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A Study On Radiological And Functional Outcome Of Distal Radius Fractures Treated By Ligamentotaxis Principles Using Ring Fixator

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Abstract

Background: Fractures of the distal radius is one of the most common injuries accounting for 21% of all fractures treated by an orthopedic surgeon. It has a bimodal age group distribution with the younger age group at the one end of the spectrum with high energy trauma and on the other end the geriatric population with low energy trauma.

Aim of the study: The objectives of management of distal end of radius fracture should be the restoration of range of motion and grip strength while facilitating early restoration to normal activities.

Methods: This study was designed to study the efficacy of ligamentotaxis using a ring fixator in manage of distal radius fractures the in the year 2022 In this study, we have studied patients coming to the emergency department with wrist injuries. Results:15 patients were age and gender-matched were identified and included in this study. Functional outcome based on modified mayo wrist score 73.33 % of patients had excellent results and 20% of patients had a good outcome. Functional outcome was assessed using the Mayo wrist score and 74% had excellent outcomes following surgery, 20% of the patient had good functional outcomes and 6% had a fair outcome**.**

Conclusion: Among the study population, postoperative complications were analyzed and 1 patient developed wrist stiffness and 1 patient had restricted finger movements which were treated vigorously by physiotherapy and mobilization exercises. Postoperatively 87% had no pain, while 1 patient had mild pain and 1 patient had moderate wrist pain. 94 % of the patients returned to work and were able to carry out professional activities without any difficulty while 1 patient had mild restriction of daily activities.

Keywords: Distal radial intra-articular fractures, Ligamentotaxis, Frykman classification

Introduction

Fractures of the distal radius are one of the most common injuries accounting for 21% of all fractures treated by an orthopedic surgeon. It has a bimodal age group distribution. More than 50% of the fractures of the distal radius involve the articular surface and any attempt to move or load the joint will lead to the motion of the fragment and hinder fracture healing leading to articular surface incongruity.[1] A distal radius is a predominantly cancellous area, which unites without significant callus and has a tendency to collapse and displace during treatment. The fixation of the distal radius intra-articular fractures has evolved through times from closed reduction and cast application to arthroscopy-assisted fragment fixation.[2] Treatment options of the past era

led to significant joint stiffness and studies showed the persistence of deformity, residual stiffness, and unsatisfactory results.[3] The problem is to maintain this reduction, as immobilization by a plaster cast is often insufficient. Failure to achieve proper angulation and length of the distal radius may result in complications of pain and instability To improve the functional outcome, new surgical options which ranged from Kirschner wire fixation to external fixation using various types of fixators, and now the era of anatomical and fragment specific reduction with plates with nonlocking and locking system.[4] The future is arthroscopy-assisted distal radius fixation and bio-degradable implants. The goals of the treatment of distal radius fractures are to restore the joint line congruity, joint stability, and alignment with minimal soft tissue dissection to encourage early mobilization and good functional outcomes.[5] The rationale in favor of employing the external fixator technique includes continuation in fracture reduction under fluoroscopic view, augmentation in reduction using ligamentotaxis, along with the ability to preserve reduction until fracture healing takes place. [6] The benefits of an external fixator are the comparatively easy application of hardware, minimal operative exposure required, and decreased operative trauma.[7] Ring fixator allows proper reduction and maintenance throughout the healing of the radius. It results in good anatomical results after the union, associated with the restoration of unrestricted function of the upper extremity.[8] Various designs of transarticular (‘‘bridging’’) fixators have been invented; they are easy to apply, allow some postoperative adjustments, and are fairly well tolerated by patients.[9,10]

Materials And Methods: This study was done on Outpatients visiting the department of orthopedics and patient coming to casualty, with distal radius fractures admitted in the Orthopaedics Department, Govt.Kilpauk Medical College & Hospital. The period of study is from January 2020 to September 2020 with a total duration of 9 months and patient followed up for 6 months. The mean duration from hospital admission to definitive surgery is 2-3 days. During this period 15 patients with the distal end of the radius were treated.

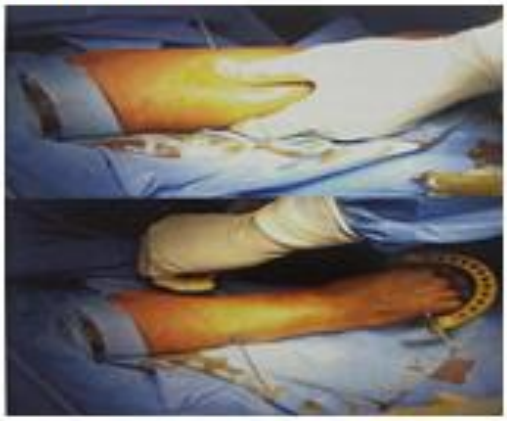
Inclusion Criteria: Extra-articular fractures of the distal radius.Comminuted and compound fractures of the distal radius.Age 16-70yrs.

