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Functional and Radiological Outcomes of Frykman Type 4 Distal Radius Fractures by Open Reduction Internal Fixation with Plate Osteosynthesis and Below Elbow Casting by Closed Manipulation

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ABSTRACT

The Study aimed to assess the functional and radiological results of intra articular distal radius fractures managed with open reduction and internal fixation with plate osteosynthesis versus below elbow casting by closed manipulation. Distal radius fractures are among the most common injuries to the musculoskeletal system of human beings, which are managed both conservatively and surgically. There are pitfalls, advantages and disadvantages in each method. The individual fracture analysis determines the therapeutic options. In our series of 40 patients, 25 were male and 15 were female. Most of the patients were between 20-30 years. (minimum age of 20 to maximum 70 and mean age of 38.62 years. The most common mode of injury, wrist involvement and fracture type were RTA (45%) and right side (52.5%), respectively. Excellent results were seen in 45% in the surgical group and 30% in the conservative group. This study concluded that surgical management is better than conservative in treating comminuted and displaced intra-articular fractures of the distal radius. Therefore, we cannot infer one treatment method for all fracture patterns and treatment should be individualized to a particular fracture pattern.

INTRODUCTION

Distal radius fractures remain the most common fracture, approximately one-sixth of all fractures treated in the emergency department. There are three main types of fracture distribution peaks in the population. The initial peak is in children aged 5-14, the second peak is in males under the age of 50 years and the final third peak is in females over the age of 40 years. Risk factors are: Decrease in bone mineral density, female gender, ethnicity, hereditary and early menopause have been all shown to be risk factors for this injury^[1]. Fracture of the distal end of the radius continues to pose a therapeutic challenge. Intra articular and extra-articular malalignment can lead to a variety of complications like post-traumatic wrist joint osteoarthritis, reduced grip strength and endurance, as well as limited range of motion and carpal instability. The majority are being treated with Plaster of Paris cast following closed reduction with local anesthesia. However, other distal radius fractures require surgical management and many treatment methods are available. The outcome of this fracture is not uniformly good regardless of treatment instituted. A complete understanding of the anatomy and concepts of the biomechanics of the Wrist is a prerequisite when treating these fractures. The quality of anatomical reconstruction and the long term functional outcome is directly related to each other^[2]. No single treatment is a solution for every kind of fracture pattern in every kind of patient. Based on the bone's functional anatomy, we analyze the actual treatment possibilities and develop strategies for different fracture types in different patient groups. The treatment aim should be to reconstruct the anatomy as good as possible so that there is no loss of reduction and to allow for functional after treatment as soon as possible^[2-4].

Aims: To Study functional and radiological results of intra articular distal radius fractures managed with open reduction and internal fixation with plate osteosynthesis versus below elbow casting by closed manipulation.

MATERIALS AND METHODS

We studied prospectively 40 patients with intra articular distal radius fractures. Among those 40 patients, 20 were treated with conservative management with below elbow casting and the other 20 patients with surgical management using plate osteosynthesis at Dept. of Orthopaedics. Records available in the form of admission notes, operative notes, progress notes and follow up OPD records were analyzed. Patients not coming up for late follow-up at OPD were interviewed on the phone and sent mail. We considered fracture united if there were no pain on palpation or attempted motion, no increase in warmth

at the fracture site, no discomfort on carrying weights and serial roentgenograms demonstrated bone trabeculae crossing fracture site. The functional and radiographic and overall results were recorded according to the Green and O'Brien scoring system and Quick DASH scoring. Functional grading was made depending on pain, mobility at the wrist and work. Radiological grading was made based on varus or valgus deformity, shortening, signs of osteoarthritis, and the fracture union. The outcomes are compared with the results available from the latest literature.

Mode of Collection Of Data:

Inclusion Criteria:

- All patients aged between 20-70years.
- Patients presented with distal radius intra articular fractures. (Frykman type 4, type 5 and type 6).
- Patients willing to give consent for surgery. 65.
- Patients not willing for surgery and who are medically unfit for surgery but wanted to be managed conservatively.

