



International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(3): 302-305
© 2020 IJOS
www.orthopaper.com
Received: 24-05-2020
Accepted: 26-06-2020

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Surgical management of fracture shaft of humerus in adults with limited contact dynamic compression plate

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DOI: <https://doi.org/10.22271/ortho.2020.v6.i3e.2217>

Abstract

Introduction: Fractures of the shaft of the humerus account for 1% to 3% of all fractures.¹ With the formation of the AO group in 1958, internal fixation of bone and joint injuries secured scientific outlook. Despite the numerous surgical techniques, Plate Osteosynthesis remains the gold standard for fixation of humeral shaft fractures. The present study reemphasizes the effectiveness of plate osteosynthesis in the management of humeral shaft fractures so as to restore the patient structurally and functionally to near normal status.

Materials and Methods: This is a prospective study of 35 adult patients with diaphyseal Humeral fractures treated with plate osteosynthesis. After a thorough pre-operative assessment cases were taken up for surgery. All the patients were assessed radiologically and clinically for fracture union at regular intervals of 6 weeks, 12 weeks and 18 weeks by using ROMMEN'S *et al.* series grading.²⁸

Results: In our series, majority of the patients were males, middle aged, with road traffic accidents being the commonest mode of injury, involving middle third. 91.43% of the fractures united with excellent, 5.71% good and 2.86% poor results

Conclusion: The LCDCP of humeral shaft fractures produce excellent results, the advantage being early mobilization, early union but the complication, duration of surgery and surgical techniques remains unchanged.

Keywords: Humeral shaft fractures, LCDCP, Open reduction and internal fixation.

1. Introduction

The upper limb in Human body is highly functional and mobile for positioning the hand in space. As the upper extremity functions with a long lever arm and highly exposed to external forces, it is predisposed to injuries frequently. Fractures of the shaft of the humerus account for 1% to 3% of all fractures ^[1]. The emphasis has changed from splinting and prolonged immobilization, to internal fixation discarding external immobilization, with return to normal function as early as possible. The main modalities of internal fixation in humerus shaft fractures are Plate osteosynthesis and intramedullary nailing. Despite the numerous surgical techniques, Plate Osteosynthesis remains the gold standard for fixation of humeral shaft fractures. Current research in this area focuses on defining the incidence and health care resources required to treat this injury, refining the indications for surgical intervention, decreasing the surgical failure rate through new implants and techniques and minimizing the duration and magnitude of disability post injury.

With this background, this study is to determine the efficacy of Limited Contact Dynamic compression plate in the treatment of humeral shaft fractures.

Materials and Methods

It is a prospective study which was carried out from April 2018 to September 2019 in S.V.S. Medical College. In this study period 20 cases of fracture shaft of the humerus were treated by open reduction and internal fixation using Limited Contact Dynamic Compression Plate.

Inclusive criteria: The fractures which are located from 5 cm distal to the surgical neck to 5 cm proximal to the olecranon fossa, age 18 or more and both sexes, open fractures grade I and II, polytrauma, instability of fracture and early failure of conservative treatment with full skeletal maturity.

Exclusion criteria were previous fractures of the humerus, pathological fractures, grade-III open fractures, children.

A careful history was elicited from the patients and/or attendants to reveal the mechanism of injury and the severity of trauma. The patients were then assessed clinically to evaluate their general condition and the local injury.

Local examination of the injured arm, revealed the attitude of the limb to be flexed at the elbow, adducted at the shoulder and supported with the other hand at the elbow. Swelling, deformity, loss of function and nerve injury were looked for and noted.

Palpation revealed tenderness, abnormal mobility, crepitus and shortening of the affected arm. Distal vascularity was assessed by radial artery pulsations, capillary filling, pallor, paraesthesia at fingertips. Radial nerve was tested by active wrist and metacarpophalangeal joint dorsiflexion. Sensation in the autonomous zone of radial nerve (1st web space) was checked for any abnormality. Standard radiographs of the humerus, i.e., anteroposterior and lateral views were obtained. The shoulder and elbow joints were included in each view. The limb was immobilized in a U-slab with sling. Injectable analgesics were given. Anterolateral approach with lateral plating was the most preferred surgical approach. Posterior approach was used in two cases due to the fracture being in the distal third. A broad and narrow 4.5mm LCDCP made of 316L stainless steel was used and a minimum of 6 cortices were engaged with screw fixation in each fragment.

Follow-up: All the patients were followed up at 6 weeks, 12 weeks and 18 weeks, later at 2 monthly intervals till fracture

union and once in 6 months till the completion of study and results assessed using ROMMEN'S *et al.* [28] series grading.

Results

The present study consists of 35 cases of humerus shaft fracture in adults treated surgically by open reduction and internal fixation using LCDCP between April 2018 to September 2019. Age of these patients ranged from 18 to 70 years with majority of patients being young and middle aged. The average age was 34.7 years. Majority of the patients, 30(85.7%) were male and 5(14.3%) were females.

Table 1: Age distribution

Age in years	Male	Female	Total
18-20	1		1
21-30	10	1	11
31-40	8	1	9
41-50	6	1	7
>51	5	2	7
Total	30	5	35

We found that road traffic accident was the most common cause of injury being responsible for 80.00% of cases followed by domestic accidents (10.00%), Fall from height (5.00%) and assault (5.00%). 12 out of 35 (34.28%) cases suffered from other injuries besides fracture of shaft of humerus. Right extremity was more often involved 80%. Left extremity was involved in only 20% of cases. 30 fractures were closed and 5 were open fractures. Most of the fractures were located in the middle third of the shaft (80%).

