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Comparative study between closed reduction and cast application versus percutaneous K- wire fixation for extra-articular fracture distal end of radius

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Abstract

Introduction: Distal radius fracture is extremely common and represents 16% of fractures treated by orthopaedic surgeons. Near anatomical reduction with restoration of radial length, radial tilt and ulnar variances are important for good functional results. A variety of treatment options have been proposed for distal radius fracture closed reduction and immobilization in cast has been the main stay of treatment, but because it invariably results in malunion, poor functional outcome and cosmetic outcome, other modality of treatment were brought into practice like percutaneous intrafocal pinning, transulnar percutaneous pinning, external fixation, plating etc. This comparative study was to compare the clinical outcomes of closed reduction with cast and closed reduction with Percutaneous Kirschner wiring.

Materials and Method: Prospective study was conducted on 60 patients attending the Department of Orthopaedics, from December 2017 to May 2019 with extra-articular fractures (AO type 23-A2 and 23-A3) of distal radius and fulfilling all the inclusion and exclusion criteria. The cases were randomly divided into two equal groups of 30 patients, the first group treated by closed reduction and below elbow cast application, while the second group were treated by closed reduction percutaneous K-wire application and below elbow cast application. The radiological outcome of both groups were evaluated by measuring the Volar inclination, Radial inclination and Radial height, while the functional outcome was evaluated by the demerit scoring system of Gartland and Werley.

Result: The Cast application group had 13 excellent, 9 good, 7 fair and 1 poor result the mean outcome score of the group was 5.2. The K wiring group had 11 excellent, 13 good, 5 fair and 1 poor result, the mean score of the group was 5.17. The unpaired student's t-test on the values obtained from both groups yielded a p-value of 0.9816. The mean radial height in the Cast application group was 8.033mm while the mean in the k wiring group was 11.783mm. The mean volar tilt was 4.867 degrees and 7.5 degrees respectively. The mean radial inclination was 14.23 degrees and 19.1 respectively. Unpaired student's t-test on the values revealed a p-value of 0.0001 for all three.

Conclusion: We concluded that closed reduction with percutaneous K-wire fixation under C-arm for treatment of extra articular fractures of distal radius gives statistically significantly better radiological outcome than treatment with closed reduction and casting alone, but there is no statistically significant difference in functional outcome.

Keywords: Comparative, application versus, extra-articular, radius

Introduction

The fracture of distal radius was previously known for being common in elderly with low function demand who sustained a low energy trauma. But the incidence of this fracture is increased due to increasing number of elderly population along with increasing number of road traffic accidents and other high energy traumas in all age groups who end up sustaining this fracture [2]. This coupled with the ever increasing demand for perfect reduction and decreased complications in treatment of this fracture among the patients has brought greater significance to the way these fractures are managed.

There are numerous treatment modalities available to orthopaedic surgeons in the treatment of a distal radius fracture; these include closed reduction and casting, closed reduction and percutaneous pinning by different methods such as Kapandiji intrafocal pinning,

transradial styloid pinning, pinning via the Listers tubercle or transulnar pinning. Other modalities of treatment include closed reduction and external fixation by means of ligamentotaxis to realign fracture displacement, open reduction by volar or dorsal approach and internal fixation by different implants such as screws, plates, or screws with locking plate

While deciding the treatment modality there are numerous factors to consider before finalizing the most appropriate one for each patient, these include the patient's age, lifestyle, associated injuries, co-morbidities, functional demands, dominance of hand, type of fracture, alignment of fracture, condition of soft tissues, weather the fracture is open or closed and economic constraints of the patient. All these factors play a paramount role in the final decision in the treatment of the distal radius fracture.

In the elderly the quality of the bones are poor compared to the young and active patients, in these patients it is hard to maintain the distal radius fracture by simple external splintage without any additional support to prevent the collapse. It is in these patients that percutaneous pinning adds the extra support needed to maintain the fracture in desired alignment and reduction.

