

Outcome of Intra-Articular Elbow Fracture Treated with Dual Plate Fixation

Kashyap L Zala¹, Kamaleshkumar A Patel^{2*}

¹Associate Professor, Department of Orthopaedic, GMERS Medical College and Hospital, Himmatnagar, Sabarkantha, Gujarat, India

²Associate Professor, Department of Orthopaedics, GMERS Medical College and Hospital, Himmatnagar, Sabarkantha, Gujarat, India

***Address for Correspondence:** Dr. Kamaleshkumar A Patel, Associate Professor, Department of Orthopaedics, GMERS Medical College and Hospital, Himmatnagar, Sabarkantha, Gujarat, India

E-mail: drkamal1710@gmail.com

Received: 19 Oct 2024/ Revised: 30 Nov 2024/ Accepted: 21 Feb 2025

ABSTRACT

Background: Elbow fractures are a heterogeneous group of injuries ranging from simple non-displaced to complex with associated soft tissue injury. Intra-articular distal humeral fractures must be treated surgically with utmost precision for optimal recovery. Dual plate fixation is a relatively new technique that has shown good results in these complex injuries; however, its comparative effectiveness remains controversial.

Methods: A prospective study was conducted on 50 patients between the ages of 19 and 70 years with intercondylar humeral fractures managed by surgical treatment using dual plating. The exclusions included unfit patients, compound fractures, and pediatric cases. The surgical procedure involved a posterior midline incision, olecranon osteotomy, and fixation with lag screws and dual plates in a 90-90 configuration. Postoperative care included elevation, early mobilization, and infection prophylaxis.

Results: The commonest complication was stiffness in the elbow, affecting 20% of the patients, delayed healing in 16%, infection in 10%, and hand wasting in 8%. Based on the Mayo Elbow Performance Score, 24% of the functional outcomes were excellent, while 40% had good results, 20% had fair, and 16% had poor results. The greatest number of fractures was sustained from road traffic accidents, 70%; more in males, 70%; and in the right upper limb, 60%.

Conclusion: Dual plate fixation is an effective way to manage complex intra-articular elbow fractures, ensuring good functional outcomes and stability. While stiffness and delayed healing were significant complications, overall recovery and patient satisfaction were quite favourable. Further comparative studies are needed to refine techniques and improve outcomes.

Key-words: Elbow fractures, Dual plate fixation, Intra-articular fractures, Mayo Elbow Performance Score, Complications

INTRODUCTION

Elbow fractures are an extremely variable group of injuries to bones in the region of the elbow joint, ranging from simple non-displaced to complex ones with associated soft tissue damage ^[1]. They are classified into types of displacement, such as posteromedial or posterolateral.

These are very common fractures in both adults and children, resulting from several mechanisms. Proper diagnosis and timely intervention will avoid complications and enable optimal recovery ^[1].

Supracondylar fractures are the most common form of elbow fracture between the ages of 5 to 10. These fractures can be further classified as Type I or minimal displacement; Type II, or displaced but with an intact posterior cortex; and Type III, or complete displacement. Flexion-type fractures are uncommon and are less than 5%. Fractures of the lateral condyle, which affect 15-20% between ages 4-10, are typically Salter-Harris type IV ^[1]. Medial epicondyle fractures occur more in boys between the ages of 9-14 years, with medial elbow pain, and may be associated with sports-related injuries. Olecranon

How to cite this article

Zala KL, Patel KA. Outcome of Intra-Articular Elbow Fracture Treated with Dual Plate Fixation. SSR Inst Int J Life Sci., 2025; 11(2): 7245-7250.



Access this article online

<https://ijls.com/>

fractures are relatively rare but may be seen in association with other fractures. One important complication is neurovascular: brachial artery and median nerve damage ^[1].

Management of intra-articular elbow fractures is challenging due to stiffness and functional loss. Rehabilitation programs are very important and critical in treating intra-articular fractures of the elbow, though these have not always been shown to be able to ensure better recovery of improved range of motion (ROM) ^[2]. Properly developed and tailored plans for rehabilitation are essential for effective postoperative complication management. Early intervention and appropriate individualized management with the support of research in the establishment of evidence-based guidelines should be prompted for optimization of patient recovery, whether the patient receives a diagnosis of an unstable or a stable fracture of the elbow ^[2].

