Original Paper Orthopaedics

A STUDY OF FUNCTIONAL AND RADIOLOGICAL OUTCOME OF LOCKING COMPRESSION PLATE OSTEOSYNTHESIS IN HUMERAL SHAFT FRACTURE

Rojy Boben[1], Ashish K. Jose[2], KrishnaGopal R.[3], Thyagarajan K.R.[4]

[1]Resident, Dept. of Orthopaedics, Mahatma Gandhi Medical College & Research Institute, Pondicherry, India
[2]Assistant Professor, Dept. of Orthopaedics, Mahatma Gandhi Medical College & Research Institute, Pondicherry, India
[3]Professor, Dept. of Orthopaedics, Mahatma Gandhi Medical College & Research Institute, Pondicherry, India
[4]Professor, Dept. of Orthopaedics, Mahatma Gandhi Medical College & Research Institute, Pondicherry, India

Corresponding Author:
Dr. Ashish K. Jose;
Dept. of Orthopaedics;
Mahatma Gandhi Medical College & Research Institute,
Pillaiyarkuppam, Pondicherry – 607402, India.
E-mail: joseashish@yahoo.co.in
Conflict of Interest: Nil
Source of support: Nil

Accepted on: November 2015

Abstract:

Background: Humeral shaft fractures are one of the most common fractures encountered by orthopaedic surgeons around the world and constitute 3-5% of all fractures.Various surgical procedures are available for its treatment. Open reduction and plate osteosynthesis is considered as the definitive treatment for humeral shaft fractures.

Aim: To determine the functional and radiological outcome of Locking Compression Plate (LCP) osteosynthesis in humeral shaft fractures.

Materials & Methods: In the present study, 30 patients with fracture shaft of humerus who presented to emergency department of Mahatma Gandhi Medical College and Research Institute, Pondicherry were treated with ORIF using LCP after adequate preoperative evaluation. Patients were followed up with ASES scoring system for functional assessment at 3 and 6 months and radiological assessment for union at 6 weeks, 3 months and 6 months.

Results: In the current study we evaluated the clinical and radiological outcome of patients with humeral shaft fractures who were treated with Locking Compression Plate. Assessment of the outcome showed that there was a union rate of 96.7% after surgery. ASES scoring done on the patients showed a mean score of 94.5 (maximum score 100) and was reported as excellent in majority of the patients. Minimal complications were noticed in our study - Neuropraxia (3.3%), superficial skin infection (3.3%), delayed union (3.3%), and non union (3.3%).

Conclusion: Locking Compression Plate can be considered as an excellent surgical option for treating patients with fracture shaft of humerus in terms of excellent union rates and minimal complications.

Keywords: *Locking Compression Plate, Fracture shaft of humerus, ASES.*

Introduction:

Humeral shaft fractures are one of the most common fractures encountered by the Orthopaedic surgeons around the world with an incidence ranging from 3-5 percent of all fractures.[1,2] Various non surgical and surgical management techniques for these fractures continue to evolve. However the ideal treatment of these fractures is still debatable. Though non surgical management yields satisfactory results in humeral shaft fractures, there are many associated morbidities like non-union and shoulder and elbow stiffness secondary to prolonged immobilization.[3-5] Hence the pendulum seems to be shifting to the surgical management of humeral shaft fractures.

The various surgical treatment options available are external fixation or open reduction with internal fixation, minimally invasive percutaneous osteosynthesis and intramedullary nailing. Of these procedures the intramedullary nailing and compression plating is considered as the definitive surgical treatment for humeral shaft fractures. With this background, our study was done to determine the efficacy of Locking compression plate in the treatment of shaft of humerus fractures.

Materials & methods:

Our study group involved all skeletally matured patients with fracture shaft of humerus who were operated with locking compression plate technique during the period January 2014 to June 2015. All the skeletally mature patients with fracture shaft of humerus willing for locking compression plate osteosynthesis were included. And patients with Type II and Type III open (compound) fractures, non-union or delayed-union, malunited fractures, patients with pathological fracture, patients with ipsilateral fractures, polytrauma and vascular injury and patients operated using other plates were excluded. During the study period, 30 patients with humerus shaft fractures satisfied these criteria and were included in this study (Figure 1). All the 30 patients were treated with locking compression plate using the posterior approach to humerus (Figure 2). Patients were reviewed at 6 weeks, 3 months and 6 months post operatively. Clinical scoring was done using American Shoulder and Elbow Surgeons score (ASES).

