Section: Orthopaedics

Original Research Article

SURGICAL OUTCOME OF COMMUNITED DISTAL RADIUS FRACTURES BY EXTERNAL FIXATION

Vishwanath C[1], Yogitha B S[2], Rajeevratna Suresh Naik[3]

[1]Associate Professor, Department of Orthopaedics, Adichunchangiri Institute of Medical Sciences, B G Nagar, Mandya, Karnataka, India
[2]Associate Professor, Department of Anaesthesia, Sri Siddhartha Institute of Medical Science and research centre, T begur, Bengaluru, Karnataka, India.
[3]Assistant Professor, Department of Orthopaedics, Adichunchangiri Institute of Medical Sciences, B G Nagar, Mandya, Karnataka, India

Received : 20/12/2024
Received in revised form : 09/02/2025
Accepted : 24/02/2025

Keywords:
Communited distal radius fracture; External fixation, Ligamentotaxis; Intra-articular fracture.

Corresponding Author:
Dr. Vishwanath C,
Email: drvishwanathc24@gmail.com

DOI: 10.47009/jamp.2025.7.1.223

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (1); 1146-1150

Abstract

Background: Distal radius fractures are among the most common orthopedic injuries significantly affecting wrist function and daily activities. Preservation of the articular congruity is the principle prerequisite for successful recovery following distal radius fractures. The best method of obtaining and maintaining an accurate restoration of articular anatomy however, remains a topic of considerable controversy. The main aim of this study is to evaluate the results obtained by treatment of communited distal end radius fractures by external fixation. **Materials and Methods:** This is a prospective controlled study, 328 cases of unstable distal end radius fractures with / without intra-articular extension were treated with uniplanar static type of external fixation using the principle of ligamentotaxis and augmentation by K-wires from July 2013 to July 2023 at our tertiary rural hospital. The age group of the patients are 18 to 60 years, external fixator was applied for a duration of 6 to 8 weeks and cases were followed up for an average of 6 to 10 months post operatively. **Result:** Assessed as per Demerit point system of Gartland and Werley (modified by Sarmiento 1975) for functional results and criteria for anatomical results by Sarmiento (1975) at the end of 6-8 months of followup. Excellent anatomical result was seen in 72 patients, good results seen in 210 patients, fair results are seen in 33 patients with 13 poor result patients. **Conclusion:** External fixation is an effective, minimally invasive and cost efficient surgical method for treating communited distal radius fractures. External fixation and ligamentotaxis provides better functional and anatomical results in comminuted intra-articular and unstable extra-articular wrist injuries. The functional result of treatment of distal radius fractures not only depends on the anatomical restoration of the articular surface but also on the associated soft tissue injuries and articular damage.

INTRODUCTION

Fractures of the distal radius continue to be the most common skeletal injuries treated by the orthopedic surgeon. In fact these injuries are the most common fractures of the upper extremity and account for approximately 1/6th (16%) of all fractures seen and treated in emergency rooms.[1,2] These involve the distal part of radius, radial styloid process, articular surface with the scaphoid and lunate fossa. Distal radius fracture have a bimodal age distribution, from young people who have been in high-energy accidents such as RTA and sports injury to older people who had fall from an insignificant height. The distal radius metaphysis, characterized by a lower proportion of strong cortical bone and a higher proportion of weaker cancellous bone, is predisposed to fractures. Distal radius fractures disturb the mechanical foundation of the man's most elegant tool, the hand. The same ligaments, retinaculae, tendons and the periosteum that envelop the fracture which are the surgical barrier for open reduction of the fracture fragments, help to achieve reduction of the fracture by ligamentotaxis4. Many fractures of the distal aspect of the radius are relatively uncomplicated and are effectively treated by closed reduction and immobilization in cast. However unstable / intra-articular fractures can jeopardize the integrity of the articular congruence and /or kinematics of these articulations.

A consensus prevails that vast majority (nearly 90%) of distal radius fractures are articular injuries resulting in disruption of both the radiocarpal and radioulnar joints.[3] Intra-articular fractures are

ISSN (O): 2687-5365; ISSN (P): 2753-6556

inherently unstable, difficult to reduce anatomically and immobilize in closed POP support and are associated with high rate of complications4. With the changing mode of injury, fracture of the distal end radius occurring in younger patients, increasing functional demands of the patients, better understanding of the fracture pattern, advances in biomechanics of the wrist and availability of treatment oriented classification system, it seems we have to look beyond the conventional teaching that they all do well ultimately. Preservation of the articular congruity is the principle prerequisite for successful recovery.[3]

