



LATE COLLAPSE OF DISTAL RADIUS FRACTURES MANAGED CONSERVATIVELY AND WITH PERCUTANEOUS PINNING (K-WIRES): A PROSPECTIVE STUDY

Orthopedics

Dr. Kaushik Mandal RMO-CT, Orthopaedics, Burdwan Medical College

Dr. Tanushree Mondal* Associate Professor And Assistant Director Of Medical Education, Dept. Of Community Medicine, Medical College, Kolkata. *Corresponding Author

Dr. Poulami Nandi Associate Professor, Microbiology, NRS Medical College

Dr. Sukanta Das RMO-CT, Dept. of G&O, SSKM Hospital

Dr. Debarshi Jana Institute Of Post-graduate Medical Education And Research, A.j.c. Bose Road, Kolkata-700020, West Bengal, India

ABSTRACT

The morbidity of distal radius fracture e.g. deformities, rigid joints, stiff and swollen fingers, loss of the pronation- supination movements and neuralgic complaints resulting from injuries of the wrist and of the carpal extremity of the forearm—one or more of these evils having been left, not merely as a temporary inconvenience but as a permanent consequence.

The aim of the study is

a) To find out whether there is any collapse of distal end radius fracture after 6 months post treatment.

Includes 25 patients treated conservatively and 25 patients treated with percutaneous pinning who fulfilled the study criteria.

Operative interventions showed a lesser no of cases having affected range of motion at 6 months. Pain was mainly complained during 1st month which regressed at later stage. No complications related to surgical wound was present by the 6 months.

Incidence of late collapse is more common in conservative group. Factors such as age, sex, DRUJ involvement, ulnar styloid fractures associated with DRUJ involvement and initial displacement are predictive of reduction loss. Patients with low functional requirements are more likely to have only conservative treatment of these fractures. Whereas distal radius fractures treated by percutaneous K wire fixation, did not suffer significant loss of reduction of fracture position after removal of wires. This remains true regardless of age, sex, fracture type or duration of wire fixation.

KEYWORDS

Distal Radius Fractures, Conservatively And Percutaneous Pinning (k-wires)

INTRODUCTION

Fracture of the distal radius with/without distal ulna is the most common fracture encountered by Orthopaedic trauma surgeons accounting for 17.5% of all adult fractures. According to the researchers, most fractures of the distal radius were caused by a fall on outstretched hand and fewer by a fall on the back of the hand. The morbidity of distal radius fracture e.g. deformities, rigid joints, stiff and swollen fingers, loss of the pronation- supination movements and neuralgic complaints resulting from injuries of the wrist and of the carpal extremity of the forearm—one or more of these evils having been left, not merely as a temporary inconvenience but as a permanent consequence. In all studies the incidences in females are higher than males by a factor of two to three. As is the case with all osteoporotic fractures, distal radius fractures occur because of a combination of a fall and low bone mineral density (BMD) ¹.

More than 20 classification systems have been proposed for distal radial fracture. These classifications can, however, help in understanding the fracture and conceptualizing some of the challenges in treatment. ^{2,3}

The main debate about treatment centred around the mechanics of reduction, the position of immobilization and the types of splint used. Management of fractures using massage and early mobilization, which were revolutionary once upon a time. It is considered that distal radius fracture was best suited to this form of treatment ^{4,5}

The indications for each differ depending on the patient, their demands, and the type of fracture. As the main goal of treatment is to maximize function of the hand and wrist, it is essential in planning treatment to consider the factors that may predict fracture instability or functional outcome. ^{6,7}

The orthopaedic surgeon contemplating the fixation of distal end of radius fracture is confronted with a myriad of choices of techniques and several hundred articles expressing different opinions are there. In addition, many of these studies are retrospective, with several sources of bias affecting the results and conclusions. Regardless of personal preference, however, each procedure has relative advantages and disadvantages and should be appropriately and individually

considered based on patient age, size, activity level, pain tolerance, and return to sports goals. The goal of the study is to provide a comparison between late collapse of distal end radius fracture managed conservatively and with percutaneous pinning (K-WIRES). ^{4,7,8}

