Section: Orthopaedic

Original Research Article

LONG TERM FUNCTIONAL OUTCOMES OF JESS DISTRACTOR IN UNSTABLE DISTAL RADIUS FRACTURES

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ABSTRAC

Background: Distal radius fractures consist of 20 percent of all fractures presenting to the emergency. The unstable fracture patterns require surgical intervention to get optimum functional outcomes. Among the various treatment like pin and plaster, external fixators and internal fixation with plates, Joshi's external stabilizing system (JESS) is an effective and economical option for treating unstable distal radius fractures. Using cost effective methods enables more patients to get standard care, especially in a government hospital setting.

Materials and Methods: This prospective observational study evaluates the functional outcomes of using JESS distractor, in 76 patients coming to Government Medical College Kottayam during February 2013 to July 2014 with unstable distal end of radius fractures. Functional outcomes were measured with the Gartland & Werley score and the modified Mayo score at three-month, six month, one year and ten year follow-up.

Results: 62 patients (81.6%) had good to excellent results at 10 years' follow-up. Eight patients developed pin tract infection, thirteen patients developed Chronic regional pain syndrome and there was late collapse of the fracture in eight patients. K-wire supplementation was done in 28 patients for distal radio ulnar joint instability and radial styloid fractures. There was no need for re-operation in any of the patients. Although early outcomes at 3 months were not satisfactory, functional outcomes at 1 year and 10 years were comparable to other methods of treating unstable distal radius fractures like volar plating.

Conclusion: JESS distractor is an effective and economical treatment option for treating unstable distal end of radius fractures.

Keywords: Distal radius fracture, JESS, Dynamic external fixator.

INTRODUCTION

Fracture distal end of radius is the most common fracture encountered by an orthopaedic surgeon in the emergency department. Nearly 20% of all fractures coming to the emergency department are distal end radius fractures and they have a bimodal age distribution.[1] Most fractures are relatively uncomplicated and are effectively treated with closed reduction and casting.[2] However, fractures which are unstable have an inherent tendency for loss of reduction, which will alter joint kinematics, articular congruence and compromise hand function.[3]

Among the various operative methods, External fixator is a popular method which combines a minimally invasive technique and the principle of ligamentotaxis.[4,5] A variety of static and dynamic external fixators are available which are made with materials like steel to carbon fiber.[6,7] The JESS distractor (Joshi's External Stabilizing System),[8,9] developed by Dr. B.B. Joshi is an economically viable and effective external fixation device made for the Indian population, which is mainly composed of patients from poor socioeconomic status.

JESS distractor is made locally and easily available in all public hospitals and can be offered as a treatment

option to patients who cannot afford costly implants like variable angled plates and column specific plates. We aim to study the long-term functional outcomes of using JESS distractor in treating unstable fractures of distal end of radius.

MATERIAL AND METHODS

We conducted a prospective observational study of 76 patients with unstable fractures of distal end of radius coming to orthopaedic op/casualty, Government Medical College Kottayam, during February 2013-July 2014. Institutional review board and Ethics committee clearances were taken, and study was conducted according to ethical standards in the Helsinki Declaration of 1975, as revised in 2000. Radiographs of the wrist were taken and fracture classified according to Frykmans classification[10]. Fractures were deemed as unstable according to the Lafontaine criteria[11] as detailed in Table 1 and included in the study group after fulfilling the inclusion and exclusion criteria given in Table 2. Informed consent was taken from the patient and admitted for procedure under regional block.

Operative technique

JESS consists of application of two 3.5 mm Schanz pins in radius and two 2.5 mm Schanz pins in the second metacarpal connected by serrated connecting rod with provision for distraction. Instrumentation and JESS applied in a patient shown in Figure 1. Distraction and acceptable reduction were achieved and confirmed in an image intensifier. In few cases of very comminuted type fracture patterns, reduction was supplemented with K-wires. The distal radio-ulnar joint instability was assessed and those with instability were fixed with transfixing k-wires from ulna to radius.

Active finger mobilization exercise began on the first postoperative day. Patient was discharged on the third day and pin tract care was explained to the patient. Patient was followed up at two weeks to check for pin tract discharge and check X-ray was done. If loss of radial height was seen, secondary distraction was done to correct it. At 6 weeks, X-rays were taken, and distractor removal was done after radiological sign of union. Then follow-up was done at three months, six months, one year, and at ten years. Functional outcome of the patients was assessed using Gartland & Werley (G&W) score,[12] and the Modified Mayo wrist score.[13]

RESULTS

A total of 123 patients of displaced distal end radius fracture were treated with the JESS during the study period. 47 patients from the initial study group were lost to follow-up and hence were not included in this long-term outcome analysis study. Out of 76 patients, 55 (72.4%) were male and 21 (27.6%) were female. Distribution of fractures as per the Frykman classification is given in Graph 1. The mean age of patients was 41 with a bimodal age distribution. The dominant hand was injured in 55 (72.4%) patients. Mean interval between injury and surgery was 1.5 days, with 77.6% cases being performed within 48 hours from time of injury.