Exclusion Criteria:

- Aged below 20 and above 70 years.
- Patients with neurological deficits.
- Open fractures(except Gustilo Anderson type I) After initial resuscitation in the emergency, closed fractures were splinted and operated on at the earliest.

Type 1 Open fractures were also included in the study. Preference was given to manage life-threatening emergencies, i.e., head injury, blunt trauma abdomen, blunt trauma chest and patients were taken up for orthopedic surgery once the patient is out of danger. Until then, fractures were managed with slab application and elevation. After the patient with intra articular distal radius fracture was admitted/planned to treat on an outpatient basis, all the necessary clinical details were recorded in the proforma prepared for this study. Most distal radial fractures, which were minimally displaced and comminuted fractures, were sent into the surgical group. After completing the hospital treatment, patients were discharged and called for regular follow-up at the outpatient level for serial clinical and radiological evaluation.

Management of Patient: Whenever a patient with suspected distal radius fracture was seen, the necessary clinical and radiological evaluation was immediately done. Patients were evaluated and managed either conservatively or by surgical method. 66 Most of the cases in the conservative group were treated on an outpatient basis, some were admitted. All the patients were evaluated for the associated medical problems and were referred to respective departments and treated accordingly. Associated injuries were evaluated and treated simultaneously.

The patients were operated on an elective basis after overcoming the avoidable anesthetic risks.

Surgical Procedure Volar Plate Fixation:

- **Henrys Approach:** Make an 8-cm incision over the forearm between the brachioradialis and the flexor carpi radialis. Extension of the incision distally at the wrist crease in a Vshape may provide wider exposure of the fracture and help prevent scar contractor. The distal incision does not need to cross into the palm. Carry the incision to the sheath of the flexor carpi radialis. Open the sheath and incise the forearm deep fascia to expose the flexor pollicis longus.
- Place an index finger into the wound and gently sweep the flexor pollicis longus ulnarly. Partially detach the flexor pollicis longus muscle belly from the radius to gain full exposure of the pronator quadratus. Make an L-shaped incision over the radial styloid along the radial border of the radius to expose the pronator quadratus and use a Freer elevator to elevate it from the radius. The entire fracture line across the distal radius is now fully exposed. Anatomic reduction of both the radial and the intermediate columns was made. Once the columns were aligned, the fracture was fixed to the palmar plate avoiding penetration of the articular surface. The wound was closed in layers.
- **Postoperative Treatment Protocol:** Routine antibiotics, analgesics and evaluation by X-rays.
- **Complications:** pre-operative, intraoperative, immediate postoperative and late.

Follow-Up Assessment was as Follows:

Assessment at One Week: Clinical assessment of pain.

Assessment at Six Weeks: Clinical assessment of pain, Range of motion.

Assessment at 3Months: Clinical assessment of pain, Range of motion Clinical and radiological assessment of union. Grip strength was measured using Dynamometer Assessment of any complications.

Assessment at Six Months: Clinical assessment of pain, Range of motion Clinical and radiological assessment of union. Clinical and functional capabilities concerning activities of daily living. Grip strength was measured using Dynamometer Assessment of any complications.

RESULTS AND DISCUSSIONS

In Our Series of 40 Patients (40 Distal Radius Fractures): There were 25 males (62.5%) and 15 females (37.5%). The minimum age was 20 years., the maximum age is 70years with a mean age of 38.62 years. The most common age group was 41-50 years (