The type and frequency of complication of distal radius vary greatly among reported series. Complications are more common in conservative treatment than operative treatment. The most common deformity after extra articular distal radius fracture is shortening, rotation of distal fragment, loss of volar tilt, loss of ulnar inclination. Other less frequently reported complications are nonunion, tendon rupture, radio ulnar synostosis, dupuytren contracture, arthritis, osteomyelitis. ^{9,10,11,12}

The aim of the study is

- To find out whether there is any collapse of distal end radius fracture after 6 months post treatment.
- To find out any difference in incidence of collapse of distal radial fractures between conservative management and percutaneous pinning method.
- To compare the functional outcome of both the procedures

MATERIAL AND METHODS

All cases of Type I Fernandez distal radial fractures who presented to the Out Patient Department of Orthopaedics, Medical College, Kolkata in a time span of 18 months was randomly assigned by a computerized method to two different treatment protocols: a) distal end of radius fracture managed conservatively, b) distal end of radius fracture fixed with percutaneous pinning (K-WIRES).

a) Study setting and time lines: Prospective observational study was conducted for 18 months. In the first 10 months, there was patient recruitment. Patients then followed up for 6 months. The patients recruited in October 2017 were followed up till April 2018. Next two months was for statistical analysis and another of two months for thesis writing and submission.

b) Place of study: Patients attending Out Patient Department of Orthopaedics, Medical College Hospital, Kolkata.

c)Sample size/ design: Includes 25 patients treated conservatively and 25 patients treated with percutaneous pinning who fulfilled the study criteria.

PROCEDURE OF CONSERVATIVE MANAGEMENT:

Conservative management was an OPD based procedure. Patient was advised NPM for at least 6hrs on the day of procedure. Under day care anaesthesia(TIVA) patient lying supine on bed and traction-countertraction done along the long axis of forearm keeping the elbow flexed at 90°. Below elbow plaster cast applied keeping the forearm in supination, palmar flexion and wrist in ulnar deviation. Patient was advised to do active range of movement of all fingers. Keep the cast for atleast 8-10 weeks. Follow up X-RAYs were taken at 1month, 3months, 6months.

RESULTS AND ANALYSIS

Our study showed that among 50 cases, 25 were managed conservatively whereas rests of the patients are managed by operative procedure.

It was found that females are the majority. Though Males are more involved in outdoor activity, here higher no of females may be due to lack of body calcium level, osteoporosis and involvement in wet indoor activity related to handling of water.

Our study showed that, 26 cases were studied in the age group of 36-50 years. Female patients were more than the no of male patients. Conservatively managed cases were 10 whereas 16 patients were managed operatively.

We found that, in the age group of 51-65yrs, 10 female and 6 males patients were included in the study population and among 16 cases, 9 were undergone conservative management whereas rest 7 cases had operative interventions.

It was found that right hand being predominant hand, out of 30 cases most of them (23) were managed by operative procedure whereas among 20 cases who had their left hand involvement, only 2 had operative management. Fracture was more common on the right side and involved dominant hand in 60% of cases, thus stressing the need for operative reduction leading to excellent functional outcome

Our study showed that different modes of injury leading to fracture of distal radius showing males are more prone to road traffic accident may be due to their involvement of outdoor activity. Whereas females sustained injury mostly due to fall. Out of 50 cases 21 patients (42%) had an history of fall thus makes fall the major cause of fracture distal radius.

It was observed that the most common cause of injury is fall (n=21) and was most common cause in operative series while in conservative cases RTA (n=16) was the main culprit.

We found that only 2 cases among group B who had undergone the operative management showed neurovascular injury. There were neither any drug related complications nor any loss of reduction or fixation.

