

## A Study on Humerus Shaft Fractures Managed By Locking Compression Plate in a Tertiary Government Hospital

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### **Abstract:**

**Background:** Majority of humeral shaft fractures were treated by conservative treatment using splints, hanging arm cast, braces compromising anatomical reduction in view of wide range of movement of shoulder and elbow joint.

**Materials and Methods:** Patients with fracture of humerus admitted in at RIMS, Kadapa from January 2016 to May 2017 were taken up for the study after obtaining consent.

**Results:** This is a prospective study with age incidence varied from 21-40 years (65%) with male predominance (70%), with type A3 as the commonest fracture (50%) involving the mid shaft (70%) of humerus, underwent open reduction and internal fixation using locking compression plate.

**Keywords:** Humerus, Shaft, Kadapa, Osteosynthesis, Diaphyseal fracture

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### **I. Introduction**

With the rapid industrialization and growth of infrastructure facilities requires speedy transport system to cope up with development.

With ever increasing vehicular traffic, leads to considerable increasing number of road traffic accidents. Speedy vehicles have high velocity injuries associated with complicated fracture. Fracture pattern are often grossly comminute and often open fractures resulting in greater morbidity among the working population. The other cause of fracture are being direct below, fall from height, assault, gunshot injuries and blast victims of terrorist activities.

More and more, devices and implants are designed to cope up with various complex fracture patterns. Gone are the days when open fractures are treated with pin and plaster and other techniques allowing the wounds to heal by secondary intention. Fractures of shaft of humerus account for 1% to 3% of all fractures and approximately 20% of all fractures involving the bone, but little is known about their epidemiology.<sup>1</sup>

The prevalence of humeral shaft non-union as a complication of both non-operative and operative treatment has been reported to range from 8% to 12%.<sup>2</sup>

In elderly patients to give early mobility and better functional out come, Surgical modalities are attempted with better fixation devices to enhance early mobilization. Whatever orthopedic surgeon does is basically to splint the fracture in a proper alignment and hold it till the union occurs. Union has to occur by itself and surgeon's role is restricted to appropriately aligning the fractures and holding it by the suitable implants.

The failure to hold the alignment results in loss of fixation and loosening of the implants, which ultimately leads to malunion and non union resulting in loss of function. Re-operation which increase the overall morbidity. When operative fixation is indicated for humeral shaft fractures, plate osteosynthesis is the gold standard to which other methods must be compared.<sup>3</sup>

The AO group has devised excellent implants for the fixation of fractures like dynamic compression plate for adult's shaft fractures like long tubular bone. Locking compression plate is a device in which the screws are locked into the threads provided in the hole of the plates so that the plate and screw become a single assembly. This is a advantage, that backing out of the screw resulting in loosening of the plate with failure of fixation may not occur especially in case of osteoporotic bone, poor quality bone, metaphyseal fixation etc. It offers numerous fixation possibilities and has proven its worth in complex fracture situations and in revision operations after the failure of other implants.<sup>4</sup>

Biomechanical studies have shown that compared to other types of available implants, the locking plate is comparatively flexible and maximizes fracture stabilization by minimizing the peak stresses at the bone-implant interface.<sup>5</sup>

The two main approaches to fracture plate fixation, compression plating and internal splinting-result in differing biomechanics and subsequent healing response patterns. A number of advantages to using the newer internal fixators have been described, but there are still several indications for traditional compression plating.<sup>6</sup> It has also been theorized that locking constructs may have a lower incidence of re-fracture because the more exuberant callus created by secondary bone healing may lead to mechanically more stable construct.<sup>7</sup> This study was undertaken to access the results of fixation of humeral diaphyseal fractures with locking compression plate and compare it with that in recent literature.

**AIM:** To study the fractures of shaft of humerus.

## **II. Materials And Methods**

### **SOURCE OF DATA:**

Patients with fracture of humerus admitted in the ward of Orthopaedics at RIMS, Kadapa from January 2016 to May2017 were taken up for the study after obtaining consent.

### **SAMPLE SIZE AND TECHNIQUE – 20**

Sample size was estimated by using the proportion of subjects with excellent and good functional recovery by plate osteosynthesis of humeral diaphyseal fractures with locking compression plate as 87.5% from the study by Kumar M N et al.<sup>8</sup>

using the formula :

Sample size –  $(Z 1-\alpha/2)^2 P(1-p)/d^2$

Here

$Z 1-\alpha/2$  = Is standard normal variate (at 5% type 1 error ( $p < 0.05$ ) it is 1.96 and at 1%type 1 error ( $p < 0.01$ )it is 2.58).

p =Expected proportion in population based on previous studies or pilot studies.

d =Absolute error or precision – Has to be decided by researcher.