Table 2: Distribution according to the level of fracture

Level of fracture	No. of cases	Percentage (%)
Proximal third	5	14.28
Middle third	28	80
Distal third	2	20
Total	35	5.72

Majority of fractures (26 cases) were transverse type, 6 cases oblique type, in 3 cases spiral type. The fracture was considered to be united when clinically there was no pain and no subjective complaints, radiologically fracture line was not visible and full unprotected function of the limb was possible. 34 patients had sound union in less than 18 weeks, 1 patient had nonunion.

Nonunion was due to inadequate reduction of fracture fragments and early weight bearing by the patient. 34 patients recovered full range of motion of shoulder and elbow joint while 1 patient recovered good range of motion (within 10-15% of full range).

There were 2 cases of radial nerve palsy following surgery which recovered in 3-4 months. There was one case of delayed union and one case of Elbow stiffness.

All the patients were assessed radiologically and clinically for fracture union at regular intervals of 6 weeks, 12 weeks and 18 weeks by using ROMMEN'S *et al.* series grading [28]. 32(91.43%) patients had excellent results, 2(5.71%) patients had good results, 1 (2.86%) patient had poor result.

Table 3: Functional Assessment

Result	No of cases	%
Excellent	32	91.43
Good	2	5.71
Poor	1	2.86

Discussion

Diaphyseal fractures of Humerus are usually a result of high energy trauma. In the by gone years orthopaedic clinicians labeled the Humeral shaft fractures as benign fractures. Irrespective of the method used, union was not a problem but malunion and cosmetic unacceptability was the real concern. It was reflected aptly in Sarmiento's observations in his text book. Patients of fractures of the Humerus are prone for economic and social

burden to their families if the recovery is not satisfactory. Plate osteosynthesis remain the gold standard in the surgical management of the humeral shaft fractures.

During the period of April 2018 to September 2019, over 35 diaphyseal fractures of Humerus were treated in orthopaedic department at SVS Medical College Hospital, Mahaboobnagar.

After excluding the fractures which come under exclusion criteria, 35 patients were selected for the detailed study. Most of our patients were of young and middle aged, 30 out of 35 patients (85.7%), the average age being 34.7 years, which correlate with

the fact that younger population is at increased risk of Humeral shaft fractures and it is lower compared to McCormack *et al.* series [29] (49 years) and Hee *et al.* [30] series (37 years).

In our study, significant male dominance 80% (28 out of 35) was seen as compared to 65.2% in Mc Cormack *et al.* [29]

series and 74.2% in Hee *et al.* [30] series. Regarding side of fracture, right side involvement is more (28 out of 35(80%)) in our study, but in the study of Hee *et al.* [30], left side involvement is more (54%) and in Kiran singiseti *et al.* [31] series no obvious sex predilection was noted. In 30 out of 35 patients (80%) fractures are due to road traffic accidents, where as in Hee *et al.* [30] and Mc Cormack *et al.* [29] series, it is 54.2% and 78.2% respectively. The level of fracture is dominated by middle 1/3rd 80% (28 out of 35 cases). This figure ranged from 66.6% and 60% in Mohandas *et al.* [21] series and Hee *et al.* [30] series respectively.

Fracture pattern in our study was transverse fracture in 26 out of 35 patients (74.28%) compared to 77.14% in Hee *et al.* [30] series. Pre-operatively radial nerve palsy was noted in none of our cases but in Hee *et al.* [30] and Kiran singiseti *et al.* [31] series it was 5 and 4 cases respectively. In most of our cases Henry's Antero-lateral approach was used. The reduction of fracture was satisfactory intra operatively in all our cases. No intra-operative complications were noted in our study. The mean duration of hospital stay in our series was 8 days which was almost equal compared to Hee *et al.* series [30] (10 days). The duration of follow up in our study ranged from 6 to 12 months where as it was 6 to 33 months in Mc Cormack *et al.* series [29] and 10 to 24 months in Kiran singiseti *et al.* [31] series.

The average time for radiological union in our series is 16 Weeks (4 months) compared to 5.3 months in Hee *et al.* series [30] and 16 weeks in

Kiran Singiseti *et al.* [31] series. One of our case developed nonunion compared to one case in Mc Cormack *et al.* [29] series and no case of non-union in Mohandas *et al.* [21] series. Shoulder/Elbow stiffness reported in one of the 35 cases in our patients compared to 20% in Hee *et al.* [30] series and 0% in Mohandas *et al.* [21] series. Post operatively two of our cases developed radial nerve palsy but Kiran singiseti *et al.* [31] series noted one such complication. Final outcome was excellent in 32 out of 35 cases (91.43%) in our study compared to 89% in Hee *et al.* [30] series and 100% in Mohandas *et al.* [21] series.

Conclusion

Fracture shaft of humerus in adults is fairly common. A detailed neurovascular examination is a must at presentation as radial nerve palsy is common.

Majority of the fractures were transverse and comminuted in the middle third and most of them were closed injuries. Early postoperative mobilization following rigid fixation of the fracture of humerus, with LCDCP lowers the incidence of stiffness. LCDCP of humerus produces comparable better results than antegrade interlocking intramedullary nailing. Proper preoperative planning, minimal soft tissue dissection, adherence to AO principles, strict asepsis, proper post-operative rehabilitation and patient education are more important to obtain excellent results.

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