Our study showed that patients managed operatively (n=13) felt more pain when compared to patients managed conservatively (n=8). Loss of reduction was seen only in cases (n=6) managed conservatively. Contact dermatitis mainly due to continuous irritation from POP cast is observed only in gr. A patients who were managed conservatively.

It was found that initially at 1 month pain was a complaint by the patient managed conservatively but in long run, by 6 months affected range of motion at wrist joint was the commonest complications affected 11 patients in group A.

We found that collapse at fracture site and affected range of motion both were higher at the end of 6 months when patients managed conservatively.

Our study showed that DASH score was poor in only 1 case who was managed conservatively. Out of 25 cases 14 cases of group B showed excellent DASH score at the end of 6 months. DASH score was considered good by the end of 6 months in 16 patients out of 25 cases managed conservatively. In this study it was observed that most of the

cases achieved Excellent DASH score when managed operatively.

DISCUSSION

In our study we had selected a total no of 50 cases keeping the inclusion and exclusion criteria in mind. Among them 25 cases were managed conservatively and rest 25 cases were managed by operative method. A similar study was done by Modi N et al¹³ with 50 cases where half the cases were selected for conservative management and rest for operative intervention.

There were 22 males and 28 female patients included in the study group. Females (56%) are the majority. Though Males (44%) are more involved in outdoor activity, here higher no of females may be due to lack of body calcium level, osteoporosis and involvement in wet indoor activity related to handling of water. But Modi N et al had 86% male patients and only 14% female patients, showing a male preponderance with the ratio being M: F; 6:1¹³. We had a similarity with the study done by Farias et al who also had a higher Female 73% population than male 27%.¹⁴ Ashish Somani et al¹⁵ selected equal number of male and female cases for their study.

According to the age, all the patients were included in 3 groups. Patients falling between age 20 and 35yrs, males were more in number and among 8 cases most of them were managed conservatively. 26 cases were studied in the age group of 36-50 years. Female patients were more than the no of male patients. Conservatively managed cases were 10 whereas 16 patients were managed operatively. In the age group of 51-65yrs, 10 female and 6 male patients were included in the study population. Among 16 cases, 9 were undergone conservative management whereas rest 7 cases had operative interventions Modi et al selected the age of the patients ranged from 21-68 years with an average of 41.26 years.¹³ Mean age of cases was 50.6 years. This shows that distal radius fracture is common in geriatric age group. Though, the incidence of distal radius fractures is increasing in the younger age group.¹⁵ W P Cooney, in his study of 65 patients of unstable Colles' fracture found that 50 patients sustained injury due to fall on outstretched hand. 6 patients sustained a motor vehicle accident. No specific mechanism of injury was recorded in 4 patients.¹⁶ In a different study by Modi et al there were 33 (66%) patients with road traffic accidents and 17 (34%) patients fell on their outstretched hand¹³.

In this study 60% had fracture of their right hand which may be due to right sided dominance. Similar study, was done by Cooney et al who also showed right sided fractures were commoner than the left sided fractures¹⁷. Right side (dominant wrist) was involved in 31 (62%) patients and the left side was involved in 19 (38%) patients (Modi et al).¹³

Different modes of injury leading to fracture of distal radius showing males are more prone to road traffic accident may be due to their involvement of outdoor activity. Whereas females sustained injury mostly due to fall. Out of 50 cases 21 patients (42%) had a history of fall thus makes fall the major cause of fracture distal radius.

