Long-term Functional Outcome in Fractures of the Lower End Radius in Young Adults Treated by Static External Fixator

Uttam Kumar Garg¹, V. P. Sharma², U. K. Jain¹

Abstract

Background: Fractures of the distal end radius represent the most common upper extremity fracture. Many external fixation devices are described to achieve reduction and fixation of the fragments without loss of position and acceptable functional results. The ligamentotaxis is the basic principle used by external fixation. The aim of the study was to assess the long-term functional outcome in fractures of the lower end radius in young adults treated by static external fixator.

Materials and Methods: A total of 56 patients (30 males and 26 females), aged between 15 and 50 years with intra-articular distal end radius fracture were treated with Modified Joshi’s External Stabilization System from 2003 to 2012. The patients were followed up at 2 weeks, 3 weeks, between 6 and 8 weeks, 6 months, 1 year and at 5 years after the surgery. The assessment of pain, range of motion, grip strength and activity were assessed at 6th month, 1 year and 5 years follow-up and scored according to Green and O’Brien scoring system.

Results: Result was excellent in 48 (85.71%), good in 5 (8.9%) and poor in 3 (5.3%) at 5 years postoperatively.

Conclusion: External fixator has been the traditional mode of treating unstable distal radius fractures and is still used by many as the preferred technique due to its acceptable results, easy application and cost-effective.

Keywords: Joshi’s external stabilization system, distal end radius fractures, Green and O’Brien scoring

Introduction

Since the description by Poteau in 1783 and by Colle’s in 1814, distal radial fractures remain a therapeutic challenge. Collapse, loss of palmar tilt, radial shortening, and articular incongruity are frequent after closed treatment and plaster application of unstable and comminuted intra-articular fractures of the distal radius. Many external fixation devices are described to achieve reduction and fixation of the fragments without loss of position and acceptable functional results. The ligamentotaxis is the basic principle used by external fixation. The aim of the study was to assess the long-term functional outcomes of distal end radius fractures managed with static monoplanar modified Joshi’s external stabilizing system (JESS) in different age group.

Material and Method

A total of 56 patients, aged between 15 and 50 years with intra-articular distal end radius fracture were treated with Modified Joshi’s External Stabilization System from 2003 to 2012. Out of 56 patients, there were 30 males, 26 females, 32 had a right side and 24 had their left wrist involvement.

External Stabilization System

Modified JESS consists of the application of a total of 4 Kirschner wires in which 2 were placed in radius (2.5 mm), and 2 were placed in 2nd and 3rd metacarpals (2 mm) together connected by 2 × 2 mm clamps and interconnected rods after pre-stressed two Kirschner wires by conversing it together. Pre-stressing the wires reduces the chances of wires pulling out from the bone. Now both units made connected with 4 mm connecting rods after applying the distractor. The frame was made more stable by applying another 4 mm rod and connected with 4 × 4 mm clamps. The distractor was removed once all...
clamps were made tighten and thus converted it into the static frame. In osteoporotic bone, we used two 3.5 mm Schanz pins in radius and 2.5 mm Schanz pins in 2nd metacarpal connected by connecting rods (JESS). If there was any wound, swab for culture sensitivity was sent, thorough debridement was done and the wound was properly cleaned. Then the fracture was stabilized by JESS. The pa-tients were followed up at 2 weeks, 3 weeks, between 6 and 8 weeks, 6 months, 1 year and 5 years after the surgery. The assessment of pain, range of motion, grip strength and activity were assessed at 6th months, 1 year and 5 years follow-up and scored according to Green and O’Brien scoring system. Acceptable reduction was achieved and confirmed in the image intensifier. If articular reduction was not found satisfactory, then the depressed fragment was elevated though Kirschner wire percutaeneously. The Guidelines for acceptable closed reduction taken were:
1. Radial inclination: ≥ 15°.
2. Radial length: ≤ 5 mm shortening.
3. Radial tilt: ≤ 15°dorsal or 20° volar tilt.
4. Articular incongruity: ≤ 2 mm of step-off.

Post-operative X-ray was taken (Fig. 2, Fig. 1 is pre-operative Skiagram). The patient was given IV antibiotics for 1 day and oral for 5 days. Active finger, elbow, and shoulder mobilization were started the 1st post operative day. Patient was discharged on the same day or on the 2nd day, and pin tract care was explained to the patient (Fig. 3).