K-wire supplementation was done in 28 cases, and it was used specifically in cases with isolated radial styloid fragment and cases with distal radioulnar joint subluxation, which did not correct after application of distractor.

Eight patients developed pin tract infection which was managed successfully by antibiotic treatment and wound care. Six patients had a loss of radial height in 2 weeks follow-up and traction had to be increased to achieve satisfactory reduction. Thirteen patients developed Complex regional pain syndrome (CRPS) but recovered after physiotherapy and conservative management at 6 months. Late collapse of fracture after JESS removal was seen in eight patients and their scores worsened at the six-month review but improved at the one year follow up. The patients with late collapse had worst scores and poorer outcomes ay 10 years, compared with the rest of the study group.

The G&W score at ten years in 62 (81.6%) patients having good to excellent results. Mayo score was 86.8 % good to excellent results at 10 years. Radiological outcome of patient no 4 given in Figure 2. Clinical outcome of patient No 16 shown in figure 3. Only 27.9% patients had good results at 3 months' follow-up and the majority (62%) of the patients had stiffness and reduced ROM. The functional scores improved significantly at 6 months after good physiotherapy and rehabilitation. 93.4% patients had good scores at 1-year follow-up. There was a significant decrease in pain and increase in range of motion (ROM), grip strength, and activity at 1-year follow-up compared to 3-month scores. None of the patients had any long-term complications at 1 year, which were related to JESS application. Average functional scores at follow-up are given in Graph 2.

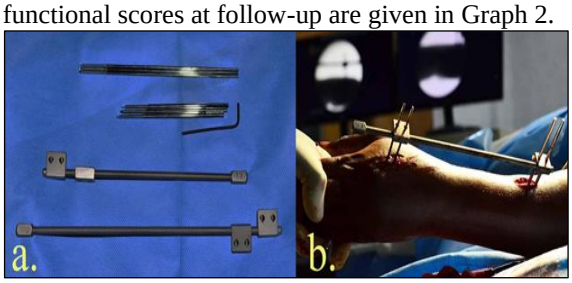


Figure 1: a. Instrumentation for JESS application. b. JESS distractor applied on Patient No. 12

Figure 2 a) AP and Lateral view of left wrist of patient no 4 at initial visit. b) Xray views after JESS application. c) Xray at 3 months follow-up

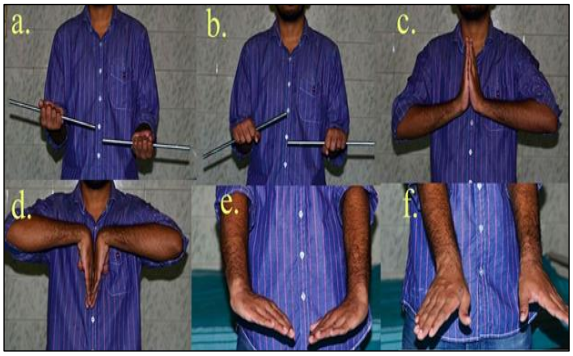
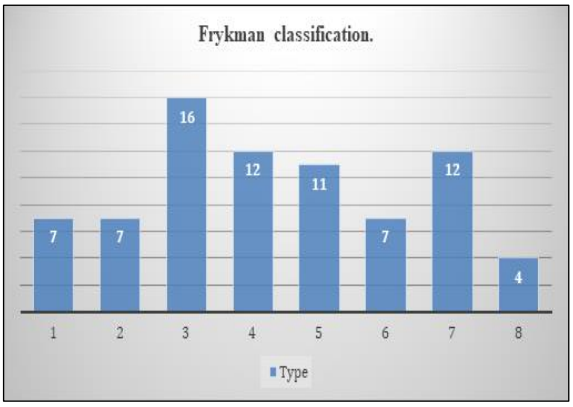
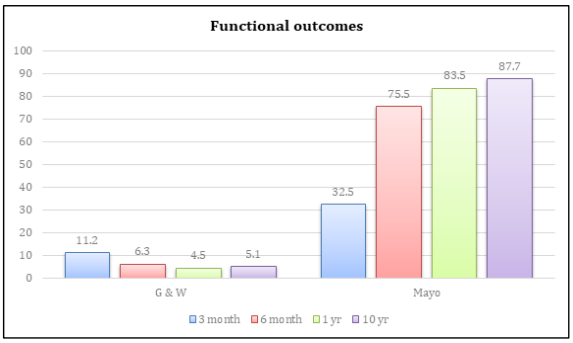


