

PERCUTANIOUS PINNING AND EXTERNAL FIXATION IN THE TREATMENT OF UNSTABLE INTRAARTICULAR DISTAL RADIUS FRACTURES

Abhilekh Mishra^A, Sandeep Bhide^B, Sameer Gupta^C,

^A- Assistant Professor, Department of Orthopaedics, Jaya Arogya Hospital and G. R. Medical College, Gwalior, Madhya Pradesh.

^B- Senior resident, Department of Orthopaedics, Jaya Arogya Hospital and G. R. Medical College, Gwalior, Madhya Pradesh

^C- Professor & HOD, Department of Orthopaedics, Jaya Arogya Hospital and G. R. Medical College, Gwalior, Madhya Pradesh

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Corresponding Author

Dr. Abhilekh Mishra
Department of Orthopaedics,
Jaya Arogya Hospital and
G.R. Medical College,
Gwalior-474009, Madhya
Pradesh

Abstract:

Introduction: We retrospectively compared the outcomes of external fixation and percutaneous pinning in treating similar unstable distal radius fractures with a minimum 12 month follow-up.

Methods: Both groups included 40 patients with an average follow-up of 12 months. The external fixation group comprised 20 patients and percutaneous pinning comprised 20 patients. Average age at presentation was 34 years in the external fixation group and 30 years in the percutaneous group. The male/female ratios were 12:8 among the external fixation group and 11:9 in percutaneous group. The two groups were compared for clinical and functional outcomes measured by the disabilities of the arm, shoulder, and hand (DASH) score. Pain scores were similar. Radiographic measurements were also evaluated between groups.

Results: Final ranges of motion and grip strengths were similar between the two groups. The mean DASH score of the percutaneous pinning group was 9 compared to 20 for the external fixation group. Radiographically, volar tilt and radial length were significantly better in the patients treated with external fixation group. The percutaneous pinning group required less therapy visits. Complications occurred in percutaneous pinning group, two patients had pin tract infections and Significant radial shortening was observed in 2 cases, Loosening of one of the K-wires was observed in 3 cases at the time of removal of the pins, and 2 had prolonged finger stiffness in external fixation group.

Conclusion: external fixation compares favorably to and pinning for amenable fracture patterns. Whereas grip and range-of-motion data were similar, DASH scores, frequency of rehabilitation, and some radiographic parameters were superior in patients treated with external fixation. Although augmented external fixation represents a popular first line treatment for unstable fractures of the distal radius this study suggests that for fractures with minimal articular displacement similar clinical results can be obtained with percutaneous pinning and casting.

Keywords: Distal Radius fracture. Percutaneous pinning, External fixation, intra-articular fractures

Introduction

Distal radius fractures are a serious medical problem. The incidence of these injuries is expected to increase with an aging population.¹ Optimal management of fractures of the distal end of the radius continues to be debated among the orthopedic community. Popular surgical options for unstable distal radius fractures include closed reduction and pin fixation with and without external fixation¹. There are published reports comparing variations and types of pinning/external fixation¹. Many other investigators have attempted to compare different types of ORIF various types of internal fixation^{1,2} and open reduction and internal fixation (ORIF) with dorsal-, volar-, and fragment-specific approaches^{3,2}.

One of the major challenges in effectively comparing treatments for distal radius fractures lies in the wide variation of injury patterns. Closed reduction and cast immobilization^{6,7} often leads to collapse of the radius. Percutaneous K-wire fixation provides additional stability and is one of the earliest forms of internal fixation.^{4,5}

Depalma described ulno-radial pinning drilled at 45° angle, 4 cm proximal to ulnar styloid. Kapandji,⁽⁵⁾ described double intrafocal pinning into the fracture surface and Rayhack described ulno-radial pinning with fixation of distal radioulnar joint.⁵ Bridging external fixators and ligamentotaxis indirectly reduce the fracture.⁶ Ruch *et al*⁵, and many others described open reduction and internal fixation of distal radius fracture. Doi *et al.* recommended it for comminuted intraarticular fractures.

Most of the work done with percutaneous pinning emphasizes that there is significant residual stiffness of the hand and wrist. The acute palmar flexed position of the wrist during the postoperative immobilization period was blamed as the main reason for stiffness.

