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Associate Professor, Department of Orthopedics, Shadan Institute of Medical Sciences, Hyderabad, Telangana, India Study on surgical management of distal humerus fractures in adults treated with bicolumnar plating

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Abstract

Background & Objectives: Distal humerus fractures in adults comprise 2% of all fractures and 30% of all humeral fractures. Intra-articular distal humerus fractures account for 37% and involve both medial and lateral columns. Most of the distal humeral fractures in adults must be treated surgically to get better functional outcome. The aim of this study was to assess the efficacy, technical requirements, functional outcome, radiological and clinical union, and complications of distal humerus fractures treated with bicolumnar plating.

Aims and Objectives: The Aim of the present study is to evaluate the Functional Outcome of Surgical Management of distal Humerus fractures by Open Reduction and Internal using bicolumnar plating technique.

Materials and Methods: A total of 30 distal humerus fractures admitted in teaching and general hospital were operated included in the study. Patients fitting in to inclusion criteria were selected. All the patients were operated with ORIF with precountered locking distal humerus plates in orthogonal fashion and outcome was measured by MEPS, rate of union, rate of complications and final range of motion.

Results: In our series of 3 0 cases, there were 22 males and 8 females with average of 36.8 years. 17 cases were due to direct fall, 10 due to road traffic accident and 3 due to direct assault. There was a predominance of left side (24). Out of 30 cases, 6 (20%) were of 13C1 type, 21(70%) were of 13C2 type and 3 (10%) were of 13C3. Excellent results in 21, good in 6 and fair in 3 cases, according to MEPS. There were 3 (10%) cases each of superficial infection and 3 (10%) cases of ulnar neuropathy, treated accordingly. There were no cases of non-union, implant failure or heterotopic ossification.

Conclusion: Operative treatment with rigid anatomical internal fixation, should be the line of treatment for fractures of distal humerus, as it gives best chance to achieve goodelbow function. During open reduction and internal fixation, anatomic reconstruction of articular surface should be given prime importance. Stable fixation allows early active and aggressive postoperative mobilization.

Keywords: ORIF, MEPS, bicolumnar plating

Introduction

Distal humeral fractures have a bimodal age distribution with high incidence between the ages of 12 and 19 years (usually in males) and more than 80 years in females (because of increased elbow carrying angle and osteoporosis)^[1].

High-energy injuries such as road traffic accidents, fall from height, sports, industrial accidents, and firearms have been the causative factor for distal humeral fractures in adults. Low-energy injuries such as fall from standing height causes fractures of distal humerus in most of the elderly patients. Historically, the treatment outcome of the distal humeral fractures remained problematic because of lack of understanding of bony anatomy, lack of precontoured locking plates, and higher rates of infection.

Till today, the treatment of the distal humerus fractures has remained a challenging problem in spite of advanced techniques and implant designs because of complex regional anatomy with limited options for internal fixation, articular comminution, and quality of architecture of inherent bones ^[2]. Type C intra-articular distal humeral fractures in adults must be treated surgically to get better functional outcome. The main goal of operative management of distal humerus fractures is to restore the anatomy of the joint surface with stable internal fixation with restoration of limb alignment, rotation, and pillar reconstruction, which allows early mobilization of joint which leads to better functional outcome. With the advent of computed

Correspondence Dr. K Raj Kumar Associate Professor, Department of Orthopedics, Shadan Institute of Medical Sciences, Hyderabad, Telangana, India tomography (CT) with three-dimensional (3D) reconstruction improves the identification and visualization of fracture pattern which helps in decision-making and identifying the location of fracture fragments intraoperatively which in turn helps in decreasing the operative time and better functional outcome ^[3].

Complex fractures of the distal humerus are not amenable to single- column plating because of thin cortices for holding screws, wide medullary canal, relative osteopenia, and fracture comminution, which are proven to be less stable to loads as compared to bicolumnar plating. Based on the clinical and biomechanical studies ^[4, 5, 6, 7], fixation with double plating is currently recommended for the management of distal humerus fractures. The precontoured bicolumnar anatomical locking plates are nowadays proven to be gold standard in treating the distal humerus fractures because the locking compression plate can be used both as a conventional plate using only dynamic compression and as a pure internal fixator using locking head screws. The purpose of this study was to assess the efficacy, technical requirements, functional outcome, radiological and clinical union, and complications of distal humerus fracture treated with bicolumnar plating.

Aims and Objectives

The Aim of the present study is to evaluate the Functional Outcome of Surgical Management of distal Humerus fractures by Open Reduction and Internal using bicolumnar plating technique.

Materials and Methods

A total of 30 distal humerus fractures admitted in teaching and general hospital were operated included in the study. Patients fitting in to inclusion criteria were selected. All the patients were operated with ORIF with precountered locking distal humerus plates in orthogonal fashion and outcome was measured by MEPS, rate of union, rate of complications and final range of motion.

