

## Original Article Orthopaedics

# EVALUATION OF DIAPHYSEAL FRACTURES OF HUMERUS TREATED WITH LOCKING COMPRESSION PLATES-A PROSPECTIVE STUDY OF 30 CASES

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### Abstract

**Introduction:** Diaphyseal fractures of humerus account for 3% - 5% of all fractures<sup>1</sup>. Although conservative methods were used frequently before the advent of metal plates for the treatment of diaphyseal fractures of humerus but nowadays Plate Osteosynthesis is the gold standard for operative treatment of diaphyseal fractures of humerus<sup>3,10</sup>.

**AIMS AND OBJECTIVES** To study the clinical, radiological and functional outcome of locking compression plates in diaphyseal fractures of humerus.

**Materials And Methods:** The present study consisted of 30 cases of age group 18 years or above of either sex, with diaphyseal fracture of humerus, admitted in the Orthopaedics department of Sri Guru Ram Das Hospital, Vallah, Amritsar who were treated with locking compression plates for diaphyseal fractures of humerus

**Summary And Conclusions:** Locking compression plate is an optimal tool for diaphyseal fractures of humerus. It is a useful implant with good results in the treatment of diaphyseal fractures of humerus, especially when fracture is severely comminuted, in osteoporotic and in peri-prosthetic fracture.

**Keywords:** Diaphyseal fractures, humerus, locking compression plates

## Introduction:

The advent of high speed transportation has been a major contributor to the problem of fractures in orthopaedics and diaphyseal fracture of humerus is no exception to same. Diaphyseal fractures of humerus account for 3% - 5% of all fractures<sup>1</sup>.

Diaphyseal fracture of humerus is easily amenable to conservative methods as the humeral shaft is well enveloped in muscle with excellent blood supply and can be easily splinted<sup>2</sup>.

Conservative treatment for fractures of the humeral shaft has been in vogue since antiquity with various types of splints, casts, coaptation splints, arm cylinders with a collar cuff sling, functional bracing, abduction splints, U casts and shoulder Spica etc<sup>1,3-9</sup>.

Open reduction and internal fixation of fractures with metal plates attains anatomical reduction, enhanced union rate, low complication rate, and a rapid return to function. The exploration and treatment of associated neurovascular injuries is possible and the fixation is stable enough to allow early usage of upper extremity in the multiply injured patients. Thus, Plate Osteosynthesis is the gold standard for operative treatment of diaphyseal fractures of humerus<sup>3,10</sup>.

## Aims And Objectives:

To study the clinical, radiological and functional outcome of locking compression plates in diaphyseal fractures of humerus.

## Material And Methods:

The present study consisted of 30 cases of age group 18 years or above of either sex, with diaphyseal fracture of humerus, admitted in the Orthopaedics department of Sri Guru

Ram Das Hospital, Vallah, Amritsar

The patients admitted were given analgesics, IV fluids and crammer wire splint as first aid in the casualty department along with antibiotics, suturing of wounds and antiseptic dressing where needed. Detailed history, past as well present, along with general physical and local examination was recorded. Necessary laboratory investigations and radiological examination were done and recorded. Any other associated injury was managed accordingly.

Operative treatment was given after obtaining written informed consent as per protocol and after pre-anaesthetic evaluation and investigations.

As per individual patient's pre-anaesthetic evaluation and associated medical condition, brachial block or general anaesthesia was given. After proper painting and draping, the fracture site was exposed; using the anterior, anterolateral or posterior approach depending upon the type and pattern of fracture, the fracture was reduced and fixed by means of Locking Compression Plate. Wound was closed in layers, leaving a negative suction drain in place. Intravenous antibiotics and analgesics were given post-operatively.

Check radiographs were taken and active physiotherapy was started at the earliest possible. Sutures were removed after eleven days post-surgery.

All patients were subsequently assessed, after every 3-4 weeks in OPD, clinically as well as radiologically, for evidence of union and complications if any and the obtained data recorded and tabulated.

## Inclusion criteria:

1. Male and female adult patients with diaphyseal fracture of humerus who had given their consent for the surgery.
2. Age more than 18 years.

## Exclusion criteria:

1. Patients not willing for surgery.
2. Patients with associated medical problems which made them unfit for surgery.
3. Patients with compound fractures.
4. Patients with pathological fractures (neoplasm and metastatic).

## Evaluation:

The patients in study were evaluated clinically, radiologically and functionally for fracture union time, complications and functional outcomes. The Modified Stewart and Hundley criteria was used to assess functional outcome<sup>10</sup>.

The complications were evaluated in terms of infections (superficial or deep or chronic osteomyelitis), delayed union, nonunion, implant failure, secondary loss of reduction, implant breakage and re-fracture after plate removal. Mal-union was defined as healing occurring at more than 15° of angulation. A delayed union was diagnosed when no satisfactory signs of healing were present at the 16-week follow-up visit. A nonunion was diagnosed when healing had not occurred after 6 months. Fractures which healed in less than 6 months were classified as unions.