35%), with the mean age being 40.85 years in the conservative group. The most common age group was 20-30 years (35%), with the mean age being 36.30 years in the surgical group. RTA was the most common mode of injury (45%). The right side was most common (52.5%). Meantime of union at six weeks was seen in 45% conservative group and 85% in the surgical group and at three months was seen in 50% in conservative group and 15% in the surgical group. Mal-union was seen in 30% of the conservative group and 10% in the surgical group. Intra articular step off was seen in 40% conservative group and 30% surgical group. Radial inclination was lost in the 45% conservative group and 30% surgical group. The radial length was lost in the 35% conservative group and 20% surgical group. The mean loss of movements for the conservative group was 33.55% and 25.85% in the surgical group. Mean dorsi flexion for the conservative group was 59.50 and 70.750 for the surgical group, and mean palmar flexion was 60.750 for the conservative group and 68.750 for the surgical group. The mean radial deviation was 8.50 for the conservative group and 9.250 for the surgical group and the mean ulnar deviation was 18.50 for the conservative group and 240 for the surgical group. Mean pronation was 68.50 in the conservative group and 71.250 in the surgical group, and mean supination was 71.50 for the conservative group and 78.750 in the surgical group. The average arc of dorso-palmar flexion for the conservative group was 120.250 and 139.50 for the surgical group. The average arc of radio-ulnar deviation for the conservative group was 270 and 33.250 for the surgical group. The average arc of supination-pronation for the conservative group was 1400 and 1500 for the surgical group. Mean grip strength was 42.75 and 62.75 in the conservative group and surgical group respectively at three months of follow-up, with significant improvement seen in the surgical group with a P-value of 0.028. Mean grip strength was 58.5 and 71.5 in the conservative group and surgical group respectively at six months of follow-up, with significant improvement seen in the surgical group with a P-value of 0.0468. Grip strength was >50% compared to the normal wrist in 55% in the conservative group and 85% in the surgical group, and it was <50% compared to the normal wrist in 45% in the conservative group and 15% in the surgical group. Complications like mal-union in the conservative group were 30% and 10% in the surgical group. Stiffness/ arthritis of wrist and fingers was seen in 10% in both groups. Hypertrophied surgical scar was seen in 10% of cases in the surgical group. Shoulder hand syndrome was seen in 10% of the conservative group and none in the surgical group. Prominent ulnar styloid was seen in 10% of the conservative group and none in the surgical group. Complex regional pain syndrome was seen in 10% of the conservative group and none in the surgical group. The surgical group did not have any plating

related surgical complications. Mean Quick DASH scores were 34.84 in the conservative group and 21.29 in the surgical group at three months follow-up and 22.73 and 15.33 respectively at six months follow-up. Quick DASH scores were significantly better in surgical management at three months follow-up, but at the final 6 months follow-up, the difference was insignificant. Excellent results were seen in 30% of cases in the conservative group and 45% in the surgical group.

We studied prospectively 40 Patients with Intra-articular distal radius fracture. Twenty were treated with conservative management, 20 cases with surgical management. Age distribution Mean age and most common age was less in the surgical group. The most common age group is 41-50 years (35.0%), with the mean age being 40.85 years in the conservative group. Whereas in the surgical group most common age group was 20-30 years (35%), with the mean age being 36.3 years, similar to Harish Kapoor *et al.* 10 study. The best outcome or results were seen among young individuals. Sex distribution In our series of 40 patients, there were 25 male (62.5%) and 15 female (37.5%), similar to Harish Kapoor *et al.* 10 study. Gender was a confounding factor as in surgical group males were 15 (75%) and females were 5 (25%), whereas in conservative group male and female were equal. Mode of injury Road traffic accident (RTA) was the most common mode of injury in the study accounted for 45% of cases, similar to Harish Kapoor^[5]. However, self fall (65%) in conservative & RTA (65%) in the surgical group was more common. Laterality Overall right side wrist is more commonly involved (52.5%). The right side was more affected among the surgical group (60%) and left in the conservative group (55%). Time of Union It is significantly less (6 weeks) associated with Surgical management (85%), similar to the results of Toshiko Hirashima 48, whereas it was more (3 months) in the conservative group (50%). 5% had a union at six months in conservative and none in surgical. Delayed union was seen more among postmenopausal females and aged males. The percentage of loss of movement did not correlate very well with a time of union. Even the patients with Time of Union of 6 weeks had a more significant percentage of Loss of Movements and also patients with Time of Union of 3 months had a good range of movements. Similarly, pain and function score at six months follow up did not correlate with TOU. The excellent and good outcome in the conservative group was seen only in stable, minimally comminuted and minimally displaced fracture pattern. Excellent and good outcomes were seen in many of such fracture patterns among the surgical group. Movements Mean loss of movements was less in the surgical group, 25.85%, than conservative group 33.55%. Mean Palmar-flexion for the conservative group was 60.750 and 68.750 for the surgical group. The mean Arc of

