

Short Term Evaluation Of Distal Radial Intra-Articular Fractures Managed By Ligamentotaxis And Jess Application With Or Without Distal Radio-Ulnar Joint Stabilisation In Adults.

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ABSTRACT

Background: Fractures of the distal end of radius have become the focus of tremendous interest and has undergone remarkable change in the area of fracture management. Intra-articular fractures of distal radius may collapse resulting in radial shortening, angulation and articular incongruity, which may cause permanent deformity and loss of function of wrist joint. External fixation is a minimally invasive procedure with reduction by ligamentotaxis. This study evaluates the functional and radiological outcome, and complications of ligamentotaxis by JESS in treatment of distal radius intra-articular fractures. **Methods:** Institution based prospective study comprising of 20 patients attending Orthopaedics emergency or O.P.D. of age group 18-60 years with intra articular distal radius fractures, who were treated by ligamentotaxis with JESS, and DRUJ stabilisation by ulno-radial k-wire in patients with DRUJ disruption. The outcome of treatment is assessed clinico-radiologically by using Demerit point system of Gartland and Werley's with Sarmiento's modification. Functional and radiological outcomes and associated complications were evaluated. **Results:** Out of 20 cases, 9(45%) were graded excellent, 6(30%) were graded as good, 4(20%) as fair and 1(5%) was graded poor. **Conclusion:** JESS effectively stabilises distal radial intra articular fractures yet allows finger movement and prevents stiffness. Anatomical reduction is predictably achieved when intra-articular fractures are treated by this procedure.

Keywords: Intra-articular, distal radius, radio-ulnar, wrist.

INTRODUCTION

The evolving demographics of distal radius fractures have been described several times in the last 50 years. Fractures of the distal end of radius represent the most common fracture in the upper extremity.^[1] There are three main peaks of fracture distribution, children aged 5 – 15, male aged under 50 and women over age of 40.

Intra-articular fracture occur mainly in young individuals with good bone stock as a result of violent compression forces and are associated with

Substantial articular and periarticular tissue damage. If these fractures are allowed to collapse radial shortening, angulation and articular incongruity may cause permanent deformity and loss of function.

Therefore fractures of the distal end of radius really have become the focus of tremendous interest and remarkable changed area of fracture management. External fixation has been popular mode of treatment in displaced unstable fractures of distal part of radius because it combines a minimally invasive procedure with reduction by ligamentotaxis.

Aim

- 1) Assessment of functional outcome after ligamentotaxis by JESS application in intra-articular distal radial fractures.
- 2) Assessment of radiological outcome after the procedure.

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- 3) To identify the complications associated with this procedure.
- 4) To calculate the percentage of cases of distal radial intra-articular fracture having concomitant distal radio-ulnar joint disruption.

MATERIALS AND METHODS

Study Area

Department of Orthopaedics, at a peripheral tertiary care institute

Study Population

Adult patients attending outpatient department and emergency with intra-articular distal radius fractures.

Inclusion Criteria

- i. All intra articular distal radius fracture with or without DRUJ disruption.
- ii. All closed and open fractures(Gustillo-Anderson I,II,IIIA).
- iii. Patients aged between 18-60 years.
- iv. Fernandez type II, III, IV fractures.

Exclusion Criteria

- i. Patients aged <18 years and >60 yrs.
- ii. Gustilo IIIB, IIIC open fractures.
- iii. Fernandez type I and IV fractures
- iv. Extra articular distal radial fractures.
- v. Fractures more than 3 weeks old.
- vi. Pathological fractures
- vii. Patients having neuro-vascular injury, medical co-morbidities.

Study Period: 18 months

Sample Size: Twenty patients (n=20)

Sample Design: Study is done till desired number of sample size is obtained.

Study Design: Institution based prospective study.

Parameters to be studied

- A. Pain, Limitation of wrist movement, Grip strength, Residual deformity
- B. Loss of radial inclination, Loss of radial height, Loss of volar tilt, Change in ulnar variance, Articular incongruity, Arthritic changes
- C. Loss of reduction, Superficial radial nerve injury, Pin tract infection and pin loosening, Delayed union, Malunion, Tendon rupture
- D. To calculate the percentage of patients with distal radial intra articular fractures having associated distal radio-ulnar joint disruption

Study Technique

Patients are treated by ligamentotaxis by JESS with DRUJ stabilisation by ulno-radial k-wire in patients with DRUJ disruption. The outcome of treatment is assessed clinico-radiologically by using demerit point system of GARTLAND

and WERLEY'S with SARMIENTO'S modification.

