

Evaluation of the Results of Open Reduction and Internal Fixation of Intercondylar Fracture of Distal Humerus in Adult by Lateral Condylar Locking Plate and Medial Condyle by Tension Band Wiring

*Siddique MA,¹ Rahman MW,² Hossain S,³ Hossain MM,⁴ Asaduzzaman⁵

Abstract

Background: The present prospective study was conducted to evaluate the functional outcomes of open reduction and internal fixation of Intercondylar fractures of the distal humerus in adults by lateral condylar locking plate and medial condyle by tension band wiring.

Methods: This study was conducted at NITOR over a period of two years. A total of 12 patients over 18 years irrespective of sex was included in this study. Only intra-articular fractures of distal humerus (Riseborough and Radin, 1996) type- III were included in this study. Patients with open fracture, fractures more than 3 weeks old and children's fractures were excluded from this study. This prospective study was carried out with an aim to evaluate the functional outcome of open reduction and internal fixation of intercondylar fractures of distal humerus in adults using lateral condylar locking plate and medial condyle by tension band wiring through extra-articular olecranon osteotomy approach within 3 weeks of incidence were enrolled in this study, who were admitted in National Institute Of Traumatology and Orthopedic Rehabilitation (NITOR) over a period of 2 years from January 2012 to December 2013.

Results: Out of 12 patients 1 patient (8.33%) was aged below 20 years, 8 (66.67%) aged 21-40 years and the rest 3 (25.0%) aged >40 years. Mean±SD was 32.50±6.40 and range 18-50 years. Out of 12 patients, 8 (66.67%) patients were male and 4 (33.33%) were female. Out of 12 study patients 2(16.67%) were housewives, 1(8.33%) businessman, 3(25%) service holder, 2(16.67%) student, 1(8.33%) farmer and 3 (25%) day labour. Out of 12 study patients distal humeral fracture in right upper limb 7(58.33%) and left upper limb 5(41.67%). Out of 12 patients, time gap between injury and operation was < 1 week in 9(75%) and > 1 weeks in 3 (25%) patients. Mean interval between injury and operation is 6 days with SD ±4.24. Out of 12 study patients, superficial infection was found in 2 (16.66%) and K-wire loosening in 1 (8.33%). On the final follow up 11(91.66%) patients had no limitation of performing comb hair and the rest 1(8.33%) had difficulty in performing comb hair. On the final follow up 91.66% of the patients could maintain personal hygiene and 8.33% could not maintain. On the final follow up 11(91.67%) of the patients had no limitation of wearing shirt /blouse and 1 (8.33%) of the patients had limitation. Out of 12 study patients, no pain was found in 11 (91.67%) patients and mild pain was found in 1 (8.33%) patient. According to Mayo Elbow Performance Scoring criteria the arc of motion of elbow was >100° in 10(83.34%) patients, arc (50 to 100)° in 2(16.66%) patients and motion arc < 50° in 0 (0%) patient. Finally, excellent result was found 11 (91.67%) & good result was found 1 (8.33%) of the study patients.

Conclusion: According to Mayo Elbow Performance Score, excellent and good outcome were considered as satisfactory & fair and poor outcome is considered as unsatisfactory. All 12 patients achieved satisfactory outcomes. No patient had an unsatisfactory outcome.

[Dinajpur Medical College Journal, 2026 Jul; 19 (2):215-219]

[Former M Abdur Rahim Medical College Journal]

DOI: <https://www.doi.org/10.69861/djmcj.2026.19.2.10>

Keywords: Distal humerus fracture, intercondylar fracture fixation, open reduction internal fixation (ORIF), lateral condylar locking plate, and tension band wiring.

1. *Dr. Md. Abubaker Siddique, Assistant Professor, Department of Orthopedic Surgery, Dinajpur Medical College Hospital, Dinajpur, Bangladesh. dipuabsiddique@gmail.com. ORCID: <https://orcid.org/0009-0004-1931-6360>.
2. Dr. Md. Wahidur Rahman, Ex-Professor, Orthopedic Surgery, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh. ORCID: <https://orcid.org/0009-0001-7505-1203>.
3. Dr. Subir Hossain, Assistant Professor, Orthopedic Surgery, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh. ORCID: <https://orcid.org/0000-0001-5593-2153>.
4. Dr. Md Mobaraque Hossain, Assistant Professor(in situ), Orthopedic Surgery, Pirganj Upazila Health Complex, Rangpur, Bangladesh. ORCID: <https://orcid.org/0009-0002-6836-6597>.
5. Dr. Asaduzzaman, Assistant Professor(in situ), Orthopedic Surgery, National Institute of Traumatology and Orthopaedic Rehabilitation(NITOR) Dhaka, Bangladesh. ORCID: <https://orcid.org/0009-0005-7881-1801>.

