A comparative evaluation closed reduction with percutaneous K-wire fixation versus closed reduction of extra articulur fracture of distal end of radius

Dr. Venkat Rama Choudary Pathuri

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Abstract

Background: Selection of method of treatment of Colles fracture depends upon age, occupation, dominant hand, type of fracture, co-morbid conditions and nature of wound. Even in the treatment of fracture in elderly patients, orthopaedic surgeon must have more thresholds for intervention in an unstable and displaced fracture than young one. There is difference in the outcome of fracture stabilisation of Colles fracture, so we have designed this study to evaluate the result of treatment of this fracture by closed reduction and plaster cast immobilisation alone or by K-wire fixation and plaster cast immobilisation.

Material and Method: As per exclusion and inclusion criteria 64 patients with fracture of distal and of radius were enrolled for this study and equally divided into two groups. Patients were assessed clinically for range of movement, fracture union and by radiologically for radiological parameters like, volar tilt which was expressed as degree from neutral position radial inclination and radial length. The range of movement was measured and compared to the normal side after 3 months for assessment of daily life activities Gartland and wereley score was used, in the form of excellent, good, fair and poor.

Result: Overall evaluation the result was excellent in 2 (6.25%) patient in group A and 4 (12.5%) in group B. It was good in 6 (18.75%) patents in group A and 18 (56.25%) patients is group B. 20 (62.5%) patients in group A have fair result and 10 (31.25%) patient in group B have fair result. Result was poor in 4 (12.5%) patient in group A and 1 (3.125%) in group B.

Conclusion: The overall evaluation result of two modalities of treatment, K-wire fixation has statistically significant better result than cast immobilisation alone. More patient in K-wire group has good result (56.25%) then closed reduction group but in closed reduction group fair result was more (62.5%).

Keywords: Colles fracture, K-wire fixation, closed reduction, outcome

Introduction

In April issue of Edinburgh medical and surgical journal 1814, Colles A, a professor of Anatomy and surgery in Royal College of surgeons in Ireland, has published an article on the fracture of the carpal extremity of the radius. Details of clinical presentation, non operative reduction and difficulties in the reduction were discussed in details. This fracture of carpal extremities of the radius is called Colles fracture by his name. Fracture of the distal end of radius accounts for 18% of all fracture above 65 yrs and because of increase in geriatric population the incidence is going to increase. Incidence is more in women than men. Many fracture of the distal end of the radius are relatively uncomplicated but the fracture that are unstable and osteoporotic, are challenges. In these condition the goal of orthopaedic surgeon is to restore the functional anatomy by a method in such a way that will not compromise the overall function of the hand. There are a number of methods available for immobilisation and treatment of these fractures which includes conservative management with cast immobilisation, closed reduction and transulnar pinning, transradial pinning or Kapandiji intrafocal pinning. Closed reduction with external fixation, open reduction with different approach using suitable implant. Selection of method of treatment depends upon age, occupation, dominant hand, type of fracture, co-morbid conditions and nature of wound. Even in the treatment of fracture in elderly patients, orthopaedic surgeon must have more thresholds for intervention in an unstable
and displaced fracture than young one. [7]

There are various risk factors which are responsible for instability and subsequent complication. Most important among them are intra articular involvement, associated ulnar fracture, dorsal comminution beyond the mid axial plane of radius, shortening of the radius more than 6mm and primary displacement with dorsal angulations more than 20 degree. There is difference in the outcome of fracture stabilisation of Colles fracture, so we have designed this study to evaluate the result of treatment of this fracture by closed reduction and plaster cast immobilisation alone or by K-wire fixation and plaster cast immobilisation.

Primary objective of this study is to compare the result of this two method of treatment with respect to volar tilt (distal articular surface) radius height restoration and radial inclination. Secondary objective is compare the efficacy of the two treatment modality with respect to movement of the wrist.

Material and Method
Present study is a prospective comparative study conducted in two centres from July 2017 to October 2019.

Selection of cases
Patients with radiologically confirmed fracture of the distal end of radius were included in this study based on exclusion and inclusion criteria.

| Inclusion criteria         | Exclusion criteria                  |
|----------------------------|-------------------------------------|
| Both sex                   | Paediatric patient                  |
| Extra articular fracture   | Intra articular compo and fracture   |
|                            | Metabolic disorder and bony deformity.|

Calculation of sample size
Based on incidence of fracture and confidence interval 85% the sample size was calculated to be 64, they were randomly divided into two groups, group A and group B having 32 patient in each group. Group A patients were treated with closed reduction with cast and group B patients were treated by closed reduction with percutaneous K-wire and cast application.

Ethics
Present study is approved by institutional ethics committee and written informed consent was taken from patient before enrolling them in this study.