External fixation is generally accepted as superior to plaster immobilization in young patients with intra-articular comminuted displaced distal radius fracture6. External fixation represents a cost effective and less resource intensive alternative to open reduction and internal fixation. This approach is particularly beneficial in resource limited emergency setting where access to advanced surgical equipment is limited. The successful use of external fixation in the management of unstable intra-articular fractures necessitates careful assessment of the fracture pattern, appropriate patient selection, meticulous surgical technique, appropriate choice of fixation devices, judicious augmentation with internal fixation and bone grafting, careful post operative monitoring and aggressive early rehabilitation.[4-7]

The main aim of this study is to evaluate the results obtained by treatment of distal end radius fractures by external fixation in terms of duration of immobilization in external fixation, restoration of anatomy of distal end radius (radial length, palmar tilt and radial angulation) and to know the effectiveness in allowing early motion of digits and prevention of deformity and disability due to malunion.[8-15]

MATERIALS AND METHODS

All the patients attending the out-patient and in-patient department of Orthopaedics at tertiary rural hospital with communited fracture of distal end radius fulfilling the inclusion criteria during the study period of July 2013 to July 2023.

Study Design: Prospective study of cases fulfilling the inclusion and exclusion criteria during the study period of July 2013 to July 2023.

Inclusion criteria for the proposed study were Unstable intra-articular distal end radius fractures with increased volar/dorsal communition and more than 2 mm spread/depression of articular surface with more than 10o angulation of major fragments. Fractures extending into radiocarpal/ radioulnar joints or with ulnar fractures (Frykman's III, VIII). Unstable extra-articular fractures with significant metaphyseal comminution and failure to maintain reduction after initial attempt at closed reduction and cast application. Open fractures of distal end radius to facilitate wound care and bilateral distal end radius fractures.

Exclusion criteria for the proposed study were the patient presents with malunited fractures. Cases with neurovascular deficit. Compound fracture cases with associated neurological deficit and fractures occurred at the metaphysis level and proximally.

In the preoperative period splint age with POP slab and elevation was carried out which facilitate fracture reduction and precision of pins while applying external fixator. Fractures were classified according to Frykman classification.

Instability was recognized based upon initial displacement:[7]

- >200 dorsal angulation,
- marked dorsal metaphyseal comminution,
- radial shortening >10mm.

Secondary instability is said to be present when closed reduction and cast immobilization fails to maintain initial reduction and is found if residual dorsal angulation>100, residual radial shortening >5mm, >2mm step-off or displacement of articular fragments, intra articular fractures, loss of radial inclination >200, metaphyseal comminution of >50% diameter of radius, associated ulnar fracture, significant osteoporosis.

- Criteria for acceptable reduction (Melone3) were:
- ≤ 2mm articular incongruity
- <100 loss of radial inclination
- <2mm volar or dorsal translation
- <100 residual dorsal tilt
- <5 mm radial shortening.

Follow up and Evaluation: The external fixation device is left in place for an average of 5-8 week still both clinical and radiological evidence of healing are seen. The fixator was removed as out patient procedure under sedation. After removal of external fixator below/ elbow POP slab / splint was applied for two weeks which was removed intermittently for exercises 8-10 weeks postoperatively strengthening exercises were begun.

Majority of cases were followed upto six months. The maximum followup in our study was 50 weeks and minimum was upto 11 weeks. The final results of all patients were evaluated as per:

- Subjective evaluation by Demerit Point System of Gartland and Werley modified by Sarmiento (1975).[16]
- Lidstorm and Frykman Criteria modified by Sarmiento (1980) were used for evaluation of anatomic results.[17]

RESULTS

In our study, the maximum patients sustained distal end radius fractures are in the age group of 20-30 (34%) followed by age groups of 41-50(26%) and 31-40(24%) with the mean age of the patients was 54 years with male population is predominantly injured in 233 patients (71%) than the female (95 patients) population (29%). In this study, 230 patients sustained the right sided injury (70%) and 98 patients

ISSN (O): 2687-5365; ISSN (P): 2753-6556

with left sided injury (30%). 210 patients (64%) sustained injury with road traffic accident, whereas 118 patients (36%) were injured in falls. In our study 92 (28%) patients sustained associated fractures than other 236 (72%) patients who sustained isolated distal end radius fracture. 80% of the patients underwent surgery within 48 hours of the injury.

In this case study of 328 patients, 26% of patients were treated with 6 weeks fixation, where as 30% of patients were continued with 7 weeks of fixation and 44% of patients were treated with a period of 8 weeks. In this study, under Frykman's classification of distal end radius fractures, there was no patients in types I and II treated with ligamentotaxis. 52 patients were classified in type III fractures, 39 patients in type IV, 20 patients in type V classification, 59 patients were classified in type VI group and 112 patients are categorized in type VII and 46 patients are categorized in type VIII classification. In our series 65 patients were found to with loss of radial length of -2mm and 170 patients were suffered with -1mm loss of radial length and 93 patients had no loss of radial length at all. In 328 patients, 46 patients were found to with rate of union in 8-10 weeks, 78 patients radiological union evident on 11-13 weeks, 150 patients were found radiological union in 14-17 weeks and 54 patients were found radiological union in 18-20 weeks and no case of delayed or nonunion was reported. 92 patients (28%) of the total 328 patients have reported to have pain on exertion and 236 patients (72%) had no such complaints.