*For correspondence

Introduction

Fractures around the elbow are critical injuries and always difficult to manage. Specially the intra-articular fractures are an orthopedic emergency and need special care to manage. If not treated properly, they end up with restricted elbow movement and limitation of daily activities. This ultimate poor outcome makes the orthopedic surgeons more cautious to face the problem with great care. Nowadays, newer, high-tech implants and surgical techniques have been introduced to treat these types of fractures with a view to obtain a good functional outcome. Desalt described the intercondylar fractures of distal end of humerus as one of the most difficult fractures to manage. His recommendations for treatment have ranged widely from essentially no treatment to operative reduction and extensive internal fixation.¹ The fracture management has become difficult by the fact that the fracture is relatively uncommon. Michael preferred open reduction and internal fixation for the treatment of displaced, intercondylar fractures of the distal end of the humerus. Adequate exposure is critical for visualization of the fracture fragments during reduction and fixation. It is generally agreed that the best exposure of both columns of the distal part of the humerus and articular surface is achieved through posterior approach which requires reflection of the extensor mechanism, typically through a triceps splitting approach or an olecranon osteotomy. For better outcome, anatomical reduction and rigid fixation is a must. Otherwise, it will end up with malunion or nonunion which may be disabling. Restricted elbow movement is common because of articular deformity, intra or extra-articular adhesion or changes in the articular cartilage. According to Henley, the recent treatment of intra articular fractures of distal humerus is immediate open reduction, stable internal fixation and early post-operative rehabilitation. Complex anatomical

configuration combined with the frequency of comminution and displacement of the fracture fragments make the surgical reconstruction difficult.² But newer implants and surgical skill can make it easier. By following the basic principles of atraumatic soft tissue technique, stable anatomical reduction of the fracture and early postoperative mobilization, approximately 75% good to excellent result can be expected. Orthopedic surgeons of our country also face difficulties regarding the management of above-mentioned fractures. Different surgical techniques and implants are used. In this study, we have preferred Müller posterior trans-olecranon approach in combination with extra-articular Chevron osteotomy for better visualization of fracture. To achieve stable fixation, we have used lateral condylar locking plate which is a new invention in orthopedic surgery ~~in addition~~ with in addition to tension band wiring for medial column fixation. Early post-operative rehabilitation was started, regular follow up was done and finally the patients were evaluated according to Mayo Elbow Performance Score. Through this study, we have tried to assess the efficacy of lateral condylar locking plate and tension band wiring in reconstruction of intercondylar fracture of distal humerus.³

Objective: To evaluate the outcome of open reduction and internal fixation of intercondylar fracture of distal humerus in adults by lateral condylar locking plate and medial condyle with tension band wiring and to assess the functional status of elbow joint by using Mayo Elbow Performance Score (MEPS).

Methods

This ~~is~~ was a Quasi experimental study among the adult patients with intercondylar fracture of distal humerus having Riseborough and Radin type III [Separation of the fragments with rotator deformity]

fracture, conducted in the National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka from January 2012 to December 2013. This study included adult patients with intercondylar fracture of distal humerus having Riseborough and Radin type III, attending at the emergency, outpatient and indoor departments of NITOR. Total number of patients was 12.

Inclusion criteria included -Adult Patients between the age of 18-60 years with Intercondylar fracture of distal humerus, fractures not more than 3 weeks old. Exclusion criteria included-Fracture more than 3 weeks, multiple fractures, open fracture. A structured data collection form was developed containing all the variables of interest. Data were collected by interview, observation and clinical examination. A pre-designed data sheet containing history and examination findings of the patient, operative procedure and follow-up were used to collect the data. Collected data were compiled and tabulated according to key variables. All statistical analysis of different variables were analyzed by standard statistical methods using SPSS 17(Statistical Package for Social Sciences). For all analytical tests, the level of significance was set at 0.05 and $p < 0.05$ was considered as significant. The summarized data were presented in the form of tables.