Figure 3: One-year follow-up of patient no 16. a) Supination b) Pronation c) Extension d) Flexion e) Adduction f) Abduction



Graph 1: No of patients in the Frykman classification



Graph 2: Gartland & Werley and Mayo score at 3 months, 6 months, 1 year and 10 years

Table 1: Lafontaine criteria for instability

Lafontaine criteria for instability[11]
Initial dorsal angulation >20
Dorsal comminution
Radiocarpal intra-articular involvement
Associated ulna fracture
Age>60 years
Fractures with > 2 criteria are deemed unstable

Table 2: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Unstable distal radius fractures	Compound fractures
Age between 18 to 65	Previous distal radius fractures
Injuries less than 2 weeks old	Fracture of other bones in the same limb

DISCUSSION

Different fracture patterns will occur due to the anatomy of the distal radius and the forces acting on the wrist at the time of injury. The successful use of external fixation requires careful assessment of fracture pattern, correct surgical techniques, supplemental fixation with K-wires, adherence to a postoperative protocol involving pin tract care, early mobilization and timely radiological follow up. Ligamentotaxis and early mobilization is the basic principle of external fixator treatment. Many external fixation devices are described to achieve reduction and fixation of the fragments without loss of position and acceptable functional results. In our study, we used a JESS distractor for treatment distal end radius fractures which allowed sound fracture union with functional mobility. Since the study was conducted in a government owned medical college hospital, patients were economically challenged and could not afford to buy any of the modern implants like variable angle locking plates, fragment specific plates and modern dynamic external fixators. JESS fixator was available in hospital stock and hence we could offer affordable treatment without any financial burden to the patient.

Good to excellent results were found in 82.2% of cases at 10 years. There was a significant reduction in pain and increase in ROM, grip strength, and patient satisfaction at 10-year follow-up when compared with three month and six-month scores. Males and patients in the age group <50 years had better results when compared with females and patients in the age group >50 years. The early mobilization of the wrist leads to normalization of blood supply, hastened functional recovery, earlier resolution of wrist swelling, and decreased joint stiffness. The static distraction provided by the JESS

aids in mobilization of the wrist while reduction of the fracture is maintained.

Volar locking plates has also shown to be a good treatment option for unstable displaced distal radius fractures. Comparing with JESS, volar plate requires open reduction, increased operative time and increased cost. The complications with JESS fixators are minimal with meticulous pin insertion and pin site care. In a systematic review by Gou et al[14] comparing volar plates versus external fixators for unstable distal radius fractures. They found that external fixators had better grip strength and no difference in radiological outcomes compared with locking plates. But locking plates had lesser complications and better disability scores than external fixators.

Another systematic review by Woolnough et al,[15] comparing surgical outcomes of various surgical techniques for distal radius fractures and found that external fixators were associated with lower complication risk compared to other techniques. They also found that intra-articular fractures are better treated with volar locking plates and had lesser complications compared to other techniques.

In a study by Duramaz et al,[16] comparing bridging external fixator versus locking plates, they found better outcomes with locking plates. They postulated that inferior results could be due to the static nature of the external fixator since the wrist in those cases had to be immobilized till union. Sharma et al,[17] noticed better grip strength in the external fixator group due to early grip strength exercises initiated in the external fixator group. Rom and strength exercises had to be delayed in the plate fixation group due to the post-operative pain. The functional outcomes were better due to early initiation of grip strengthening and range of movement exercises.

We also noticed that in our group better outcomes were seen in extra-articular fracture patterns, than more comminuted intra-articular types. The functional outcomes improved till the sixth month and one-year mark. The outcomes did not deteriorate at the 10-year mark in many of the patients, in fact there was improvement in scores in few patients compared to the one-year outcomes, although not statistically significant. Complication rates are higher when compared to plate fixation, but all are short term complications and did not influence the outcomes beyond the six months follow-up. No other study has documented 10-year long-term follow-up of results of using JESS in unstable distal end radius fractures.

CONCLUSION

External fixation with the JESS is an effective and economical treatment method for unstable distal end radius fractures with complication rates like other treatment options.

Limitation

No control group was included in our study due to financial concern for the patient. There was loss to follow-up of 47 patients at the 10-year review, since many patients had migrated, expired and could not be contacted with their given phone number and address.

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