According to GARTLAND AND WERLEY score for the outcome, 72 patients (22%) had excellent result, 210 patients (64%), 33 (10%) patients had fair result and 13 (04%) patients had poor result. [Table 3]

Table 1: Frykman's Type.

Frykman's Type	No. of patients	%
I	0	0
II	0	0
III	52	16
IV	39	12
V	20	06
VI	59	18
VII	112	34
VIII	46	14
Total	328	100

Table 2: Rate of Union

Duration in Weeks	No. of patients	%
8-10	46	14
11-13	78	24
14-17	150	46
18-20	54	16
Total	328	100

Table 3: Result

Result	No. of patients	%
Excellent	72	22
Good	210	64
Fair	33	10
Poor	13	04
Total	328	100

DISCUSSION

Although Abraham Colles was evidently satisfied with the results of his treatment of distal radial fractures in 1814, more recent authors have drawn attention to the high prevalence of unsatisfactory results.

In 1952, DePalma hypothesized that a residual dorsal tilt of the distal end of the radius of more than 5 degrees led to a poor result10. Gartland and Werley found that immobilization of a distal radial fracture in a cast resulted in a 60 percent loss of reduction and an unsatisfactory result with regard to pain and loss of function in nineteen (32 per cent) of sixty patients.[13]

Cole and Obletz documented radial shortening of three millimeters or more in twenty-two (67 percent) of thirty-three patients and radial shortening of six millimeters or more in eleven patients (33 percent) after fixation with pins and plaster.[18-22]

Clyburn et al. reported radial shortening of five millimeters or more in twenty (25 percent) of eighty patients who had been managed with the same technique; a complication led to a reoperation in thirteen patients (16 percent).[23]

Kliena et al. found that loss of volar tilt after a distal radial fracture led to progressive load on the ulnocarpal and radioscaphoid articulations, which caused pain and early degenerative disease.[24]

Taleisnik and Watson reported an association between malunion of the distal end of the radius and dynamic midcarpal instability.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Unsatisfied with the available methods of treatment, Cooney et al., in 1979, critically reviewed external fixation for the treatment of distal radial fractures and reported a good result for fifty-one (85 percent) of sixty patients, with decreased radial shortening and improved volar tilt. Since then, external fixation has become a popular and reliable method for the treatment of these frequently seen fractures. A common algorithm for unstable distal radial fractures is external fixation, supplemental fixation with Kirschner wires, and, frequently, the use of a bone graft or bone substitute.[17]

The external fixator is a versatile tool in the treatment of intra-articular fractures of the distal radius.[1] Our standard reduction procedure is similar to the conservative management of these fractures. Continued traction results in controlled distraction of the fracture and facilitates manipulation. This technique is simpler than other techniques. The procedure is performed during a short hospital stay.[4]

The external fixator is reliable in terms of maintaining reduction of axes as well as of radial length. Simple intra-articular fractures with dorso ulnar fragments can be reduced with ligamentotaxis [Vidal et al].[23]

In our study, among 328 patients Excellent results were obtained in 72 patients good results in 210 patients and fair results in 33 patients and 13 poor result patients. Overall we had a high rate of favorable results and low rate of complications.

The relatively long period of immobilization (6-8 weeks) had no adverse effects on the long-term functional outcome. The fixator can therefore be left according to the radiologic evidence of fracture healing.

Our prospective study of the results of distal radius fractures treated by external fixation emphasizes that,

1. External fixation for distal radius fracture is a safe and reliable method in terms of fracture fixation, with good functional results and a low complication rate, in particular when external fixation is the primary treatment.
2. Eight weeks of fixation are well tolerated.
3. External fixation is not an adequate tool to maintain volar tilt.

CONCLUSION

External fixation of the distal radius has evolved from its early beginnings in pins and plaster fixation. The current designs of fixators are well established and can be used to reliably treat many fractures around the wrist.[22]

In our study external fixator was used in 328 patients with fracture distal end of radius. The mechanism of injury was fall in 118 patients and RTA in 210 patients. 92(28%) patients had associated injuries. The external fixator was maintained for 6-8 weeks. Favorable results were obtained in 86% of the cases. The rate of serious complications is low. With careful stab incision and placement of the pins, injury to the superficial sensory branch of the radial nerve and extensor pollicis longus tendon can be avoided. Aggressive pin-tract care can prevent many superficial infections from occurring. Most complications are minor and easily treated and do not affect outcome.