Results:

Out of the 30 patients in the study 25 were male and 5 were female, with 16 patients injuring their right arm and 14 injuring their left arm. The most common mode of injury was road traffic accident (Table 1) and the maximum incidence was seen in the 41-50 years age group (Table 2).

Table 1: Mode of Injury

Mode of Injury	Percentage %
RTA	21 (70.0)
Fall from height	5 (16.7)
Domestic accidents	3 (10.0)
Assault	1 (3.3)
Total	30(100.0)

Table 2: Age group

Age group (in years)	Percentage %
21-30	9 (30.0)
31-40	4 (13.3)
41-50	13 (43.3)
51-60	2 (6.7)
>60	2 (6.7)
Total	30 (100.0)

Out of the 30 patients, 25 had closed fractures and the most common fracture pattern was transverse - Muller type 3 (Table3)

Table 3 : Frequency for Muller type

Muller type	Percentage %
A1	7 (23.3)
A2	6 (20)
A3	13 (43.3)
B2	3 (10)
C2	1 (3.3)

6 weeks follow up (Table 4):

28 patients had nil complaint, 1 patient had wrist drop and 1 patient had superficial surgical site infection that healed with antibiotics and daily dressing. Radiograph showed signs of union in 28 patients (Figure 3).

Table 4: Six weeks follow up Clinical assessment and Radiological outcome

Clinical assessment	Percentage %
Nil complaints	28 (93.3)
Surgical site infection	1 (3.3)
Neuropraxia	1 (3.3)
Radiological outcome	**Percentage %**
Sign of Union	28 (93.3)
No Sign of Union	2 (6.7)

3 months follow up (Table 5):

29 patients had good clinical outcome and 1 patient had wrist drop. Radiologically union was seen in 28 patients and delayed union in 2 patients (Figure 4). The ASES score was excellent in 73.3% patients.

Table 5: Three month follow up Clinical assessment and Radiological outcome

Clinical Assessment	Percentage %
Good	29 (96.7)
Poor (Neuropraxia)	1 (3.3)
Radiological outcome	**Percentage %**
Union	28 (93.3)
Delayed Union	2 (6.7)
ASES score	**Percentage %**
Excellent	(73.3)
Very good	16.7
Good	6.7
Fair	3.3

29 months follow up (Table 6):

29 patients had good clinical outcome and 1 patient had good outcome. This patient, who had wrist drop post operatively, has improved clinically.

Radiologically union was seen in 29 patients (Fig.5) and non union was seen in 1 patient. This patient with non – union was treated with bone marrow injection at the fracture site. The ASES score was excellent in 26 patients.

Table 6:
Six month follow up. Clinical assessment, radiological outcome and ASES score

Clinical Assessment	**(%)**
Excellent	29 (96.7)
Good	1 (3.3)
Radiological outcome	**(%)**
Union	29 (96.7)
Non union	1 (3.3)
ASES score	**(%)**
Excellent	26 (86.7)
Very good	2 (6.7)
Good	1 (3.3)
Fair	1 (3.3)

