



International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(4): 482-486
© 2020 IJOS
www.orthopaper.com
Received: 09-11-2020
Accepted: 11-11-2020

Dr. Vivek Amritbhai Patel
Associate Professor of
Orthopaedics & HOU,
Department of Orthopaedics,
Gujarat Adani Institute of
Medical Sciences & GK General
Hospital, Bhuj, Kutch, Gujarat,
India

Dr. Vishal Pushkarna
Assistant Professor of
Orthopaedics, Department of
Orthopaedics, Gujarat Adani
Institute of Medical Sciences &
GK General Hospital, Bhuj,
Kutch, Gujarat, India

Dr. Hardik Padhiyar
Resident, Department of
Orthopaedics, Gujarat Adani
Institute of Medical Sciences &
GK General Hospital, Bhuj,
Kutch, Gujarat, India

Dr. Saurabh Patel
Resident, Department of
Orthopaedics, Gujarat Adani
Institute of Medical Sciences &
GK General Hospital, Bhuj,
Kutch, Gujarat, India

Dr. Vraj J Patel
Resident, Department of
Orthopaedics, Gujarat Adani
Institute of Medical Sciences &
GK General Hospital, Bhuj,
Kutch, Gujarat, India

Dr. Smit D Dave
Resident, Department of
Orthopaedics, Gujarat Adani
Institute of Medical Sciences &
GK General Hospital, Bhuj,
Kutch, Gujarat, India

Corresponding Author:
Dr. Vivek Amritbhai Patel
Associate Professor of
Orthopaedics & HOU,
Department of Orthopaedics,
Gujarat Adani Institute of
Medical Sciences & GK General
Hospital, Bhuj, Kutch, Gujarat,
India

Effectiveness of closed reduction & minimally invasive percutaneous fixation of dorsally displaced distal radius & associated fractures

**Dr. Vivek Amritbhai Patel, Dr. Vishal Pushkarna, Dr. Hardik Padhiyar,
Dr. Saurabh Patel, Dr. Vraj J Patel and Dr. Smit D Dave**

DOI: <https://doi.org/10.22271/ortho.2020.v6.i4g.2377>

Abstract

Introduction: Distal radius fractures & associated wrist injuries are common. No doubt prevails for treatment of volar fragment intraarticular injuries. For dorsal comminution extraarticular & dorsal fragment intraarticular injuries various methods available & all have various implications on optimization of the treatment.

Material & Methods: We treated (n=25) patients of distal radius dorsally displaced intraarticular & extraarticular fractures with percutaneous K wires fixation with or without external fixation ligamentotaxis at our unit. All were closed fractures. Age mean was 62.5 years. Preoperatively they were classified according to Frykman classification.

Results: Postoperative evaluation by Sarmiento *et al.* modification of demerit point system of Gartland and Werley. 8% had Excellent, 48% had Good, 32% had Fair & 12% had Poor results. Non union rate was zero (n=0). Average union time was 4.5 weeks.

Conclusion: Distal radius fractures treated with percutaneous pinning yields high union rate with closed reduction benefits like fracture hematoma prevention & low infection rates. It also provides mechanical stability with some allowable micromotion as far as dorsal comminution or interarticular dorsal fractures of distal radius concern. It provides cost effective & better alternative to closed reduction & cast treatment.

Keywords: Minimally invasive, distal radius, dorsally displaced, K wires, ligamentotaxis

1. Introduction

Fall on outstretched hand is one of the commonest mechanism of injury. It describes from motor vehicle accident to trivial trauma. Distal radius fracture constitutes 8-15% of all skeletal injuries [1]. Traditionally many methods of fixation including open reduction & internal fixation with plating, Conservative cast treatment, Intramedullary nail & closed pinning with percutaneous fixation prevails. Non-operative treatment i.e. reduction and cast were producing too many unsatisfactory results, up to 30% in large surveys [9]. A persistent dorsal tilt results in incongruity in the distal radioulnar joint (DRUJ) & changes in the transfer of force with dorsal overload and secondary carpal bone disease [8]. The shoulder hand syndrome which is a nightmare complication of distal radius fracture causes lots of finger stiffness & makes rehabilitation complicated [7].