Results

The present study was intended to evaluate the outcome of open reduction and internal fixation of intercondylar fracture of distal humerus in adult by lateral condylar locking plate and tension band wiring in medial column through extra-articular, trans-olecranon approach. The findings derived from data analysis are documented below. From January 2012 to December 2013, a total number of 12 patients were selected for this study at NITOR. Age range was 18-60 years,

male-08 and female-04. All the patients were radiologically and clinically evaluated. Every patient was followed up regularly at least up to 6 months.

Table I :Post-operative complications of the study patients

Complication	No. of patient	Percentage (%)
Superficial Infection	2	16.66
Implant loosening	1	8.33

Table I shows that out of 12 study patients, superficial infection was found in 2 (16.66%) patients and implant loosening was found in 1 (8.33%) patient.

Table II :Distribution of the patients according to pain symptom (n=12)

Type of pain	Frequency	Percentage (%)
No pain	11	91.67
Mild pain	1	8.33
Moderate pain	0	0
Severe pain	0	0
Total	12	100

Table II shows that out of 12 study patients no pain was found in 11 (91.67%) patients and mild pain was found in 1 (8.33%) patient.

Table III: Distribution of the patients according to the motion arc of elbow joint (n=12)

Motion	Frequency	Percentage (%)
Arc $> 100^0$	10	83.33
Arc (50 to 100^0)	02	16.67
Arc $< 50^0$	00	00
Total	12	100.00

Table III shows that according to the Mayo Elbow Performance Scoring criteria the arc of motion of elbow was $> 100^0$ in 10(83.33%)

patients, arc (50 - 100)⁰ in 2 (16.67%) patients and motion arc < 50⁰ in 0 (00%) patient.

Table IV: Final outcome of the patients. Evaluation of the outcome at final follow up (n=12)

Outcome	Number of patients	Percentage (%)
Excellent	11	91.67
Good	01	08.33
Total	12	100

Table IV shows that out of 12 patients, excellent result was found in 11 (91.67%) patients & good result was found in 1 (08.33%) patient. According to the Mayo Elbow Performance Score, excellent and good outcome are considered as satisfactory & fair and poor outcome are considered as unsatisfactory. Out of 12 patients, satisfactory result was found in all 12 study patients. No patient was found unsatisfactory.

Discussion

Intercondylar fractures of the distal humerus are relatively uncommon injuries and always difficult to manage. Treatment option varies widely from conservative to extensive surgical intervention. But for better functional outcome, surgery is preferred. Surgical techniques and implants vary from surgeon to surgeon and outcome also varies from each other. We have conducted this study at NITOR over a period of two years from January 2012 to December 2013 on 12 adult patients having intercondylar fracture of distal humerus to assess the functional outcome of open reduction and internal fixation of intercondylar fractures of distal humerus in adult by lateral condylar locking plate and medial condyle by tension band wiring. In this study, all the patients were aged over 18 years irrespective of sex. Only intra-articular fractures of distal humerus Riseborough and Radin type- III were included in this study.⁴ Patients with open fracture, fracture more than 3 weeks old,

multiple fractures and fractures with other comorbidities were excluded from this study. In this study, we have preferred posterior Müller trans-olecranon approach. Extra-articular Chevron osteotomy was done, lateral column was fixed with lateral condylar locking plate and medial column by tension band wiring. Drain off and stitches off were done on second and fourteen post operative day respectively. Long arm back slab was removed after two weeks and elbow bag was applied for the next two weeks. Early post-operative exercise of the shoulder, elbow and wrist were started as pain permitted. Follow-up was done after two, four, eight, twelve and twenty-four weeks. In each follow-up, patients were carefully evaluated clinically and radiologically.⁵ For few cases, physiotherapy was done in respective department. Final follow-up was done after twenty-four weeks and the functional outcome was evaluated according to Mayo Elbow Performance Score. In this study, out of 12 patients, 1 patient (8.33%) was aged below 20 years, 8(66.67%) were aged between 21-40 years and the rest 3(25.0%) were aged > 40 years. Mean $\pm$ SD was 32.50 $\pm$ 6.40 and range was 18-60 years. Out of 12 patients, 8(66.67%) were male and 4(33.33%) were female. Out of 12 patients 2 (16.67%) were housewife, 1(8.33%) was businessman, 3(25%) were service holder, 2(16.67%) were student, 1(8.33%) was farmer and 3 (25%) were daily labourer. Out of 12 study patients, distal humeral fracture in right side was 7(58.33%) and left side was 5(41.67%). Out of 12 patients, time gap between injury and operation was < 1 week in 9 (75%) and > 1 week in 3 (25%) patients.⁶⁻⁹ Mean interval between injury and operation was 6 days with SD $\pm$ 4.24. Regarding post operative complications, superficial infection was found in 2 (16.67%) and K-wire loosening in 1(08.33%) patient. On the final follow up 11(91.67%) patients had no limitation of performing comb hair and the rest 1(08.33%)