72.5% of patients were injured following fall on outstretched hand. This leads Somani et al to conclude that self-fall as the major cause for distal radius fractures.¹⁵

As per the study by Modi N et al Right side (dominant wrist) was involved in 31 (62%) patients and the left side was involved in 19 (38%) patients¹³

In a study 64% of the patients had road traffic accident and 36% had a fall on the outstretched hand. John K. Bradway et al (1989) and Louis Catalano III et al (1997) reported fall on the outstretched hand as the most common mode of injury. It was reported road traffic accident as the more common mode of injury. Jesse B. Jupiter et al (1996) and Harish Kapoor et al (2000) also reported similar findings in their series. Our series is comparable to that of Harish Kapoor et al (2000) as it was also done in the Indian subcontinent and in a similar setup. Somani et al observed 27.5% of the patients sustained distal radius fracture following RTA^{15,18,19,20,21,13} Modi N et al studied there were 33 (66%) patients with road traffic accidents and 17 (34%) patients fell on their outstretched hand.¹³

Neurovascular injury happened as intraoperative complication in 2 cases of group B who were managed with operative intervention.

Shows the complications observed after both type of management. Pain though is a subjective entity felt by more number of patients who were managed with K-wire. Late collapse was observed in 6 patients who undergone conservative management. One patient in group B showed neurovascular deficit. Contact dermatitis was seen in 2 patients who were applied plaster of paris cast during their conservative intervention.

Patients were followed up after 1 month, 3 month and 6 month.

8 patients undergone conservative management complained pain after 1 month which was reduced to only one patient after 3 months. Collapse at fracture site was observed in 2 patients after 3 months and it was 6 after 6 months. Restricted range of motion at wrist joint was seen in 11 patients after 6 months by conservative management.

Infection at surgical site was observed in 3 patients after 1 month which was reduced to 1 patient after 3 months and it was completely cured with proper treatment for all the patients. Pain as complained by 13 patients after 1 month follow up and reduced to only 7 patients after 3 months and none of them complained unbearable pain at fracture site after 6 months. No patient had collapse at fracture site. Range of motion was affected in 1 patient after 6 month follow up which was considerably low when compared with 11 patients who were managed conservatively.

The incidence of complications was high ranging from 20 to 60%. The complications included infection of pin track, radial sensory neuritis, reflex sympathetic dystrophy, stiffness of the wrist and fracture through the pin sites. Although improved techniques of insertion of pins, pre-drilling have reduced the problems related to pins, the potential for wrist stiffness still remains a concern. In a landmark study in 1979, Cooney et al, reported only a slight loss of motion in patients who were followed for two years or more^{16,22}

Collapse at fracture site and restricted range of motion at wrist joint were significantly high in patients managed conservatively after 6 months in comparison to operative intervention.

When managed by operative method, most of the patients achieved excellent outcome. None of them had a poor outcome. But in case of conservative management patients were achieved Good results mostly.

A number of studies have reported favorable results with external fixation, although most of the studies were retrospective and, thus are difficult to interpret due to the heterogeneous group of patients with a variety of skeletal and soft tissue injuries.²³ The average outcome in our study is comparable to the studies of John K. Bradway et al, Jesse B. Jupiter et al (1996) and Harish Kapoor et al .Louis Catalano III et al. also had the similar kind of result. In a similar study conducted by Gupta et al (1999) 40% patients had good result and 20% had fair or poor result in cases of plaster cast application whereas in patients who had K-wire fixation: 18% had good results and 4% had fair to poor results. In a study by Das AK et al (2011) excellent to good results were seen in 93.75% of the cases while 6.25% had fair results amongst patients treated by percutaneous pinning for noncommittened fractures of distal radius.^{18,19,20,24,25,26,27} Several studies have shown that closed reduction and percutaneous pinning reinforced by a below-elbow cast for distal radial fractures gives more superior results. In a series of 30 patients with different types of distal radial fractures, Mam et al found no difference in the functional outcome with closed reduction and K-wires fixation versus closed reduction and cast alone. All patients were followed for a minimum period of 6 months. For each visit, patient was evaluated clinically and radiologically and the final results were analysed. Despite wide spread enthusiasm for operations, current literature does not demonstrate the clear benefit of this. When a fracture is well reduced, either technique will provide similar good results.^{28,29,30,31}

CONCLUSION

Distal end radius fracture is the most common fracture encountered in daily life. Most common mode is fall on outstretched hand and more common in the peri-menopausal females. The conventional plaster cast method for treatment of colles' fracture usually can't maintain radial length & angulation in many instances and results significant anatomical difficulty and functional disability. On the other hand after close reduction additional fixation in the form of percutaneous crossed K-wire can maintain the reduction till bony union & prevent late

collapse at fracture site & provides better result. Simple percutaneous fixation by two kirschner wire can successfully maintain reduction in most displaced Colles' fracture, with a very low incidence of complications and unsatisfactory results.

