

Functional Outcome of Unstable Distal Radius Fractures Managed by Ligamentotaxis with External Fixation

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Received: 16-06-2023 / Revised: 14-07-2023 / Accepted: 23-08-2023

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Conflict of interest: Nil

Abstract:

Fracture of distal end of radius continues to be one of the most common skeletal injuries since the description by Colle's in 1814. Management of these fractures is still a challenge for orthopaedic surgeon in achieving good functional results. Numerous techniques have been described and developed to treat the fracture in an effort to improve the outcome. A prospective study of management of fracture-distal radius by external fixator using the principle of ligamentotaxis was conducted at our institute to evaluate the clinical efficacy of external fixator with ligamentotaxis in distal radius fracture reduction, fracture healing, functional recovery after surgery and common complications encountered.

Keywords: Distal end of radius, Colle's fracture, ligamentotaxis, External fixation.

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Introduction

Fractures of the distal radius are among the most common fractures seen in an emergency department. [1] The classic fracture described by SIR ABRAHAM COLLES in 1814 – low energy, extra articular, osteoporotic distal radius fracture – often does well with closed reduction and cast immobilization. [2] High velocity injuries have resulted in severely comminuted and unstable fractures with intra articular components treatment has become increasingly difficult. [3]

Many methods like closed reduction and casting, pins and plaster, percutaneous pinning, external fixation with ligamentotaxis, internal fixation, combined internal and external fixation and arthroscopically assisted reduction have come up.

Percutaneous pinning has all the disadvantages of external fixator like inability to achieve direct reduction, immobilization of radio carpal joint and pin tract infections. It also lacks some of the advantages of external fixators like adjustability, known strength and reusability for a specific patient Many unstable distal radial fractures are treated by closed reduction and casting with even small degrees of mal alignment adversely affects functional outcome has stimulated interest in external fixation and ligamentotaxis. [4]

External fixation for distal radius fracture relies on the principle of Ligamentotaxis in which, a distraction force applied to the carpus aligns the fragments

by means of intact ligaments. Distraction assisted reduction and maintenance of distal radius fracture is a widely used and reliable treatment method. [5]

If the principles of ligamentotaxis are applied rationally the factors that cause instability are identified clinically and managed surgically, a satisfactory outcome can be expected.

Aim:

The aim is to study the functional outcome of unstable distal radius fractures managed by ligamentotaxis with external fixation

Materials and Methods

This study was conducted in Department of Orthopaedics, Govt. General Hospital attached to Government Medical College, Kadapa from October 2020 to September 2022. Patients with unstable distal radius fractures were selected and treated with external fixator based on the principle of ligamentotaxis.

Most of the cases resulted from high velocity injuries and fall on outstretched hand. The cases presented with swelling, pain of the wrist and painful movements.

All the patients were evaluated with X rays of the wrist postero – anterior view and lateral view. The patients for whom external fixation and ligamentotaxis was planned were temporarily given below elbow plaster splint to relieve pain and limb elevated

for edema to subside. Injection tetanus toxoid was given to all the patients.

Most of the patients were operated on the day of admission in the emergency operation theater and few cases were delayed due to the medical conditions and in cases of gross edema to subside. All the patients were given per-operative antibiotics

Inclusion Criteria:

1. Age >20 years and < 70 years
2. Patients with Unstable Distal radius fractures were selected.

Exclusion Criteria:

1. Stable fracture with dorsal angulation < 20°
2. Previous ipsilateral or contralateral fracture of wrist.
3. Age less than 20 years were excluded from study.

In this study, we followed Frykman's classification to classify the fractures. Unstable fractures were identified and managed with external fixator & ligamentotaxis.

Surgical Technique – Ligamentotaxis with External Fixation.

Electively under Regional Anaesthesia with the patient in a supine position the limb was painted and draped. The metacarpal pins were applied first. 1cm incision made over metaphyseal flare of second metacarpal. Blunt dissection was carried out avoiding injury of superficial radial nerve and first dorsal interosseous muscle.

Second metacarpal was drilled with 2.0mm drill bit while protecting soft tissues using drill guide. Then 2.5mm × 100mm schanz pin inserted. A second pin was applied distally by same method. Radial pins were applied 10cm proximal to radial styloid. 1 cm incision was made along the line joining lateral condyle Humerus and Lister's tubercle of distal Radius,

blunt dissection carried out to reach radial shaft avoiding injury to radial sensory nerve and extensor tendons.

Radial shaft was drilled with 2.5mm drill bit while protecting soft tissues with drill guide. Drilling was done in such a way that pins were placed on radial side and 30° dorsally. A 3.5mm × 100mm schanz pin inserted. Second radial pin was applied distal to first pin by same method.

The metacarpal pins were connected to multiaxial ball clamp and radial pins were connected to another multiaxial ball clamp. The ball clamps were connected to distraction rod. Check X rays taken and fine tuning of distraction done. No more than 2 - 3mm distraction was applied over radio carpal joint.