Exclusion Criteria: Age <16 years, Undisplaced fracture, Patient with severe comorbidities.

Surgical Technique

Volume 5, Issue 6; November-December 2022; Page No 669-678

The second wire is medial to lateral transfixes both the bones at the level of mid forearm



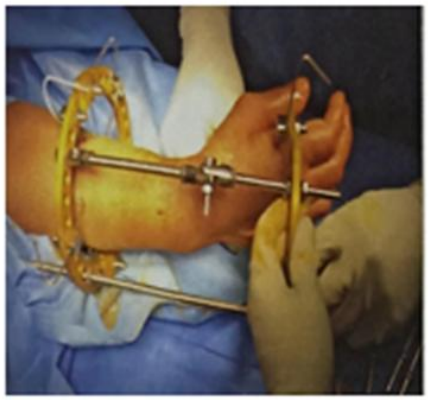
Attached to a full ring of appropriate size

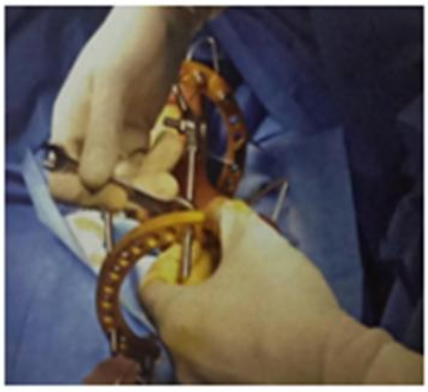
Volume 5, Issue 6; November-December 2022; Page No 669-678

Third trans-radial wire inserted at the level of mid forearm in safe zone.

Traction is now applied on both rings and positioned in correct axis. Hinges are applied at wrist level in correct position of reduction, distraction, and alignment.

Threaded rods are tightened





A final C-arm confirmation is done to ensure reduction is hairline,articular surface is fully congruent and radial variance is restored to normal.

Volume 5, Issue 6; November-December 2022; Page No 669-678

The post-operative protocol was to follow an up-one week of pin tracts inspected, cleaned with disinfectant, and left open. Check the X-ray taken to see the reduction and any modifications and adjustments done. The patient's activity level is assessed and encouraged to get back to the best functional level that the frame would permit. Active finger movements are encouraged. The time of frame removal varies between 5-7 weeks. The patient was informed to report in case there is a sudden increase in pain, numbness, inflammation, fever, and axillary lymphadenopathy.

Results

Table 1-Distribution Of Study Participants Based On Gender

Females were predominant in the study

SEX	**NUMBER OF CASES**	**PERCENTAGE**
MALE	6	40%
FEMALE	9	60%

Table 2-Distribution Of Study Based On Side Of Involvement

The non-dominant hand is more involved in this study- most of them being the left side

SIDE	NUMBERS	PERCENTAGE
LEFT	8	53.3%
RIGHT	7	46.7%

Table 3-Distribution Of Study Based On Mode Of Injury

Injury arising from self-falls constitutes more in this study.

MODE OF INJURY	**NUMBER OF PATIENTS**	**PERCENTAGE**
SELF FALL	9	60%
ROAD TRAFFIC ACCIDENT	5	33.3%
ASSAULT	1	6.67%

Table 4-Distribution Of Patients Based On Classification Our Study Is Based On Ao Classification.

CLASSIFICATION	**NUMBER OF CASES**	**PERCENTAGE**
23-A1	0	0
23-A2	3	20%

Volume 5, Issue 6; November-December 2022; Page No 669-678

23-A3	3	20%
23-B1	1	6.67%
23-B2	1	6.67%
23-B3	3	20%
23-C1	1	6.67%
23-C2	2	13.3%
23-C3	1	6.67%

Articular Involvement

In our study,11 patients had extra-articular involvement with dorsal displacement and 4 patients had intra-articular involvement.

Table 5-Distribution Of Study Based On Articular Involvement

FRACTURE PATTERN	TOTAL NUMBER OF CASES	PERCENTAGE
EXTRA-ARTICULAR	11	73.3%
INTRA ARTICULAR	4	26.7%

Table 6-Distribution Of Patients Based On Status Of Fracture In Our Study 3 Patients Had Compound Fractures.

Fracture status	Number of patients
CLOSED FRACTURE	12
COMPOUND FRACTURE	3

Table 7-Distribution Of Patients Based On Fracture Healing Time

In our study, 14 patients had fracture union within 6 weeks and 1 patient had a union in 8 weeks.

AVERAGE PERIOD OF UNION	NUMBER OF PATIENTS	PERCENTAGE

Volume 5, Issue 6; November-December 2022; Page No 669-678

4-6 WEEKS	14	93.3%
6-8 WEEKS	1	6.7%

Table 8-Complication In The Study

A reduced range of motion was observed in one patient. One patient developed finger stiffness and with physiotherapy was able to return to normal function.