The advantages for Dorsal spanning plate fixation has been described as an effective treatment option for unstable comminuted distal radius fractures, bilateral wrist fractures with metaphyseal bone loss or diaphyseal extension, and complex injuries requiring extensive soft tissue and bony reconstruction.⁷ In addition, this method allows for early weight bearing and transfer in polytrauma patients with pelvic and lower extremity fractures. The pin is temporarily fixed to the second or third metacarpal under the extensor tendons. After fracture healing is confirmed at

approximately 12 weeks, the plate is removed and therapy is initiated for wrist motion and strengthening. The goals of surgical treatment are anatomic reduction of the distal radius, placement of a stable construct to enable fracture healing, and restoration of normal wrist kinematics.⁸

Materials and Methods

This study was done prospectively in the Department of Orthopaedics and Trauma Centre in J. A. Group of Hospitals, Gwalior (M. P.) from July 2015 to 2016 for the period of 1 year. Total of 40 distal radius fractures, treated with External fixators and of percutaneous pinning. Fractures were classified using Frykman classification⁹ and Randomization was done to allocate the patient to one of the External fixators groups.

Pinning and External Fixation Technique

The fracture is reduced with traction and direct manipulation. A series of k-wires are then used to maintain the reduction. Typically, at least three 0.62 k-wires are used to secure the radial styloid to the diaphysis. This is followed by two 0.45 subchondral k-wires from the radial styloid to the lunate facet fragments. On occasion, dorsal-to-volar Kapandji-style pins¹⁰ are utilized to help maintain the reduction. After k-wire stabilization, the external fixator is applied. Two pins are placed into the index finger metacarpal through a dorsal-radial incision. The apparatus is measured out to length and an incision is placed over the radial-dorsal aspect of the radius. Two radius pins are placed between the extensor carpi radialis brevis and longus. The device is then secured and the traction is removed. Final x-rays are used to confirm that the reduction is maintained. A bulky dressing and splint is applied. Postoperatively, the fixator remains in place for approximately 6 weeks. Finger ROM is encouraged immediately. At 2 weeks after surgery, the sutures are removed and xrays obtained. A supportive removable splint is prescribed and pin care initiated. Wrist ROM is started after external fixator removal. Strengthening is initiated as ROM improves and symptoms normalize.

Results

This study was conducted in the Department of Orthopedics, Jaya Aarogya Hospital, Gwalior over a period of 12 months

to assess Irrespective of the direction and amount of initial displacement, a great majority of intra articular fractures of the distal radius can be managed with a Distractor and percutaneous approach. Distraction fixation for distal radius fractures is safe with minimal complications.

Table 1 Demographic data between groups.

Distractor group

Sex	Number of patients	%
Male	12	60%
Female	08	40%

Percutaneous pinning group

Sex	Number of patients	%
Male	11	55%
Female	09	45%

**Table 2 : Side Affected:
Right Handed Versus Left Handed**

Handedness	Distractor	Percutaneous pinning
Right (Rt)	12	13
Left (Lt)	08	07
Total	20	20

Table:3 Clinical Outcome

Distractor fixator(n=20)			
	6 month	1 year	P value
Flexion (°)	50°	56°	0.046
Extension(°)	55°	58°	0.070
Pronation (°)	85°	89°	0.230
Supination (°)	86°	89°	0.025
Radial deviation (°)	22°	24°	0.004
Ulnar deviation (°)	38°	38°	0.373
Percutaneous pinning (n=20)			
	6 month	1 year	P value
Flexion (°)	50°	54°	0.275
Extension(°)	49°	56°	0.080
Pronation (°)	88°	89°	0.828
Supination (°)	79°	85°	0.025
Radial deviation (°)	20°	21°	0.603
Ulnar deviation (°)	35°	37°	0.373

Table 3 Radiographic results at final follow-up to date

	Ex-fix Group (N=20)	Pinning Group (N=20)	P Value
Ulnar variance (mm)	-0.3 (-2-0)	+1.3 (-0.3-3)	0.013
Articular step off (mm)	0.2 (0-1)	0.7 (0-2)	NS
Volar tilt (°)	11 (3-20)	3 (-3-12)	0.041
Radial height (mm)	11 (7-13)	10 (6-12)	NS
Radial inclination (°)	23 (18-27)	21 (15-25)	NS

Discussion

The use of external fixation and pinning has demonstrated successful outcomes in multiple studies¹. Cooney et al. demonstrated 90% good and excellent results in their review of external fixation and pinning for unstable distal radius fractures¹. Superiority to closed reduction and casting has been demonstrated in several studies⁶. In the current study, the clinical outcomes and radiographic parameters in patients treated with external fixation are comparable with percutaneous pinning. In our practice, this technique maintains an important role in the treatment of distal radius fractures.