Inclusion criteria were (a) the patients with closed distal humerus fractures, (b) age limit: mature skeleton, and (c) patients who were medically fit for surgery. Exclusion criteria were (a) medically unfit patients for surgery, (b) compound fractures, (c) patients not willing for surgery, (d) pathological fractures, and (e) infections. On admission, detailed examination of the patients was done after hemodynamic stabilization, which includes screening for head, abdominal, and pelvic injury, and patients were subjected to routine preoperative investigations. All our patients received primary immobilization with an above-elbow slab. X-rays of the elbow with humerus, both anteroposterior and lateral views were taken. Patients with severe comminution required CT scan/3D CT scan for better understanding of fracture anatomy. Patients were operated in lateral decubitus position with upper arm supported by a padded post/bolster with the application of the tourniquet in the upper arm. Posterior approach with Chevron osteotomy was used, and fixation was done using 4 mm CC screws and bicolumnar plating. Osteotomy was fixed with k wire and tension band wiring, and the wound was closed in layers. Postoperatively, strict limb elevation was given to reduce swelling and active finger movements was started. Above-elbow slab was given for 1 week, for soft tissue to heal. Suction drain removal and first wound check dress were done on day 3. Intravenous antibiotics were continued for 3-5 days. Postoperative physiotherapy was started depending on the stability of the fixation, and in most of the cases, range of motion (ROM) of

the elbow was initiated by 7–10days, to give time for soft tissues to heal and to prevent wound gaping. Suture removal was done on 10–14 days. The first follow-up was at 6 weeks and subsequent follow-ups were done at 3 months, 6 months, and at 1 year and 2 years. In each follow-up, the functional MEPS (excellent >90, good 75–89, fair 60–74, and poor <60) was recorded to compare the improvement or deterioration in the outcome. At every follow-up, X-rays were taken to check for union, delayed union, nonunion, and implant failure. We also assessed elbow range of movements, explained the role of physiotherapy in getting full range of elbow movements.

Results

In our series of 3 0 cases, there were 22 males and 8 females with average of 36.8 years. 17 cases were due to direct fall, 10 due to road traffic accident and 3 due to direct assault. There was a predominance of left side (24). Out of 30 cases, 6 (20%) were of C1 type, 21(70%) were of C2 type and 3 (10%) were of C3.

 Table 1: Type of fracture- ao classification

Type of fracture (Ao classification)	No. of cases	Frequency
B2	0	0%
C1	6	20%
C2	21	70%
C3	3	10%

Left-sided fractures were seen in 80% of cases. Associated fractures were seen in 20% of patients, in that 14% were distal end radius (DER) fractures, and Monteggia and proximal humerus fractures were 3% each. Duration of trauma was <10 days in 80% and >10 days in 20% of the cases, with an average of 8.68 days and the range from 2 to 17 days.

Table 2: Duration of trauma

Duration of trauma	No. of cases	Frequency
< 10 days	24	80%
>10 days	6	20%

Excellent results in 21, good in 6 and fair in 3 cases, according to MEPS. There were 3 (10%) cases each of superficial infection and 3 (10%) cases of ulnar neuropathy, treated accordingly. There were no cases of non-union, implant failure or heterotopic ossification.

Table 3: Complications after surgery

Complications	Frequency
Superficial infections	10%
Deep skin infections	4%
Neuropraxia	10%
Screw back out	3%
Implant failure	3%
Non union	3%
Stiffness	3%
Implant prominence	2%

We used conventional plates in 40% and locking plates in 60% of the patients. 60% of the patients required >120 min for surgery and 40% required <120 min; ulnar nerve transposition was done in 22% of the patients mainly in C2 and C3 fractures.

Intraoperative complications noted were difficulty in reduction (9%) and unstable fixation (10%). The average blood loss was 157 ml with a range of 100–220 ml. Early postoperative complications were superficial skin infection

(10%), deep infection (4%), and neuropraxia (10%); the late postoperative complications were screw back-out (3%), implant failure (3.%), stiffness (3.%), nonunion (3%), and implant prominence (2%).

In the present study, 40% of the patients showed clinical union at 1–3 months and 60% in 3–6 months with an average of 14 weeks with a range of 10–24 weeks. 29% of patients showed radiological union at 1–3 months and 73% showed at 3–6 months with an average of 18 weeks with a range from 10 to 28 weeks and the average ROM observed was 104.66°.

We observed 8% unstable fixation, 4% difficult reduction with conventional plating, and 6% difficult reduction with locking plate intraoperatively. 44% of patients with C1 fractures and 41% of patients with C2 fractures showed excellent-to-good functional outcome; 36% of patients with conventional bicolumnar plate and 52% of patients with locking bicolumnar plate showed excellent-to-good functional outcome; and the difference was not statistically significant (P = 0.916). The mean MEPS was 78 at 3 months, 83.2 at 6 months, and 85.2 at 1 year, and we observed 39% excellent outcome, 49% good outcome, 12% fair outcome, and 3% poor outcome

Table 4: Outcome of the surgery.

