Original Article

To pin or not to pin, extra-articular distal radius fractures?

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Abstract

Distal radius fracture is a common injury faced in orthopedics, and managing these fractures is not founded on a well-established algorithm. To assess the functional and radiologic consequences of closed reduction and percutaneous pinning of extra-articular distal radius fractures, we conducted a prospective cohort study of twenty (20) patients with extra-articular comminuted extra-articular distal radius fractures managed by closed reduction and percutaneous pinning and followed up for six (6) months. We found that the mean age of patients was 41.4 years. 16 (80%) patients were male. Motor vehicle accidents were the reason for trauma in 13 (65%) patients. Restoration of more than 74% of normal wrist range of motion. Pin loosening was documented in 3 cases. Pin track superficial infection (n=4) and malunion (n=1) were the other complications detected. The mean radial length, radial volar tilt, and radial inclination were 10.6 mm, 8.1 degrees, and 20.4 degrees, respectively. The functional consequences were excellent in 8 cases (40%), good in 6 cases (30%); fair in 4 (20%) cases, and poor in 2 cases (10%). Clearly, we concluded that percutaneous pinning is a good modality in treating less comminuted extra-articular distal radius fractures.

Keywords: Extra-articular, Distal radius fractures, Percutaneous pinning, CRPP outcome

INTRODUCTION

Distal radius fractures cover almost one-sixth of all fracture cases faced in the Emergency Department. They are a popular injury, remarkably in the elderly population. [1, 2]

Distal radius fractures (DRF) are restrained between the radiocarpal joint and up to 3 cm to the proximal fragment. These fractures are mostly closed and the overlying skin is intact but counted complex as they usually involve additional injuries to the nearby ligamentous and cartilaginous structures. [3]

An ultimate treatment that can offer desirable anatomical reduction and fixation of fracture fragments is essential to avoid long-term dysfunction. [4-6]

Numerous possibilities exist for the treatment. Nonoperative management consists of closed reduction and casting. Operative treatment possibilities include pinning with Kirschner wire (K wire), bridging and nonbridging external fixation, and different methods of internal fixation and open reduction.

When operative interference is indicated, considerations should be given to the features of the fracture and the surgeon's experience with different treatment modalities. [1, 7, 8]

The American Academy of Orthopedic Surgeons has published clinical practice guidelines on the treatment of distal radius fractures [9]. The Academy recommends operative fixation for fractures with dorsal tilt greater than 10°, post-reduction radial shortening of more than 3 mm, and step-off or intra-articular displacement of more than 2 mm.

Thus, to attain the target of near anatomical reduction and stable fixation with least operative intervention, an easily performed technique, which holds low morbidity, is the ultimatum of this era. Accordingly, Percutaneous pin fixation is simply a role classic treatment method for these fractures as it is comparatively simple to execute.

Closed reduction and percutaneous pinning is a conventional treatment method that involves the insertion of pins through the skin to hold the reduced fragments until the union. [3]

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This regularly necessitates an external reinforcement by cast or slab.

Aim of work

This study aimed at evaluating the clinical and radiological consequences of managing patients with extra-articular distal radius fractures by closed reduction and percutaneous pinning (CRPP) and comparing the findings with previous literature.

Method

The prospective study of 20 patients was managed at the Orthopedics Department of Zagazig University Hospital. Adult patients with extra-articular DRF class A2 & A3 of both genders were involved. Patients with intra-articular involvement, open fractures, fractures older than 2 weeks or concomitant forearm injuries were excluded.

A meticulous history was taken and a full systematic examination of the patient was performed. Radiographs of the wrist were done to verify the fracture. Then transitory splinting of fracture was executed with below elbow POP slab. All patients were transferred for elective surgery after essential investigations. The patients were kept in the supine position in an operating table after general anesthesia. The hand was prepared and draped. The fracture traction was performed by the assistant with pulling thumb with one hand and pulling index ring and middle fingers with the other. Counter traction was given at elbow with the elbow flexed by the other assistant. Closed reduction was confirmed by C-arm imaging in the anterior-posterior and lateral views.

The traction was sustained on the fracture in a reduced position, the first 1.5-2.0 mm K-wire was introduced from the dorsolateral side of the distal radius fragment crossways the fracture into the proximal fragment under C-arm imaging guidance. The second K-wire was inserted through the dorsomedial side of the distal fragment across the fracture into the proximal fragment. After testing the fracture stability under the image intensifier, if needed, a third K-wire was passed through the dorsolateral side from distal to proximal fragment. The wires were drilled to engage the far cortex. K-wires were bent at a right angle and short cuts were made outside the skin for easy removal. A sterile dressing was applied around K-wire as sponge padding. The dorsal above elbow POP slab was applied. Postoperative pain and inflammation were controlled with analgesics, anti-edema drugs, and limb elevation. Direct postoperative check x-rays were performed in both posterior-anterior and lateral planes, the reduction of fracture was assessed. Patients were advised to actively move their shoulders and fingers from day one. Patients were discharged the next day post-surgery after confirming good distal circulation of fingers. Sutures would be removed after 10 days. The assessment was made at 4th week, 4th month, 6th month for the occurrence of complications. We assessed the Postoperative range of motion in all directions. Patient Rated Wrist Evaluation Score (PRWE) accomplished in the 6th month.

