

Original Research Article

Humerus Shaft Fractures Managed by Locking Compression Plate

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Abstract: Background: The incidence of nonunion of humerus has been as high as 15% of all humeral fractures. 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. **Methods:** The prospective study was conducted at Dept. of Ortho-Surgery, Sheikh Sayera Khatun Medical College & Hospital, Gopalganj, Bangladesh from January 2021 to June 2022. Total 20 patients with fracture shaft humerus, who were treated with locking compression plate from the period were study. 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 at interval of 6 weeks, 3 months than 6 months and study will be conducted on a minimum of 20 patients. **Results:** Total 20 patients with fracture shaft humerus, who were treated with locking compression plate from the period of study. 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. 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. **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.

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

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INTRODUCTION

The incidence of nonunion of humerus has been as high as 15% of all humeral fractures [1]. Various devices such as dynamic compression plates (DCP), angled blade plates, wave plates, autograft or allograft struts, locked intramedullary nails and Ilizarov external fixators have been used in the management of nonunion of fractures of humeral diaphysis [2]. Very few studies have been published about the use of locking compression plate (LCP) in the management of a nonunion of humeral fractures [3, 4]. Fracture pattern are often grossly comminute and often open fractures resulting in greater morbidity among the working population. With ever increasing vehicular traffic, leads to considerable increasing number of road traffic accidents. Speedy vehicles have high velocity injuries associated with complicated fracture. 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 [5]. The prevalence of humeral shaft nonunion as a complication of both non-operative and operative treatment has been reported to range from 8% to 12% [6]. 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. In elderly patients to give early mobility and better functional outcome, surgical modalities are attempted with better fixation devices to enhance early mobilization. Union has to occur by itself and surgeon's role is restricted to appropriately aligning the fractures and holding it by the suitable implants.

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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 [7]. 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. It offers numerous fixation possibilities and has proven its worth in complex fracture situations and in revision operations after the failure of other implants [8]. Non-operative treatment requires a long period of immobilization, which carries a risk of prolonged shoulder joint stiffness and inconvenience for the patient [9, 10]. Furthermore, non-union after conservative treatment of these fractures does occur in up to 10 % of the cases, and treatment of this condition can be very difficult [11, 12]. There is a growing interest in treating even simple humeral shaft fractures by surgical modalities in order to avoid these problems and to allow earlier mobilization and rapid return to work [13, 14]. The usual operative methods involve the use of dynamic compression plate (DCP) or interlocking nail (ILN). Plate and screw fixation has traditionally been the preferred method and remains the gold standard for surgical management [14].

MATERIALS AND METHODS

The prospective study was conducted at Dept. of Ortho-Surgery, Sheikh Sayera Khatun Medical College & Hospital, Gopalganj, Bangladesh from January 2021 to June 2022. Total 20 patients with fracture shaft humerus, who were treated with locking compression plate from the period, were study. 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.*, [15]. This study proposes to include patients sustaining fracture of humerus shaft due to trauma. 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 at interval of 6 weeks, 3 months than 6 months and study will be conducted on a minimum 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. All the cases have 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 salbactam 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.

Data Analysis:

Data will be entered into Microsoft excel data sheet and will be analyzed using "SPSS" 20 version software. Categorical data will be represented in the form of Frequencies and proportions.

RESULTS

Table-1: Age Distribution (N=20)

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

Total 20 patients with fracture shaft humerus, who were treated with locking compression plate from the period of study. 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-1).

Table 2:- Sex Distribution (N=20)

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 outpatient as well as the emergency trauma section (Table-2).

Table 3:- Side & Site of Injury (N=20)

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 fracture located in middle third of shaft, in

6 (30%) cases the fractures was in lower third of humeral shaft (Table-3).

Table 4: Type of Fracture (N=20)

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 gives 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-4).

Table 5: - Mode of Injury (N=20)

Mode Of Injury	No	%
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-5).

Table 6:- Associated Injuries (N=20)

Associated Injuries	N	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 (Table-6).

DISCUSSION

Humerus fracture is unique amongst the long bone fractures in its tolerance of less than anatomical reduction. Shortening up to 3 cm, rotation $<30^\circ$ and angulation up to 20° are considered acceptable [16]. Due to this fact, most of the humerus fractures are still managed conservatively and have good functional results. The most common indication of operative intervention is inability to achieve acceptable reduction, followed by associated vascular lesions, open fractures, radial nerve palsy, polytrauma patients, floating elbow and pathological fractures [17]. The preponderance of the fracture in young males, commonly in third and fourth decade of life, was seen in our series, as has been reported by other similar studies [18]. Road traffic accident is the most common mode of injury, especially in younger patients. Total 20 patients with fracture shaft humerus, who were treated with locking compression plate from the period of study. 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. Sommer *et al.*, [19], published the results of the first general study of various Locking compression plates in 2003. We evaluated our results and compared them with those obtained by various other studies utilizing different modalities of treatment. Our analysis 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. Most of our patients were male. It reflected the general population which visits our both outpatient as well as the emergency trauma section. The mean age of our patients was 46 years in comparison with the mean age of 72 years in the study by Ring *et al.* Another difference from the series by Ring *et al.*, is that 9 out of 24 patients in their series had delayed union and 15 had nonunion, whereas in our series, all patients had established non-union [20]. In our series, 10 (50%) fractures are right sided and 10 (50%) fractures are left sided. 14 (70%) cases were having fracture located in middle third of shaft, in 6 (30%) cases the fractures was in lower third of humeral shaft. Plate osteosynthesis has been considered by several authors to be better than intramedullary nailing for primary management of humeral shaft fractures [17, 21]. In our study the fracture pattern was taken into account and the figures gives 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. 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 [18]. 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%). However, the presence of segmental bone loss and cortical defects necessitated the insertion of maximum possible screws so as to minimize the risk of plate failure. In our present study, 1 patient (5%) had ipsilateral fracture radius and ulna along with the fracture shaft of humerus. In our study, good outcome was noted in proximal third fractures as well as mid-shaft and distal third nonunions. Thus, LCP is useful at all levels of the humeral shaft. Nadkarni *et al.*, have used LCP in two patients with nonunion with previously inserted intramedullary nail [4]. The nails were left *in situ* and LCP was applied along with bone grafting. Union occurred in about 6 months. Unlike Nadkarni *et al.*, we removed the previous intramedullary nail prior to LCP application. This facilitates better application of the plate and allows intramedullary placement of bone grafts [22].

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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