The external fixator is simple and inexpensive. It effectively stabilizes fractures yet allowing for hand motion and prevents stiffness. When intra-articular fractures are treated by conventional methods, pain and restriction of joint motion are not uncommon. Whereas when treated by ligamentotaxis by static external fixator, anatomical reduction is predictably achieved at fracture site. Though some cases have residual joint stiffness, pain and arthritis can be prevented. Limitations of the study include volar and dorsal bartons fractures which were treated with pre-contured locking plates.

Careful review of the recent literature reveals that external fixation appears to have benefits that outweigh associated complications and as such, make it an attractive treatment option for fractures of the distal radius that require surgical treatment. Both its ease of use and successful track record make it an extremely versatile tool for the treatment of these injuries.

REFERENCES

1. Jupiter JB. Current concepts review-Fractures of the distal end of the radius. J Bone Joint Surg (Am). 2009; 73-A: 461-469.
2. Melone CP Jr. Distal radius fractures: Patterns of articular fragmentation. Othop Clin North Am.2013; 24 (2): 239-253.
3. Knirk JL, Jupiter JB. Intra-Articular Fractures of the Distal End of the Radius in Young Adults. J Bone Joint Surg. 2006; 68-A: 647–659.
4. Simic PM., Weiland AJ. Fractures of the distal aspect of the Radius: Changes in Treatment Over the past two decades. J Bone Joint Surg (Am).2013; 85-A: 552-564
5. Jenkins NH, Jones DG, Mintow CW et al. External fixation and recovery of function following fractures of the distal radius in young adults. Injury. 2008; 19: 235-238.
6. Seitz WH Jr. External fixation of distal radius fractures: Indications and Technical Principles. Othop Clin North Am. 2011; 24 (2): 255-264.
7. Standring S. Gray's Anatomy-The Anatomical basis of Clinical practice. 41th edition. Elsevier Churchill Livingstone publication. 2015.
8. Palmer AK, Werner FW. The triangular fibro cartilage complex of the wrist–Anatomy and function. J Hand Surg. 2011; 6: 153-162.
9. Putnam MD, Seitz WH. Fractures of the distal radius. Chapter 20 in Rockwood and Green's Fractures in Adults. Edited by Bucholz RW, Heckman JD. Lippincott Williams and Wilkins Publication. 2011: 815-867.
10. Watson-Jones R. Fractures and Joint injuries, 4th edition. Baltimore, Williams and Wilkins.1962.
11. GartlandJ Jr, Werley CW. Evaluation of Healed Colles' Fractures. J Bone Joint Surg. 1951; 33-A: 895–907.
12. Rayhack JM. The history and evolution of percutaneous pinning of displaced distal radius fractures. Orthop Clin North Am. 1993; 24 (2): 287-300.
13. Lidstrom A. Fractures of the Distal End of the Radius: A Clinical and Statistical Study of End Results. Acta Orthop Scand. 2009; 41(Suppl): 1–118.
14. Sarmiento A, Pratt GW, Berry NC, Sinclair WF. Colles' Fractures: Functional Bracing in Supination. J Bone Joint Surg. 1975; 57-A: 311–317.
15. Cooney WP. Fractures of the distal Radius: A modern Treatment based Classification. Orthop Clin North Am. 1993 April; 24 (2): 211-216.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

16. Fernandez DL. Fractures of the distal radius: Operative treatment. Instr Course Lect. 1993; 42: 73-88.
17. Metz VM, Gilula L A. Imaging techniques for Distal radius fractures and related injuries. Orthop Clin North Am. 1993 April; 24 (2): 217-228.
18. Raskin KB, Melone CP Jr. Unstable articular fractures of the distal Radius: Comparative techniques of Ligamentotaxis. Othop Clin North Am. 1993; 24 (2): 275-286.
19. Pruitt DL, Gilula LA, Manske PR, Vannier MW. Computed tomography scanning with image reconstruction in evaluation of distal radius fractures. J Hand Surg. 2014; 19-A: 720–727.
20. Cole JM, Obletz BE. Comminuted fractures of the distal end of the radius treated by skeletal transfixion in plaster cast. J bone Joint Surg. 2016; 48-A: 931-945.
21. Clyburn TA. Dynamic external fixation for comminuted intra-articular fractures of the distal end of the radius. J Bone Joint Surg 2007; 69-A: 248–254.
22. Kleina W, DeÂeb W, Riegerc H, Neumanna HS, Joostenc U. Results of trans articular fixator application in distal radius fractures. Injury.2014; 31: 71-99.
23. Vidal Jet al. Treatment of articular fractures by 'Ligamentotaxis' with external fixator. Edited by Brooker and Edwards: External Fixator – the current state of art. 2008.

ISSN (O): 2687-5365; ISSN (P): 2753-6556