Intra-articular distal humeral fractures are complex injuries; inadequate treatment severely impairs elbow function. Most of these fractures need to be treated surgically to regain the elbow's range of motion and function ^[3]. Open reduction and internal fixation (ORIF) with plates and screws have gained maximum favour, with double plating being recommended especially for columnar fractures. The use of plates can be in parallel or orthogonal configurations. The olecranon osteotomy is one of the surgical approaches for ORIF; however, the Olecranon-preserving techniques that make use of the triceps-reflecting, triceps-splitting, participial, and anconeus pedicle approaches are increasingly employed ^[3]. The procedure is done to identify the ulnar nerve and either decompressed in situ or transposed anteriorly. In elderly patients in whom bone quality is poor, elbow arthroplasty has been proposed as a potential alternative to ORIF ^[3].

Dual plating is chosen by many clinicians for the treatment based on the 2-column theory. Recently, anterolateral dual plate fixation (ADPF) has been quite promising surgical method and may improve treatment efficiency compared with lateral single-plate fixation without significantly increasing incision sites and operation time. However, previous studies advocating ADPF were all subject to small samples with insufficient biomechanical evidence ^[4]. While dual-plating osteosynthesis is considered the gold standard in these fractures, the optimal position of plates is still debated,

and there seems to be no unanimous agreement as to whether orthogonal or parallel configurations enjoy more favourable clinical outcomes. Modern, contoured, locking compression plates further complicate this question ^[5]. Increased stiffness associated with parallel plating was suggested by biomechanical studies. There is almost a complete lack of rigorous clinical investigation on the subject, and there is scant literature on outcomes after operative treatment ^[5].

The purpose of the present study is to evaluate the outcomes of dual plate fixation for intra-articular elbow fractures in terms of clinical recovery, functional improvement, complication rates, and patient satisfaction. The underlying hypothesis is that dual plate fixation offers superior treatment outcomes compared to other available methods. This study aims to contribute to the existing literature in orthopaedics and trauma care, support the development of improved patient management strategies, and potentially influence clinical guidelines and best practices.

MATERIALS AND METHODS

Study Design and Participants- This prospective study was conducted on 50 patients presenting with intercondylar distal humerus fractures at a tertiary care hospital in India. The study duration and ethics clearance details (if applicable) can be added here.

Inclusion Criteria

- ✓ Patients aged between 19 and 70 years
- ✓ Radiologically confirmed intercondylar fractures of the distal humerus
- ✓ Medically fit and willing for surgical intervention

Exclusion Criteria

- ✓ Patients with compound fractures
- ✓ Patients who were unfit or unwilling for surgery
- ✓ Pediatric cases (age <18 years)
- ✓ Patients with associated major neurovascular injuries

Preoperative Evaluation- All patients underwent thorough clinical examination and radiographic evaluation (AP and lateral X-rays). A temporary above-elbow POP slab was applied, and surgical fitness was assessed.

Surgical Procedure

Positioning and Preparation- Patients were positioned laterally. A tourniquet was applied, and the arm was disinfected and draped.

Incision and Exposure- A posterior midline incision was made. The ulnar nerve was identified and retracted. A chevron olecranon osteotomy was performed to expose the articular surface.

Fracture Fixation- The fracture was reduced and temporarily stabilized with K-wires. Final fixation was achieved using lag screws and dual plates in a 90–90 orthogonal configuration.

Wound Closure- The olecranon osteotomy was fixed with tension band wiring. The wound was closed over a suction drain, and a posterior POP slab was applied.

Postoperative Care and Rehabilitation

Elevation of the limb and early finger movements were encouraged.

Antibiotics- Third-generation cephalosporins were administered intravenously for 5 days and continued orally for another 7 days.

Mobilization- Active elbow mobilization was initiated in the early postoperative period.

Follow-up- Sutures were removed on postoperative day 10. Postoperative radiographs were taken to assess fixation.

Statistical Analysis- All collected data were compiled and analyzed using Microsoft Excel and SPSS software. Descriptive statistical methods were employed to interpret the results. Categorical variables such as complication rates, gender distribution, mode of injury, and Mayo Elbow Performance Scores were presented as frequencies and percentages. Continuous variables such as age were expressed as mean and range. The functional outcomes were evaluated using the Mayo Elbow Performance Score and categorized into excellent, good, fair, and poor based on standard scoring criteria. This statistical approach enabled a comprehensive understanding of the patient demographics, clinical outcomes, and the incidence of postoperative complications following dual plate fixation.

RESULTS

Table 1 shows complications among 50 patients treated for lower-end humerus fractures. The commonest complication was stiffness of the elbow, seen in 20%, followed by delayed healing in 16% of the cases. Infection in 10% and hand wasting in 8% were seen. These results suggest that post-operative elbow stiffness and delayed healing are important concerns, evidencing the need for focused rehabilitation with timely strategies of management in mitigating these issues.

