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## Efficacy of dynamic compression plating (DCP) in treating adults with humerus shaft fractures

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### Abstract

**Introduction:** Fractures of the humerus shaft accounts about 3 to 6% of all fractures of which majority can be managed by conservative management but some will require surgery. The objective and aim were to determine the efficacy of dynamic compression plate (DCP) in the treatment of humeral shaft fractures in adults.

**Materials and Methods:** This was a prospective study of 20 cases of fracture shaft of humerus admitted to Navodaya Medical Hospital and Research Centre, Raichur between December 2019 and October 2021. Cases were taken according to inclusion and exclusion criteria, with written informed consent. The study was approved by the Ethical committee of the institute.

**Results:** Out of 20 cases, there were 14 (70%) men and 6 (30%) women. 15 (75%) cases were admitted due to Road Traffic Accident and 5(25%) had fall at home. Of 20 cases, 2 cases (10%) were proximal third, 14 (73%) were middle third, and 4 (20%) were distal third. Short oblique fractures or Transverse were commonly found. The fractures united in 18 (90%) patients, with 2 (10%) cases showed delayed union due to deep infection. Good range of mobility of shoulder and elbow joints was present in 18 (90%) patients, with 2 (10%) patients having poor mobility.

**Conclusion:** Open reduction and Internal fixation of the humerus shaft fractures treated with dynamic compression plate provides higher union rates as compared to other modes of treatment available.

**Keywords:** Dynamic compression plate, delayed union, humeral shaft fractures, short oblique, transverse

### Introduction

Fractures of humeral shaft account for approximately 3-5% of all fractures. Appropriate conservative care heals majority of people, however for optimal outcome surgery is required for a small yet consistent number<sup>[1]</sup>. Current research studies published focuses on assessing the resources to treat this injury, indications of surgical intervention, reducing the failure rates by introducing newer implants and techniques and decreasing the post-operative disability. The successful treatment of a humeral shaft fracture may not end with bony union: as "holistic" approach to patient care and a knowledge of anatomy, surgical indications, techniques and implants, and patient functions and expectations<sup>[2]</sup>. With this background, this study was done to determine the efficacy of dynamic compression plate (DCP) in the treatment of humeral shaft fractures in adults.

### Materials and methods

This prospective study was carried out from December 2019 to October 2021 in Navodaya Medical College and Hospital, Raichur, Karnataka state, India. In this study period, 20 cases of fracture shaft of the humerus were treated by open reduction and internal fixation using DCP.

### Inclusion criteria

- Patients aged 18 or above
- Only the diaphyseal humerus fracture
- Fresh fractures

### Exclusion criteria

- Non-union delayed union
- Patients treated conservatively

- Pathological fracture
- Patients who are lost to follow up

Preoperative evaluation was done including history, examination, standard radiographs of the humerus, i.e., anteroposterior and lateral views, were obtained. In each view the shoulder and elbow joints were included. A U-slab with sling was to immobilize limb. Injectable analgesics were given. Informed consent was taken and routine investigations were administered, and fitness certificate was obtained by

physician.

**Procedure**

The most preferred surgical approach is Anterolateral approach, it was used with 17 cases. In 3 cases as the fracture was in the distal third, the posterior approach was used. A broad 4.5-mm DCP made of stainless steel was used, and a minimum of six cortices were engaged on either side of the fracture with screw fixation in each fragment. The standard surgical procedure was followed.



Case 1: Anterolateral Approach

Case 2: Posterior Approach

Fig 1: Depicting surgical approaches in sample cases.

**Results**

Out of 20 cases there were 14 (70%) men and 6(30%) women. 15 cases (75%) admitted due to road traffic accident and rest fall at home 5 (25%). The age range of the cases ranged from 20-50 years. Transverse or short oblique in 16 patients (80%), spiral fracture 1 patient (5%), long oblique 3(15%), no segmental fractures. General anesthesia and brachial block was given for all the cases. Two cases were proximal third (10%), 14 were middle third (70%) and distal third 4(20%)

[Table 1]. The anterolateral approach of henry was used in 16(80%) cases and posterior approach was used in 4(20%) cases as the fracture was distal. In order to avoid obstructions in surgery Tourniquet was avoided. The follow-up ranged from 6 months to 18 months. The fractures united in 18 (90%) patients with 2 cases showed delayed union due to deep infection. Good/ full range of motion of shoulder and elbow joints was present in 19 (95%) patients, with 1(5%) patient having stiffness of shoulder and elbow joint [Table 2].



