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Functional and radiological outcome of percutaneous pinning in the management of extra-articular distal radius fractures

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Abstract

Introduction: Distal radius fractures are common injuries encountered in orthopaedics casualty. Range of fracture extends from simple extra-articular to highly comminuted intra-articular fractures.^{1, 2} Restoration of wrist function is the primary goal in the treatment of extra articular distal radius fractures. Most of the fractures are effectively treated with closed reduction and immobilization in a plaster cast. Percutaneous pinning provides anatomic reduction and rigid fixation and allows earlier rehabilitation.³ Aim of the study was to assess the functional and radiological outcome of percutaneous pinning in distal radial fractures. **Materials and Method:** This is prospective study of 28 patients conducted at department of orthopaedics over a period of 2 years.

Results: Age of the patients was ranged from 20 to 65 years with mean age of 40.2 years. Maximum incidence of injury was observed at 4th (50%) and 3rd (25%) decade of life. 20(71.43%) patients were male. 16 (57.14%) patients attained fracture due to motor vehicle accidents. Pin loosening was encountered in 5 cases. The mean radial length, radial volar tilt, and radial inclination were 10.24 mm, 8.26 degree, and 19.82 degree respectively. Functional outcome was excellent results in eight cases (28.57%), good in 13 cases (46.43%), fair in 5 (17.86%) cases and poor in 2 cases (7.14%).

Keywords: percutaneous pinning, distal radius fractures, extraarticular.

Introduction

Fractures of the distal radius constitute about 16 % of all fractures treated in emergency department. Distal radius fractures are the most common injuries seen in orthopaedics casualty due to more number of vehicles on road and increased industrialization. Range of fracture extends from simple extra-articular to highly comminuted intra-articular fractures^[1, 2, 4]. In young adults the fractures are usually resulting from high energy injuries and in elderly population, the fractures are usually resulting from low energy injuries. Most of the fractures are effectively treated with closed reduction and immobilization in a plaster cast^[5]. It is well accepted that the restoration of disrupted radial anatomy, maintenance of accurate and stable reduction, and nearly hand mobilization are required for good functional results in distal radius fractures^[3].

Treatment modalities depends on patients age, lifestyle, compliance, functional demands, dominance of limb, type of fracture, alignment of fracture, soft tissue condition and associated medical co morbidities. Treatment options for distal radius fractures include closed reduction and POP cast, closed reduction and percutaneous pinning methods such as Kapandji intrafocal pinning, transradial styloid pinning, pinning via the Lister's tubercle or transulnar pinning. Other modalities include ligamentotaxis, open reduction and internal fixation by implants such as screws and plates^[5, 6].

The principle of percutaneous K-wires fixation is either to maintain reduction between two fragments or else to buttress the distal fragment. This technique is preferred in elderly patient with reduced bone quality because K-wires provides extra support needed to maintain the

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fracture in desired alignment and reduction [7, 8]. Aim of the study was to assess the functional and radiological outcome of percutaneous pinning in distal radial fractures.

Materials and Method

The prospective study of 28 patients conducted at department of orthopaedics Basaveshwara Medical College and Hospital from Jan 2015 to Dec 2016 in selected group of patients. Post operative follow-ups were done at 4th week and 4 months. Adult patients with extraarticular fractures, fracture not older than 2 weeks, failure to maintain reduction of fracture, displaced fracture in cast and patient willing for proposed surgery were included. Patients with open fractures, neurovascular injuries, polytrauma patients, musculoskeletal injuries to the same limb, patients who lost follow up and patients with psychiatric illness were excluded from the study.

Method

A detailed history was taken and a systematic examination of the patient was conducted according to proforma. Radiographs of wrist were taken to confirm the fracture. Then temporary splinting of fracture was done with below elbow POP slab. All patients were taken for elective surgery as soon as possible after necessary investigations. Patient was kept in supine position in an operating table after general anesthesia. Hand was prepared and draped. The fracture traction was given by assistant by pulling thumb with one hand and pulling index middle and ring fingers with another hand. Counter traction given at elbow with elbow flexed with another

assistant. Closed reduction is assessed and confirmed under C-arm imaging in anterior-posterior and lateral planes.