P = 87.5

q =12.5

d =20%

Using the above values at 99% Confidence level a sample size of 20 subjects with humeral diaphyseal fractures will be included in the study.

### **Data Analysis:**

Data will be entered into Microsoft excel data sheet and will be analyzed using SPSS20 version software. Categorical data will be represented in the form of Frequencies and proportions.

**PERIOD OF STUDY:** January 2016 to May2017

### **METHOD OF COLLECTION OF DATA:**

This study proposes to include patients sustaining fracture of humerus shaft due totrauma. All patients are admitted and subjected to clinical & radiological examination,necessary lab investigations are carried out for proposed surgery.Regular follow up will be carried out by clinical examination and with X-rays atinterval of 6 weeks,3 months then 6monthsand study will be conducted on aminimum of 20 patients.

### **INCLUSION CRITERIA:**

- 1) All patients in age group of 18 years and above.
- 2) All Closed and Grade 1 open fractures (Gustillo& Anderson type).
- 3) Polytrauma patients.
- 4) Associated with Radial nerve palsy.
- 5) Failed closed reduction.
- 6) Bilateral humeral fractures.

### **EXCLUSION CRITERIA**

- 1) Pathological fractures.
- 2) Open grade 2&3 fractures.
- 3) Segmental fractures.
- 4) Medically unfit patient.

**PRE OPERATIVE WORK UP INVESTIGATIONS**

- Blood – Hb%, PCV, Electrolytes, Total count, Differential count, Grbs
  - Blood grouping and Rh typing
  - Bleeding time and Clotting time.
  - HIV, HbsAg, HCV
  - Blood Urea, Serum Creatinine
  - ECG, Urine Routine
  - Chest X –ray
- Cardiac evaluation if needed.

**OPERATIVE PROTOCOL**

A single dose of a third generation cephalosporin (ceftriaxone; 1 gm) will be administered intravenous about one hr. prior to procedure. The affected limb will be marked pre-operatively. Physician fitness will be taken if required. All the cases has Pre-Anesthetic evaluation before taking up for surgery.

**ANAESTHESIA:**

The procedure will be performed under regional block / general anaesthesia.

**Following parameters were noted intra-operatively:**

1. Total time of the surgery.
2. Blood loss: it was counted approximately by counting 50ml per mop used.
3. Intra-operative complications.

**OPERATIVE:**

All the cases will be put in intensive care unit for 24hrs postoperatively. In the immediate postoperative period, care will be given to the general condition and fluid balance. Parenteral cephalosporins for 3 days, parenteral salbutamol for 3 days, and analgesics will be given. Oral antibiotics for next 3-4 days. Oral analgesia started from 2nd day till adequate pain relief was obtained. Suture removal will be done after 1 week. This also will help us to mobilize the patients faster.

**III. Results**

We studied 20 patients with fracture shaft humerus, who were treated with locking compression plate from the period January 2016 to May 2017 in the prospective study.

**Table-1: Age Distribution**

Age	Number	Percentage
<20	3	15
21-30	6	30
31-40	7	35
>40	4	20
Total	20	100

The age group of the patients in our study ranged from 15 years to 65 years. Most of the patients belong to 21-40 years.

**Table 2:- Sex Distribution**

Gender	No. of Patients	Percentage
Male	14	70
Female	6	30
Total	20	100

Most of our patients were male. It reflected the general population which visits our both out patient as well as the emergency trauma section.

**Table 3:- SIDE & SITE OF INJURY**

	Right humerus	Left humerus
Upper 1/3rd shaft	0	0
Middle 1/3rd shaft	8	6
Lower 1/3rd shaft	2	4
Total	10	10

In our series, 10 (50%) fractures are right sided and 10 (50%) fractures are left sided. 14 (70%) cases were having a fracture located in middle third of shaft, in 6 (30%) cases the fractures were in lower third of humeral shaft.

**Table 4: TYPE OF FRACTURE**

Type of fracture	No.	Percentage
Type A1	1	5
Type A2	7	35
Type A3	10	50
Type B2	2	10
Total	20	100

In our study the fracture pattern was taken into account and the figures give the general fracture pattern, which is most prevalent in humerus diaphyseal fracture. In our study the most common fracture pattern is A3 (Transverse) in AO classification which accounts to 50% of the overall fracture pattern.

**Table 5: - MODE OF INJURY**

MODE OF INJURY	No.	Percentage
RTA	11	55
Fall	9	45
Total	20	100

In our study, the commonest mode of injury was road traffic accidents (55%) seen in 11 patients. Nine patients had a history of fall (45%).

