

A STUDY OF SURGICAL MANAGEMENT OF DIAPHYSEAL FRACTURES OF HUMERUS BY DYNAMIC COMPRESSION PLATE OSTEOSYNTHESISKuppa Srinivas¹, Dema Rajaiah, Yerukala Ramana³, Sujith Omkaram⁴, S. Venkateswar Reddy⁵**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: AIMS AND OBJECTIVES: To study the fractures, mechanism of injury, union rates and functional results of humeral shaft fractures treated with open reduction and internal fixation with dynamic compression plate. **RESULTS:** In present study, 25 patients of diaphyseal fractures of humerus, surgically managed by dynamic compression plate & screws, between October 2012 to September 2014 in government general hospital attached to kurnool medical college were included. The average age of the patient is 38.9 years, road traffic accidents being the most common mode of accident with 72%, middle third fractures were commonest with 80%, transverse fractures were the commonest with 52%, anterolateral approach was used in 88%, union achieved in 88% with mean time for union 15.56 weeks, iatrogenic radial nerve palsy in 4%, postoperative infection in 4%, full range of movements in 80%, with 8% nonunion. **CONCLUSION:** By the analysis of the data collected in the present study, dynamic compression plate & screws remains the implant of choice in the management of diaphyseal fractures of humerus.

KEYWORDS: humerus, diaphyseal fracture, dynamic compression plate.

INTRODUCTION: Fractures of the humerus shaft are commonly encountered by orthopaedic surgeons representing between 3% and 5% of all fractures.^{1,2} Most will heal with appropriate conservative care, although a small but consistent number will require surgery for optimal outcome. Most of these fractures are inherently unstable due to distraction force of the gravity in the upper limb and strong muscles contraction accounting for the instability. Given the extensive range of motion of the shoulder and elbow, and the minimal effect from minor degrees of shortening, a wide range of radiographic malunion can be accepted with little functional deficit.^{1,3}

With the formation of the AO group in 1958, the base for evolution of internal fixation in skeletal surgery was set. Internal fixation techniques were tried in all types of diaphyseal fractures, and with increasing frequency in fracture shaft of humerus.

The two modalities of internal fixation in fracture shaft of humerus are plate osteosynthesis and intramedullary nailing. Plate osteosynthesis remains the "gold standard" of fixation for humeral shaft fractures. Plating can be used for fractures with proximal and distal extension and for open fractures. Plate fixation with open reduction provides direct fracture visualization, allows anatomical reduction and rigid fracture fixation (using dynamic compression plates). It also provides enough stability to allow early upper extremity weight bearing in polytrauma patients and produces minimal shoulder or elbow morbidity.

Some conditions, where operative treatment is indicated include failed conservative treatment, polytrauma patients with multiple injuries, associated injuries in the same extremity e.g. floating elbow, segmental fractures, Pathological fracture, fracture associated with major vascular injury, Holstein Lewis fractures/spiral fractures of lower third humerus shaft, and open fractures.

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With this background, current study focuses on defining the incidence and the indications for surgical intervention with open reduction and internal fixation with dynamic compression plate, decreasing the surgical failure rate and minimizing the duration and magnitude of disability post injury.^{3,4}

MATERIALS AND METHODS: This is a study of surgical management of humeral shaft fractures treated with open reduction and internal fixation with dynamic compression plating which were conducted in the Department of Orthopedics at Government General Hospital, Kurnool over two years from October 2012 to September 2014. The total number of cases studied was 25. The average age of patient was 38.9 years with the oldest patient 60 years and youngest 24 years.

The goal of humeral shaft fracture management is achievement of union with an acceptable humeral alignment and, restoration of the patient's prior level of function.

The most of the patients were brought to the casualty. Remaining cases were admitted through the Outpatient Department at Government General Hospital attached to Kurnool Medical College, Kurnool.