Method
After admission history of nature of fall and severity of injury was taken and examined thoroughly. Patients were examined for deformity inflammation, bony irregularity, relative position of radial and ulnar styloid process. Movements of the wrist were evaluated. Vascularity was accessed and plaster last was applied. All routine investigation was done. Radiological assessment of injured arm was done by AP and lateral view, the parameters like radial inclination, length, and palmer tilt was noted.

For closed reduction and cast application we used standard procedure, under continuous longitudinal traction the fracture was disimpacted and there was increase in dorsal angulations, this was followed by the reducing hand forces the distal fragment to the volar side under continuous traction, at the mean time stabilizing hand holds the proximal radius, the result of the reposition is maintained by pronating the distal fragment and traction was stopped, this ends the manoeuvre. [7] A Plaster cast was applied extending from below elbow to metacarpal head, palmer flexion and ulnar deviation was maintained.

For surgical technique in group B first reduction of fracture was done and checked by fluoroscopy, once satisfactory reduction was achieved, under general anaesthesia K-wire of 1.5mm size was pierced, through radial styloid process and the medial cortex of the proximal fragment. Once satisfactory reduction was achieved which was confirmed by C-arm, the plaster cast was opposed with wrist in natural position.
Fig: Fracture distal end of radius with closed reduction and k-wire fixation

For post operative pain, inflammation and infection, anti inflammatory analgesic and antibiotic was used. Post operative X-ray was done to confirm the reduction and displacement if any. After 6 weeks cast and K-wire was removed and patients were assessed clinically for range of movement, fracture union and by radiologically for radiological parameters like, volar tilt which was expressed as degree from neutral position radial inclination and radial length. The range of movement was measured and compared to the normal side after 3 months for assessment of daily life activities Gartland and wereley score was used, in the form of excellent, good, fair and poor.

Result

As per exclusion and inclusion criteria 64 patients with fracture of distal and of radius were enrolled for this study and equally divided into two groups. Patient of group A were treated with closed reduction and cost immobilisation and group B were treated with percutaneous K-wire and cast immobilisation.

Table 1: Demography of the patients in two groups

| Variables            | Group A Number (%) | Group B Number (%) | P value       |
|----------------------|--------------------|--------------------|---------------|
|                      | >30 yrs            | 2 (6.25%)          | 1 (3.125%)    | 0.8038 chi-square statistic 1.6275 |
|                      | 31 - 40 yrs        | 2 (6.25%)          | 4 (12.5%)     | |
|                      | 41 - 50 yrs        | 6 (18.75%)         | 4 (12.5%)     | |
|                      | 51 - 60 yrs        | 6 (18.75%)         | 6 (18.75%)    | |
|                      | > 60 yrs           | 14 (43.75%)        | 17 (53.125%)  | |
| sex                  | Male               | 14 (43.75%)        | 15 (46.875%)  | 0.8017 chi square statistic 0.0631 |
|                      | Female             | 18 (56.25%)        | 17 (53.125%)  | |
| Side of injury       | Right              | 22 (68.75%)        | 20 (62.5%)    | 0.598 chi square statistic 0.2771 |
|                      | Left               | 10 (31.25%)        | 12 (37.5%)    | |
| Moge of injury       | RTA                | 2 (6.25%)          | 2 (6.25%)     | 0.545 chi square statistic 0.3657 |
|                      | Fall on out streach hands | 24 (75%) | 26 (81.25%) | |
| Type of fracture     | I                  | 22 (68.75%)        | 24 (75%)      | 0.57815 chi statistic 0.3092 |
|                      | II                 | 10 (31.25%)        | 8 (25%)       | |

As per table-1 out of 64 patients 3 patients (4.68%) were below 30 yrs of age. 6 patients(9.375%) were between 31to 40 hours of age, 10 (15.625%) were between 41to 50yrs, 12 (18.75%) were between 51 to 60yrs of age and remaining 31 (48.43%) were above 60yrs. The P value was 0.80, which is not significant statistically. In group A there was 14 male and 18 female and group B there was 15 male and 17 female, the P value was 0.80, which is not significant statistically. In group A right side was affected in 22 (68.75%) patients and left side was affected in 10 (31.25%). Similar in group B right side was affected in 20 patients and left side was affected in 10 patients. The P value was 0.598 which is not significant. In group A mode of injury was RTA in 8 (25%) patients and 24 (75%) patient in group A has fall on outstretched hand. In Group B mode of injury by RTA was in 6 (18.75%) patients and fall on outstretched hand was 26 patients (81.25%). Type-I fracture was present in 22 (68.75%) patients in group A and 24 (75%) in group B. Type-II fracture was present in 10 (31.25%) in group A and 8 (25%) in group B.

