ANATOMICAL AND FUNCTIONAL END RESULTS OF UNSTABLE DISTAL RADIUS FRACTURES WITH PERCUTANEOUS CROSS K WIRES

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ABSTRACT

Distal radius fractures are most common fractures of the upper limb. Many methods have been described in literature to manage unstable distal end radius fractures. We evaluated the anatomical and functional end results of unstable distal end radius fractures treated with percutaneous cross k wires fixation. 60 patients with unstable distal end radius fractures were included in this prospective study. Unstable fractures were differentiated from stable fractures by criteria given by Cooney et al. Fractures with shearing force and ipsilateral forearm injuries were excluded from the study. All patients underwent percutaneous cross K wires fixation. Radiographs were taken before and after procedure. They were followed up regularly at 6 weeks, 12 weeks and by the end of one year. Results were assessed by Lidstrom's criteria. Mean age in the study group was 61 years. 80% patients were above 40 years. 46 patients were female (76.67%) in our study as compared to 14 males (23.33%). Fall on outstretched hand was most common mechanism of injury (73.33%). Mean loss of radial angle was 1.9º, mean loss of palmar angle -3.5º, and mean radial shortening was 3.8mm. 76.7% had satisfactory (excellent and good) anatomical results. 83.3% had satisfactory functional results. Percutaneous cross K wires fixation of unstable distal end radius gives satisfactory and reproducible anatomical and functional results.

Keywords: Distal radius fracture, K wires.

INTRODUCTION

In 1814, Abrahm Colles [1] first described distal end radius fracture with characteristic deformities well before the advent of radiographs. Since then, many variants and classification has been described in the literature. But still, there is debate over the classification of unstable distal radius fracture and there is no consensus regarding management of same.

Unstable fractures treated with conservative methods have high rates of loss of reduction, malunions, osteoarthritic pain and carpal instability. Unstable distal end radius fractures can be treated by percutaneous K wire fixation and open reduction and stabilization with plates. Percutaneous K wire fixation is a common procedure and many different techniques have been explained in literature. Most common among them were Willenegger’s divergent k wire fixation from radial styloid [2], Kapandji intrafocal pinning [3], modified Kapandji pinning [4] and cross K wire fixation [5]. Cross K wire fixation and willenegger transstyloid fixation are easy methods with less local complications than intrafocal fixation. Our study evaluated anatomical and functional end results of cross k wire fixation in unstable distal end radius fractures.

MATERIAL AND METHODS

Sixty adult patients were included in our study. Fracture anatomy was studied by plain posteroanterior and lateral radiographs of affected wrist joints.
The fractures were termed as unstable according to Cooney et al [6] criteria.
1. Marked dorsal comminution of distal end radius
2. Dorsal angulation more than 20°
3. Radial shortening more than 10mm 4. Fractures involving wrist with articular step more than 3mm. Loss of reduction with dorsal angulation of more than 10° and 5mm or more of radial shortening after closed reduction. The fractures were classified by Frykman’s classification [7].


SURGICAL TECHNIQUE- Under regional /general anaesthesia, the reduction was achieved by using a handshake grip to distract the fracture while counter traction was applied proximal to the elbow by the assistant. The surgeon’s contralateral thumb was used to restore normal volar tilt once distraction of the fracture was adequate. Reduction was then evaluated in posteroanterior and lateral planes with C-arm (ITV). Once the length, the dorsal and radial angles and the joint surface of the radius had been restored, two crossed K wires were passed. The first K wire was passed through radial styloid process just dorsal to first extensor compartment, aiming to cross the fracture line in both planes. This required about 45° angle with the long axis of the radius on the anteroposterior view and aiming the wire 10° dorsally on lateral view. Second K wire was passed from distal dorso-medial to proximal-ventrolateral direction. Both K wires were advanced to just penetrate the cortex of the proximal fragment. If necessary, one additional K wire was passed from radial styloid divergent or parallel to first K wire. The accuracy of reduction and of the placement of the Kirshner wires was assessed with C-Arm. Kwires were then bent and cut. Post-operative x-rays were taken (picture-1). A sterile dressing using povidone iodine was kept at pin site. Well-padded dorsal and volar plaster splints were applied keeping the wrist in neutral position.

Postoperative Management: Hand was elevated for 24 hours with monitoring of neurovascular status. Early movement of fingers, elbow and shoulder was encouraged. Intravenous antibiotics were continued for 48 hours.six weeks, cast and k wires removed as outpatient procedure. Check radiographs were taken. Patients were regularly followed up at 12 weeks, 26 weeks and one year. The assessment included the subjective impressions of the patient, objective grading of mobility (Picture 2,3,4), function and deformity, comparison of final and initial radiograph. A detailed questionnaire was completed with each patient to evaluate subjective factors such as pain, functional limitations and occupational considerations. Objective examination included inspection of the wrist for deformity, tenderness, abnormal mobility of the distal radio ulnar joint, measurement of the range of movements and grip strength (picture-2). The radiographic evaluation included radial length, dorsal angle and any evidence of joint incongruity, radioulnar joint instability and radial collapse.

The subjective, objective and radiographic findings were quantified by Lidstrom’s system [8]. The outcome of each fracture was graded as excellent, good, fair or poor. The final evaluation done by suitable statistical tests.