There are different classifications available includes AO, Fernandes, Melone, Frykman & many more [3]. All are according to distal radius & ulnar fragments morphology, distal radioulnar & radiocarpal relationships. Triangular fibrocartilage complex (TFCC) disturbance has invariably importance on functional outcome [2]. Proximal raw carpal bones cartilage nutrition deprivation due to lack of relative mobility after early immobilization days may increases chances of wrist arthritis & future stiffness.

2. Material & Methods

In the current retrospective study of (n=25) patients 14 patients were female & 11 patients were male operated at tertiary level medical centre (Table:1).

In the recent study we have evaluated 25 patients operated for lower end radius fractures by percutaneous K (Kirschner's) wiring [5]. With splint support with or without wrist ligamentotaxis (External distracter) [6]. We have operated the patients with due consents between July 2019 to February 2020.

Table 1: Age & Sex distribution

Age	Patients (n=25)	Females	Males
<25 years	4(16 %)	1(4%)	3(12%)
25-50 years	4(16%)	1(4%)	3(12%)
50-75 years	9(36%)	7(28%)	2(8%)
>75 years	8(32%)	5(20%)	3(12%)

We classified the preoperative patients by Frykman classification [18] (Chart:1). All patients were closed fractures. All the patients operated within 5 days of trauma. Minimum injury to operation duration was 1 day & maximum was 5 days with Mean 2.4 days. Out of (n=25) patients (n=6) patients were associated with lower end ulna shaft fractures & another (n=5) patients were associated with ulnar styloid process fractures. All the patients did not have any associated long bone injury of same upperlimb.

Exclusion criteria: Previous fractures or nonunions of the wrist, bilateral fractures, open fractures, volar-angulated fractures (smith fractures), ipsilateral limb injuries, late injury more than a week, associated nerve injury.

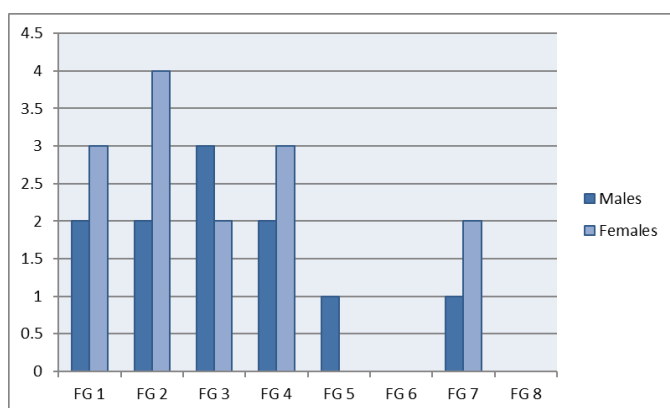


Chart 1: Patients fractures classified according to Frykman classification (FG-Frykman Grade) showing n (number of patients) out of (n=25)

Patients were followed up at the fifth day post operatively & then at 4 weeks. If fixator was used it was removed at five weeks postoperatively i.e one week after K-wires removal. All the patients with lower end ulna fracture given above elbow splintage & rest were given above elbow splintage with plaster of paris (POP) material.

2.1 Operative Management: Surgical planning made by AP & Lateral wrist with full forearm CT scan was done for intraarticular fractures. All the patients were given supine position intraoperatively. For inserting K wires the entry of K wires taken from the dorsal aspect of the wrist. Two to three K wires were used trying to hold the distal fragments as many as possible. All K wires were pierced far cortex of the proximal long bone. If Fracture fixation still found unstable they were additionally fixed with external fixator ligamentotaxis. All the fractures were supported with external POP splintages either in the Posterior plaster splintage (slab) or Cast form.

2.2 Post Operative Management: Active and passive range of motion exercise of the digits and the elbow (except for patients had above elbow slab) were initiated after some hours of operation as early as possible. Wound dressing was carried out at third post operative day at pin ends or external fixator pin site. The K-wires were removed at the outdoor setup at four weeks after operation. Range-of-motion exercise of the wrist and hand exercises was encouraged afterwards. If external fixator used it was removed at six weeks post operatively. Patient followed up then every monthly for 2-3 months.



