

A COMPARATIVE STUDY OF ANATOMICAL AND FUNCTIONAL OUTCOMES OF CLOSED REDUCTION AND PLASTER CAST APPLICATION VERSUS CLOSED REDUCTION AND KIRSCHNER WIRE FIXATION IN COLLES' FRACTURE: A NON-RANDOMISED CONTROLLED TRAIL

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Abstract

Background: In Colles' fracture the traditional treatment has been closed reduction and POP cast application however difficulty faced by surgeons is in maintaining proper reduction due to dorsal comminution of fracture. Closed reduction and percutaneous k wire fixation is also widely accepted modality of treatment. But there is no consensus on its outcome in comparison to closed reduction and cast application. This study compares the anatomical and functional outcome of closed reduction and casting versus closed reduction with percutaneous K-wire fixation in the treatment of Colles' fracture. **Materials and Methods:** The study was conducted on 124 patients from August 2020 to November 2022. The cases were randomly divided into two equal groups of 62 patients, operative and nonoperative group, the first group was treated by closed reduction and below elbow cast, while the second group was treated by closed reduction and percutaneous K-wire fixation. The results of both groups were evaluated radiologically and functionally as per our protocol. **Result:** At 9 months, according to Gartland and Werley patients in operative group had significantly better functional outcomes as compared to non operative group. According to Sarmiento Radiological Score 50% patients in operative group had excellent outcome as compared to 13% in nonoperative group. **Conclusion:** Colles' fracture treated by closed reduction and Kirschner wire fixation provided additional stability and excellent radiological and functional outcome as compared to those treated with closed reduction and below elbow casting.

INTRODUCTION

Sir Abraham Colles of Dublin in Ireland first described the Colles' fracture in 1814 after whom it is named.^[1] In early days distal radius fracture was most frequently occurring in elderly population and postmenopausal women. But of late due to high velocity injuries and road traffic accidents the incidence is increasing in younger population.^[2] An orthopedic surgeons' challenge in dealing with displaced, comminuted Colles' fracture is that, they tend to heal with malunion. Sometimes alignment with regards to radial length and angulation cannot be maintained by conventional method of treatment. As a result there is significant anatomic deformity and functional disability. Dorsal angulation reduces the range of motion by disturbing radio-carpal function. Grip strength also decreases due to radial inclination or radial shortening. Radial length is important factor

for regaining function of the wrist. More than 4 to 6 mm shortening at distal radio ulnar joint compromises the function. The most common modality of treatment of Colles' fracture is closed reduction and splintage with POP cast.

Considering the changing trends of lifestyle and quality of life and availability of newer modalities of treatment unacceptability of deformity with mild residual functional impairment even by older patients is becoming a norm.^[3]

Purpose of our study was to compare the outcome with colles' fracture treated by closed reduction and casting versus closed reduction and percutaneous K-wire fixation and to determine which of the above two methods is better.

MATERIALS AND METHODS

With the approval of the REB (Research Ethics Board), RIMS, all cases of Colles' fractures who attended casualty and OPD from January 2021 to June 2022 were identified. All patients above the age of 30 years and injuries not older than 2 weeks were included. Patients with open fracture, bilateral fracture, polytrauma patients, previous fracture in the same limb, preexisting impairment of function of the same limb, mental or physical inability to cooperate were excluded. Randomisation was done with computer generated numbers into two groups Group A and Group B. 62 patients were enrolled in Group A for operative treatment and Group B for non-operative treatment. Prior to initiation of treatment informed written consent was taken from each patients for inclusion for the study.

In the non operative group, closed reduction of all the fractures was done under short general anaesthesia. The patients were kept in supine position on the table with abduction of the shoulder and flexion of the elbow. Reduction of the fracture was done by using Charnley's method.⁴ Plaster of Paris slab was changed on the third week to keep the wrist in neutral position and was removed at the completion of 6 weeks. Then patient was advised to follow up at the end of 12 weeks, 24 weeks and 36 weeks.

In the operative group, reduction was done as in the nonoperative group and checked by IITV. The technique of Kirschner wire insertion described by Clancey⁵ was used to fix the fracture fragments. For this purpose, 1.5 mm/2mm Kirschner wire was used. The first K-wire was inserted at the radial styloid between the first and second dorsal wrist extensor compartments at a 45° angle with the long axis of the radius and 10° dorsally. The K-wire was engaged into the ulnar cortex of the proximal radius. The radial artery was avoided by palpating in the anatomical snuff box. The second K-wire was introduced in between the fourth and fifth dorsal wrist extensor compartments, starting at the ulnar corner of the distal radius, avoiding the semicircular notch. It was directed 45° to the long axis of the radius and 30° palmarly, and was inserted into the radial cortex of the proximal radius. The quality of reduction was again checked under image intensifier television. A 15 cm wide below elbow plaster of Paris slab was applied dorsally. Plaster of Paris slab was removed on first follow up on 7th post op day. Regular exercises were advised on the day of removal of the plaster. Then patient was advised to follow up again at the end of 3 weeks, 6 weeks, 12 weeks, 24 weeks and 36 weeks, and recording of the range of motion was done. The wires were removed on 6th week, depending on the radiological and clinical evidence of union. The Sarmiento Radiological Score the Gartland and Werley Score and fracture union of distal radius were assessed in both the groups at 36th week after treatment.

All patients having excellent and good outcomes were considered satisfactory and fair and poor outcomes were considered unsatisfactory.

Data was analyzed using Statistical Package for Social Sciences (SPSS V.21). The sociodemographic characteristics and outcomes in the groups were compared by using chi-square test. Independent T test was used for comparing the mean age in the two groups. P value < 0.05 was considered as significant.