Case 3: Pre-OP

Case 3: Post-OP

Case 3: 18weeks Post-OP

Fig 2: Depicting one sample case from the study

**Duration of fracture union**

Sound union in 18(90%) patients is less than 6 months, delayed union in 2(10%) patient– due to deep infection.

**Range of mobility of the shoulder and elbow joints**

18 (90%) patients recovered full range of mobility (ROM) of

shoulder and elbow joint. 2(10%) patients having stiffness of shoulder and elbow. The American shoulder and elbow surgeons score (ASES) [3], shoulder score is for 13 activities of daily living requiring full shoulder and elbow movement. The maximum possible score is 52 points. The patients got an average ASES of 48.



**Fig 3:** Depicting the range of mobility at shoulder and elbow in one sample case

**Table 1:** Profile of cases, gender, cause of fracture, type & site of fracture

Gender	Male 14(70%)	Female 6(30%)	20 (100%)
Cause of Fracture	RTA 15(75%)	Fall at home 5 (25%)	20 (100%)
Type of Fracture	Short oblique 16 (80%)	Spiral 1(5%)	Long oblique 3 (15%)
Site/Zone of fracture	Proximal third 2 (10%)	Middle third 14(70%)	Distal third 4(20%)

**Table 2:** Profile of approach used and duration of union

Approach	Anterolateral 16 (80%)	Posterior 4 (20%)	20(100%)
Duration of Fracture Union	Sound union 18(90%) Less than 6months	Delayed Union 2(10%) More than 6 months	20 (100%)

**Table 3:** Profile post-surgery, mobility and complications

Range of mobility (ROM) ASES	Good mobility 18(90%)	Poor mobility 2(10%)
Complications	Radial nerve Palsy 1(5%)	Delayed Union 2(10%)

**Discussion**

In this study, the fractures united in 18(90%) patients with 2 (10%) cases going for delayed union due to deep infection which united after six months. Good or full range of mobility of shoulder and elbow joints was present in 18 (90%) patients with 2 (10%) patient having poor mobility due to stiffness of shoulder and elbow joint.

Open reduction with plate fixation usually ensures a high chances of anatomic reduction, radial nerve exploration, and ideal in patients with narrow medullary canal [1]. Operative treatment may be considered to avoid complications such as malunion, delayed union, rotational deformity, shoulder and elbow stiffness, limb length discrepancy, psychological problems and long hospital stay [4]. Disadvantages of plating

are extensive dissection with greater disruption of the soft-tissue envelope, risk of infection, potential injury to the radial nerve [1]. Patient education regarding physiotherapy during postoperative management is a must to avoid elbow and shoulder stiffness [1] in other mode of treatment with intramedullary nailing complications are higher compared to DCP group. Shoulder pain/stiffness can occur if patient has been treated with intra medullary nail as it can damage rotator cuff [5, 6].

Previous studies conducted using have shown similar findings, Heim *et al.* used DCP in 127 patients and obtained good results in 87.3% of patients. Used DCP and intramedullary nailfixation with 95.7% good results.

**Table 4:** Findings from previous studies

Global studies			
Authors, year, location of study	Sample size	Method of treatment	Results
Heim <i>et al.</i> 1993 [7]	127	DCP	87.3% Excellent/Good
Mc Cormack <i>et al.</i> 2000 [3]	44	DCP and Intramedullary nail fixation	95.7% good
Indian studies			
Singiseti, Ambedkar, 2010, Vishakhapatnam [8]	45- 2 groups	Antegrade interlocking nail fixation & DCP	75% better response with DCP
Haveri & Maheshwarappa, 2012, Belgaum [11]	35	DCP	95% Excellent/Good
Bharathi & Ganesan, 2018, Chennai [9]	30	DCP	93.3% Excellent/Good
Current study, 2021 Raichur	20	DCP	90% Excellent/Good

DCP- Dynamic compression plate

**Conclusion**

Strict following of AO principles during fixation, meticulous attention to maintenance of asepsis during surgery, patient

education regarding post-operative physiotherapy are paramount to obtain good results. If these principles are followed for DCP fixation of humerus shaft fractures, it

results in less complications and good patient satisfaction [1]. Fixation with intramedullary nailing has special indications like segmental fractures and pathological fractures [1, 4, 5, 6]. Dynamic compression plating of the humerus produces comparable better results than ante grade interlocking intramedullary nailing [2, 5, 6]. Dynamic compression plate is still the standard treatment of choice for fracture shaft of humerus, achieving a higher union rate and good functional outcome [1, 4].

### Acknowledgements

**Conflict of interest:** None to declare.

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