OBSERVATION AND RESULT
In this study, 76.66% patients were females as compared to 23.34% males. 43.33% patients were in the age group of 40-60 years followed by 36.66% in above 60 group. Average age was 61 years. Fall on outstretched hand was the commonest mechanism of injury (73.33%). 38 patients had fracture on dominant hand as compared to 22 patients who had fracture in non-dominant hand. 53.33% patients had extra-articular fracture; in which 30% were type 2. 33.3% patients had radio-carpal joint involvement and 26.6% patients had distal radio ulnar joint involvement. 13.3% patients had both radio-carpal and distal radio ulnar joint involvement. Two patients had superficial skin infection with skin necrosis. Two patients had severe wrist stiffness which lasted for 6 months. One patient had causalgia. Two patients had paraesthesia around anatomical snuffbox. One patient had shoulder stiffness. Two patient had pain in ulnar styloid especially on supination. Supination and palmar flexion movements were regained later than other movements of wrist. Anatomical mean radial shortening was 3.9 mm. Mean loss of radial angle was 2° and loss of volar angle was 4.48°. Anatomically, 30 patients (50%) had excellent, 18 (26.7%) good, 8 patients (16.7%) and 4 patients (6.7%) had poor outcome as per Lidstrom’s criteria. Functionally 30 patients (50%) had excellent, 20 patients (33.3%) had good, 8 patients (16.7%) had fair and 2 patients (3.3%) had poor results as per Lidstrom’s criteria.

DISCUSSION
75% of forearm fractures involve the distal radius [9] as noted by a Swedish study. Undisplaced and stable fractures can be treated by the conservative method. Three methods that are usually followed in treating unstable distal radial fractures are 1) Percutaneous K wiring 2) External fixation 3) Open reduction and internal fixation. Each method has its own advantages and disadvantages. Percutaneous K wire fixation is a simple and accepted treatment for both unstable intra articular and extra articular fractures. External fixation is a good option for intra articular fractures.

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fracture but maintaining alignment with unilateral frames is difficult in diaphyseal comminution. External fixator maintains rigid fixation but over distraction can lead to 1) triangular fibrocartilage complex related problems, 2) severe stiffness of wrist and hand, 3) collapse of fragments once fixator is removed [10]. Patient’s compliance is poor with external fixator. Volar plating is getting popular recently especially with contoured locking plates. These plates give the option of early mobilization. But they are expensive. Intra articular penetration of distal screws is a worrisome complication leading to severe restriction of joint motion and secondary osteoarthritis over a period of time. Extensor tendon attrition due to long screws can lead to rupture of extensor tendon of wrist and abductor pollicis longus [11]. Karantana et al [12] concluded that use of volar locking plate resulted in faster recovery of function than percutaneous k wire fixation. However, there was no significant difference at 6 or after twelve weeks. Costa et al [13] did a multicentric randomized controlled study to compare clinical effectiveness of k wire fixation and locking plate fixation. He concluded that there is no differences in functional outcome treated with k wires or plates. However, K wire is cheaper and quicker to perform. The goal of treatment in unstable distal radius fracture is to maintain the anatomical originality and to retain it till union, without further compromising the soft tissue damage. Percutaneous K wire fixation is a well accepted treatment technique for unstable distal end radius fracture. Many techniques of K-wire fixation have been described such as Kapandji intrafocal k wires, modified kapandji k wires, conventional willenegger radial styloid k wires and cross pinning technique. Comparative study between these techniques has not shown any difference in clinical outcome. Injury to tendons and superficial radial nerve are common complications with percutaneous k wire fixation [14]. Biomechanical study on distal radius fractures showed that Cross k wire fixation gives stable biomechanical construct [15].

We classified distal radius fractures by Frykmans classification.53.33% patients had extra-articular fracture; in which 30% were type 2. 33.3% patients had radiocarpal joint involvement and 26.66% patients had distal radio ulnar joint involvement.13.3% patients had both radiocarpal and distal radio ulnar joint involvement. Frykman’s classification gives good account of breach in the anatomy of distal end radius and its joints. However, it does not take into consideration the degree of displacement, degree of comminution, and bone quality. We have included only unstable or displaced fracture in our study. Other limitation of Frykman’s classification is that it does not give information about the anatomy of the fracture. Fractures in coronal plane like dorsal and volar Barton are better stabilized by plates and not by k wires. We have excluded these fractures in our study. Most of the fractures in our series are extra-articular fractures (53.3%) with low energy impact. This could be due to 76.66% patients were females, fall on outstretched hand is the most common mechanism of injury (73.3%) and 80% of the patients were above 40 years.

Injury to superficial nerve and extensor tendon is a known complication of percutaneous k wire fixation [14]. Two patients complained paraesthesia around dorsum of first web space probably due to injury to the branch of superficial radial nerve. We did not encounter any weakness of finger or rupture of tendon in our series. But two patients suffered wrist pain and stiffness which lasted for six months. This can be attributed to tendon tethering and adhesion to the surrounding structure.

Anatomical mean radial shortening was 3.9 mm. Mean loss of radial angle was 2° and loss of volar angle was 4.48°. 30 patients (50%) had excellent anatomical outcome, 18 patients had (26.7%) good, 8 patients (16.7%) fair, and 4 patients (6.67%) had poor outcome as per Lidstrom’s criteria. There was no correlation between Frykman types and anatomical end results. Functionally, 30 patients (50%) had excellent, 20 patients (33.3%) had good, 8 patients (16.7%) had fair and 2 patients (3.3%) had poor results as per Lidstrom’s criteria. Again there was no correlation between Frykman’s type and functional end results. We agree with Keerthi et al [16] that Frykman’s classification seems to have no relevance in terms of overall outcome. Results in this study suggest that maintenance of an anatomical reduction is more important. Results also show that good functional result usually accompanies good anatomical results.
CONCLUSION
Frykman’s classification does not have prognostic value. Percutaneous cross K wire fixation for unstable distal end radius is a simple, reliable and reproducible technique which gives satisfactory anatomical and functional results.

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CONFLICT OF INTEREST:
The authors declare that they have no conflict of interest.

REFERENCES