Table 1: Complications Seen in Patients Treated for Lower-End Humerus Fracture

| Complications | No. of patients (n=50) | Percentage (%) |
|-----------------|------------------------|----------------|
| Elbow stiffness | 10 | 20% |
| Infection | 5 | 10% |
| Delayed healing | 8 | 16% |
| Hand wasting | 4 | 8% |

Table 2 provides an overview of the distribution of study participants according to the Mayo Elbow Performance Score. Of those, 24% had results of 91-100, and 40% turned in good results from 75-90. Fair results were found in 20%, and 16% had poor results of less than 60. These results suggested that most patients, 64%, had good outcomes after surgery, among which a large number turned out to have excellent or good MEP scores, indicating that the condition of most of the patients was well managed and rehabilitated.

Table 2: Distribution of Patients According to the Mayo Elbow Performance (MEP) Score Among Participants in the Study

| MEP score range | Categories | No. of patients (n=50) | Percentage (%) |
|-----------------|------------|------------------------|----------------|
| 91-100 | Excellent | 12 | 24% |
| 75-90 | Good | 20 | 40% |
| 60-74 | Fair | 10 | 20% |
| <60 | Poor | 8 | 16% |

Most of the patients in this study had injuries from road traffic accidents, which accounted for 70% and became the most common mechanism. There was more frequent affection of the right upper limb than the left, which was 60%.

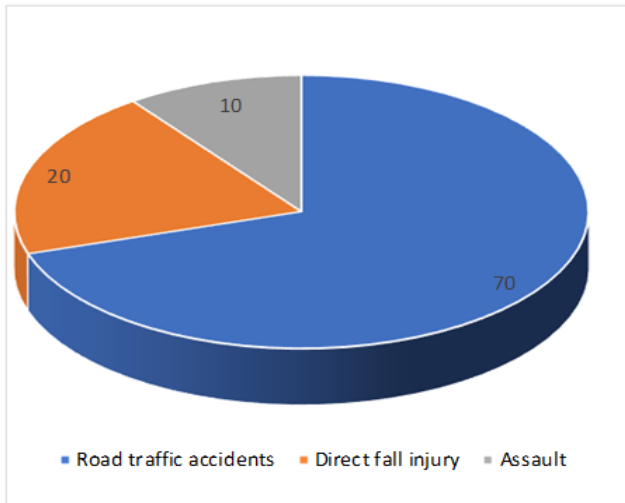


Fig. 1: Mode of injury distribution

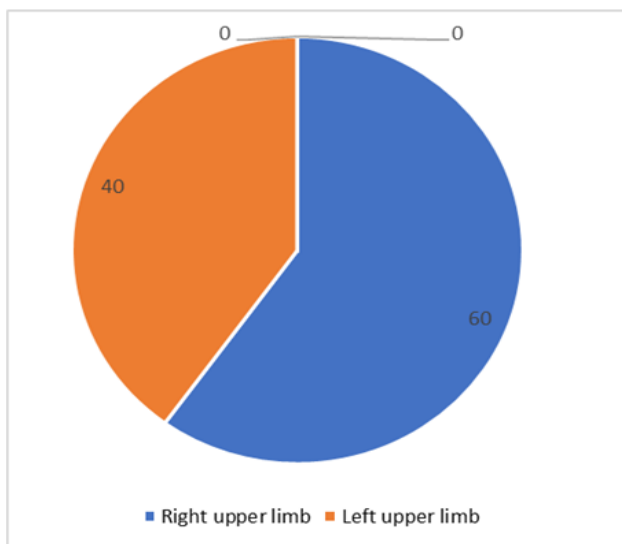


Fig. 2: Side involvement of the patients

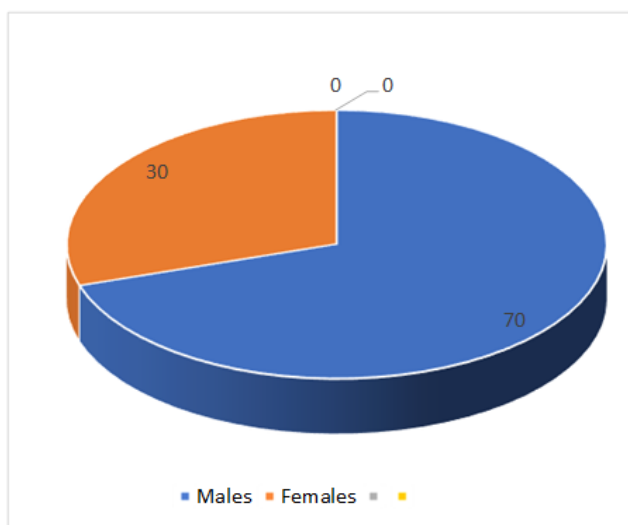


Fig. 3: Gender distribution

findings reflect typical patterns in most trauma settings, where males and road traffic accidents are commonly observed to be the major contributors to upper-limb fractures (Fig. 1-3).