Figure 1: a and 1b- shows patient treated with closed reduction and her functional outcome at 9 months.

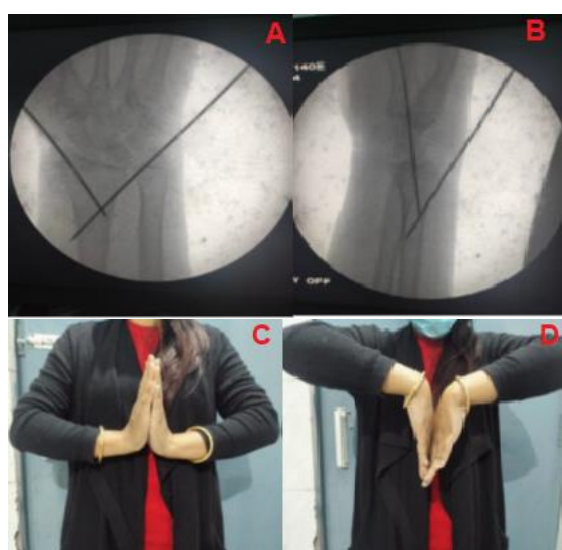


Figure 2: a to d - shows patient treated operatively and her functional outcome at 9 months.

RESULTS

124 patients were enrolled in the study with 62 patients in each group. The two groups were comparable in patient characteristics with respect to age and sex and statistically not significant (p value>0.05).

Around 59% of the participants had their right hand involved and around 41% had their left hand involved. Most of the patient presented on the day of injury i.e. on day 1 (74.2%) followed by on day 2 (15.3%) and on day 3 (10.5%). 88% and 83% of the patients had injury due to fall on outstretched hand in Group A and Group B respectively and there is no significant difference (P>0.05).

By 36 weeks 87.1% of the patients had satisfactory outcomes in the operative group whereas only 35.4% patients had satisfactory outcome in nonoperative group measured by Sarmiento Radiological score [Table 2].

According to Gartland and Werley score satisfactory (excellent/good) outcomes were present in 77.4% and 54.8% of patients in Group A and Group B respectively [Table 3].

The operative group had 2 cases of post operative pin tract infection which were managed conservatively

with regular antiseptic dressing and antibiotic coverage. 1 case of Complex regional pain syndrome (CRPS) was also seen in this group.

The non operative group had 4 cases of arthritic changes in wrist joint and 2 cases of Complex regional pain syndrome (CRPS).

Table 1:

Parameters	Group A	Group B	P value
Age (years)	54.16 ± 8.408	56.00 ± 9.128	0.246
Sex (M/F)	17/45	21/41	0.280

Table 2:

Outcome (%)	Group A	Group B
Excellent	50	12.9
Good	37.1	22.5
Fair	8.1	35.5
Poor	4.8	29.1

P value < 0.05

Excellent/Good = Satisfactory

Fair/Poor = Unsatisfactory

Table 3:

Outcome (%)	Group A	Group B
Excellent	56.5	32.2
Good	20.9	22.6
Fair	16.1	29.1
Poor	6.5	16.1

P value < .05

Excellent/Good = Satisfactory, Fair/Poor = Unsatisfactory

DISCUSSION

A total of 124 patients of Colles' fracture participated in this non randomized control trial study; 62 each in the operative and non operative group. Out of 124 patients 30.6% (38) were males and 69.4% (86) were females.^[4,5] Even though females dominated the study population, both males and females were well distributed in the two groups and made them comparable. In a similar study by Uzzaman KS et al,^[6] females constituted 72.5% of the study population with male: female ratio of 1:3, in their study. Females were seen more with this fracture than males, this may be due to postmenopausal osteoporosis.

In terms of age distribution, most of the study populations were middle age group, but the mean age of the operative group was 54.16 ± 8.408 and the mean age of the non-operative group was 56.00 ± 9.128. In a similar study by Adarsh T et al,^[7] the mean age of the participants were 51.27 years with most of the participants in the 51-60 years of age in both the group.

In this study, most of the cases came on the first day of injury (74.2%), followed by second day (15.3%) and the remaining on third day (10.5%). Among the two groups, around 88.7% of the non-operative group presented on the first day in comparison to 59.7% of the operative group, and there was a significant difference.

The two groups had a different findings regarding outcome of their respective procedure based on

Sarmiento Radiological Score. The operative group (closed reduction and percutaneous pinning fixation with kirschner wires) had more no. of patient in the excellent and good outcome than the non-operative group (closed reduction and casting). On the other hand non-operative group had more no. of patients in the fair and poor outcome than the operative group. This difference was found to be statistically significant and comparable to the study by Uzzaman KS et al.^[6]

Similarly based on Gartland and Werley Score, the outcome was found to be significantly different among the two groups. Most of the patients who had an excellent outcome belonged to the operative group in comparison to the non-operative group. But those who had good outcome were more or less equally distributed among the two groups. Further those patients who had fair and poor outcome were dominated by the non-operative group in comparison to the operative group. On statistical analysis, there was a significant difference in the outcome of the two groups who had different procedure. This study finding was also reported by a similar study conducted by Singh G et al.^[8]

The limitation with this study is the relatively small sample size which may not be truly representative of the true comparison between the two treatment modalities.

CONCLUSION

In the management of Colles' fracture closed reduction and percutaneous pinning fixation with kirschner wires offers more positive result than conventional closed reduction and casting with fewer complications. Therefore, for better outcome, this simple and minimally invasive procedure i.e. closed reduction and percutaneous pinning fixation with kirschner wires should be the first line of management in this case.

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