Dorso-palmar flexion for the conservative group was 120.750 and 139.50 for the surgical group. Mean Radial deviation was 8.50 conservative group and 9.25 surgical group. Mean Ulnar deviation for the conservative group was 18.50 and 240 for the surgical group, the mean arc of Radio-ulnar deviation for the conservative group was 27 0 and 32.250 for the surgical group. Mean Pronation for the conservative group was 68.5 0 and 71.250 for the surgical group. Mean Supination for the conservative group was 71.250 and 78.750 for the surgical group. The mean arc of Pronation-supination for the conservative group was 139.50 and 1500 for the surgical group. All movements were similar to the study of Harish Kapoor *et al.* Mal-union was seen in 30% of cases in the conservative group and 10% in the surgical group. Mal-union was seen and in the case of fractures with excess initial displacement, excess comminution treated. Stiffness of wrist and fingers was seen in 10% in both the groups. Shoulder hand syndrome was seen in 10% in the conservative group and none in the surgical group. Complex regional pain syndrome was seen in 5 % in the conservative group and none in the surgical group. The incidence of complex regional pain syndrome after distal radius fractures was between 3 and 25%^[6]. In this study, we found that 5% of cases have developed CRPS. The risk of complex regional pain syndrome has increased in incidence in elderly women whether treated with surgical management of cast immobilization. Arora *et al.* reported similar results in terms of patient-rated outcome variables like DASH, PRWE and pain level and ROM between 36 operatively and 37 non-operatively treated cases, while complication rate was 36% and 14% in operative and non-operative group respectively^[7]. With an incidence of 3.3-17.2%, Carpal tunnel syndrome was a well described complication following distal radius fractures^[8]. In the present study, one case which is managed with conservative management developed carpal tunnel syndrome, which had moderate symptoms, which is managed conservatively with drugs. The intra-articular step was seen in 30% of the conservative group and 40% in the surgical group. In contrast to other studies like Harish Kapoor *et al.*, it was best corrected with plating and least with an external fixator. Radial inclination was lost in 45% cases in the conservative group and 30% in the surgical group. The radial length was lost in 45% of cases in the conservative group and 35% in the surgical group. Some authors reported that they observed satisfactory functional results following plaster cast application of an unstable distal radius fracture in low-demand elderly patients, regardless of the radiographic results, in younger patients, it is a norm to attain anatomical reduction to improve functional outcomes in intraarticular distal radius fractures^[9]. Bartl^[10] reported that volar plating for the distal radius fractures gave

better radiological results and wrist range of motion than the casting group at three months follow-up, but similar functional results and quality of life at 12 months postoperatively. Grip strength was significantly better in the surgical group in both three months and six months follow-up when compared to the casting group. Mean grip strength being 42.75 and 62.75 in the conservative and surgical group respectively at three months follow up and 58.5 and 71.5 in the conservative and surgical group respectively at six months of follow up. Mean Quick DASH score was significantly better in surgical group at 3 months follow up but was insignificant at six months follow up. Quick DASH score was 34.84 in the conservative group and 21.29 in the surgical group at three months follow up. 22.73 and 15.33 in the conservative and surgical group respectively at six months follow up.

CONCLUSION

From the study, we concluded that early significant improvement (i.e., at 3 months) in terms of DASH score, better grip strength and early range of movements achieved with surgical management. Time of union is also significantly less associated with surgical management. But the DASH score, complications and range of movements were insignificant between the surgical and conservative groups at final followup (at 6 months). Significantly better grip strength and radiological improvement were observed in the surgical group at final followup (at 6 months). Conservative management is better in managing undisplaced minimally comminuted fractures and fractures with minimal initial displacement. Therefore we cannot generalize treatment for all fracture patterns and treatment should be individualized to a particular fracture.

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