Inclusion criteria were age more than 17 years, fractures of humeral shaft from 3cm proximal to the olecranon fossa to within 2cm of the surgical neck of the humerus and fractures with unacceptable alignment after closed reduction. Nonunion, delayed union, and pathological fractures, open fractures were excluded.

A careful history was elicited from the patients and/ or attenders to reveal the mechanism of injury and the severity of trauma. The patients were then assessed clinically to evaluate their general condition and local injury. The vital signs were recorded and associated injuries were carefully assessed. Local examination was carried out to detect the signs of fracture like swelling, deformity, tenderness, abnormal mobility and crepitus. Any associated neurovascular deficit was noted. Radiographs of the affected arm including shoulder and elbow joints were taken in antero-posterior and lateral views. The limb was immobilised in a U-slab with collar and cuff sling and analgesics were given. The operative procedure, its advantages and likely complications were explained to the patient and informed consent was obtained. All the necessary blood investigations (complete blood count, blood urea, serum creatinine, blood sugar, HIV, HBSAg) were done. The ECG and chest X-ray were taken. Physician's fitness for surgery was obtained. All the cases were treated by open reduction and internal fixation with dynamic compression plate and screws.

RESULTS: In this study, 25 patients of diaphyseal fractures of humerus, surgically managed by dynamic compression plate & screws, between October 2012 to September 2014 in government general hospital attached to kurnool medical college were included.

The age of the patients in the study ranged from 21 to 58 years, average being 38.9 years.

In the study, 21 were male patients & 4 were female patients.

In the study, 18 patients sustained fracture shaft of humerus following road traffic accident, 4 following fall, 2 following industrial injury and 1 following assault.

14 patients had the injury on the right side, 11 patients had the injury on the left side. In the study, twenty were middle third, three were proximal third, two were distal third. Transverse fractures were the commonest with thirteen patients, nine had comminuted fracture, three had oblique fracture.

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Seventeen patients had isolated fracture of the humerus, three patients had head injury, two patients had clavicle fractures, one patient had chest injury, one patient had ipsilateral fracture of both bones forearm, one patient had post traumatic radial nerve injury.

Most (92%) of the patients showed fracture union by twelve to sixteen weeks. In one patient fracture united by 22 weeks & in two patients there was non-union.

In the study, one patient (4%) had transient iatrogenic radial nerve palsy which recovered in three months.

By six months, twenty patients (80%) of the patients had full or almost full range of movements & three patients (12%) had good rom and two had poor rom (8%).

In the study there were two non-unions for which revision plating was done with bone grafting & later the fracture united. In the study of twenty five patients, 88% of patients had excellent/good results, 12% had poor results.

DISCUSSION: In our study of 25 patients 21 (84%) were males and 4 (16%) were females. In study by M. J. Bell et al, incidence of males was 71.05%.⁵ This difference might be because males are highly exposed to the risk factor, due to highly demanding physical work and vehicular accidents.

Mean age of patients was 38.9 years (range: 23-56 years). In the study by M. J. Bell et al mean age was 31.5 years.⁵ Mean age was comparable with other studies explaining high incidence in young, active individuals in productive age group who are involved in demanding physical work and vehicular accidents.

Road traffic accident was the commonest mode of injury in most of the studies. In the present study most common mode of injury was road traffic accidents in 18 patients (72%), fall in 4 patients (16%), accident at work place in 2 patients (8%), and assault in one patient (4%). In study by Tzu-Liang Hsu et al, road traffic accident was the commonest mode of injury (71.4%).⁶

In our study of 25 cases, twenty (80%) were middle third, three (12%) were proximal third and two (8%) were distal third. In study by R V Griend middle third fractures were the commonest with 63.9%.⁷ Transverse fractures in 13 patients (52%), comminuted fractures in 9 patients (36%), Oblique fracture in 3 patients (12%) and no spiral or segmental fractures. In our series right side was affected in 14 patients (56%) and left side was affected in 11 patients (44%). In study by R V Griend left was the most common side involved (58.3%).⁷ In the present study, we approached fracture site using Henry's anterolateral approach in 22 out of 25 patients (88%). We used posterior approach in 3 patients (12%), of which 2 patients had distal third humerus fractures and one patient had radial nerve palsy preoperatively.

