

## Original Research Article

# Functional and radiological outcome of comminuted shaft of humerus fracture treated by dynamic compression plate

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### ABSTRACT

**Background:** Humeral shaft fractures represents between 3% and 5% of all fractures of which a certain number of patients require surgical intervention. This study aims to determine the efficacy of dynamic compression plate in the treatment of humeral shaft fractures.

**Methods:** A prospective study was carried out over a period of 2 years in Sri Ramachandra Medical College, Chennai including 30 cases of shaft of humerus fractures treated by open reduction and internal fixation using Dynamic Compression plate among which both comminuted and segmental closed shaft of humerus fractures were included. While open fractures and ipsilateral forearm and clavicle fractures were excluded. AO classification was used to classify the fractures and the average follow up period was two years. The American Shoulder and Elbow Surgeons (ASES) shoulder score and Romen al series grading were used.

**Results:** We had 93.3% excellent/good result and 6.7% poor results. In our series we had one non-union, one delayed union and one case of deep infection.

**Conclusions:** Proper preoperative planning, minimal soft tissue dissection, strict asepsis, proper postoperative rehabilitation and patient education were essential to obtain excellent results. Early post-operative mobilization following rigid fixation of the fracture of humerus, with DCP lowered the incidence of stiffness and sudecks dystrophy.

**Keywords:** Humerus shaft, DCP, ASES

### INTRODUCTION

Humeral shaft fractures represents between 3% and 5% of all fractures.<sup>1,2</sup> Most will heal with appropriate conservative care, although a small but consistent number require surgery for optimal outcome.<sup>1,3,4</sup> Current research in this area focuses on defining the incidence and health care resource required to treat this injury, refining the indications for surgical intervention, decreasing the surgical failure rate through newer implants and techniques, and minimizing the duration and magnitude of disability post injury. With this background, this study

aims to determine the efficacy of dynamic compression plate (DCP) in the treatment of humeral shaft fractures.

The study was conducted with the aim to evaluate the functional outcome of comminuted shaft of humerus fractures treated surgically with DCP.

### METHODS

A prospective study was carried out from April 2014 to February 2016 in Sri Ramachandra Medical College, Chennai. In this study period, 30 cases of shaft of humerus fractures were treated by open reduction and

internal fixation using DCP. Inclusion criteria were both comminuted and segmental closed shaft of humerus fractures while open fractures and ipsilateral forearm and clavicle fractures were excluded.

Posterior approach was used for the surgical approach. A Broad 4.5 mm DCP made of 316L stainless steel were used and a minimum of six cortices were engaged with screw fixation in each fragment. All the patients were followed up at monthly intervals for the first 3 months, and further at three month intervals till fracture union was observed and once in six months till the completion of study. The average follow up was for two years. The American Shoulder and Elbow Surgeons (ASES) shoulder score and Romen al series grading were used. The fracture was considered to be radiologically united, when there was no visible fracture line and evidence of callus bridging at the fracture site. Clinical healing of the fracture was defined by the absence of functional pain and local tenderness at the fracture site.

## RESULTS

Twenty three were males and seven were female patients of a total 30 patients in the study (Table 1). Age of these patients ranged from 20 to 60 years.

**Table 1: Sex distribution.**

<b>Male</b>	23
<b>Female</b>	07

The right side was affected in 19 patients and left side in 11 patients (Table 2).

**Table 2: Laterality.**

<b>Right</b>	19
<b>Left</b>	11

Mode of injury was RTA in 20 cases, due to slip and fall in 8 cases, due to fall from height in 2 cases. AO classification was used to classify the fractures. 12 patients had B type fractures while remaining had C type fractures (Table 3). One patient had associated contralateral radius fracture, two had metacarpal fractures while the remaining patients did not have any other associated injuries.

**Table 3: AO classification.**

<b>Type B fractures</b>	12
<b>Type C fractures</b>	18

**Table 4: Results.**

	No of patients	Percentage (%)
<b>Excellent</b>	25	83.3
<b>Good</b>	3	10.0
<b>Poor</b>	2	6.7

The American Shoulder and Elbow Surgeons (ASES) shoulder score and Romen et al series grading were used. We had 93.3% excellent/good results and 6.7% poor results (Table 4).