DISCUSSION

Dual-plate osteosynthesis for intra-articular distal humerus fractures initially used orthogonal constructs as described by Schuster *et al.* [6] in 1985 and emphasized by ASIF guidelines [6]. In a series of 39 patients, 27 patients (69.2%) showed good or excellent results whereby an orthogonal plate provided stability, which allows early motion [7,8]. However, further research demonstrated that the failure rate with this method was 20% to 25%, so in 2005, O'Driscoll adopted the parallel plating technique. The parallel plating technique was introduced for better fixation of the distal segment and more stability for the supracondylar joint [9]. Although these findings may be indicative, comparative literature regarding the effectiveness of parallel versus orthogonal plating remains scant and indefinite, ultimately leaving the most optimal plating strategy for comminuted, bicolunar distal humerus fractures debated [5].

In a study by Kavi *et al.*, there were 20 patients with fractures of the distal humerus treated by ORIF 65% of the patients were males and 35% were females, while in our study, 70% were males and 30% were females. 60% of the fractures occurred on the left side, while in our study, it was more commonly involved on the right side. Considering the mode of injury, a previous study showed that 55% of the fractures were due to falls from height and 45% from RTAs, while in our study, RTAs constituted about 70%, followed by direct falls at about 20%. Complications in the previous study included a 10% superficial infection rate at the site, like our study where it was comparable with varied complication profiles. As for the functional outcome, Kavi *et al.* described 85% excellent and 15% good according to the Mayo Elbow Performance Score; in our study, 40% had excellent, 30% good, 20% fair, and 10% poor outcomes, thus showing a slightly lesser percent of an excellent outcome and more variation in recovery levels. These differences underscore some of the differences in the demographics of patients and injury mechanisms between the studies and with differences in functional outcomes [10].

In a study by Shaik *et al.*, 80% of the cases belonged to the age group of 18-40 years. In our study, the age of the

Also, male patients had a greater predominance in this study, accounting for 70% of the cases, thereby suggesting a greater exposure to risk in this group. These

patients with these types of injuries ranged from 19 to 70 years, and the age distribution in our series was more uniform. In both studies, RTA was the major mode of injury, although Shaik *et al.* observed RTAs as the major cause for 70% of cases, while in our study RTAs accounted for 60% of cases with additional contribution from falls. Shaik *et al.* reported 70% of patients were male and 60% had fractures on the right upper limb which is closely approximated with our findings of 65% male patients and 60% involvement on the left side. The study reported the clinical results according to MEP score as 20% excellent, 50% good, 25% fair, and 5% poor. In our study, patients had 40% excellent, 30% good, 20% fair, and 10% poor outcomes, which proves that our cohort had a higher percentage of excellent results. This could be attributed to different demographic populations compared with the earlier trial, the differences in injury severity, or treatment protocols [11].

Dual plate fixation of elbow fractures gives added stability that reduces possible complications such as radial nerve palsy. It also yields good functional results manifesting in the form of good elbow joint function and a better range of motion compared to other techniques. There are fewer complications, and functional exercises can be started earlier, thereby yielding better overall results. Moreover, dual plating reduces implant-related symptoms and reoperations. It yields reliable fixation and good patient outcomes [10-12]. Dual plate fixation for elbow fracture has several limitations. The rate of soft tissue complications may be increased since it is an invasive technique. Sensory symptoms are also higher in patients in comparison with other fixation techniques. Besides, this method could lengthen the operative time, which is associated with some complications such as infections and ulnar neuropathy. In elderly patients, this fixation technique also showed high rates of complications despite its conventional use as a standard approach [13,14].

Further research in the realm of dual plate fixation of elbow fractures should be oriented toward comparative studies with other methods of fixation, biochemical investigations in construct stability, and long-term clinical results about patient-reported outcomes and complications. Optimal patient profiling and investigation into new techniques to improve efficacy while cutting down on associated complications are also imperative [4,11,12].