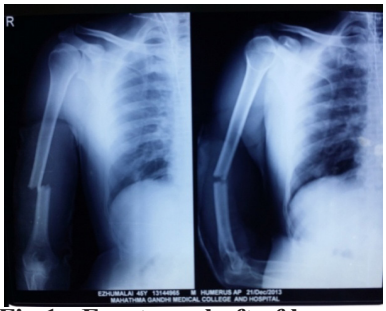

Fig.1 : Fracture shaft of humerus

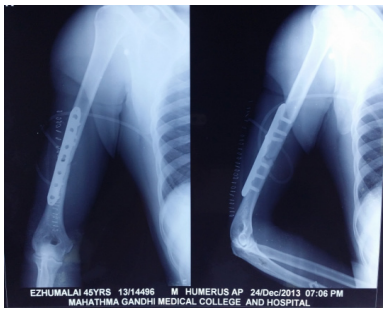

Fig.2 : Immediate post-op x-ray

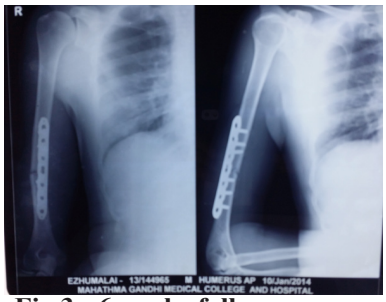

Fig.3 : 6 weeks follow up x-ray

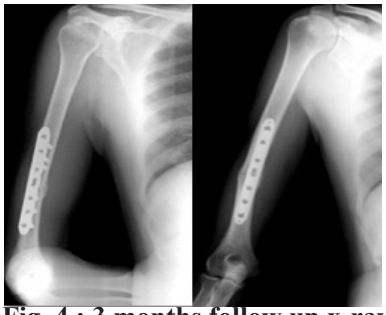

Fig. 4 : 3 months follow up x-ray

Fig. 5: 6 months follow up x-ray

Discussion:

As the severity and complexities of fractures are increasing, concepts in the management of trauma in Orthopaedics is changing very rapidly. Humeral shaft fractures are very frequently associated with multiple injuries, leading to complications like shortening, mal union, infection, delayed union, non union, etc. Hence its management is always a challenging problem to the orthopaedic surgeon.

The aim of treatment in these fractures is to achieve length and alignment and produce favourable environment for bone and soft tissue healing. The U-plaster cast has been the classical method of treatment of humeral shaft fractures. With this method satisfactory results can be obtained but there have been many reports of residual angulation, mal-rotation and limb length discrepancy. Operative treatment avoids complications such as malunion, delayed union, rotational deformity, shoulder and elbow stiffness, limb length discrepancy and prolonged hospital stay.

Our study was done to assess the functional and radiological outcome of using locking compression plate osteosynthesis in the treatment of humeral shaft fractures. 30 patients with fracture shaft of humerus were treated with open reduction and internal fixation using LCP.

Most of the patients were male. The maximum incidence of these fractures was seen in 41-50 years age group. The commonest mode of injury was Road Traffic Accidents (RTA). The type of fracture most frequently seen was transverse fractures (A3).

The duration taken for fracture union was found to be around 3 months in majority (93.3%) of the patients. This is partially supported by the studies of Guthrie [6] and Pal et al [7]. Their findings indicated that non- displaced humeral shaft fractures takes between 10-12 weeks to heal, and it has been found that spiral fractures tend to heal faster than transverse fractures.

In our study, all the 30 patients were measured using American Shoulder and Elbow Surgeons Score (ASES) [8]. They were assessed at 3 months and 6 months as per ASES guidelines and their score revealed that out of the maximum score of 100, the mean value was found to be 95.22%. The reported range of motion is found to be full in all patients except one. This is comparable to the study of McCormack et al [9] and Bell et al [10]. Hence we infer that LCP gives good functional outcome when used in the treatment of humeral shaft fractures.

Our study shows a primary union rate of 93.3%. Bell et al reported a primary union rate of 97% in cases of humeral shaft fractures after plating in polytrauma patient [10]. Another study by Vander Griend et al reported a primary union rate of 96% in a series of humeral shaft fractures fixed by DCP [11]. Hence, plating can be considered as the gold standard for operative treatment of humeral shaft fractures with high

union rates and good outcome.

The results of this study revealed some complications. Few complications such as superficial wound infections, delayed union, non union and neuropraxia were reported. In a study of Shao et al [12] it was reported that the injury to the radial nerve is a common complication of this fracture.

One patient (3.3%) had neuropraxia in the immediate post operative period and it recovered spontaneously after 5 months. Another patient (3.3%) had superficial wound infection which subsided with daily dressing and antibiotics. Two patients had delayed union at 3 months post-op, out of which one patient showed union at 6 months and the other was treated with bone marrow injection. Similar results were obtained in the study done by Kumar et al [13]. A study done by Rupesh Kumar et al [14] suggested that the rate of non-union is about 5%, infection about 2-4% and radial nerve palsy about 2-5%.

Most of the patients in this study had good outcome after the surgery (96.7%). Similar results were also obtained in studies conducted earlier by McCormack et al [9], and Gongol et al [15]. Hence it can be inferred that the functional and radiological outcome of locking compression plate osteosynthesis is good. The mode of approach opted for all the patients in this study were the posterior approach and it proved to be a good option for treatment of humeral shaft fractures.