Patient was followed up at 2 weeks to check for pin tract discharge or loosening. Dynamization of the frame was done at 3 weeks routinely by loosening the proximal clamps and then again re-tightened. At 6 weeks postoperative X-ray was taken and then distractor removal was done between 6 and 8 weeks depending on the fracture union. The wrist exercises were started after removal of the fixator. Follow-up was done at 6 months, 1 year and 5 years for the final outcome (Fig. 4, 5, 6, 7, 8). Outcome of the patient was assessed using Green and O’Brien Scoring system modified by Cooney, at 6th months, 1 year and 5 years after the surgery (Fig. 9). The final score of 90-100 was considered as excellent, 80-89 was good, 65-79 was fair and below 65 was considered as poor results.

Results
A total of 56 patients of displaced distal end radius fracture were treated with JESS during the study period. Out of 56 patients, 30 (53.57%) were male, and 26 (46.42%) were female. Out of 56 wrists, 32 were right, and 24 were left wrist involvement. According to Green and O’Brien criteria pain, muscle strength, range of motion, and functional status of the patient were recorded for evaluating the final functional results of our study. The mean age of pa-tients was 36.07 ± 13.93 years. Mean interval between injury and surgery was 3.2 days. The average operative time was 28 min (range: 20 – 45 min). Mean duration of fixator application was 7 weeks. Mean time of radiological union was 7 weeks. Five patients (8.92%) developed pin tract infection which was managed successfully by antibiotic treatment. Swelling, inflammation, and occasional pain were observed in 4 patients (7.14%). One patient (1.78%) developed paraesthesia along radial cutaneous nerve distribution area which was resolved in 18 months. One patient (1.78%) developed undisplaced fracture shaft radius at proximal pin site after 4 months of the removal of pin due
to trivial trauma. It was managed conservatively by simple above elbow plaster for 6 weeks. One patient with a severe crush (Type 5) injury had only a minimal functional range of wrist movement. Two patients had restricted finger movement; this was generally related to failure to co-operate with early post-operative rehabilitation. No patient had an extensor lag of the index finger. Result was excellent in 48 (85.71%), good in 5 (8.9%), and poor in 3 (5.3%). Five patients (8.9%) had a residual deformity of the wrist; in all distal ulna was prominent.

Discussion
Different surgical strategies are available for treating unstable intra-articular distal radius fractures, including external fixator, open reduction, and internal fixation with locking or non-locking palmar plates. External fixator is versatile in managing both intra- and extra-articular fractures with acceptable functional results. Many external fixation devices are described to achieve reduction and fixation of the fragments without loss of position and acceptable functional results [1]. The ligamentotaxis is the basic principle used by external fixation [15]. We attributed our satisfactory results to the recognition and definition of the injury at the initial assessment, the simplicity of the technique, and to careful post-operative management. The use of an external fixator in the treatment of unstable intra-articular fractures of the distal radius has received support [6, 8, 12, 19]. Many earlier experience of treating these fractures by closed reduction and immobilization in plaster, with or without transfixing pins, gave indifferent results. Gartland and Werley, Boyd and Horne, and Kongsholm and Olerud [4, 9, 13] reported different results with the same technique. Full open reduction of severely comminuted fractures is technically difficult and method requires excessive stripping of soft tissues giving a poor functional result [7, 21]. Others have advocated open reduction and internal fixation with multiple Kirschner wires, followed by early mobilization [2, 17, 22, 23]. Melone failed to achieve adequate anatomical reduction reporting an average loss of radial length of 3.2 mm, and an average loss of volar tilt of 8.5°. 93% of his patients had some joint irregularity or degenerative change. Bradway [5] using similar methods reported a 25% incidence of joint incongruity and an 18% infection rate. Others consider that it has a high incidence of complications, most of which are related either to pin problems or inadequate reduction [22]. Prolong immobilization of the wrist in an external fixator leads to decreased blood supply to the bone and soft tissues and causes peri-articular fibrosis. This can be minimized by dynamization of the frame after 3 weeks post-operatively. Modified JESS fixator application allowed good fracture union with excellent functional mobility in our study. In conclusion, modified JESS or simply JESS is a good option in patients with displaced distal end radial fractures.

Conclusion
External fixator has been the traditional mode of treating unstable distal radius fractures and is still used by many as the preferred technique due to its acceptable results, easy application and cost-effective. The results are comparable to volar or dorsal locking plates as reported in literature. In our study of 56 patients (30 males and 26 females), aged between 15 and 50 years, the result was excellent in 48 (85.71%), good in 5 (8.9%), and poor in 3 (5.3%) patients. However the result depends on the achieving the good articular congruity post-operatively. If we can’t achieve so by close reduction or distraction alone, then one should have no hesitancy to minimal open the joint to get it anatomical. What we did here was that we just elevated the depressed articular surfaces using a K wire percutaneously.
Reference


How to Cite this Article