In R V Griend et al, they have preferred antero-lateral approach in 90% of cases⁷. In present study, we preferred posterior approach in 12% of cases due to distal third fractures in 8%, due to the ease in placement of plate on posterior surface, as the humerus is flattened anteroposteriorly in distal part, making lateral plating difficult and in 4% of cases because of radial nerve palsy, as posterior approach is preferred for exploration of nerve, which is particularly useful in Holstein-Lewis fractures. In the present study, solid union is seen in 22 (88%) cases in less than six months, with 2 (8%) cases going for nonunion due to deep infection in one and in other case it may be due to immediate weight-bearing activity done by the patient. There was one (4%) case of delayed union, which united after six months. Tingstad et al reported 94% union of humeral shaft fractures treated with AO plating techniques⁸. In the present study, majority had a total duration of hospital stay of two

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to two and half weeks with a mean duration of hospital stay of 2.4 weeks. Rest of the patients required longer duration of stay because of associated injuries. Mean A.S.E.S. score in the present study was 43.08 which was comparable to mean A.S.E.S. score of 48 in the study by McCormack et al.⁹

In the present study, average time taken for union was 15.56 weeks. In R V Griend et al, average time taken for union was 15.6 weeks.⁷

Because the radial nerve lies in close proximity to the humeral shaft, it may be injured by any operative approach to the humerus. In our series one patient (4%) had transient iatrogenic nerve palsy and one more already had preoperatively. The radial nerve recovered in 3 months. Seddon stated that 70% of radial nerve injuries associated with humeral shaft fractures will recover.

R. V. Griend et al and Bell et al reported transient iatrogenic nerve palsies in 2.9% humeral fractures treated with plating.^{5,7} Most of the iatrogenic radial nerve palsies are neuropraxias due to excessive retraction, which will recover spontaneously in 8 to 16 weeks. Because of the good vascular supply and large soft tissue surrounding the humerus, infection is relatively infrequent. In our series we had one patient (4%) with secondary infection which landed in infected nonunion, which was managed with removal of plate and replaced with nailing. RV Griend et al reported 5.9% infection rate after plate fixation of humeral shaft fractures⁷. Postoperative early mobilization of the shoulder and elbow was very critical in attaining full range of movements. It was observed that the movements and the functional ability of the shoulder depended upon the patient's adherence to rehabilitation programme and early intensive physical therapy hastened the recovery of shoulder function. Twenty (80%) patients recovered full range of mobility (ROM) of shoulder and elbow joint. Three (12%) patients recovered good ROM (within 10-15% of full range).

Two (8%) patients had poor ROM and of these, 1 (4%) patient had a wrist drop. R V Griend et al reported full ROM in 85.4%.⁷ In present study, incidence of non-union was in two cases (8%). In the study by R V Griend et al, incidence of non-union was 2.7%.⁷ Probable cause of non-union in one case (4%) in the present study was infection and in the other (4%) it might be due to comminuted fracture. Open reduction with plate fixation usually ensures a high likelihood of anatomic reduction, radial nerve exploration, and ideal in patients with narrow medullary canal. Disadvantages of plating are extensive dissection with greater disruption of the soft-tissue envelope, risk of infection, potential injury to the radial nerve (5%), poor fixation in osteoporotic bone with DCP, and the possible need for plate removal at a later date. In the present study, 88% of patients had excellent/good results, 12% had poor results. In the study by Heim et al in the series of 127 cases treated with DCP 87.3% had solid union.¹⁰