### The Modified Stewart And Hundley Criteria

Good	No pain, limitation of adjacent joint mobility less than 20° and angulation at fracture site less than 10°
Fair	Pain after efforts of fatigue, limitation of adjacent joint mobility ranging between 20° and 40° and angulation at fracture site more than 10°
Poor	Permanent pain, limitation of adjacent joint mobility more than 40° and non-union



**FIG.1 Showing follow up at 3 months with complete union at fracture site**



**FIG 2. X-Ray showing union at 4 months follow up**

### Discussion:

In the present study 30 cases of diaphyseal fractures of humerus from the Orthopaedic department of Sri Guru Ram Das Hospital, Amritsar were operated upon by open reduction and internal fixation with a locking compression plate. The radial nerve was not identified except in those cases which had associated radial nerve injury. Patients who had closed fractures and who were above 18 years of age were included in the study. Patients with open fractures, pathological fractures and medical comorbidities were excluded from the study. The Modified Stewart and Hundley criteria was used to assess functional outcome.

In the present study the age incidence ranged between 19-70 years with an average age of 43.64 years. Out of the 30 patients included in the study 20 (66.66%) patients were males and 10 (33.34%) were females. In our study 21 (70%) of the fractures were caused by RSA and 9 (30%) were due to fall. In the present study the site of fracture was the middle third of the diaphysis of humerus in 18 patients (60%), lower third in 9 patients (30%) and the upper third of the diaphysis in 3 patients (10%). Thus the middle third was found to be the most common site for fracture. Amongst the 30 patients included in our study 12 (40%) patients had associated injuries. Radial nerve palsy was present in 3 patients (10%). Successful fracture union was defined as complete bridging callus in 3 cortices together with painless movements. In our study of 30 patients, 12 (40%) patients had union within 16 weeks, 12 (40%) patients between 17-20 weeks, 6 (20%) patients between 21-24 weeks. The average radiological union time was 13 weeks. No patients had implant failure or non-union.

**Table 1**  
**Showing Results using The Modified Stewart And Hundley Criteria**

Results	No. of Patients	Percentage
Good	24	80%
Fair	6	20%
Poor	NIL	0%
Total	30	100%

**Table 2**  
**Showing Mode Of Injury**

Sex	No. of Patients	Percentage
Road side accident	21	70%
Fall from height	7	21%
Assault	2	9%
Total	30	100%

### Summary And Conclusions:

In our study, good results were obtained in 80% patients and fair in 20% patients.

It was concluded that locking compression plates provide an excellent choice of implant for the treatment of diaphyseal fractures of humerus with reduced incidence of malunion and non-union of fractures and with special benefit in osteoporotic bones and fractures which are comminuted.

Thus, locking compression plate is an optimal tool for diaphyseal fractures of humerus. It provides rigid fixation and since the plate does not depend on a tight fit to the bone for stability, substantially less soft tissue dissection is required, thus preserving the local blood supply and enhancing fracture healing while ensuring minimal surgical damage to the periosteal blood supply as compared to normal plates. Locking compression plate also offers the advantage of increased pull-out

resistance of the locking head screws compared with that of conventional screws. Thus, in osteoporotic bones where poor bone stock make fracture fixation difficult, locking compression plating has an edge over conventional plates. In simple, non-comminuted, diaphyseal fractures of humerus, locking compression plates can also be used according to the compression principle through eccentric placement of screws in the dynamic compression unit of combi hole. Moreover the screw insertion is also easier due to use of the self-tapping screws and helps in reducing operative time.

To conclude, Locking compression plate is a useful implant with good results in the treatment of diaphyseal fractures of humerus, especially when fracture is severely comminuted, in osteoporotic and in peri-prosthetic fracture

humerus. *J Bone Joint Surg Am* 1977;59:596-601.

6. Holm CL. Management of humeral shaft fractures. Fundamental nonoperative techniques. *ClinOrthopRelat Res* 1970;91:132-139.
7. Christensen S. Humeral shaft fractures: Operative and conservative treatment. *ActaChirScand* 1967;133:455.
8. Caldwell JA. Treatment of fracture of the shaft of the humerus by hanging cast. *SurgGynecolObstet* 1940;70:421.
9. Charnley J. The closed treatment of common fractures. Baltimore: Williams & Wilkins; 1961.
10. Stewart MJ, Hundley JM. Fractures of the humerus; a comparative study in methods of treatment. *J Bone Joint Surg Am* 1955; 37-A(4): 681-92.

## References:

1. Schemitsch LH, Bhandari M. Fractures of the diaphyseal humerus. In: Browner BD, Jupiter JB, Levine AM, Trafton PG, eds. *Skeletal trauma*, 3rd ed. Toronto: WB Saunders; 2001; 1481-511.
2. Laing PG. The arterial supply of the adult humerus. *J Bone Joint Surg Am* 1956;38:1-105.
3. Gregory PR. Fractures of the humeral shaft. In: Bucholz RW, Heckman JD, eds. *Rockwood and Green's fractures in adults*, 5th ed. Philadelphia: Lippincott Williams & Wilkins; 2001:973-996.
4. Sarmiento A, Zagorski JB, Zych G, et al. Functional bracing for the treatment of fractures of the humeral diaphysis. *J Bone Joint Surg Am* 2000;82:478-486.
5. Sarmiento A, Kinman PB, Calvin EG, et al. Functional bracing of fractures of the shaft of the