Table 2: Outcome of the treatment two groups

| Variables            | Group A Number (%) | Group B Number (%) | P value |
|----------------------|--------------------|--------------------|---------|
| Radial length (mm)   | 9.28±0.730         | 11.12±1.1074       | 0.0001  |
| Radial inclination   | 20.30±1.89         | 22.87±3.60         | 0.0001  |
| Volar tilt           | 4.01±0.52          | 7.70±0.607         | < 0.0001|
| Palmar flexion       | 60.81±9.33         | 65.43±6.871        | 0.0001  |
| Dorsi flexion        | 62.42±6.32         | 63.46±3.32         | 0.04    |
| Supination           | 63.94±7.370        | 68.44±6.342        | 0.001   |
| Pronation            | 62.01±5.112        | 63.9±7.02          | 0.02    |
As per table -2 regarding outcome of the treatment, radial length mean value was 9.28±0.730mm in group A and 11.12±1.10mm in group B, the P value was less than 0.0001, which is highly significant. The radial inclination was 20.30±18.9 degree in group A and 22.87±3.60 degree in group B. The P value was 0.0001 which is significant statistically. The Volart tilt was 4.01±0.52 degree in group A and 7.70±0.607 degree in group B. The P value was less than 0.0001. Regarding range of movement the mean of palmer flexion was 60.81±9.33 degree in group A and 65.43±68.71 degree in group B, dorsi flexion was 62.42±6.32 degree in group A and 63.46±3.31 degree in group B. The supination was 63.94±7.30 degree in group A and 68.44±6.32 degree in group B.

The pronation was 62.01±5.112 degree in group A and 63.9±7.02 degree in group B, ulnar deviation was 23.22±2.312 degree in group A and 24.36±3.012 degree in group B. Radial deviation mean was 17.01±1.82 degree in group A and 18.2±2.11 degree in group B. This difference in range of movement was significant statistically as P value was <0.05.

With respect to complication in both group infection was present in 2 patients in group B but absent in group A, malunion was present in 4 patients in group A and 1 patient in group B. Stiffness of wrist was present in 2 patients in group A and 1 patient in group B. Residual pain was there in 6 (18.75%) patient in group A but only 1 patient in group B. Reduced grip strength was present in 8 (25%) patient in group A and 1 (3.125) in group B but these findings are not significant statistically.

As per table-3 regarding overall evaluation the result was excellent in 2 (6.25%) patient in group A and 4 (12.5%) in group B. It was good in 6 (18.75%) patients in group A and 18 (56.25%) patients is group B. 20 (62.5%) patients in group A have fair result and 10 (31.25%) patient in group B have fair result. Result was poor in 4 (12.5%) patient in group A and 1 (3.125%) in group B.

**Discussion**

During the study 64 patients were enrolled for this study having radiologically confirmed fracture of distal end of radius. It has been observed that three patients were below 30yrs of age but most of the patients were above 60yrs of age. There was female predominance; this finding is supported by the work of Baron JA et al [2] and Baron et al [3]. Right side injury was more common than the left side, that is (54.68% vs 45.31%), Bagul et al has reported (56.66% vs 43.37%) which support our finding, Leung et al has reported that right side fracture is 61.11% in right side which support our study.[9, 10] fall on out stretched hand was more common made of injury than. Road traffic accident (RTA) This finding corroborates with the finding of venkatesh RR et al [11] and Aggarwal A [12] et al. Type I fracture was more common than Type -2 fracture which is supported by work of Bagul RR et al and Aggarwal et al [9, 12].

Regarding variables of the outcome of treatment, the radiological parameter, the radial length was significantly longer in K- wire fixation group than closed reduction group. The radial inclination was significantly more in K- wire fixation group. Volart tilt was also significantly more in k-wire group. This finding corroborates with the finding of venkatesh RR et al. [11] So K –wire fixation group has better and statically significant anatomical reduction. This finding is supported by the work of Panthi s et al and stein AHJr et al [13, 14]. We have observed that there was significant difference in the range of movement in two group which is supported by the work of Mohamad F et al and Venkatesh RB et al. [11, 15].

Range of movement like palmer flexion, dorsal flexion, supination and pronation, ulnar deviation and radial deviation are significantly better in K-wire fixation group. Venkatesh RB et al has also found the same but the difference was not significant statistically. The complication was less is K-wire group but it was not significant this finding is supported by the work of Gills et al [10]. The residual pain and reduced grip strength was more common in closed reduction and cast application group.

The overall evaluation result of two modalities of treatment, K-wire fixation has statistically significant better result than cast immobilisation alone. This finding is supported by the work of Baba Anetal and Venkatesh RB et al [11, 17]. More patient in K- wire group has good result (56.25%) then closed reduction group but in closed reduction group fair result was more (62.5%). This finding corroborates with the work of Kumar p et al.

**Conclusion**

To conclude K-wire fixation is associated with better anatomical reduction as observed radiologically. Range of movement like palmer flexion, dorsal flexion, supination and pronation, ulnar deviation and radial deviation are significantly better in K-wire fixation group. The overall evaluation result of two modalities of treatment, K-wire fixation better result than closed reduction.

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