends proximally from pectoralis major insertion to the supracondylar ridge distally. The radial nerve lies in close proximity to humeral shaft posteriorly where it lies in spiral groove, and it serves as an important anatomical landmark. This nerve can easily be injured in humeral shaft fracture particularly spiral fractures where it can be caught between fracture fragments.[2,3] Although the laterally located radial nerve is protected from the lateral portion of the brachialis, its identification is imperative with more distal extension.[4] The main goal of fracture treatment is to achieve union and early movement of the joints.

There are various methods to treat humeral shaft fractures. Non-operative treatment with plaster cast is still considered the most common method of managing humeral shaft fractures.[5] Conservative management in plaster cast lead to fracture union by secondary bone healing and callus formation.[6] There is high union rate with this conventional method but with significant rate of deformities period of immobilization required is 12 to 16 weeks.[6] In contemporary times both deformities and longer period of immobilization are not accepted by the patients.

Open reduction and internal fixation is indicated in open fractures, vascular or radial nerve injury which is entrapped in fracture fragments, unacceptable reduction in plaster cast, ipsilateral fractures of the forearm or contralateral humeral shaft fractures, patients having multiple injuries and in cases where patient's tolerance to functional bracing is poor.[3] Various surgical management options include rigid internal fixation with dynamic compression plate, intramedullary nailing and external fixation.[5,6] Internal fixation with plate-and-screws allows fracture reduction under direct vision, compression of the fracture fragments and radial nerve can easily be identified and protected.[4,7]. In comparison to nailing, plating has reduced risk of shoulder impingement and movement restriction. Although plate fixation requires extensive dissection and periosteal stripping it is still considered the gold standard to treat humeral shaft fractures.[2,7,8] The rationale of the study was to add to literature the loco-regional data related to the management of humerus shaft fracture with dynamic compression plate (DCP) and compare the results reported from different countries.[9,10]

METHODOLOGY:

This was a cross sectional study conducted in the Department of Orthopedic Surgery, Jinnah Postgraduate Medical Centre Karachi, from November 2017 to May 2018. Sample size calculated was 65, based upon proportion of good to excellent outcome (satisfactory outcome) =91% with confidence level= 95% and absolute precision= 07%.[9]

Patients were recruited using non-probability purposive sampling technique. Patients of age range 20 to 60 years of both gender with humeral shaft fractures confirmed on radiographs with duration of fracture 4 weeks or less were included. Patients with previous nonunion, pathological fractures, with open fractures and poly-trauma (involving multiple bones) were excluded from the study.

For this study permission from ethical review committee was obtained. Patients meeting the selection criteria were explained the purpose of study, procedure to be performed, with merits and demerits and informed consent was obtained. The main outcome variables and demographics like age, gender, height, weight, BMI, mechanism of injury, duration of fracture were entered in the predesigned form. All the surgeries were done under general anesthesia.

The surgical approach used for fixation of humeral shaft fractures was anterolateral with the plate applied on lateral surface of the humerus. A broad 4.5 mm dynamic compression plate was used, and a minimum of six cortices were engaged with screw fixation on either side of the fracture. Immediate range of motion exercises of shoulder and elbow were started. No external splint was applied. All the patients were followed up at monthly intervals for the first three months. Final Outcome was assessed at the end of 6 months as per Rommens et al series grading.[11]

Outcome is considered excellent when there is solid union at fracture site and less than 10^0 loss of motion at both shoulder and elbow joints. Good results show solid union at fracture site and loss of range of motion at shoulder and elbow between 10 and 30^0, where as poor outcome is related to non union at fracture site and loss of motion at elbow and shoulder of more than 30^0. Good to excellent results are considered satisfactory.

SPSS version 21 for windows was used for data entry and data analysis. Mean±SD were calculated for age, duration of fracture, weight and height and body mass index of the patients. Frequencies and percentages were calculated for gender, mechanism of injury, side of fracture, excellent, good, poor and satisfactory outcome. Effect modifiers were controlled through stratification of age, gender duration of

are considered satisfactory. fracture, side of fracture and BMI of the patient to determine the effect of these on outcome. Post stratification, Chi square test was applied and p value =0.05 were taken as significant.

RESULTS:

Out of 65 patients with humeral shaft fracture, there were 36 (55.4%) males and 27 (44.6%) female patients with mean age of 36.29±11.17 year (from 21 – 60 year). The most common age group was noted between 31-45 years (n=27 - 46.2%), while 22 (33.8%) were less than 30 year of age. Mean duration of fracture was 6.27±4.70 days (from 1 – 24 days). Mean BMI was 26.08±4.12 kg/m^2 (from 18.07 - 34.85 kg/m^2). In the majority of patients fracture resulted after road traffic accident (n=47 - 72.3%) patients. Other modes of injury included assault (n=12 - 18.5%), and fall from height (n=6 - 9.2%). Fractures were on left side in 45 (69.2%) patients and on right side in 20 (30.8%). Mean fracture healing time was 16.41 weeks.