Result

The patients' age ranged from 20 to 68 years with the average age of 41.4 years. 16 (80%) patients were male and 4 (20%) patients were female. The right wrist was affected in 11 (55%) patients, while the left wrist was affected in 9 (45%) patients. 13 (65%) patients got fractures due to motor vehicle accidents, 6 (30%) cases due to self fall, and 1 (5%) case due to sports injuries.

The mean range of motion was 58.5 degrees in flexion, 58.8 degrees in extension, 24.45 degrees in ulnar deviation, 6.95 degrees in radial deviation, 64.75 degrees of pronation, and 61 of supination (Table 1). Pin loosening was reported in 3 cases. Pin site superficial infection (n=4) and malunion (n=1) were the other complications detected. Reflex sympathetic dystrophy, post-traumatic arthritis of the wrist, subluxation of DRUJ, and neurovascular problems were not spotted.

The average radial length, radial volar tilt, and radial inclination were 10.6 mm, 8.1 degrees, and 20.4 degrees, respectively. The functional result of the patients was evaluated at 4 months postoperatively by PRWS score system and we found that excellent results were perceived in 8 cases (40%), good in 6 cases (30%); fair in 4 (20%) cases, and poor in 2 cases (10%) (Table 1).

Discussion

Distal radius fractures are common injuries faced in orthopedics and managing these fractures is not founded on a well-established algorithm. Numerous studies revealed that the outcomes of distal radius fractures CRPP seem superior when matched with other treatment options. [10-12]

We intended to evaluate our results of CRPP of distal radius fracture and compare them with previous literature.

We managed twenty (20) patients with extra-articular distal radius fractures (DRF) by closed reduction and percutaneous pinning (CRPP) at Zagazig University hospitals with the average age of 41.4, which was similar to the studies of Hanumantharaya et al. [13] (mean age 40.2), Adawy et al. [14] (mean age 45), and Özkan et al. [15] (mean age 47); and unlike Shrestha et al. [16] study with the average age of 27.6 and this could be accidental due to the randomization in patient selection in Shrestha et al. comparative study.

Table 1. Final Rom & Radiological Parameters Distribution

Flexion	Mean± SD	58.5±5.4
	Median (Range)	60.0 (45-65)
Extension	Mean± SD	58.8±5.3
	Median (Range)	60.0 (40-64)

Radial deviation	Mean± SD	6.95±1.14
	Median (Range)	7.0 (4-8)
Ulnar deviation	Mean± SD	24.45±1.79
	Median (Range)	25.0 (20-26)
Pronation	Mean± SD	64.75±7.5
	Median (Range)	65.0 (45-75)
Supination	Mean± SD	61.0±7.5
	Median (Range)	65.0 (45-70)
Radial height	Mean± SD	10.6±1.9
	Median (Range)	11.0 (7-15)
Radial inclination	Mean± SD	20.4±2.7
	Median (Range)	21.5 (15-24)
Volar tilt	Mean± SD	8.1±2.85
	Median (Range)	10.0 (0-12)

In our study, the prevalence of DRF was greater in males (80%), which is comparable to that of Hanumantharaya et al. [13], Adawy et al. [14], and Shrestha et al. [16] probably due to the participation of men in outdoor activities, riding vehicles, and heavy manual works. While Özkan et al. [15] conveyed in their study a higher prevalence in females (82%) and this variance may be due to altered lifestyles of the studied population.

In our study, road traffic accidents (RTA) were the major cause of trauma with a percentage of 65%, and after that self falls were the common cause. These results are in line with Hanumantharaya et al. [13] study in which they described RTA as the most common cause of DRF followed by self falls.

Furthermore, Adawy et al. [14], Özkan et al. [15] and Shrestha, B et al. [16] reported in their studies that self-falls were the major cause of DRF.

As regards the inclusion criteria, extra-articular DRF class A2-A3 were involved in our and Hanumantharaya et al. [13] studies, while, Adawy et al. [14], Özkan et al. [15], and Shrestha et al. [16] included partially articular DRF class B1.

The total follow up period was at least 6 months and K-wires were removed after 5-6 weeks, which is analogous with other studies [13-16]

At final follow up of our study, the mean wrist flexion, extension, radial deviation, ulnar deviation, pronation, and supination were 58.5, 58.8, 6.95, 24.45, 64.75, and 61, respectively, showing that the final range of motion (ROM) outcome is comparable with Hanumantharaya et al. [13], Adawy et al. [14], Özkan et al. [15], and Shrestha et al. [16] apart from forearm rotation, which was better in the study by Shrestha et al.