CONCLUSIONS

This study concluded that dual plate fixation has demonstrated efficacy as a surgical technique for the management of difficult intra-articular distal humerus fractures. This method provides secure fixation, facilitating early mobilization and enhancing positive functional recovery. Although elbow stiffness and protracted healing were the predominant consequences, most patients (64%) nonetheless had good to excellent outcomes, as assessed by the Mayo Elbow Performance Score. These findings underscore the significance of focused post-operative therapy in reducing functional impairments and enhancing recovery. The research underscores the necessity for continuous clinical oversight and enhancement of surgical and rehabilitative approaches to mitigate complication rates. The findings endorse dual plating as a dependable method for rehabilitating elbow function in complex fracture scenarios. The study emphasizes the importance of future research to refine treatment methods and improve patient outcomes after lower-end humerus fractures.

CONTRIBUTION OF AUTHORS

Research concept- Dr Kashyap L Zala, Dr Kamaleshkumar A. Patel

Research design- Dr Kashyap L Zala

Supervision- Dr Kashyap L Zala

Materials- Dr Kamaleshkumar A. Patel

Data collection- Dr Kashyap L Zala

Data analysis and Interpretation- Dr Kamaleshkumar A. Patel

Literature search- Dr Kashyap L Zala

Writing article- Dr Kamaleshkumar A. Patel

Critical review- Dr Kamaleshkumar A. Patel

Article editing- Dr Kashyap L Zala

Final approval- Dr Kamaleshkumar A. Patel

REFERENCES

- [1] Saeed W, Waseem M. Elbow fractures overview. StatPearls Publishing, 2023. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK441976/>.
- [2] Donati D, Aroni S, Tedeschi R, Sartini S, Farì G, Ricci V, et al. Exploring the impact of rehabilitation on post-surgical recovery in elbow fracture patients: a cohort study. *Musculoskelet Surg.*, 2024.

- [3] Zalavras CG, Papasoulis E. Intra-articular fractures of the distal humerus—a review of the current practice. *Int Orthop.*, 2018; 42(11): 2653-62.
- [4] Ha C, Choi I, Lee JK, Oh J, Ahn W, et al. Anterolateral dual plate fixation for distal metaphyseal-diaphyseal junction fractures of the humerus: biomechanical finite element analysis with clinical results. *Clin Orthop Surg.*, 2024; 16(3): 493.
- [5] Haglin JM, Kugelman DN, Lott A, Belayneh R, Konda SR, et al. Intra-articular distal humerus fractures: parallel versus orthogonal plating. *HSS J.*, 2022; 18(2): 256-63.
- [6] Schuster P, Thomsen M, Keller J, Smolen D, Fürnstahl P, et al. Operative treatment of intra-articular distal humerus fractures: outcomes and prognostic factors. *J Shoulder Elbow Surg.*, 2021; 30(8): 1805–13. doi: 10.1016/j.jse.2020.12.016.
- [7] McKee M, Jupiter J, Toh CL, Wilson L, Colton C, et al. Reconstruction after malunion and nonunion of intra-articular fractures of the distal humerus: methods and results in 13 adults. *J Bone Joint Surg Br.*, 1994; 76: 4.
- [8] Sanchez-Sotelo J, Torchia ME, O’Driscoll SW. Complex distal humeral fractures: internal fixation with a principle-based parallel-plate technique. *J Bone Joint Surg Am.*, 2007; 89(5): 961-69.
- [9] O’Driscoll SW. Optimizing stability in distal humeral fracture fixation. *J Shoulder Elbow Surg.*, 2005; 14(1): S186-S94.
- [10] Kavi S, Patel I, Amin T, Makwana V, Prajapati M, et al. Results of intra-articular distal humerus fracture treated with open reduction and internal fixation. *J Orthop Dis Traumatol.*, 2023; 6(1): 3.
- [11] Shaik RB, Reddy V, Naidu A. Study of clinical outcome in intra-articular distal humerus fractures treated with dual plating. *Int J Res Med Sci.*, 2017; 5(6): 2438.
- [12] Zhang L, Sun C, Yang F. Therapeutic effect of dual plate internal fixation through triceps approach for the treatment of type C3 fracture of distal radius. *Zhongguo Gu Shang*, 2019; 32: 4.
- [13] Tanaka K, Takegami Y, Tokutake K, Oshika Y, Iwase K, et al. A less invasive operative method using a medial cannulated cancellous screw and single plate fixation for the treatment of transcondylar fracture of the humerus in elderly patients: a multicenter (TRON group) study. *Eur J Orthop Surg Traumatol.*, 2022; 33(6): 2481-87.
- [14] Plath JE, Förch S, Haufe T, Mayr EJ. Ellenbogenfraktur im Alter—Erhalt oder Ersatz? *Z Orthop Unfall.*, 2018; 156(1): 30-40.