**Table 6:- ASSOCIATED INJURIES**

ASSOCIATED INJURIES	No.	Percentage
No injury	19	95
Ipsilateral fracture both bones-forearm (Radius & Ulna)	1	5
Total	20	100

In our present study, 1 patient (5%) had ipsilateral fracture radius and ulna along with the fracture shaft of humerus.

#### IV. Discussion

This study was a prospective study conducted at in the Department of Orthopaedics, at Rajiv Gandhi Institute of Medical Sciences and research, Kadapa, YSR District, which involved 20 patients. A study of treatment of diaphyseal fractures of humerus by using locking compression plate was done between the period April – 2016 to March- 2017.

Sommer<sup>9</sup> et al published the results of the first general study of various Locking compression plates in 2003. In their prospective study, they treated 144 patients with 169 fractures involving tibia (57), humerus (45), radius (19), and femur (18) and assessed the patients for 1 year. In 130 fractures the healing took place in the expected period without any complications. A total of 27 complications occurred (19 patients) including implant loosening/pull out (5 patients), plate failure (4 patients), non-union (1 patient), secondary fractures immediately adjacent to implant after a subsequent injury (5 patients) and infection (2 patients). Analysis by the experts concluded that the mechanical complications arose entirely from technical errors of application.

No purely implant related complications occurred. They concluded that the LCP was a technically mature and has proven its worth in complex fracture situations and in revision operations after the failure of other implants. We evaluated our results and compared them with those obtained by various other studies utilizing different modalities of treatment. Our analysis is as follows:

In the present study the commonest age incidence was 15 to 65 years. Most of the patients belong to middle aged. This is due to the fact that persons of this age group are more exposed to road traffic accidents and other trauma, which are the commonest cause of humeral shaft fractures. The average age incidences in other series are as follows:

#### AGE INCIDENCE IN VARIOUS STUDIES

Series	Year	Total no of patients	Average Age
Kumar MN et al 8	2013	24	41
Ashutosh Kumar Singh et al 10	2014	212	37
Fan Y et al 11	2015	30	39
Rajesh Govindaswamy et al 12	2016	18	44
Lalitkumar et al 13	2017	40	36

Gongol T, Mracek D14	2002	32	47
McCormack RG et al15	2000	44	49
Wilairatana V, Prasongchin P16	2001	21	29
Present Study	2017	20	35

Most of the patients were males. It reflects the general population which visit our both out patient as well as the emergency trauma section. Sex incidences in other series are as follows:

**SEX INCIDENCE IN VARIOUS STUDIES**

Series	Year	M:F ratio	% of males
Strong GT, Walls N, McQueen MM17	1998	111:138	44.6
Tingstad EM et al18	2000	44:38	53.6
McCormack RG et al15	2000	28:16	63.6
Wilairatana V, Prasongchin P16	2001	16:5	76.2
Kumar MN et al8	2013	19:5	79.2
Fan Y et al11	2015	19:11	63.3
Rajesh Govindaswamy et al12	2016	12:6	66.6
Lalit Kumar et al13	2017	30:10	75
Present Study	2017	14:6	70

In our series, left humerus was involved in 50% cases, while right was involved in the other 50% of cases.

**SIDE AFFECTED IN VARIOUS STUDIES**

Series	Right (%)	Left (%)
Heim D et al (1993)19	44.9	55.1
Strong GT, Walls N, McQueenMM (1998)17	44.2	55.8
Kumar M N etal8	45.8	54.2
Rajesh Govindaswamy et al12	55.55	45.45
Present Study	50	50

In our series, 14 cases ( 70%) were h a v i n g f r a c t u r e located in middle third of shaft, in 6 (30%) cases the fractures was in lower third of humeral shaft.

**SITE OF FRACTURE**

Series	Year	Total no of patients	Commonest site affected	No of cases
Klenerman L20	1966	98	Middle third	44 (44.9%)
Bell MJ et al21	1985	38	Upper third and middle	15(38.5%)
Strong GT, Walls N and McQueen MM17	1998	249	Middle third	160(64.2%)
Kumar MN et al8	2013	24	Middle third	16(67%)
Rajesh Govindaswamy et al12	2016	18	Middle third	10(56%)
Lalit Kumar et al13	2017	40	Middle third	23(58%)
Present Study	2017	20	Middle third	14(70%)

Most of the fractures in our series were transverse, Type A3 10 (50%) patients.

**V. Conclusion**

The age of the patient ranged from 15 years to 65. Majority of the patients were males. (M : F = 14: 6). In our series, left humerus was involved in 50% cases, while right was involved in the other 50% of cases.

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**Conflict of Interest:** None

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