Outcome	Frequency
Excellent	39%
Good	49%
Fair	12%
Poor	3%

Discussion

The peak incidence of fracture was found to be in the age group of 36.8 years, because of falls, which is comparable to the study by Ditsios *et al.* ^{[]8} majority of the patients were

males comprising 80%, which is similar to study by Pantalone *et al.*^[9] and Biz *et al.*^[10].

Left-sided fractures were more, which is similar to Kumar *et al.* ^[11] 17 cases were due to direct fall, 10 due to road traffic accident and 3 due to direct assault which is comparable to the study by Biz *et al.* ^[10] Out of 30 cases, 6 (20%) were of C1 type, 21(70%) were of C2 type and 3 (10%) were of C3.

This is similar to the study by Kural *et al.* ^[12] Associated fractures were seen in 20% of patients, in that 14% were distal end radius (DER) fractures, and Monteggia and proximal humerus fractures were 3% each. Hence, detailed clinical examination of other joints such as ipsilateral wrist and shoulder is essential to diagnose other associated injuries as advised by Gradl and Jupiter^[13].

In CT scan in 17.14% of patients and 3D CT scan in 51.42% to know the fracture anatomy better preoperatively to prevent time consumption during surgery and to achieve accurate reduction. Gradl and Jupiter ^[13] suggested the use of CT scan for classification and preoperative planning of articular comminution.

The duration between trauma and surgery is essential to get better functional outcome; 39% excellent and 49% good outcome in patients treated before 10 days and it is comparable to Sailesh *et al.* ^[14] 60% of the patients required more than 120 min for surgery and 40% required <120 min. Most of the C2, C3 fractures and use of conventional plate required more time because of difficulty in reduction, maintaining reduction in osteoporotic bones and time consumption in bending, contouring of conventional plates, which is similar to the study by Kelkar and Rajput ^[15] with the Mean operating time of 120.33 min.

Anterior transposition of ulnar nerve was done in 22% of patients, mainly in types C2 and C3, because more fracture comminution can lead to excessive callus formation, which may compress the ulnar nerve. We did not find any ulnar nerve palsy after the anterior transposition. In the nonulnar nerve transposition group, one patient had ulnar nerve neuropraxia, which was recovered fully in 6 weeks and Patel et al.^[16] also observed one case of neuropraxia. Meticulous dissection and handling of ulnar nerve during surgery is important to prevent postoperative ulnar nerve injury. The intraoperative, early postoperative, and the late postoperative complications are similar to Patel et al. [16] we observed more complications (unstable fixation, nonunion, and screw backout) with the conventional plating. Nonunion was managed with bone grafting, stiffness was managed with continuous passive motion (CPM) exercises, superficial skin infection was managed with appropriate antibiotics and dressing, deep infections were managed with debridement and wound wash, and implant prominence was managed with implant removal after the fracture union. We observed less complications with locking bicolumnar plates, as it provides more stable fixation and hold the fracture fragments better till union occurs as it is a fixed angle implant.

44% of patients with C1 fractures and 41% of patients with C2 fractures showed excellent-to-good functional outcome; 36% of patients with conventional bicolumnar plate and 52% of patients with locking bicolumnar plate showed excellent-to-good functional outcome; and the difference was not statistically significant (P = 0.916). We observed the clinical union at 3–6 months in 60% and at 1–3 months in 40% of patients with an average of 13.94 weeks with a range of 10–24 weeks. Clinical union was assessed by absence of pain, tenderness, no motion at fracture site on examination, full range of movements at the nearby joints, and ability to perform daily routine activities without pain ^[15]. Radiological union was assessed by observing the callus formation on three cortices in two views ^[15] this is similar to the study by Kumar *et al.* ^[11] with an average union time of 14.6 weeks.

The mean_MEPS was 78 at 3 months, 83.2 at 6 months, and 85.2 at 1 year, and we observed 39% excellent outcome, 49% good outcome, 12% fair outcome, and 3% poor outcome, which is similar to the study by Ditsios *et al.* ^[8] and the mean MEPS in the present study is 84.42, which is similar to Kural *et al.* ^[12] Four patients got the ROM more than 120°, 23 got 100°–120°, and 08 patients got <100°. The mean ROM achieved was 106.51° with a range from 80° to 128°, which is similar to Daniel *et al.* ^[17] It is important to start the elbow mobilization early to get better ROM and better functional outcome.