In our series we had one non-union, one case of delayed union and one case with deep infection (Table 5).

**Table 5: Complications.**

Complications	No of patients
<b>Radial nerve palsy</b>	1
<b>Stiffness</b>	2
<b>Infection</b>	1
<b>Delayed union</b>	1
<b>Non union</b>	1

## DISCUSSION

28 of the 30 fractures in our study, united without complications, with one fracture resulting in non-union and one case of delayed union. We observed 93% union rate, 3% non-union and 3% delayed union. Our study is comparable to that of Bell et al who had 97% union rate with 34 patients and Tomasin et al whose study showed 97% union and 3% delayed union.<sup>5</sup> 28 (93%) patients had sound union in less than six months, 1 (3%) patient had delayed union and 1 (3%) patient developed non-union, due to deep infection.

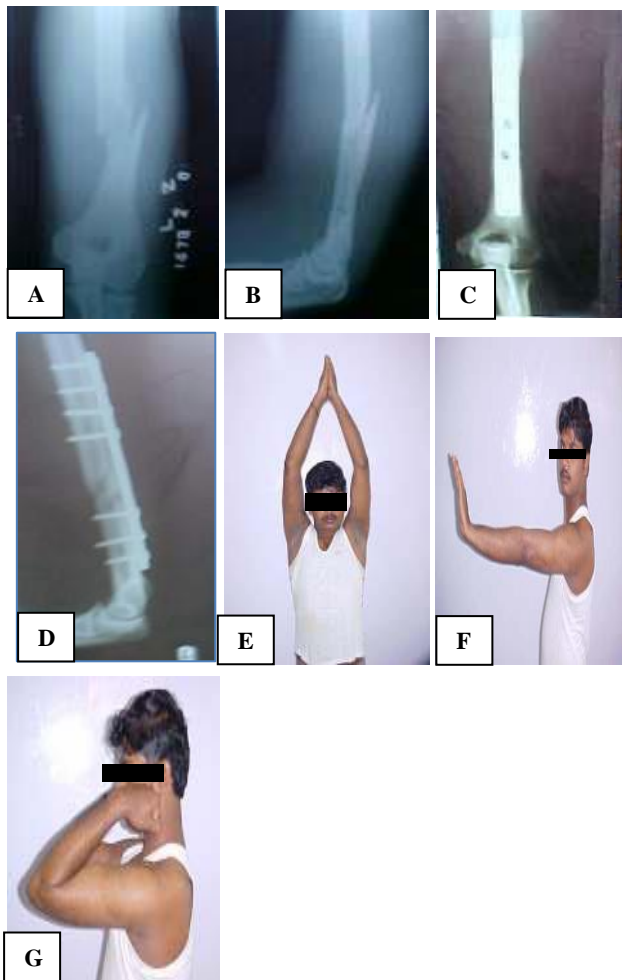
Out of the 30 patients in our series, 25 (83%) patients had full range of motion of shoulder and elbow joint while 3 (10%) patients had good range of motion while 2 (7%) patients had poor range of movement. Of these, 1 (3%) patient had radial nerve palsy, 1 (3%) patient had delayed union. We observed 93% patients had good range of mobility at the end of the study. Our results are comparable with those of Griend et al.<sup>6</sup> The higher percentage of stiffness in this series, as compared to studies done by Bell et al and Griend et al, emphasizes of the importance of patient education and physiotherapy during the postoperative period.<sup>5,6</sup>

The American Shoulder and Elbow Surgeons (ASES) shoulder score is for the 13 activities of daily living, requiring full shoulder and elbow movement. The maximum possible score is 52 points. The average ASES score obtained in our series was 48. This is comparable to the ASES score of 48 obtained by McCormack et al, when treating humeral shaft fractures with DCP.<sup>6</sup> We had 28 (93%) patients with excellent or good results out of 30 patients in our series. Our results are comparable to that of Bell et al who had 92% good results, Rodriguez et al observed 95% good results while Tingstad et al had 94% good/excellent results.<sup>5,7,8</sup> The results obtained by various authors using different modalities of treatment have ranged from 75% to 100% good or excellent results.<sup>9</sup> Our study had a comparable overall result of 93% good or excellent results.

