

A Clinical Study of Management of Comminuted Distal Radial Fracture in Adults by External Fixation and Ligamentotaxis

Modi Pulkit¹, Ashif Yusufbhai Suthar^{2*}

¹Associate Professor, Department of Orthopaedic, GMERS Medical College, Dharpur Patan, Gujarat, India

²Assistant Professor, Department of Orthopaedic, Banas Medical College and Research Institute, Palanpur, Gujarat, India

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Abstract

Background: The primary goals of distal radius fracture fixation are to put the pieces back where they belong and, most importantly, to do so by a method that does not compromise hand function. Displaced comminuted intraarticular fractures of the distal radius are difficult to treat; successfully by traditional nonoperative methods. Thus, external fixation plays a very distinct role. **Methods:** Twenty adult patients with closed comminuted intraarticular fractures of the distal radius were treated by closed reduction and immobilization with an external wrist fixator during 1 year period Six weeks later, the fixator was removed. The patients then were observed for an average of 6 months to 1 year. **Results:** An excellent outcome was seen in 3 patients (15%) good outcome in 11 patients (55%) and a fair outcome in 5 patients (25%) and poor outcome in 1 patient (5%). Minor complication, pin tenderness were present but recovered completely after removal of the fixator. **Conclusion:** External fixator is simple and inexpensive. Displaced severely comminuted intraarticular fractures should be treated with an external fixator. It effectively stabilises fractures yet allowing for hand and prevents stiffness. It is difficult to regain volar tilt by ligamentotaxis and maintain it by external fixators. Most complications are minor and easily treated and do not affect Outcome. The ease of use of the implants and successful track record make it an extremely versatile tool for treating complex fractures of the distal radius.

Keywords: Distal radius; comminuted Intra-articular fractures; external fixator; ligamentotaxis.

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Introduction

Treatment of displaced fractures of the distal end of the radius has changed over the course of time. In the past, closed reduction with immobilization in a plaster cast was considered the treatment of choice.

Nearly 20% of all fractures that are treated in emergency departments in the United States involve the distal end of the radius and have a bimodal age distribution, with the adolescent or young adult and elderly populations being the most affected.

*Correspondence

Dr. Ashif Yusufbhai Suthar

Assistant Professor, Department of Orthopaedic,
Banas Medical College and Research Institute,
Palanpur, Gujarat, India.

E-mail: drashif05@gmail.com

About 50% of metaphyseal fracture of the distal aspect of the radius also have involvement of the radiocarpal and/or distal radioulnar joint¹.

Over the past twenty years, more sophisticated internal and external fixation techniques and devices for the treatment of displaced fractures of the distal end of the radius have been developed². The use of percutaneous pin fixation; external fixation devices that permit distraction and palmar translation; low-profile internal fixation plates and implants; arthroscopically assisted reduction; and bone-grafting techniques, including bone-graft substitutes, all have contributed to improved fracture stability and outcome.

Many different external fixation devices have been developed and used. Even in severe fractures of the distal radius, they allow reduction and fixation of fragments without loss of position and good functional results. Clinical and anatomic studies show that ligamentotaxis is the basic principle used by external fixation. Through prolonged distraction by the fixator,

tension is provided by the capsuloligamentous structures. Even in severe injuries, the soft tissues, such as ligaments, retinacula, tendons, and periosteum, remain intact

The goals of treatment are to

- To assess the effectiveness of external fixator and ligamentotaxis in comminuted, intra-articular fracture distal end of radius.
- To assess anatomical and functional outcome

Material and Methods

We studied 20 patients with comminuted intra-articular fracture distal end of radius prospectively at general hospital. The age of the patients ranged from 20 to 60 years. 16 were men and 4 were women. The mechanism of injury was a fall (low impact) in 12 patients and a motor vehicle accident (high impact) in 8. The dominant side was injured in 14 cases, the nondominant side in 6 cases

All patients had unilateral closed fractures of the distal part of the radius. According to the Frykman classification, 4 fractures were Type III (20%), 3 were Type IV (15%), 2 were Type V (10%), 4 were Type VI (20%), 4 were Type VII (20%), and 3 were Type VIII (15%). 3 patients with high impact type injuries had additional fractures, 1 patient had fracture shaft of femur, 1 had fracture of both bones of leg, and 1 had fracture of the Rt patella.

Pre-operative clinical evaluation, showed deformity and swelling on inspection, the distal end of radius was tender on palpation and the styloid process of the radius and the ulna were at the same level. Movements at the wrist were painful and restricted. In our study, there was no median nerve involvement.

Pre-operative radiological evaluation was done in two planes- antero-posterior and lateral views and the fractures were classified according to Frykman's classification. Routine blood and urine investigations were done. Consent for surgery was taken. In our study we included comminuted intra-articular fractures in adults only, extra-articular fractures were excluded. Children were not included in the study.