Concerning radiological findings in our study, the mean radial inclination, radial height, and mean volar tilt was 20.4, 10.6, and 8.1, respectively, which is near to the radiological outcome of Hanumantharaya et al. [13] Adawy et al. [14], Özkan et al. [15], and Shrestha et al. [16].

In relation to PRWE, 70% of our patients ensured an excellent to good outcome, 20% poor, and 10% fair outcome, which is close to the final outcomes of Hanumantharaya et al. [13], Adawy et al. [14], and Özkan et al. [15] (Fig 1).

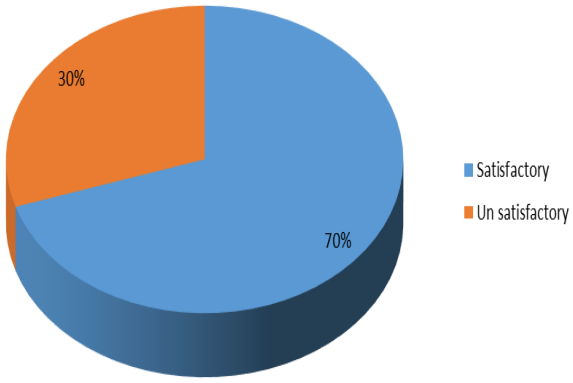

Figure 1: Outcome distribution

Fair and poor results in our study were considerably related to higher AO class (A3), Pin-tract infection, and pin loosening.

Shrestha et al. [16] found 96.6% excellent to good outcomes, which is superior to other studies [13-15] and this may be due to the larger sample size and the dissimilar methods of outcome evaluation.

The postoperative complications in our study were trivial superficial Pin-tract infection in 4 cases, K-wire slackening in 3 cases, and malunion in one case and other complications were not considered (Fig 2).

Hanumantharaya, et al. [13] remarked Pin-tract infection and pin loosening in 5 cases, malunion in 2 cases, joint stiffness in 5 cases, and reduced grip strength in 2 cases and reported that CRPP is a simple, inexpensive, minimally invasive, and effective method of treatment for extra-articular DRF with good functional outcome.

Adawy, et al. [14] remarked Pin-tract infection in 10 cases and 14 cases had Sudeck's atrophy and acclaimed CRPP as an excellent procedure for both extra-articular and articular DRF without severe comminution.

Özkan et al. [15] remarked one case of Pin-tract infection and one case of K-wire subcutaneous migration requiring a minor further procedure for removal and determined that CRPP is a good choice in patients with good-sized DRF

fragments, and it should be deliberated as an effective tool to restore radiographic parameters and functional outcome.

Shrestha et al. [16] mentioned that Pin-tract infection and pin loosening were less than 5% of their study cases and complications were greater in cast group than pin group and reported that CRPP is a safe and simple process of treating non-comminuted extra-articular and partially articular DRF with improved radiological and functional results than cast.

Liao et al. [17] directed a retrospective review of 633 patients with DRF treated by CRPP and 701 patients with DRF treated by volar locking plating (VLP) and compared reoperation rates between the two groups and concluded that generally, reoperation rates were comparable between the two methods, however, there was a difference in the complication profile and kind of revision surgery. These results are useful when counseling treatment possibilities with DRF patients.

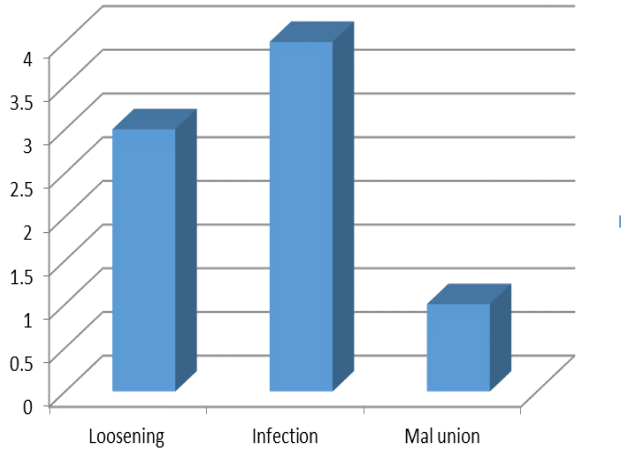

Figure 2: Complication distribution

Conclusion

Briefly, our results showed that CRPP could be an effective tool for restoring radiographic parameters and wrist functions after wisely selected distal radius fractures and that most patients reveal a good or excellent range of wrist motion after treatment with CRPP.

Compliance with ethical standards

Conflict of interest:

The authors declare that they have no conflict of interest related to this work.

Funding:

No funding was received for this study.

Ethical approval:

The study was approved by the local patient protection committee and the study was registered.

Informed consent:

All patients were included after signed consent.

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