had difficulty in combing the hair, 11 (91.67%) patients could maintain personal hygiene properly and 1 (8.33%) had difficulty to maintain.¹⁰⁻¹³ On the final follow up 11 (91.67%) patients had no limitation of wearing shirt/blouse and 1 (8.33%) patient had limitation. Out of 12 study patients, no pain was found in 11 (91.67%) patients and mild pain was found in 1 (8.33%) patient. According to Mayo Elbow Performance Scoring criteria, the arc of motion of elbow was $>100^{\circ}$ in 10 (83.33%) patients, arc $(50-100)^{\circ}$ in 2 (16.67%) patients and motion arc $< 50^{\circ}$ in 0 (00%) patient. Finally excellent result was found in 11 (91.67%) patients and good result was found in 1 (8.33%) patient. According to the Mayo Elbow Performance Score, excellent and good outcomes are considered as satisfactory & fair and poor outcomes are considered as unsatisfactory. Out of 12 patients, satisfactory result was found in all 12 patients and no patient was found unsatisfactory.¹⁴

Conclusion

Treatment of the inter-condylar fracture of the distal humerus in adults by open reduction and internal fixation with lateral condylar locking plate in lateral column and tension band wiring in medial column provides adequate stability to allow for the early start of post-operative functional rehabilitation with a predictably high rate of fracture union, there by better functional and anatomical results can be achieved.

References

1. Lottes J. Medullary nailing of the tibia with the triflange nail. Clin. Orthop. 2011; 105: 253-266.
2. Wiss DA. Flexible medullary nailing of acute tibial shaft fractures. Clin. Orthop. 2012; 212: 122-132.
3. Alho A, Benterud JG, Høgevoll, HE, Ekstrand A, Stromsøe K. Comparison of functional bracing and locked intramedullary nailing in the treatment of displaced tibial fractures. Clin Ortho. 2007; 277: 243-50.
4. Brug E, Pennig D. Indications for interlocking nailing. Unfallchirurg 2009; 93: 492-8.
5. Tanna D.D. Interlocking tibial nailing without an intensifier. J Bone Joint Surg (British) 2011; 76: 670.
6. Alho A, Ekstrand A, Stromsøe K, Folleras G, Thoresen BO. Locked intramedullary nailing for displaced tibial shaft fracture. J Bone Joint Surg (British). 2010; 805-9.
7. Gleeson NFR, Nachinolcar UG. Management of fracture shaft of tibia interlocking nailing versus plating. Indian J Orthopaed. 2009; 32: 103-6.
8. Thomas A Russell. Fractures of Tibia and Fibula. Rockwood and Greens - Fractures in Adults, 4th edition, 2010; 2109-20.
9. Court Brown CM, Christie J, McQueen MM. Closed Intramedullary Tibial Nailing: Its use in closed and Type I open fractures. J Bone Joint Surg. 2012; 72B:605-11.
10. Whelan DB, Bhandari M, McKee MD, et al. Interobserver and intraobserver variation in the assessment of the healing of tibial fractures after intramedullary fixation. J Bone Joint Surg [Br] 2008; 84-B: 15-18.
11. Whelan DB, Bhandari M, Stephen D, et al. Development of the radiographic union score for tibial fractures for the assessment of tibial fracture healing after intramedullary fixation. J Trauma 2010; 68:629-632.
12. Moed BR, Watson JT, Goldschmidt P, van Holsbeeck M. Ultrasound for the early diagnosis of fracture healing after interlocking nailing of the tibia without reaming. Clin Orthop Relat Res. 2007; 310:137-144.
13. Tower SS, Beals RK, Duwelius PJ. Resonant frequency analysis of the tibia as a measure of fracture healing. J Orthop Trauma. 2008; 7:552-55
14. Esterhai J, Alavi A, Mandell GA, Brown J. Sequential technetium-99m/ gallium-67 scintigraphic evaluation of subclinical osteomyelitis complicating fracture nonunion. J Orthop Res. 2009; 3:219-225.