Fig 1: Patient 1 Pre op.



Fig 2: Patient 1 Post op.



Fig 3: Paediatric pinning



Fig 4: Crossed K-wiring.

3. Results

Average union time was 4.5 weeks postoperatively. Minimum Union time was 4 weeks & maximum union time was 6 weeks clinicoradiologically. No (n=0) case of k wires cutout. No (n=0) case of revision surgery. No (n=0) case of skin reaction or pressure sore due to superimposed POP splint. Functional analysis of the results done by Sarmiento *et al.* modification of demerit point system of Gartland and Werley^[4] (Table:2).

No case of deep infection. One case had superficial skin infection which lateron healed after removal of K wires early at 3 weeks postoperatively (fracture became sticky), two consecutive dressings & short term oral antibiotics. No case of neurovascular injury, no case reported for tendon entrapment. One case reported of shoulder hand syndrome lateron relieved by vigorous physiotherapy & NSAIDS. All fractures united in the due course of time.

Table 2: Functional analysis at last followup after union: (Sarmiento *et al.* modification of demerit point system of Gartland and Werley).

Subjective Functional Evaluation	End result
Excellent	2 (8 %)
Good	12(48 %)
Fair	8(32 %)
Poor	3(12 %)



Fig 5: Wrist Flexion at final follow up



Fig 6: Wrist Extension at final follow up



Fig 7: Wrist Supination at final follow up



Fig 8: Wrist Pronation at final follow up

4. Discussion

Different clinical studies as well as laboratory assessment of force and stress have demonstrated the importance of anatomic reduction in this commonest orthopaedic injury^[16, 17]. In fractures with radial shortening greater than 5 mm, articular displacement greater than 2 mm or dorsal angulation greater than 20° results are compromised as reported in other published studies^[15].

In our study we have majority of the patients (except 12% with poor outcome) have good results. Distal radius fractures with fracture comminution & especially dorsal are considered unstable fractures after fracture reduction. This will cause radioulnar length variance with radial shortening. This also can leads to significance wrist mobility problems & radial angulation. Radial length problems leads to loss of wrist ligaments tension optimization & wrist stiffness. Long tendons tension optimization loss leads to significant fingers movement loss & stiffness.

One study infers that displaced distal radius fractures with dorsal comminution and significant displacement are considered unstable so there is no definite, reliable method of treatment, in osteoporotic bone ^[10].

The traditional treatment of distal radius fractures in osteoporotic patients is closed reduction and immobilization in cast. This method cannot maintain the length as study shows Loss of reduction usually occurs after two weeks of initial closed reduction ^[12] despite having benefit of nonsurgical method & so surgical complications ^[11]. The finger stiffness imparted by rigid casting overweighs other complications of pinning. For comminuted intraarticular fracture treatment of distal radius, Spira & Weigl *et al.* reported 51% unsatisfactory result with closed reduction and cast ^[13]. One review of 14 publications shows no overall results difference between ORIF (open reduction & internal fixation) or Percutaneous pinning. They have not found any superior benefit of ORIF over K wires ^[14].



Fig 9: Distractor



Fig 10: Patient with Distractor Ligamentotaxis & mobile elbow.



Fig 11: Patient 2 Preop.



Fig 12: Patient 2 Post op at follow up.



Fig 13: Patient 3 Preop.



Fig 14: Minimally invasive Pinning.

5. Conclusion

Distal radius fracture is common fracture in elderly osteoporotic bones, trivial trauma & first impact fracture at wrist usually. More common in females than males. It can affect wrist, hand & shoulder function tremendously. K-wires & external fixators are cost effective treatment especially in countries with low resources. It also yield low infection rates, early return to the work against conservative cast treatment & no future incisional implant removal. However some studies shows good results in plating series but long time follow up

in percutaneous pinning studies did not show any significant lack in results; especially when combined with its minimally invasive beneficial nature. Our short term study especially when it excludes lower end radius volar fragment fractures shows good early attractive results in provinces & regions with scarcity of proper postoperative follow up of patients & financial constrains.