CONCLUSION: In this study, 25 patients of diaphyseal fractures of humerus, surgically managed by dynamic compression plate & screws, between October 2012 to September 2014 in government general hospital attached to kurnool medical college were included. The age of the patients in the study ranged from 21 to 58 years, average being 38.9 years. In the study, 21 were male patients & 4 were female patients. In the study, 18 patients sustained fracture shaft of humerus following road traffic accident, 4 following fall, 2 following industrial injury and 1 following assault. 14 patients had the injury on the right side, 11 patients had the injury on the left side. In the study, twenty were middle third, three were proximal third, two were distal third. transverse fractures were the commonest with thirteen patients, nine had comminuted fracture, three had oblique fracture. Seventeen patients had isolated fracture of the humerus, three patients had head injury, two patients

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had clavicle fractures, one patient had chest injury, one patient had ipsilateral fracture of both bone forearm, one patient had post traumatic radial nerve injury. Most (92%) of the patients showed fracture union by twelve to sixteen weeks. In one patient fracture united by 22 weeks & in two patients there was non-union. In the study, one patient (4%) had transient iatrogenic radial nerve palsy which recovered in three months. By six months, twenty patients (80%) of the patients had full or almost full range of movements & three patients (12%) had good rom and two had poor rom (8%). In the study there were two non-unions for which revision plating was done with bone grafting & later the fracture united. In the study of twenty five patients, 88% of patients had excellent/good results, 12% had poor results. By the analysis of the data collected in the present study, dynamic compression plate & screws remains the implant of choice in the management of diaphyseal fractures of humerus.

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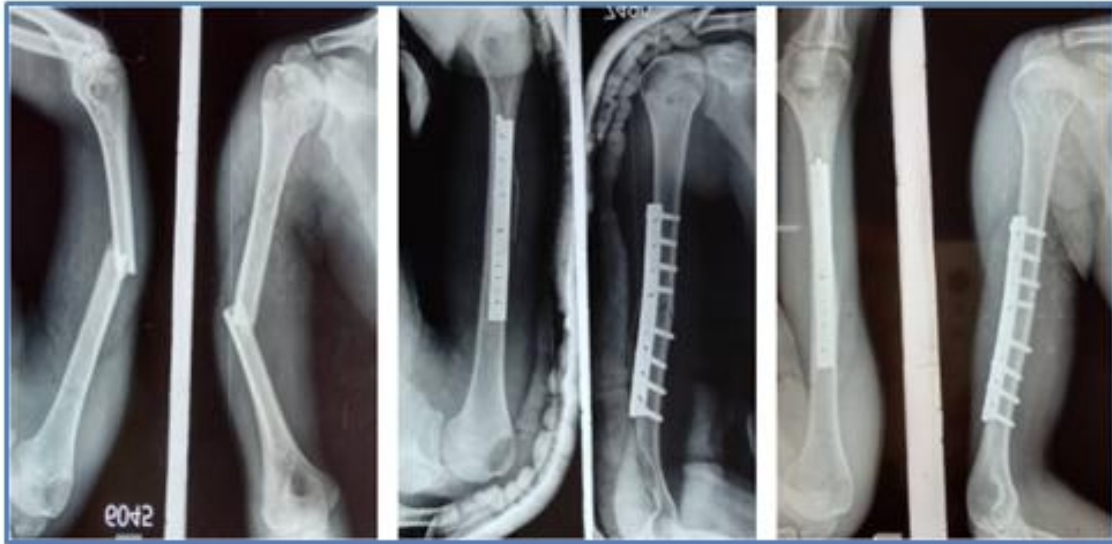