Several prospective studies have included external fixation and various methods of fixation. Hutchinson et al. prospectively evaluated external fixation and pins with plaster technique¹. Clinical outcomes were similar between groups. The external fixation group was better at maintaining radial length long-term. McQueen et al¹. prospectively evaluated four options in the treatment of distal radius fractures that had lost their reduction after attempted closed treatment: (1) remanipulation and plaster, (2) open reduction and bone grafting, (3) closed reduction and application of external fixator (3) with mobilization at 3 weeks, and (4) without mobilization at 3 weeks. Despite improved radiographic appearance in the open reduction and bone grafting group, clinical outcomes were similar between groups at 1 year follow-up.⁴

Accurate reduction of the fracture is the first step in the treatment of distal radial fractures. Many options are available to maintain this initial reduction. The most common traditional method is closed reduction and cast immobilization, but this often fails to prevent early radial collapse and is associated with a high risk of malunion,

joint stiffness and painful wrist. Hence, this method is for low-demand elderly patients.⁵

Percutaneous pinning with K-wires was first recommended by Green as a simple and inexpensive procedure.¹¹ Various techniques of percutaneous pinning are available. Most studies attribute poor results of this technique to radial shortening, wrist stiffness and reflex sympathetic dystrophy.⁵

In Percutaneous pinning with K-wires wrist stiffness and reflex sympathetic dystrophy occur because of the palmar-flexed position of the wrist in which postoperative immobilization of the fracture is done. Prolonged immobilization of the wrist for greater than 3 weeks increases the magnitude of the problem. Hence we developed our protocol for the treatment of extra-articular distal radius fractures. Fracture reduction was achieved by longitudinal traction and direct pressure over the displaced fragment followed by percutaneous pinning.¹²

Significant radial shortening was observed in 2 cases only. Radial shortening remains the main displacement in distal end radius fractures, especially intra-articular and comminuted fractures.⁵

Loosening of one of the K-wires was observed in 2 cases at the time of removal of the pins, but it did not jeopardize fracture alignment. Circumferential cast for additional immobilization was not necessary.¹²

Radiographic outcomes, the given values of which were compared with those for the contralateral extremity, may affect functional outcome. It is the surgeon's goal to restore the distal radius to its normal anatomical alignment and congruity. How accurately this is achieved can be measured from radiographs by comparing volar tilt angle, radial inclination etc. with published normal values⁸. In our study, radial inclination and ulnar variance were superior in the EF group six months postoperatively.

Conclusion

Although augmented external fixation represents a popular first line treatment for unstable fractures of the distal radius this study suggests that for fractures with minimal articular displacement similar clinical results can be obtained with percutaneous pinning and casting.

CASE 01

Figure 1 post op

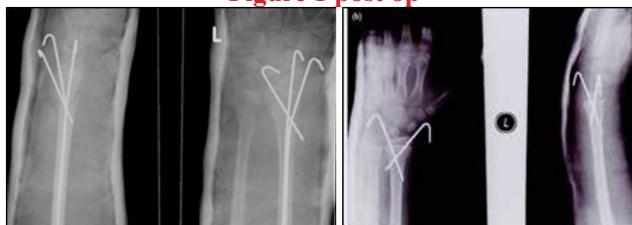


Figure 2 pre op

post op



CASE 02

Figure 3 pre op

Figure 4 post op



INTRA OP



Clinical Pic Of Percutaneous Pinning



dorsiflexion flexion extension grip strength

Clinical Pic Of Distractor Fixator
Dorsiflexion **Palmar Flexion**



Radial Deviation



Ulnar Deviation



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