Maintain the traction as the fracture in the reduced position, the first K-wire of 1.5-2.0 mm was inserted from the dorsolateral aspect of the distal radius fragment across the fracture and into the proximal fragment under image intensifier guidance. A second K-wire was passed from the dorsomedial aspect of the distal fragment across the fracture into the proximal fragment. After checking the stability of the fracture under image intensifier, if required, a third K-wire was passed from dorsolateral aspect from distal to proximal fragment. The wires were drilled to engage the opposite cortex. K-wires were bent at a right angle and cut short outside the skin for easy removal. A sterile dressing including sponge padding was applied around K-wire. Dorsal below elbow POP slab was applied. Postoperative pain and inflammation were managed with analgesics, anti edema medications and limb elevation. Immediate postoperative check x-rays were taken in both anterior-posterior and lateral planes, the reduction of fracture was confirmed. Patients were asked to perform active finger movements, elbow and shoulder movements from day one. Patients were discharged 24 hours post surgery after ensuring good distal circulation of fingers.

They were seen at ortho OPD at 4 weeks, when the cast was changed to remove k-wires. They were subsequently referred to physiotherapist. Radiological parameters include radial volar tilt, radial length, and radial inclination were assessed at pre reduction, post reduction, 4 weeks and 4 months.

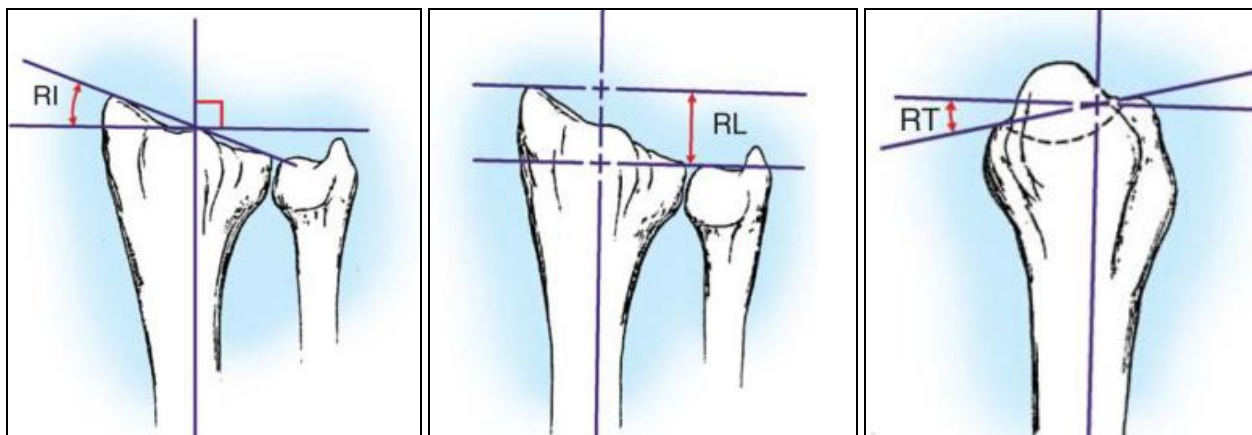


Fig 1: Normal average distal radial angles [10]. Radial inclination (RI; average 22 degrees). Radial length (RL; average 12 mm). Radial volar tilt (RT; average 11 degrees)

Functional evaluation of each patient was done at 4 months as per Gartland and Werley demerit scoring system. The data

thus collected was compiled and analysed using Statistical package for social services (SPSS vs 20).

Table 1: Gartland and Werley demerit scoring system [9]

Result	Points
I. Subjective evaluation	0-6
• Excellent: no pain, disability, or limitation of motion	0
• Good: occasional pain, slight limitation of motion, and no disability	2
• Fair: occasional pain, some limitation of motion, feeling of weakness in wrist, no particular disability if careful and activities slightly restricted	4
• Poor: pain, limitation of motions, disability, and activities more or less markedly restricted	6
II. Objective evaluation	0-5
• Loss of dorsiflexion	5

• Ulnar deviation	3
• Supination	2
• Palmar flexion	1
• Radial deviation	1
• Circumduction	1
• Distal radioulnar joint	1
III. Residual deformity	0-3
• Prominent ulnar styloid	1
• Residual dorsal tilt	2
• Radial deviation of hand	2-3
IV. Complications	0-5
• Arthritic changes minimal	1
Minimal with pain	3
Moderate	2
Moderate with pain	4
Severe	3
Severe with pain	5
• Nerve complications (median)	1-3
• Poor finger function due to cast	1-2
Final result	
0-2 Excellent	
3-8 Good	
9-20 Fair	
21 Poor	

Results

Age of the patients was ranged from 20 to 65 years with mean age of 40.2 years. Maximum incidence of injury was observed at 4th (50%) and 3rd (25%) decade of life. 20(71.43%) patients were male and 8(28.57%) patients were female. Right wrist involved in 18(64.28%) patients, while the left wrist was involved 10(35.72%) patients. 16 (57.14%) patients attained fracture due to motor vehicle accidents, 10(35.72%) cases attained due to self fall, and 2 (7.14%) attained due to other causes.