COMPLICATION	NUMBER OF PATIENTS	PERCENTAGE
Reduced range of motion	1	6.67%
Finger stiffness	1	6.67%

Table 9- Distribution Of Patients Based On Pain

CHARACTER	NUMBER OF CASES	PERCENTAGE
No pain	13	86.66%
Mild	1	6.67%
Moderate	1	6.67%
Severe	0	0

Table :10 The Shows Movements After 6 Months Compared With Normal Side.

Movements	NORMAL ROM (in degrees)	RESULT(average)
Palmar flexion	80	75
Dorsi flexion	75	70
Supination	85	80
Pronation	75	70
Ulnar deviation	30	25

Volume 5, Issue 6; November-December 2022; Page No 669-678

Radial deviation	20	15

Table 11-Distribution Of Patients Based On Grip Strength

Grip strength in %	Number of patients	Percentage
0-24	0	0
25-49	0	0
50-74	1	6.67%
75-99	6	40%
100	8	53.33%

Table12- Distribution Of Patients Based On Modified Mayo Wrist Score

Score	Number of patients	Percentage
Excellent	11	73.33%
Good	3	20%
Fair	1	6.67%
Poor	0	0

Discussion-

Fractures around the wrist are the most common injuries accounting for around 21% of all fractures treated by an orthopedic surgeon in clinical practice. The treatment of distal radius fractures has been evolving since ancient times and identifying the ideal treatment modality based on each fracture pattern has always been challenging. The majority of the fractures can be treated nonoperatively with near-normal alignment which is not ideal and may provide a function that is inadequate for a high-demand working population. 1. Restoration of normal anatomy is important for the restoration of function.[11] For the preservation of function, radial length plays an important role. Loss of radial length leads to ulnar impaction or dysfunction of DRUJ, with restricted pronation and supination.2.Residual dorsal angulation will precipitate midcarpal instability, ulnar impaction, and altered stress concentration leading to early arthritis. In ligamentotaxis with external fixation the radial length, ulnar variance, and radial angulation are restored to normal but correction of volar tilt though adequate is not complete.[12] This is attributed to the fact that volar ligaments are stronger and become taut on distraction before the dorsal ligaments which are in a relative 'Z' orientation. So, on distraction, the palmar cortex is brought out to length before the dorsal cortex preventing full correction of dorsal tilt.In this study, we have studied patients coming to the emergency department with wrist injuries. Plain radiographs of wrist joint were taken and patients who had distal radius fractures were identified and included in the study population after taking into consideration other patient factors

Volume 5, Issue 6; November-December 2022; Page No 669-678

such as age, gender, medical co-morbidities, general condition of the patient, fracture pattern, intra articular extension of fracture, displacement, angulation, impaction, presence/absence of an open wound and distal vascularity.[13]15 patients were age and gender-matched and were identified and included in this study they were explained about the various treatment modalities available along with the pros and cons of each modality. After obtaining written informed consent, participants were taken up for ligamentotaxis using a ring fixator.14 Functional outcome based on modified mayo wrist score 73.33 % of patients had excellent results and 20% of patients had a good outcome. [14] The average healing time of 14 cases was between 4-6 weeks and one case was between 6-8 weeks Postoperatively 87% had no pain, while 1 patient had mild pain and 1 patient had moderate wrist pain. 94 % of the patients returned to work and were able to carry out professional activities without any difficulty while 1 patient had mild restriction of daily activities.[15] The key to success is to restore anatomic parameters of the distal radius while minimizing insult to the soft tissue envelope. Functional outcome was assessed using the Mayo wrist score and 74% had excellent outcomes following surgery, 20% of the patient had good functional outcomes and 6% had a fair outcome. Hence external fixators can be safely considered for the management of comminuted intraarticular fractures of the distal end radius.

Conclusion

Distal radius fractures have a high rate of displacement, usually within the first 2 weeks. Hence using a ring fixator helps in the reduction of fracture by ligamentotaxis and also in maintaining the reduction. Being a multiplanar system, it gives three-dimensional correction thereby helping in accurate reduction, which the uniaxial Schanz pin-based fixators are incapable of. Ilizarov is an intrinsic dynamic system with the advantages of small corrections and fine-tuning during treatment which cannot be done by other methods. Alignment of the fracture and radial length helped in getting excellent functional outcomes. Being a dynamic system with a 360-degree stability ring fixator gives an excellent outcome in the treatment of distal radius fracture. A dedicated post-operative mobilization protocol helped us achieve better functional results.

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Volume 5, Issue 6; November-December 2022; Page No 669-678

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Volume 5, Issue 6; November-December 2022; Page No 669-678