Data Analysis

The patients are evaluated in details in pre and post-operatively both clinically and radiologically at a regular interval and results are analysed .

Treatment

At the outset a clinical thorough assessment for arterial/neural injuries were made and anteroposterior and lateral view of wrist was taken. After admission to reduce pain and swelling and patient was kept on below elbow Plaster of Paris (POP) slab.

20 patients were treated with Joshi's External Stabilisation System (JESS). All patients gave informed consent prior to the procedure. All patients were admitted into the general ward and none was operated as a day care surgery. JESS frames were applied in usual manner.

All cases were operation under regional anaesthesia.

Post-Operative Management

Meticulous pin site care was taken under regular cleaning with 70% alcohol (spirit). Pin site infection and pin site loosening were assessed continuously. Skiagrams were taken at first postoperative day, 6 weeks and 10 weeks to assess progression of union and maintenance of alignment. The Fixator was kept in place for 6-8 weeks.

Patients were followed up at 3, 6, 9 weeks and 3 months. Patients were evaluated both clinically and radiologically.

Clinical parameters evaluated were pain, swelling, tenderness, deformity any obvious nerve palsy, compression of the level of radial and ulnar styloid process on normal and abnormal side and any complication thereof recorded. Patients were assessed for range of motion of wrist, finger and elbow (for range of motion Goniometer was used).

Radiological Assessment: In radiological assessment x-rays of both wrists anteroposterior and lateral views were taken preoperatively at regular interval. Radiographs were assessed for radial tilt, radial angle and radial length.

Measurement was done on the basis of Van Der Linder and Ericson method.^[2] Dorsal tilt was expressed as the number of degrees from neutral position and taken as negative. Volar tilt was taken as positive. Malunion was defined as more than 15 deg of residual tilt or >3 mm radial shortening compared to the opposite normal wrist

Radial height was assessed on the PA view.^[3]

Radial inclination and ulnar variance was measured on PA view.^[4]

Volar tilt or palmar inclination was measured on the lateral view

Rehabilitation: Shoulder exercises of Codman type was started from the second postoperative day in most cases. The key shoulder exercise to avoid shoulder hand syndrome was active elevation and rotation. The patients were instructed to perform that at least thirty times a day. Six pack hand exercise was taught to each patient and it was started from the second postoperative day.

RESULTS

The subjective, objective and radiographic findings were quantified by the demerit system of Gartland and Werley as modified by Sarmiento et al. The outcome of each fracture was graded as excellent, good, fair and poor. Demerit point system used to evaluate end result of healed distal radius fractures. Our study is an institution based prospective study conducted among 20 patients having distal radial intra-articular fractures with mean period of follow up being 58.5 weeks with a range of 20 weeks to 72 weeks. Following are the results of our study.

Table 1: Age and Sex Distribution of study population.

Age group	No of Males	No of Females	Total	Percentage
18-30	8	0	8	40%
31-40	4	2	6	30%
41-50	1	1	2	10%
51-60	1	3	4	20%
Total	14	6	20	

- In our study 70% patients are male patients and 30% being female patients.
- In our study majority of patients 70% belongs to 18-40 years age group followed by 51-60 years(20%) with mean age being 39.6 years.
- In our study majority of the fractures is due to fall on hand(65%) followed by RTA which is 35%.

Table 2: Distribution of Cases According To Type of Injury.

Types	Open Injuries			Closed Injuries	Total
	GA I	GA II	GA IIIA		
Number of Cases	3	1	1	15	20
Percentage (%)	15	5	5	75	00

Table 3: Types of Fracture According To Fernandez Classification.

Fracture type	No of patients	Percentage
Type II	5	25%
Type III	12	60%
Type V	3	15%

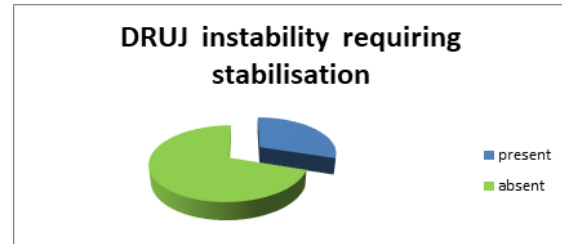


Figure 1: Associated Distal Radio-Ulnar Joint Disruption Requiring Stabilisation.