Percutaneous pinning is recommended as a simple way of providing additional stability to immobilization in a cast in extra articular fracture of distal radius in which anatomical reduction is obtained by closed reduction

Materials and Methods

This prospective randomized control study was conducted on 60 patients attending as out-patient or in-patient at Department of Orthopaedics in our tertiary care center from December 2017 to May 2019 who have been found to have extra-articular fractures of distal radius and fulfill all the inclusion and exclusion criteria.

Inclusion criteria

All patients with radiologically confirmed extra-articular fractures of distal radius (AO types 23-A2, 23-A3), are medically fit, willing for the procedure and consented to be part of the study, are above the age of 18 years and presenting with injuries not older than 2 weeks.

Exclusion criteria

Patients with intra-articular fractures involving radio-carpal joint, Open fractures of distal radius, Distal radius fracture associated with Neurovascular Deficit, Fractures in children and Patients found to be at poor anaesthetic risk are excluded.

Based on the selection criteria: 35 cases of closed reduction and casting and 35 cases of percutaneous k wire fixation were included of which 5 patients in each group were lost to follow up. Sampling was done by simple randomization of the cases done according to a computer generated simple randomization protocol. The data obtained from the two groups was analysed by using unpaired student's t-test for continuous variables. The results were analysed by SPSS version 20.

The 70 patients were between the ages of 24 years to 73 years

with a mean age of 47.45 years. The patients were allocated randomly into two equal groups of 35 patients each as per the simple computer randomization protocol. The first group was treated by closed reduction and cast application and the second group was treated by closed reduction percutaneous K-wire fixation and cast application. Five patients in each group were lost to follow up and hence the final study was conducted with 30 patients in each group and a total of 60 patients.

All fractures were classified by AO classification and only AO type 23-A2 and 23-A3 fracture patterns were included in the study.

Following admission, complete history was noted regarding the mode of injury, severity of trauma. All patients were examined for deformity, swelling, tenderness, bony irregularities of distal radius and relative position of radial and ulnar styloid process were elicited. Movements of the wrist and hand were evaluated. Distal vascularity was assessed. The involved forearm and wrist was immobilized in a below elbow slab and kept elevated. Pain and inflammation were managed with analgesics and anti oedema medications. All routine investigations were done.

Radiographs of injured wrist with forearm in neutral position were taken both in Posteroanterior view and Lateral view. The following radiographic parameters were noted, Radial inclination in PA view, Radial length in PA view, Palmar tilt in Lateral view.

The fracture reduction was carried out under short general anaesthesia (SGA). Reduction was achieved by firm longitudinal traction to the hand against the counter traction by an assistant who grasped the arm above the flexed elbow while the distal fragments were pushed into palmar flexion and ulnar deviation using the thumb of the other hand, the patient's hand was brought into pronation, palmar flexion and ulnar deviation. A plaster cast was applied extending from below the elbow to the metacarpal heads, maintaining the wrist in palmar flexion and ulnar deviation (Colles Cast) in the closed reduction group. While in the K wiring group, once acceptable reduction is achieved 1.5 mm K-Wires were passed through the radial styloid process piercing the far medial cortex of proximal fragment under C arm guidance. An additional K-wire was passed through the ulnar side of the radius engaging the opposite cortex when deemed necessary by the operating surgeon. Confirming the satisfactory reduction under C arm, K-Wires were bent and cut, sterile gauze applied beneath the pin. Plaster cast was applied extending from below elbow to metacarpal heads with wrist in neutral.

Results

This study was conducted with a total of 60 patients, 30 patients were each randomly divided into two groups. 30 patients in the first group were treated with closed reduction and casting, 30 patients in group two were treated with closed reduction percutaneous pinning with K-Wires and cast application.

There was no statistically significant difference in the range of movement outcomes between the two groups.