Surgical Technique

Under the effect of anesthesia the patient was placed supine on the operating table. Longitudinal traction was given with manual moulding of the fracture fragments back into a more normal alignment (severe hyper-flexion or hyperextension is avoided). The wrist

is maintained in mild flexion and ulnar deviation. The arm, fore-arm and hand were draped under aseptic precaution. The injured upper limb was placed on the side arm board. A stab incision was made approximately 10 cm proximal to the radial styloid over the lateral aspect of the radius.

Post-Operative Care and Rehabilitation

Check X-rays were taken in both Antero-posterior and lateral views on post-operative day one. The reduction of the fracture was confirmed and any displacement of fracture was studied. Tension across the wrist generated by the external fixation device should provide enough ligamentotaxis, so that on an Antero-posterior radiograph the radiocarpal articulation was seen to be 1 mm wider than the midcarpal joint.

Active exercises of fingers and thumb were commenced from the day of operation. Third post-operative day the dressing were removed. The pins were cleaned with spirit on every alternate day for one week; later the patient was educated regarding pin site care. The patient was taught exercises for the hand, pronation and supination of the forearm and active movement of the elbow and shoulder were advised throughout the period of the healing.

Results

The assessment of anatomical and functional outcome was made according to modified Gartland and Werley scoring system as follows

3 patients had no deformity of the wrist and there was no pain. Limitation of motion of wrist and fore-arm was less than 20% to that of the normal. They did not have any complications and hence the result was rated as excellent.

11 patients had no deformity of the wrist. Occasional pain and some limitation of motion was present initially. The limitation of motion of wrist and fore-arm was less than 20% to that of normal. One patient had superficial pin tract infection, which was controlled with oral antibiotics. Hence the result was rated as good.

On subjective evaluation, 5 patients had pain, limitation of motion and restricted activities around the wrist. Range of motion of wrist and fore-arm had limitation to less than 50% to that of normal. In this group 2 patients had ulnar styloid process prominence and the result was rated as fair.

1 patient who was operated 12 days after injury, had dinner fork deformity with pain, limitation of motion and restricted activities around the wrist. There was limitation of motion more than 50% associated with slight crepitation and the result was rated as poor.

Radiographs demonstrated maintenance of radial length between 1-4 mm of original reduction in the patients.

The overall results according to the rating system based on modified Gartland and Werley 1951 demerit point rating was:

Excellent	3	(15%)
Good	11	(55%)
Fair	5	(25%)
Poor	1	(5%)

Table-1: Frykman’s Classification of Distal Radial Fractures

Fracture	Distal Ulna Fracture Abscent	Distal Ulna Fracture Present
Extra- Articular	I	II
Radiocarpal Joint	III	IV
Radio-Ulnar Joint	V	VI
Radio- Carpal and Radio-Ulnar Joint	VII	VIII

Table-2: End Result Using Gartland-Werely System

Grade	No.of Cases	Percentage
Excellent	3	15
Good	11	55
Fair	5	25
Poor	1	5

TABLE-3: AGE Distribution

Age Distribution		
Age	No. of Patients	Percent
11-20	1	5
21-30	10	50
31-40	5	25
41-50	2	10
51-60	2	10

Table-4: Mechanism of Injury

Mechanism of Injury	
Injury	N
Fall	12
Rta	8

Table-5: Sex Distribution

Sex Distribution	
Gender	n
Male	16
Female	4

Table-6: Associated Injury

Associated Injury	
Injury	n
Present	3
Absent	17

Table-7: Side of Fracture

Side of Fracture	
Side	N
Dominant	14
Non - Dominant	6

Table-8: Distribution of 20 Patients With 20 Fractures

Type	No. of Cases	Percentage
III	4	20
IV	3	15
V	2	10
VI	4	20
VII	4	20
VIII	3	15

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 result. 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. Cole and Oblatz 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. Simic et al.² 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). Fernandez et al.¹ 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.

In our study, patient 11 was operated 12 days after injury, he ended with poor results. The soft tissue changes that had occurred with in these twelve days prevented adequate dorsiflexion and ulnar deviation. Hence, we recommend external fixator to be applied within seventy-two hours to achieve 253avourable results.

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.³⁻⁸

Eight weeks of fixation are well tolerated, and the fixator can be left in place according to the radiologic evidence of fracture healing and External fixation is not an adequate tool to maintain volartilt.

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 about the wrist. In our study external fixator was used in 20 patients with comminuted, intra-articular fracture distal end of radius. The mechanism of injury was fall in 12 and RTA in 8. 3 patients had associated injuries. The external fixator was maintained for 6- weeks. Favorable results were obtained in 70% of the cases. The rate of serious complications is low. With careful dissection 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 comminuted, intra-articular fractures are treated by conventional methods, pain and restriction of joint motion are not uncommon. Whereas when treated by ligamentotaxis by external fixator, anatomical reduction is predictably achieved at fracture site. Though some cases have residual joint stiffness, pain and arthritis can be prevented. 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.

Conflict of Interest: Nil

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