Table: Evaluation Of Patients By Dash Score(disability Of Arm Shoulder And Hand)at 6 Months

Grading	Gr.A at 6 months (n=25)	Gr.B at 6 months (n=25)	Mann-Whitney U test (p value)
EXCELLENT (0-5)	5	14	0.024
GOOD(6-15)	16	8	
FAIR(16-35)	3	3	
POOR (>35)	1	NIL	

Table: Clinical Finding At 1,3,6 Months Post Treatment By Conservative Method And Post Treatment By Operative Method

	Clinical	1 month	3 months	6 months
Conservative (Gr.A)	Pain at fracture site.	8	1	NIL
	Collapse at fracture site	NA	2	6
	Range of motion of affected wrist joint	NA	5	11
Operative (Gr.B)	Surgical site infection	3	1	NIL
	Pain at fracture site.	13	7	NIL
	Collapse at fracture site	NIL	NIL	NIL
	Range of motion of affected wrist joint	NA	3	1

REFERENCES

1. Abraham Colles (1972) The classic. On the fracture of the carpal extremity of the radius. Edinburgh Med Surg J ClinOrthop 83:3-5
2. "Fractures of the Shoulder, Arm, and Forearm." Campbell's Operative Orthopaedics, by Willis C. Campbell et al., 13th ed., vol. 3, Mosby/Elsevier, 2013, pp. 2927-3016.
3. Jupiter J, Fernandez DL. Comparative classification for fractures of the distal end of the radius. J Hand Surg 1997;22(4):563-571.
4. Fernandez DL. Fractures of the distal radius: operative treatment. Instr Course Lect 1993;42:73-88.
5. Simic PM, Weiland AJ (2003) Fractures of the distal aspect of the radius: changes in treatment over the past two decades. Instr Course Lect 52:185-195
6. "Injuries of the wrist."System of orthopaedics and trauma, by Apley and Solomon et al., 10th ed., CRC press, 2018, pp. 797-813
7. Azzopardi T, Ehrendorfer S, Coulton T, et al: Unstable extra-articular fractures of the distal radius: a prospective, randomized study of immobilization in a cast versus supplementary percutaneous pinning. J Bone Joint Surg 87B:837, 2005
8. Green DP: Pins and plaster treatment of comminuted fractures of the distal end of the radius. J Bone Joint Surg 57A:304, 1975.
9. Jupiter JB, Fernandez DL: Complications following distal radial fractures, J Bone Joint Surg Am 83:1244, 2001.
10. Frykman G: Fracture of the distal radius including sequelae—shoulder-hand-finger syndrome, disturbance in the distal radio-ulnar joint, and impairment of nerve function: a clinical and experimental study, Acta Orthop Scand 108(Suppl):1, 1967.
11. McKay SD, MacDermid JC, Roth JH, Richards RS: Assessment of complications of distal radius fractures and development of a complication checklist, J Hand Surg Am 26:916, 2001.
12. Young BT, Rayan GM: Outcome following nonoperative treatment of displaced distal radius fractures in low-demand patients older than 60 years, J Hand Surg Am 25A:19, 2000.
13. Modi N, Deshmukh P. A comparative study of closed reduction and plaster cast application versus Kirschner wire fixation in colles fracture. J Res Med Den Sci 2015;3(3):238-43.
14. Farias EC, i Gil FO, Trueba CD, Jaspeado RR. Functional result in distal radius fractures. Comparison among the severity of the fracture, the treatment of choice and the baseline X-Ray parameters. Acta Ortopédica Mexicana 2010; 24(4): Jul.-Aug: 220-228