Table 1: Mean Range of Movements

	Palmar Flexion	Dorsi flexion	Supination	Pronation	Ulnar deviation	Radial deviation
Cast application group	63	61	64	61	22	16
K-wiring group	64.5	62	67	64.5	23	17

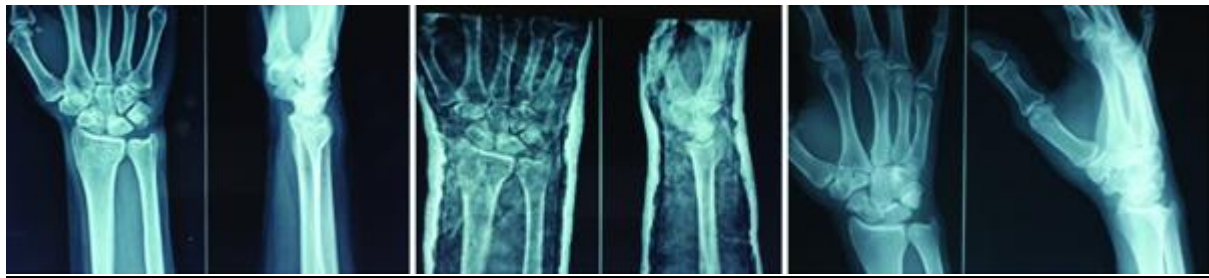


Fig 1: Pre Op, Post Op and 6 month follow up X-rays of a patient from the cast application group



Fig 2: Pre-Op, Post Op and 6 month follow up X-rays of a patient from the K-wiring group.

There was a statistically significant difference in all three radiological parameters of the patient groups.

The mean radial height in the casting group was 8.033mm while the mean in the k-wiring group was 11.783mm. The unpaired student’s t-test on the values obtained in both groups revealed a p-value of 0.0001.

The mean volar tilt in Cast application group was 4.867 degrees and that in the k-wiring group was 7.5 degrees the unpaired student’s t-test revealed a p-value of 0.0001.

The mean radial inclination in the Cast application group was 14.23 degrees and that in the k -wiring group was 19.1. Unpaired student’s t-test on the values revealed a p-value of 0.0001.

The functional scoring was done as per the Gartland and Werley demerit scoring system.

mean in the K-wiring group was 11.783mm, the unpaired student’s t-test on the values obtained in both groups revealed a p-value of 0.0001. The mean volar tilt in Cast application group was 4.867 degrees and that in the K wiring group was 7.5 degrees, the unpaired student’s t-test revealed a p-value of 0.0001. The mean radial inclination in the Cast application group was 14.23 degrees and that in the K wiring group was 19.1. Unpaired student’s t-test on the values revealed a p-value of 0.0001, this was in line with other studies of similar nature conducted by Azzopardi *et al.*, Das AK *et al.*, and RR Bagul *et al.*, which also concluded the same.

The functional outcome in our study was assessed by demerit score system of Gartland and Werley unlike other studies like the one by Wong [6] which used activities of daily life or Azzopardi [11] who used Mayo wrist score. In the present study, statistically there was no significant difference in the functional outcome between the two groups.

Table 2: Functional Outcome.

	Excellent	Good	Fair	Poor
Cast application Group	13	9	7	1
K-wiring Group	11	13	5	1

The Cast application group had thirteen excellent, nine good, eight fair and one poor result the mean outcome score of the group was 5.2. The K wiring group had eleven excellent, thirteen good, five fair and one poor result, the mean score of the group was 5.17. The unpaired student’s t-test on the values obtained from both groups yielded a p-value of 0.9816. Indicating that statistically there was no significant difference in the functional outcome between the two groups.

Discussion

Our prospective randomized control study compared closed reduction and below elbow cast immobilization and closed reduction with percutaneous K wiring and below elbow cast immobilization of extra articular fractures of the distal radius (AO class 23-A2 and 23-A3). Both groups were immobilized for a period of six weeks in well moulded below elbow cast. Studies by Jupiter and Sahin have shown no advantage of above elbow casting [2].

There was a statistically significant difference in all three radiological parameters of the patient groups. The mean radial height in the Cast application group was 8.033mm while the

Conclusion

It can be concluded that closed reduction with percutaneous K wiring and below elbow cast application is a simple, minimally invasive technique that provides added stability and better radiological outcome with respect to treatment of extra-articular distal radius fracture as compared to closed reduction and below elbow cast application, but the functional outcome between the two treatment modalities is not statistically significant.

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