The two cases with poor results was due to non-union in one case (caused by deep infection) and delayed union with stiffness in the other. The one case of deep infection which progressed to non-union and further required implant removal. The other patient had a delayed union and developed stiffness of the shoulder and elbow joints. There were no cases of superficial infection. There was one case of radial nerve palsy, which developed post-operatively, which could have been due to excessive retraction of soft tissues with the nerve. Radial nerve palsy recovered in this case after 3 months. All of the above are preventable complications. Strict adherence to the AO principles during fixation, meticulous attention to maintenance of asepsis during surgery, patient education and a well-planned rehabilitation program are required to obtain good results. If these principles are adhered to, DCP fixation of humeral shaft fractures results in fewer complications and greater patient satisfaction.

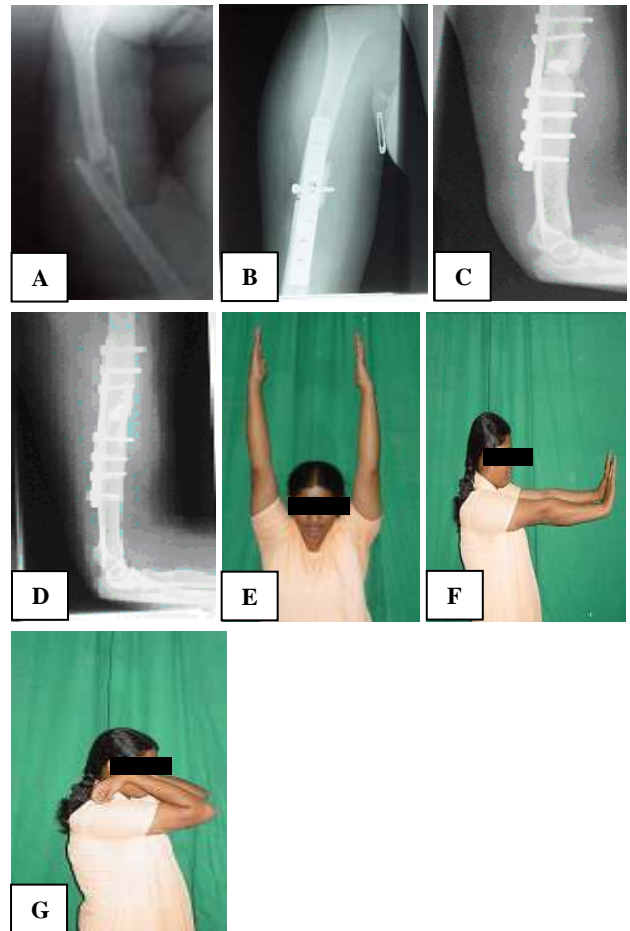
**Illustrations**

*Excellent*



**Figure 1: A=preoperative AP, B=preoperative LAT, C=postoperative, D=48 weeks, E=shoulder abduction; F=wrists dorsi flexion; G=elbow flexion.**

*Good*



**Figure 2: A=preoperative AP; B=postoperative; C=8 weeks; D=24 months; E=shoulder abduction; F=wrists dorsi flexion; G=elbow flexion.**

**CONCLUSION**

Dynamic compression plating of the humerus produces excellent results in case of both comminuted and segmental humerus fracture. Proper preoperative planning, minimal soft tissue dissection, strict asepsis, proper postoperative rehabilitation and patient education are more important to obtain excellent results. Injury to the radial nerve is rare, 3.3% in our series. Yet, it is necessary to look for neurovascular injury and rule out the same. Early post-operative mobilization following rigid fixation of the fracture of humerus with DCP, lowers the incidence of stiffness and sudecks dystrophy. Prolonged immobilization is against the principle of obtaining early, active, pain free mobilization. Internal fixation of the humerus with DCP avoids these complications and achieves higher union rates as compared to conservative management.

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