6. References

- Pogue DJ, Vegas SF, Patterson RM, Peterson PD, Jenkins DK, Sweo TD *et al.* Effects of distal radius malunion on wrist joint mechanics. *J Hand Surg Am* 1990;15:7217. [PubMed] [Google Scholar]
- Casadei K, Kiel J. Triangular Fibrocartilage Complex. [Updated 2020 Apr 20]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing 2020 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK537055>.
- Jupiter JB, Fernandez DL. Comparative classification for fractures of the distal end of the radius. *J Hand Surg Am*. 1997;22(4):563-71. doi: 10.1016/S0363-5023(97)801104. PMID: 9260608.
- Sarmiento A, Pratt GW, Berry NC, Sinclair WF. Colles' fractures: functional bracing in supination. *J Bone Joint Surg Am* 1975;57(3):311-7.
- Franssen, Bas, Schuurman, Arnold, Molen, Aebele. One century of Kirschner wires and Kirschner wire insertion techniques: A historical review. *Acta orthopaedica Belgica* 2010, 76.
- Leung KS, So WS, Chiu VD, Leung PC. Ligamentotaxis for comminuted distal radial fractures modified by primary cancellous grafting and functional bracing: long-term results. *J Orthop Trauma* 1991;5(3):265-71. doi: 10.1097/00005131-199109000-00003. PMID: 1941307.
- Otto Steinbrocker. The shoulder-hand syndrome: Associated painful homolateral disability of the shoulder and hand with swelling and atrophy of the hand, *The American Journal of Medicine* 1947;3(4):402-407, ISSN 0002-9343, [https://doi.org/10.1016/0002-9343\(47\)90170-8](https://doi.org/10.1016/0002-9343(47)90170-8).
- Thomas BP, Sreekanth R. Distal radioulnar joint injuries. *Indian J Orthop* 2012;46(5):493-504.
- Daniel A Rikli, Adrian Businger, Reto Babst. Dorsal double-plate fixation of the distal radius. *Operat Orthop Traumatol* 2005;17:624-40.
- Walton NTJ Brammar J, Hutchinson D, Raj. Treatment of unstable distal radial fractures by intrafocal, intramedullary K-wires Coleman Injury, *Int. J. Care Injured* 2001;32:383-389
- Weil WM, Trumble TE. Treatment of distal radius fractures with intrafocal (Kapandji) pinning and supplemental skeletal stabilization: *Hand Clin* 2005;21(3):317-28.
- Fu YC, Chien SH, Huang PJ *et al.* Use of an external fixation combined with the buttress-maintain pinning method in treating comminuted distal radius fractures in osteoporotic patients. *J Trauma* 2006;60:330-3.
- Spira E, Weigl K. The comminuted fracture of the distal end of the radius. *Reconstr Surg Traumatol* 1968;11:128-38.
- Francesco Franceschi, Edoardo Franceschetti Michele Paciotti Francesco Cancilleri Nicola Maffulli Vincenzo Denaro. Volar locking plates versus K-wire/pin fixation for the treatment of distal radial fractures: a systematic review and quantitative synthesis *British Medical Bulletin* 2015;115:91-110.
- Gartland JJ, Jr, Werley CW. Evaluation of healed Colles' fracture. *J Bone Joint Surg Am* 1951;33:895-907.
- Knirk JL, Jupiter JB. Intra-articular fractures of the distal end of the radius in young adults. *J Bone Joint Surg Am* 1986;68:647-59.
- Trumble TE, Schmitt SR, Vedder NB. Factors affecting functional outcome of displaced intra-articular distal radius fractures. *J Hand Surg Am* 1994;19:325-40.
- Shehovich A, Salar O, Meyer C, Ford DJ. Adult distal radius fractures classification systems: essential clinical knowledge or abstract memory testing? *Ann R Coll Surg Engl* 2016;98(8):525-531. doi: 10.1308/rcsann.2016.0237. Epub 2016 Aug 11. PMID: 27513789; PMCID: PMC5392888.