Internal fixation has immense use in providing better results in the form of less deformity, early mobilization and good union. Plating is a better option for fixation in terms of lesser union time, better joint function and lesser need for re-surgery.

Better results after surgery are obtained if there is strict adherence to AO principles during fixation, meticulous attention to maintain asepsis during surgery, patient education and well planned rehabilitation programme. Greater patient satisfaction with fewer complications will result if these principles are strictly adhered to in the treatment of humeral shaft fractures with LCP fixation.

Conclusion:

We concluded that locking compression plate is an excellent option in the treatment of humeral shaft fractures with good functional and radiological outcome and minimal complications.

The successful treatment of a humeral shaft fracture may not end with bony union. The current emphasis is on a holistic approach to patient care and the treating Orthopaedic surgeon can intervene and improve a patient's life beyond what is recognized as the surgeon's role traditionally. The successful treatment of a humeral shaft fracture demands a knowledge of anatomy, surgical indications, techniques and implants, patients functions and expectations.

References:

1. McKee MD, "Fractures of The Shaft of The Humerus" Rockwood & Green's Fractures in Adults, 6th Edition, Bucholz, Robert W.; Heckman, James D.; Court-Brown, Charles M. Lippincott 2006: 1118-1159.
2. Brinker MR, O'Connor DP. The incidence of fractures and dislocations referred for orthopaedic services in a capitated population. J Bone Joint Surg Am 2004; 86:290-29
3. Management of humeral shaft fractures. Fundamental non operative techniques. Clin. Orthop. 71 (1970), pp. 132–139.
4. W Hosner. Fractures of the shaft of the humerus. An analysis of 100 consecutive cases. Reconstr. Surg. Traumatol., 14 (1974), pp. 38–64.
5. R.G Thompson, E.L Compere, W.J Schnute, C.L Compere, W.T Kennahan, R.D Keagy, et al. The treatment of humeral shaft fractures by the hanging cast method. J. Internat. Coll. Surg., 43 (1965), pp. 52–60.
6. Guthrie K. A Funny Fracture [Internet]. Life in the Fast Lane. 2015 [cited 2015 Aug 4]. Available from: http://lifeinthefastlane.com/a-funny-fracture/
7. Pal CP, Goyal A, Shakunt RK, Kumar D, Singh A, Dinkar KS. A comparative study of the results of locking compression plating and stack nailing in diaphyseal fracture of humerus. J Orthop traumatol rehabil 2013;6:74-7
8. McClure PM, SennettnBJ. American shoulder elbow surgeons standardized shoulder assessment form, patient self – report section: reliability, validity, and responsiveness. J Shoulder elbow surg. 2002 Nov-Dec;11(6):587-94
9. McCormack RG, Brien D, Buckley RE, McKee MD, Powell J. Fixation of fractures of the shaft of the humerus by dynamic compression plate or intramedullary nail. J Bone Joint Surg Br 2000; 82(3): 336-39.
10. Bell MJ,Beauchamp CG, Kellan JK, McMutry RY. The result of plating humeral shaft fractures in patients with multiple injuries. J Bone Joint Surg Br 1985; 67(2): 293-296
11. Griend R V, Tomasin J, Ward E F. Open reduction and internal fixation of humeral shaft fractures. J Bone Joint Surg 1986; 68A:430-3.
12. Shao YC, Harwood P, Grotz MRW, Limb D, Giannoudis P V. Radial nerve palsy associated with fractures of the shaft of the humerus:

a systematic review. J Bone Joint Surg Br. 2005;87(12):1647–52.

13. Kumar MN, Ravindranath V P, Ravishankar M R. Outcome of locking compression plates in humeral shaft nonunions. Indian J Orthop 2013;47:150-5
14. Rupesh K, Pankaj S, Lal Jee Chaudhary, Shailendra Singh. Humeral shaft fracture management, a prospective study; nailing or plating. J Clin Orthop Trauma. 2012 Jun; 3(1): 37–42.
15. Gongol T, Mracek D. Functional therapy of diaphyseal fractures of the humeral bone. Acta Chir Orthop Traumatol Cech 2002; 69(4): 248-253.