Excellent results were seen in 30 (46.2%) cases, good in 26 (40%). Satisfactory outcome was found in 56 (86.2%) patients. The overall satisfactory outcome of fracture shaft of humerus was found in 56 (86.2%) patients. Poor results found in nine patients were related to complications such as infection, non union and radial nerve palsy. Radial nerve palsy was found in five (7.6%) patients, three recovered well in three months period whereas remaining two (3.0%) required further procedures of tendon transfer. Two patients developed infected non union which were managed with implant removal, extensive debridement, antibiotic cement beads and external fixator. After six weeks cement beads and external fixator were removed and fixation with locking plate and bone grafting was done. In the remaining seven patients exchange locking plate with bone grafting was performed to achieve fracture healing.

To check the association of satisfactory outcome with different confounding variable of the study, appropriate Chi-square test was applied. Age groups, gender and side of fracture were found statistically significant while duration of fracture and BMI were found insignificantly associated with overall satisfactory outcome.

Table I: Descriptive Statistics of The Study In Adults Patients With Humerus Shaft Fracture (N-65)

	Satisfactory outcome (Good + Eexcellent) n (%)		Total n (%)	p-value
Age (in years)	**Yes**	**No**		
<30 Years	19 (29.2%)	3 (4.6%)	22 (33.8%)	0.041
31-45 Years	26 (40%)	1 (1.5%)	27 (41.5%)	
46-60 Years	11 (16.9%)	5 (7.7%)	16 (24.6%)	
Body Mass Index (BMI) (in kg/m2)				
>30 Years	30 (46.2%)	4 (6.2%)	34 (52.4%)	0.037
<30 Years	26 (40%)	5 (7.6%)	31 (47.6%)	
Duration of Fracture (in days)				
<5 Years	30 (46.2%)	4 (6.2%)	34 (52.4%)	0.259
>5 Years	26 (40%)	5 (7.6%)	31 (47.6%)	
Side of fracture				
Left	36 (55.4%)	9 (13.8%)	45 (69.2%)	0.031
Right	20 (30.8%)	0 (0%)	20 (30.8%)	
Gender				
Male	36 (55.4%)	0 (0%)	36 (55.4%)	0.001
Female	20 (30.8%)	9 (13.8%)	29 (44.6%)	

DISCUSSION:

The operative treatment of acute humeral shaft fractures is still fraught with a high complication rate, even with current fracture fixation techniques. Therefore the best treatment modality of humeral shaft fracture fixation is still debatable. In our series most of the patients were male and these findings are supported in the study done by Singisetti K et al where authors reported 77% males though it is higher than ours.[9] Similar observations are also reported by others.[10,11]

Average age of the patients in our study was 36.29±11.17 year and nearly half of the patients were found in the age group between 31-45 years. In our study most fractures were found in younger age group in contrast to the study of Walia JPS Et al[12] where most of the patients were above the age of fifty years and 24.6% cases were in the age group of 46-60 year.

In our series more than 70% of the patients sustained humerus shaft fracture resulting from motor vehicle accidents. Findings in the study of Memon FA support our data where 63.7% of the cases had fractures resulting from road traffic accident and 36.2% were the due to fall at ground level. [13] Other studies also found road traffic accident as the major cause of humerus shaft fractures.[14]

With regard to the functional outcome in our patients Excellent and good results were considered as satisfactory outcome and found in 86.2%. These results correspond to the study done by Memon FA, which showed satisfactory outcome with fracture healing in 90% of the cases.[13] In a recent prospective study on 26 patients with humeral shaft fractures treated with dynamic compression plate, fracture healing was achieved in majority of the patients (88%) within four months.[15] In another prospective randomized series of 30 patients, no significant difference was found in terms of healing rate and range of motion between conservative management and operative fixation of humeral shaft fractures.[16] However, malunion was more frequent in conservative group (12.7%) in comparison to operative group (1.3%). Pansey NK et al found no remarkable differences in functional outcome between two groups of humeral diaphyseal fractures managed with plating and intramedullary nailing.[17]

Poor outcome is related to the development of complications like wound infection, delayed union, injury to the radial nerve and nonunion.[18] In our cases poor outcome was found due to non union of fractures in nine (13.8%) patients which required additional surgical procedures of exchange plating and bone grafting and radial nerve palsy in two patients not recovered requiring tendon transfers. The reported rate of nonunion is different in various studies ranging between 0-8%.[19,20] In a prospective study on 30 patients with humeral diaphyseal fractures treated with dynamic compression plate, the reported complication rate was 10% with pain as the main complaint after surgery.[21] In a comparative retrospective study on 91 patients, no remarkable difference was noted between intramedullary nailing group and plate and screw fixation group in terms of functional outcome and fracture healing, however there were more post surgical complications in nailing group. The research recommended plate and screw fixation as primary surgical procedure for humeral shaft fractures.[22]

The limitation of our study is that there was no comparative group treated by other method. Therefore we cannot truly determine whether other methods are better than this method. However our results are comparable to other national and international series.

CONCLUSIONS:

Surgical treatment with dynamic compression plate was found useful as a treatment modality for humeral shaft fractures in terms of fracture union time and functional outcome with low complication rate.

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