15. Ashish Somani, Uday Mahajan, Sanjay Mulay, Nikhil Suri. Outcome of various modalities for treatment for distal end radius fracture - An observational study International J. of Healthcare and Biomedical Research, Volume: 04, Issue: 01, October 2015, Pages 96-106
16. William P. Cooney, III, MD, Ronald S Linscheid, M.D, External Pin Fixation for Unstable Colles' Fracture, Journal of Bone and Joint Surgery 1979;61(6):840-45.
17. Cooney WP 3rd, Dobyns JH, Linscheid RL. Complications of Colles' fracture. Bone Joint Surg Am 1980;62:613-19
18. Jakiml, Pieterse, Sweet MBE. External fixation for intra-articular fractures of the distal radius. J Bone Joint Surg 1991;73-B:302-6.
19. Jupiter JB, Fernandez DL, Toh CL, Fellman T, Ring D. Operative treatment of volar intraarticular fractures of the distal end of the radius. J Bone Joint Surg (Am) 1996;78:1817-28.
20. Kapoor H, Agarwal A, Dhaoon BK. Displaced intraarticular fractures of distal radius: A comparative evaluation of results following closed reduction, external fixation and open reduction with internal fixation.
21. Catalano LWIII, Cole RJ, Gelberman RH, Evanoff BA, Gilula LA, Borrelli J Jr. Displaced intraarticular fractures of the distal aspect of the radius. J Bone Joint Surg 1997;79-A(9): 12901302.
22. James W Pritchett, External Fixation Or Closed Medullary Pinning for Unstable Colles Fracture. British Journal of Bone and Joint Surgery 1995;77(2):267-269
23. Jupiter Jesse B. Jupiter, MD, Current Concepts Review Fracture of the Distal End of Radius, Journal of Bone and Joint Surgery 1991;73(3):114-17.
24. Teunis, Teun, Mulder, Frans, Nota, Sjoerd P, Milne, Leslie W, Dyer, George S M, No Difference in Adverse Events Between Surgically Treated Reduced and Unreduced Distal Radius Fractures. Journal of orthopaedic trauma, Nov 2015, vol. 29, no. 11, p. 521-525

25. Das AK. Percutaneous pinning for noncomminuted extra-articular fractures of distal radius. *Indian J Orthop* 2011;45(5):422-6.
26. Gupta R, Raheja A, Modi U. Colles' fracture: management by percutaneous crossed-pin fixation versus plaster of paris cast immobilization. *Orthopedics* 1999;22(7):680-2.
27. Rodriguez-Merchan EC. Plaster cast versus percutaneous pin fixation for comminuted fractures of the distal radius in patients between 46 and 65 years of age. *Journal of Orthopaedic Trauma* 1997;11(3):212-7.
28. Mah ET, Atkinson RN. Percutaneous Kirschner wire stabilization following the closed reduction of Colles fractures. *J Hand Surg. [Br]*. 1992; 17: 55-62.
29. Clancey G.J.: Percutaneous Kirschner-wire fixation of Colles' fractures. *J Bone Joint Surg. [Am]*. 1984; 66:1008-1014.
30. Benoist L.A., Freeland A.E. Buttress pinning in the unstable distal radius fracture. *J Hand Surg. [Br]*. 1995; 20:82-96.
31. Mam MK, Prabhakar S, Prakash J S, et al. Functional Outcome Following Treatment Of Colles Fracture: A comparative study of closed reduction and plaster cast application versus kirschner wire fixation. *WebmedCentral TRAUMA* 2011; 2(1): (online) available: http://www.webmedcentral.com/article_view/1472. (Accessed 18th February, 2013).