Functional evaluation

Table 4: Range Of Motion Dorsiflexion-Palmar Flexion Arc

DF-PF arc (degrees)	No of patients	Percentage
>120	16	80%
91-120	3	15%
61-90	1	5%
<60	0	0%

Subjective Evaluation

Among the twenty patients 5 (25%) patients complained of pain on exertion. among the 5 patients 4 patients (20%) had pain around distal radio-carpal joint and 1 patients (5%) had pain around the radio-ular joint. One patient(5%) had poor pain, disability, limitation of motion along with markedly restricted activity. Other 4 (20%) patients had mild to moderate pain on exertion.



Figure 2: Final results (Modified Sarmiento Gartland and Werley (Demerit point system) scoring system

Among the 12 patients (60%) where injury surgery interval was 1-3 days 8 patients (40%) had excellent outcome, 3 patients (15%) had good outcome and 1 patient (5%) had fair outcome.

Among the 5 patients having type II fracture results are equivocal, but in 12 patients with type III fractures mostly have favourable outcomes.

Radiological Evaluation

- In amongst the patients in this study group mean radial inclination at the most recent follow up is 18.75 degrees with a range between 10-21 degrees.
- Mean radial length at the recent follow up is 8.32 mm with a range between 5-11 mm.

- The mean ulnar variance at the recent follow up is - 1.05 mm with a range between 0 to - 1.2 mm.
- The normal volar tilt is reduced in all patients in the study group. All patients except two(2) have achieved volar tilt between neutral to 15 degrees. The mean volar tilt in the study group is 4.5 degrees with a range between -3 to 10 degrees.

Table 5: Complications.

Complication	No of patients	Percentage
Pin tract infection	2	10%
Loss of reduction	2	10%
hypoesthesia	1	5%
CRPS type I	1	5%

Operative steps



Reduction by manual traction Confirmation of reduction and DRUJ stabilisation Per-operative pin placement

Case Photos



Pre-Operative X-rays



Post-Operative X-Rays



Clinical follow-up after implant removal

DISCUSSION

Our study is an institution based prospective study with 20 patients of intra articular distal radial fractures managed by ligamentotaxis by applying JESS and DRUJ stabilisation in patients with associated DRUJ disruption.

- Patients in the age group of 18-60 yrs were taken and most patient in the age group of 18-40 years. Kulsrestha et al showed in their study that mean age group involved was 41.2 which is comparable to our study.^[6]
- Patients were predominantly males (70%). Kulsrestha et al in their study showed patients were predominantly males(67%).^[6]
- Fractures were classified according to Fernandez classification
- Non-dominant hand was involved more commonly (65%)
- Mean injury surgery interval was 4.05 days. In patients where operation were done within 1-3 days showed excellent to good outcome and where operation were delayed >7 days showed fair to poor result. Delay in surgery was due to delayed admission. Kulsrestha et al in their study showed mean delay of 3.5 days between injury and surgery.^[6]
- JESS was removed in 6-8 weeks.
- 30% patients had associated distal radio-ulnar joint injury. According to Dinesh K Gupta et al, DRUJ stabilisation helps to maintain reduction, prevent radial collapse and to maintain DRUJ stability in comminuted intra articular distal radial fractures.^[5]
- Combined dorsiflexion-palmar flexion arc of >120 degree was achieved in 80% of cases.

- According to modified Gartland and Werley scoring system 45% had excellent outcome, 30% had good outcome, 20% had fair outcome and 5% had poor outcome. Similar results were shown by Christensen (2002) and McKenna (2000).^[7,8]
 - Outcome is favourable when injury surgery interval is within 1-3 days.
 - The radiological outcome in our study is comparable to other studies.
 - Complication rate in our study is 25% which is comparable to literature which shows complication rate varying from 10%-38%. Pin tract infection in our study is 10% which is comparable to the study of Jakim et al in which it was 7.2%.^[9]
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CONCLUSION

To conclude, we have shown that JESS effectively stabilises distal radial intra articular fractures, allowing finger movement and prevents stiffness. When intra articular fractures of distal radius are treated by conventional methods, pain and restriction of joint motion is not uncommon. Whereas when treated by ligamentotaxis with JESS, along with DRUJ stabilisation, anatomical reduction is predictably achieved. Though there were complications associated with this procedure, the benefits outweigh various potential problems and complications. With careful assessment, good surgical technique and early mobilisation, distal radial intra articular fractures can be managed effectively with predictably good outcome using JESS fixator.

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