Conclusion

Open reduction and internal fixation is the treatment of choice for distal humerus fracture mainly in the type B and type C fractures. Careful examination of ipsilateral shoulder and wrist is essential to rule out other associated fractures. Fracture types influence the final functional outcome along with stable internal fixation that is C1 fractures have better functional outcome than C3 fractures. Preoperative CT scan is very essential for planning of surgery, and early surgery is recommended to get better elbow ROM and good functional outcome. Locking compression plate is the better option to treat distal humerus fractures with good functional outcome and less complications as compared to conventional plates. Anatomical reduction, stable fixation, and early elbow mobilization are the prerequisite for the better functional outcome.

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Conflict of Interest

None

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References

- 1. Palvanen M, Kannus P, Parkkari J, Pitkäjärvi T, Pasanen M, Vuori I, *et al.* The injury mechanisms of osteoporotic upper extremity fractures among older adults: A controlled study of 287 consecutive patients and their 108 controls. Osteoporos Int. 2000;11:822-31.
- 2. Robinson CM, Hill RM, Jacobs N, Dall G, Court-Brown CM. Adult distal humeral metaphyseal fractures: Epidemiology and results of treatment. J Orthop Trauma. 2003;17:38-47.
- 3. Brouwer KM, Lindenhovius AL, Dyer GS, Zurakowski D, Mudgal CS, Ring D. Diagnostic accuracy of 2-and 3dimensional imaging and modeling of distal humerus fractures. J Shoulder Elbow Surg. 2012;21:772-6.
- 4. Watson JD, Kim H, Becker EH, Shorofsky M, Lerman D, O'toole RV, *et al.* Are two plates necessary for extraarticular fractures of the distal humerus?. Current Orthopaed Pract. 2014;25:462-6.
- 5. Corradi A, Talamonti T, Cabitza P, Bottiglieri G, Secondi F. Innovative techniques for the osteosynthesis of distal humeral fractures. Injury. 2010;41:1117-9.
- Caravaggi P, Laratta JL, Yoon RS, De Biasio J, Ingargiola M, Frank MA, *et al.* Internal fixation of the distal humerus: A comprehensive biomechanical study evaluating current fixation techniques. J Orthop Trauma. 2014;28:222-6.
- 7. Taylor PA, Owen JR, Benfield CP, Wayne JS, Boardman ND 3rd. Parallel plating of simulated distal humerus fractures demonstrates increased stiffness relative to orthogonal plating with a distal humerus locking plate system. J Orthop Trauma 2016;30:e118-22.
- 8. Ditsios K, Stavridis SI, Savvidis P, Dinopoulos H, Petsatodis G. Midterm clinical and radiological outcomes of the surgical treatment of complex AO type C distal humeral fractures with two different double plate fixation techniques. Hippokratia. 2017;21:38-42.
- 9. Pantalone A, Vanni D, Guelfi M, Belluati A, Salini V. Double plating for bicolumnar distal humerus fractures in the elderly. Injury. 2017;48(3):S20-3.
- Biz C, Sperotto SP, Maschio N, Borella M, Iacobellis C, Ruggieri P. The challenging surgical treatment of closed distal humerus fractures in elderly and octogenarian patients: radiographic and functional outcomes with a minimum follow-up of 24 months. Archives of Orthopaedic and Trauma Surgery. 2017;137:1371-83.
- 11. Kumar J, Katto MS, Ahmed MW, Jamil M, Rajput IM, Siddiqui AA, *et al.* Dual plating osteosynthesis technique used for fixation of inter-condylar distal humerus fractures via transolecranon approach. J Liaquat Univer Med Health Sci. 2017;16:139-44.
- 12. Kural C, Ercin E, Erkilinc M, Karaali E, Bilgili MG, Altun S. Bicolumnar 90-90 plating of AO 13C type fractures. Acta Orthop Traumatol Turc. 2017;51:128-32.

- 13. Gradl G, Jupiter JB. Current concepts review-fractures in the region of the elbow. Acta Chir Orthop Traumatol Cech. 2012;79:203-12.
- 14. Senthil Sailesh S, Kannan P, Vignesh PS. Clinical Outcome Analysis of Parallel Plate Technique in Distal Humerus Fractures, International Journal of Scientific Research, 2017, 6pp.
- 15. Kelkar R, Rajput DS. Functional outcome of orthogonal plating in treatment of distal humerus fracture. Int J Orthopaed. 2018;4:78-83.
- 16. Patel J, Motwani G, Shah H, Daveshwar R. Outcome after internal fixation of intraarticular distal humerus (AO type B & C) fractures: Preliminary results with anatomical distal humerus LCP system. J Clin Orthop Trauma. 2017;8:63-7.
- 17. Leigey DF, Farrell DJ, Siska PA, Tarkin IS. Bicolumnar 90-90 plating of low-energy distal humeral fractures in the elderly patient. Geriatr Orthop Surg Rehabil. 2014;5:122-6.