Functional Outcome Following Treatment of Distal Radius Fracture: A Comparative Study of Closed Reduction and Plaster Cast Application versus Kirschner Wire Fixation

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Research Article

Abstract: Distal Radius Fractures are one of the common Fractures of day to day practice. There are many classifications and varied treatment options with variable results. Various studies with short term and long term results of treatment of distal radius fractures have correlated deformities with loss of function. This prompted us to undertake a comparative study to determine the functional outcome with clinicoradiological analysis of patients with distal radius fractures treated with closed reduction and cast application versus K wire fixation and cast. At last follow up no significant difference in functional outcome was obtained with closed reduction and cast versus K wire fixation with cast.

Keywords: Distal Radius Fracture, K wire, Plaster Cast.

Introduction

Fractures near the wrist joint due to fall on the outstretched hand constitute one of the largest of all groups of bone injuries and are estimated to account for one-sixth of all fractures seen and treated in the emergency room. With the passage of time, the epidemiological pattern of fractures has evolved from a non-comminuted extra-articular fracture as classically described by Colles to a comminuted articular fracture associated with high velocity trauma. Middle aged or elderly women often sustain this fracture following low velocity trauma while in the young, it is caused by high velocity trauma. The treatment modalities for this fracture have also evolved over time as understanding of this injury has changed. The concept of ligamentotaxis to reduce the fracture with the help of external fixation was introduced by Vaughan in 1985. However, closed reduction and immobilization in a plaster cast remains the accepted method of treatment for 75% to 80% of fractures of the distal radius. Various K-wire fixation techniques have been described but Azzopardi et al state that biomechanically a crossed K–wire construct provides the greatest stability and supplementary K-wires do not provide a better clinical outcome. Some authors believed that no special treatment was needed as the resulting deformity barely resulted in loss of function. However this concept has been challenged and the restoration of normal anatomy is now considered essential for normal function. Various studies with short-term and long-term results of treatment of distal radius fracture have correlated deformities with loss of function. This prompted us to undertake a comparative study to determine the functional outcome with clinico-radiological analysis of patients with distal radius fractures treated with closed reduction and cast alone versus closed reduction, Kirschner wire fixation and cast.

Methods

The study was conducted at the department of Orthopaedics, Father Muller Medical College & Hospital, Mangalore, Karnataka. All patients with distal radius fracture between June 2009 and June 2011 were studied. The patients were followed up at 3 weeks, 6 weeks, 3 months, 6 months and 1 year. A complete clinicoradiological assessment was performed at each visit. Patients with fused epiphysis, sustaining distal radius fracture was included in the study. Patients with open fractures, additional major fractures in the ipsilateral upper limb, associated neuro-vascular deficit and with bilateral distal radius fractures were excluded from the study. Initial anteroposterior and lateral radiographs of both the injured and uninjured side were taken. The "Universal Classification" modified from the classifications of Gartland (1951) and Sarmiento (1975) was used in the study. The fractures were divided into - Extra-articular fractures: Type - I, non-displaced and stable, Type – II, displaced and unstable. Intra-articular fractures: Type – III, non-displaced; Type – IV, displaced. 23 cases were manipulated under general anaesthesia. 7 cases were manipulated under regional

anaesthesia. Fracture stability was assessed intra-operatively after reduction under C-arm. Patients with stable fractures underwent closed reduction and cast. Those with unstable fractures underwent closed reduction, K-wire fixation and cast application. For patients undergoing closed reduction and cast application, the patient was positioned on the operating table. The surgeon grasped the injured hand and disimpacted the fragments by firm longitudinal traction. An assistant provided counter-traction by grasping the arm above the flexed elbow. After steady traction, displacement was corrected. Reduction was confirmed using an image intensifier. Three point fixation was obtained in a well moulded plaster cast which was applied to maintain the wrist in the desired position. For comminuted fractures an above elbow cast was given. Stable fractures were given a below elbow cast. Active finger mobilization, shoulder exercises and elbow mobilization (in patients with short arm casts) was started immediately postoperatively. A long arm cast was converted to short arm cast at 3 weeks which was continued for another 3 weeks. Total duration of casting was 6 weeks. In the percutaneous pinning group, the limb was prepared and draped before closed reduction. The fracture was reduced in the manner described above and then fixed using two smooth Kirschner wires. The wires were inserted through small stab incisions under fluoroscopic control. One wire was inserted from the styloid process of the radius directed proximally and medially through the fracture site . The other wire was passed from the lateral border of the radius in a proximal to distal direction to engage the ulnar aspect of the distal fragment. Both wires engaged the opposite cortex. In few cases the second wire was passed through the dorso-ulnar border of the distal fragment in a distal to proximal direction.Damage to the superficial branch of the radial nerve and the extensor tendons was minimized by blunt dissection to the bone. The pins were left protruding percutaneously, dressed and the fracture was then immobilized in a well moulded long arm cast for unstable fractures. It was converted to a short arm cast at 3 weeks. The wires and cast were removed after 6 weeks. Active finger mobilization and shoulder exercises(elbow with short arm cast patients) were begun immediately postoperatively. Patients treated were followed up at 3 weeks, 6 weeks, 3 months and 9 months in the Orthopaedics OPD. Clinico-radiological assessment of the patients was performed at each follow-up visit. Functional scoring was done using the Gartland and Werley 9 scoring scale. The radiographs of the wrist joint of the patients were evaluated and the anatomical scoring method of Stewart et al was used to assess the fracture reduction.