Average range of motion was 60 degree in flexion, 62 degree in extension, 26 degree in ulnar deviation, 8 degree in radial deviation, 70 degree of pronation and 65 of supination. Pin loosening was encountered in 5 cases. Pin site superficial infection (n=3), malunion (n=2), joint stiffness (n=5) and reduced grip strength (n=2) were the other complications observed. Reflex sympathetic dystrophy, post-traumatic arthritis of wrist, subluxation of DRUJ and neurovascular were not seen.

The mean radial length, radial volar tilt, and radial inclination were 10.24 mm, 8.26 degree, and 19.82 degree respectively. The functional outcome of the patients was assessed at 4 months postoperatively by demerit score system of Gartland and Werley and we found that excellent results were seen in 8 cases (28.57%), good in 13 cases (46.43%); fair in 5 (17.86%) cases and poor in 2 cases (7.14%).

Discussion

Distal radius fractures are common injuries encountered in orthopedics casualty; especially with increasing number of low energy fractures in elderly patients [1]. Management of distal radius fractures has a very long history which includes various modalities from non operative to surgical treatment. Abraham Colles (1814) described the dorsally displaced distal radius fracture that bears his name. Kapandji in 1976 first described two pin intrafocal pinning technique for distal radius fractures [5].

The average age of our study is 38.46 years which is comparable to the studies of John Bradway [11] and Harish

Kapoor [12] who had an average of 40 yrs, 39 yrs respectively. Increased incidence in males is probably due to their involvement in outdoor activities, riding vehicles and heavy manual labour. The common causes of distal radius fracture are road traffic accidents and fall on out stretched hand. In elderly patients simple fall on outstretched hand seems to be the most common cause and these fractures are usually extra-articular fracture of distal radius. John K Bradway [11] reported fall on outstretched hand as the most common mode of injury whereas, Harish Kapoor [12] reported RTA as most common mode injury.

Walton *et al.*, conducted a study of 102 patients were treated with percutaneous pinning for distal radius fractures and they presented this as a reliable and useful method of treatment in osteoporotic bones [13]. Das AK *et al.* conducted a prospective study of 32 patients treated with closed reduction and percutaneous pinning. They concluded that percutaneous pinning followed by immobilization of wrist in neutral position is a simple and effective method to maintain reduction and prevent stiffness of wrist and hand. They showed excellent to good results were seen in 93.75% of the cases while 6.25% had fair results [14].

Gupta *et al.* [15] reported that 18% patients had good result and 4% had fair to poor results in K-wire fixation for distal radius fractures. Board T *et al.* [16] conducted a retrospective study of 23 patients aged over 55 years with percutaneous pinning for distal radius fractures. They showed functional results (Gartland and Werley) were excellent or good (19/23).

In our series, we had excellent results were seen in 8 cases (28.57%), good in 13 cases (46.43%); fair in 5 (17.86%) cases and poor in 2 cases (7.14%). Two cases of poor results were non compliant to physiotherapy and follow up. Both patients are willing to undergo corrective surgery or Darrack's salvage surgery at a later date.

In our study pin loosening due to superficial pin site infection was encountered in 5 cases. The infection subsided with removal of the pins at 4 weeks. We noticed malunion in 2 cases, joint stiffness in 5 cases and reduced grip strength in 2 cases were observed. Green DP *et al.* reported that eight

patients had malunion with significant radial shortening, wrist joint stiffness and reduced grip strength^[17, 18].

The limitations of our study are in the number of patients (n-28) and short follow up (4 months). A greater number of patients and longer follow up would have given more conclusive results. Finally we conclude that percutaneous pinning technique is a simple, cheap, minimally invasive and effective method of treatment for extra articular distal radius fractures with good functional results.

Conflict of interest: Nil

Source of support: None

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