Fig. 1: preoperative, immediate post-operative, union xrays

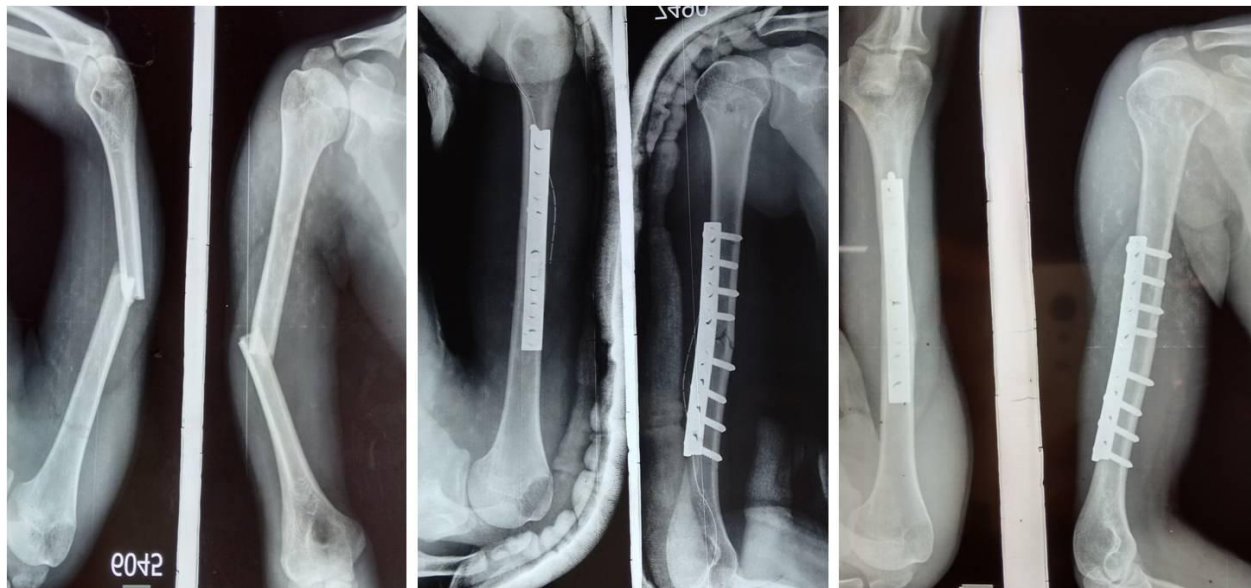


Fig. 2: preoperative, immediate post-operative, union xrays

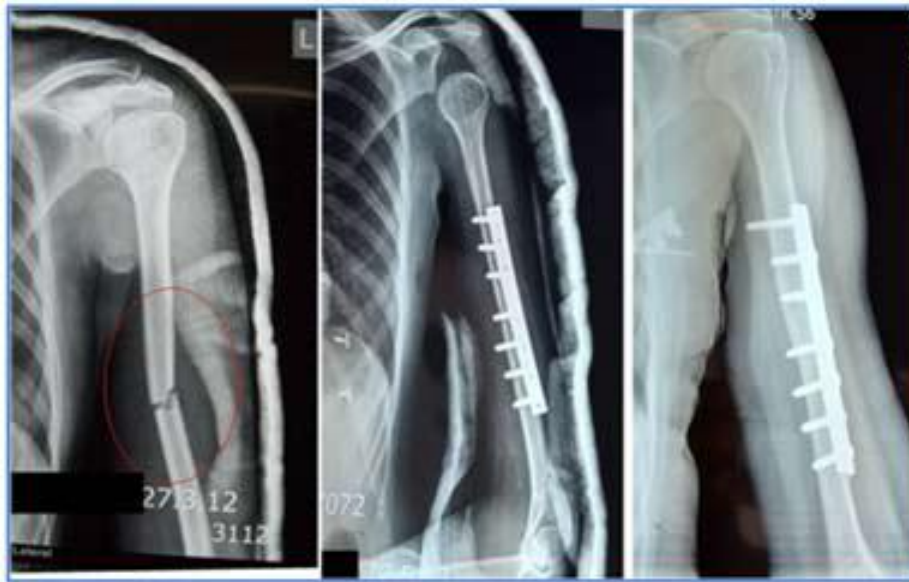


Fig. 3 : preoperative, immediate post-operative, union xrays

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