Results

A total of 62 patients with distal radius fracture managed at the Dept. of Orthopaedics from June 2009 to June 2011 were studied. Of these, 8 cases were excluded from the study. (4 had bilateral Colles' fracture, 2 had associated ipsilateral humerus fracture and 2 were compound injury). Group I, which included patients who underwent closed reduction and cast application, had 26 patients. Group II (closed reduction, K-wire fixation and cast) had 28 patients. The patients were followed up immediately post-op, at 3 weeks, 6 weeks, 3 months and 9 months. 4 patients from group I and 6 patients from group II were lost to follow-up. These patients were also excluded from the study. The final analysis was performed on 44 patients, closed reduction and cast (Group I) with 22 patients and K-wire and cast (Group II), also with 22 patients. The mean age at injury was 46 yrs for males and 54 yrs for females. The age ranged from 21 to 62 years for the whole group and 21 yrs to 58 yrs for males and 30 yrs to 62 yrs for females. There was no statistically significant difference in age between the patients with different types of distal radius fractures according to the Universal Classification ($p > 0.503$). The female to male ratio was 1.2:1 with 24 females and 20 males. The dominant side was involved in 24/44 (54.55%) patients whereas the non dominant side was involved in 20/44(45.45%) patients. The distribution of the injuries according to the Universal Classification System is shown in Table. Majority of patients in both the groups were in Universal Classification type 4. The post-op functional scores in both groups showed improvement over time. There was however no statistically significant difference in the post-op function scores between the two groups ($p=0.267$). In Group I (closed reduction and cast), the anatomical scores showed worsening in 7 out of 15 cases. The anatomical scores improved after surgery and remained the same post operatively in all except 3 cases in Group II. There was worsening after 3 weeks in 3 and after 3 months in the other. However, the difference between the two groups was not statistically significant ($p= 0.412$). The correlation between pre-operative anatomical score and post-operative functional scores at 6 weeks, 3 weeks and 9 months was investigated. However, there was no statistically significant correlation between pre-operative anatomical score and post-operative functional scores (p-0.3).

Discussion

Fractures of the distal radius are one of the commonest skeletal injuries treated by orthopaedic surgeons and account for approximately one sixth of all fractures seen and treated in emergency rooms. Majority of the patients in the present study had intra-articular fractures. A similar observation was made by Altissimi et

al and Sandhu et al .Jupiter reported that the epidemiological pattern of fractures has evolved from a non-comminuted extra-articular fracture as classically described by Colles to a comminuted articular fracture. In various studies there is still no consensus regarding the management and assessment of outcomes of distal radius fracture. This has made it difficult to evaluate various methods of treatment. The functional scores at 6 weeks, 3 months and 9 months for treatment Groups I and II in the present study showed that there was no statistically significant difference in the functional outcome. Azzopardi et al reported similar findings. However our findings are different from those of Sandhu et al who reported a higher percentage of excellent and good results with K-wire fixation as compared to closed reduction and cast alone. In the anatomical scores of Group I (closed reduction and cast) worsening was seen in 7 out of 22 cases. In Group II (K-wire and cast) worsening was seen in only 3 cases. However, the data was not statistically significant. Our findings are comparable with those of Azzopardi et al who reported that the differences in the radiological parameters between K-wire fixation and cast immobilization in their study were within errors of measurement. They concluded that functionally K-wire fixation was marginally superior to cast immobilization in maintaining fracture reduction after closed manipulation. In our study the functional scores did not correlate with anatomical scores. Our findings are comparable with those of Smaill, Stewart et al, Dias et al and Gaur et al. Gaur et al reported that despite a high deformity rate with cast alone there were no patients with poor functional results at 5 year follow up. Smaill's and Dias et al's reported that good function may be present in spite of residual bony deformity. Stewart et al reported that there was no correlation between anatomical and functional results at 6 months follow up. Azzopardi et al reported that only 1/30 patients (3.3%) in the K-wire group required removal of the K-wires at 2 weeks due to pin tract infection. In our study none of the patients required removal of K-wires due to infection. The mean age in our study was 50 yrs which is less as compared to 59 yrs in the study by Azzopardi et al. Therefore, probably there were fewer chances of pin loosening and infection in younger individuals with normal bone quality versus elderly patients with osteopenic bone. In our study 1 patient out of 44 patients (0.02%) sustained a rupture of the extensor pollicis longus tendon. Our observations are similar to those of Frykman. The patient, however, recovered by 9 months with excellent functional scores. Our observations are comparable with those of Benjamin. He reported that patients with extensor pollicis longus tendon rupture left untreated for an year had no functional disability from the tendon rupture. In our study 5/44 (11.3%) patients developed reflex sympathetic dystrophy. 3 patients had been treated with cast alone and 2 patient with K-wire fixation. The patients showed recovery of their functional scores by 9 months after physiotherapy. Our findings are comparable to those of Frykman.Our study demonstrates that there is no significant difference in the functional outcome obtained with closed reduction and cast versus closed reduction, K-wire fixation and cast. However, K-wire fixation may play a role in maintaining post operative reduction and anatomical score. This is evident by the fact that loss of reduction post operatively was seen in fewer cases with K-wire fixation as compared to cast alone, even though the difference was not statistically significant. Possibly a study with a larger number of cases and a longer follow up is required to elucidate this difference.

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Table 1: Functional Scoring Method: (Gartland and Werley, 1951)9
MOVEMENT /FUNCTION Range (in degrees) Score
Dorsiflexion <45 5
Palmar flexion <30 1
Ulnar deviation <25 3
Radial deviation <15 1
Supination <50 2
Pronation <50 2
Circumduction loss 1
Finger flexion Not to distal crease 1-2
Grip Loss of strength 1
Radial / Median neuritis Mild- severe 1-3
FINAL GRADE Excellent 0-2
Good 3-8
Fair 9-14
Poor >15