Postoperatively patients were encouraged to do active finger movements from day one. Six pack exercises were taught. Limb was kept elevated for 24 – 48 hours. Pin sites were regularly inspected and Betadine dressings given. Patients were discharged by fifth day and reviewed every week till six weeks. On every visit, extent of finger movements was noted. Pin site was examined for infection. At six weeks after confirming union, external fixator was removed and sterile dressing and elastocrepe bandage applied. A radiograph was also taken. Active wrist mobilization was started. Patients were reviewed on three months of treatment. Every time functional and radiological assessment were made and compared to the normal side.

Results

The results of this study were analyzed using the patient evaluation and subjective rating scheme. This system was introduced by Gartland & Werley in 1951 and modified by Sarmiento. This is a functional demerit system and allow for comparison of results among several studies and also different methods of fixation.

Table 1: Distribution of study subjects

Total number of cases	20
Bilateral	0
Total number of wrists	20

A total of 20 study subjects were selected after meeting inclusion and exclusion criteria.

Table 2: Distribution of study subjects based on gender

Males	9
Females	11

Among the enrolled study subjects, females were comparatively high than males.

Table 3: Distribution of study subjects based on age group

Age	Male	Female
20-30	3	2
31-40	1	1
41-50	2	3
51-60	2	2
61-70	1	3

Among the enrolled study subjects, majority of them belonged to 20-30 and 41-50 year age groups.

Table 4: Distribution of study subjects based on side of injury

Right	13
Left	7

Among the enrolled study subjects, majority of them belonged to right side fractures.

Table 5: Distribution of study subjects based on mode of injury

Road traffic accidents	12
Fall on out stretched hand	8

Among the enrolled study subjects, majority of fractures were due to Road traffic accidents.

Table 6: Distribution of study subjects based on FRYKMAN'S TYPE

Type	No. of Cases
I	0
II	2
III	2
IV	1
V	1
VI	2
VII	5
VIII	7

Bony union was achieved in all patients. DRUJ pain occurred in 2 patients and DRUJ instability in 3 patients. At the end of 3 months patient were evaluated using the Gartland & Werley's system as follows. It consists of

Subjective Evaluation	0- 6 points
Objective Evaluation	0 – 3 points
Residual Deformity	0 – 5 points
Complications	0 – 5 points
Final Result	Total

Final Result

Excellent	0-2
Good	3 – 8
Fair	9- 20
Poor	>21

In our study, according to the system out of 20 Cases treated the results were as follows

Outcome	Number of Patients	Percentage
Excellent	2	10
Good	8	40
Fair	8	40
Poor	2	10

The results of the procedure were analysed radiographically and clinically at 3 months postoperatively. Three patients had superficial pintract infections which were treated with antibiotics and pintract care. All subsided without sequelae. In five cases the fragments are displaced even after ligamentotaxis, so it is augmented with K wire fixation in those cases.

Discussion

Paul A. Vaughan et al in their study on unstable distal radius fracture treated by external fixation obtained 29% excellent and 60% good result. [6] Restoration of normal anatomy is important for restoration of function. Normally 82% of the compressive load across the Wrist is borne by distal radius and remaining by distal ulna. With 2.5mm

loss of radial length, ulna bears 42% load and at 20 degree dorsal angulation, ulna bears 50% load.

Preservation of radial length is the most important factor for preservation of function. Loss of radial length can lead to ulnar impaction or dysfunction of Distal Radio Ulnar Joint, with limited range of motion in pronation and supination, depending on the volar or dorsal subluxation of the ulnar head within the sigmoid notch. [7]

In ligamentotaxis with external fixation, radial length, ulnar variance and radial angulation are restored to normal but correction of volar tilt though adequate, is not complete.¹

The external fixator was also unable to correct the depressed lunate fossa(as pointed out by Melone et

al., which may need additional procedures like pinning and elevation of the depressed fragment. [8]

Higher velocity injuries yield poor results. This reiterates the role of soft tissue and ligaments in fracture healing. So, the addition of palmar plaster splint as advocated by Fernandez and Palmer et al., [9-10] was effective in giving rest to soft tissues and also supportive in unstable fracture patterns.

The ulnar styloid fractures with displacements > 3 mm indicates higher degrees of fracture displacements and injury to triangular fibrocartilage & it needs to be fixed.

We encountered DRUJ pain in 3 patients and DRUJ instability in 2 patients. It might have been useful to have cross-pinned the ulna to radius in supination.

Conclusion

The external fixation and ligamentotaxis proved to be a very useful method for treating unstable distal radius fracture. Though an effective method, it is not a panacea for all the injuries as different patterns of injuries emerge due to increased accidents and high velocity injuries.

Acknowledgements: We would like to thank all the study participants and the authors from where we have cited the references for publication of this article.

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