Original Article

Fracture of Distal Radius Treated by Orthofix v/s Plaster Cast

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ABSTRACT

OBJECTIVES: To compare the functional outcome and the complications of plaster cast & orthofix in the management of distal radius fracture.
SETTING: Department of orthopaedic surgery & truamatology (DOST) Liaquat University of Medical & Health Sciences (LUMHS) Jamshoro.
STUDY DESIGN: Comparative Study.
DURATION OF STUDY: 18 months from 2nd March 2012 to 1st September 2013.
MATERIAL & METHODS: A total of 40 patients fulfilled the inclusion criteria were included in this study. Patients were randomized allocating to either treatment with conventional closed method (group I) or orthofix (group II). After one week of the initial treatment, patients of either group were followed in the orthopaedic wards and OPD. Clinical and radiological assessment was carried out and recorded. Subsequently, patients were advised for follow up for six weeks. After removal of either plaster or orthofix; patient was reviewed at monthly interval to access the wrist function. Data was collected on Performa.
RESULTS: There were statistically significant differences between the orthofix group and plaster cast group on the average, regarding radial length, radial angle, palmar tilt, p value was calculated 0.05, 0.004 and 0.0005 respectively.
All patients in orthofix group achieved union and maintained good reduction after closed reduction of the fracture. Complications were seen among both the groups; Mal-union, Stiff hand and Non union, Pressure sore, Shoulder stiffness were not significant between groups.
CONCLUSION: it is concluded from this study that external fixator one of the best tool have over edge on plaster cast in the treatment of distal radius fracture.

KEY WORDS: Plaster cast, Orthofix, distal radial fractures.

INTRODUCTION

Distal radius fractures are among the most common fractures of the upper extremity. Fractures of distal radius represent approximately one-sixth of all fractures treated in emergency departments.[1, 2] The incidence of distal radius fractures in the elderly correlates with osteopenia or osteoporosis and rises in incidence with increasing age, nearly in parallel with the increased incidence of hip fractures[2]. Risk factors for fractures of the distal radius in the elderly include decreased bone mineral density, female sex, white race, family history, and early menopause[3].

Fractures of the distal radius are classified into five types. “I” fractures are extra-articular meta-physeal bending fractures, such as colle’s (dorsal angulation) or smith (volar angulation) fractures. One cortex fails in tension, and the opposite cortex is comminuted and impacted. “II” fractures are intra articular and are produced by shearing forces. These include volar Barton, dorsal Barton and radial styloid fractures. “III” fractures results from compression injuries that cause intra articular fractures and impaction of metaphyseal bone. These include complex articular fractures and radial pilon fractures. “IV” fractures are avulsion fractures of ligament attachments that occur with radio carpal fracture-dislocations. “V” fractures arise from high velocity injuries involving multiple forces and extensive injury[2]. Comminuted intra-articular fractures of distal radius are common injuries that will not do well unless certain treatment criteria are met and result will be painful, stiff and dysfunctional wrist[4-6]. The goal of the treatment is to achieve and maintain certain extra articular and intra-articular criteria during healing[3]. Numerous techniques have been described and developed to treat these complex fractures in an effort to improve the outcome [3, 4, 7]. Past decade as witnessed various modalities of treatment in an effort to improve the outcome of these fractures[7]. The external fixator is a versatile tool that was now well established in the treatment of these fractures. It has several distinct advantages over conventional POP cast and plate fixation[8, 9].

External fixator is very useful in maintaining restored axes and length. The principles of external fixation involve longitudinal traction (ligamentotaxis) and, most importantly, palmar translation[10]. Longitudinal

traction alone cannot restore palmar tilt[11]. All fractures should undergo closed reduction, even if it is expected that surgical management will be needed. Fracture reduction helps to limit post-injury swelling, provides pain relief & relieves compression on the median nerve[12]. The purpose of this study is to compare the results of plaster cast & orthofix, with respect to the functional outcome and complications. The results of this study will be beneficial for researchers, clinicians and for patients as well.

MATERIALS & METHODS

This is a comparative study, carried out in Orthopaedics Unit-I, LUMHS Jamshoro, from 02-03-2012 to 01-09-2013. An ethical approval was obtained from the ethical committee of University. All the procedures were explained to the patient and written consent was taken for examination, management and for the publication of the results. Inclusion Criteria were fractures presenting within seven days of injury, fractures according to Frykman classification, all closed extra or intra articular fracture of distal radius, isolated bone injury without neurovascular injury, patients above 15 years of age. Exclusion Criteria were the multiple injuries & previous injury to same limb, associated ipsilateral neurovascular injury, patients younger than 15 years of age. Total numbers of 40 cases were included in this study. Cases were divided into two groups with 20 cases in each group & selection was randomized by simple lottery method.

Group One –Closed Reduction and Cast Application*:* After clinical examination and radiographic assessment (AP and Lateral), the fractures were reduced under anesthesia and image intensifier guidance and above elbow cast was applied with elbow in ninety degrees flexion, forearm pronated, wrist in 10-15 degree palmar flexion and 20-25 of ulnar deviation. After checking radiograph, the limb was elevated and active finger movement was advised. Patients were reviewed in the fracture clinic after seven days with repeat radiographs. Manipulation and cast application was repeated if needed on follow up. After two weeks, the patient was reviewed again and the elbow cast was converted to the below elbow cast and mobilization was encouraged. The patient was then further reviewed at six weeks post reduction and the cast was removed. Clinical and radiological assessments were done and active wrist mobilization was advised. Patient reviewed at monthly intervals to assess the hand functions for six months.

Group two-Orthofix*:* After clinical examination and preoperative workup orthofix was applied. Two pins were passed through the second metacarpal and two pins were passed through the radius proximal to the fracture. The fracture was then reduced and the orthofix applied with wrist checking in image intensifier in flexion and ulnar deviation. The fixator was removed at six to eight weeks and then the same protocol as for the Group I was followed.

Data was collected on prescribed Performa from ward record of every patient of either group. Data was entered and analyzed in statistical software SPSS-19. Frequency and percentages were computed for categorical variables like gender, mode of injury, symptoms, complication and analyzed by chi-square or fisher exact test. Mean and standard deviation were computed for quantitative observation like age, radial length, Radial angle, Palmar Tilt were analyzed by independent sample t test. $P<0.05$ was considered level of significant with 95% confidence interval test.

RESULTS

Total 40 patients were included in this study. The mean age of the patients was 32.43 ± 10.91. The patients were equally divided into two groups (20 in group Orthofix and 20 in Plaster group). Out of 40 patients, 55% were males and 45% were females. Regarding mode of injury, 21 (52.5%) patients presented with the history of fall, out of them 14 (70%) patients were in orthofix group and 7 (35%) patients in plaster cast group; out of 13 (32.5%) patients of road traffic accidents, 4 (20%) were orthofix group and 9 (45.0%) patient were in plaster case group and 6 (15%) patients were assault in which 2 (10%) were in orthofix group and 4 (20%) patients in plaster cast group. Significant difference was not observed between groups (Figure I).

Deformity, pain, swelling and inability to move symptoms were commonly observed in patients. Significant difference was not observed in symptoms between groups (Table I) Most frequent fracture was type IV observed in 20 (50%) cases other frykman's type was also presented (Figure II).

There were statistically significant differences between the orthofix group and plaster cast group, regarding radial length, radial angle, palmar tilt (Table II). Comparison of functional outcome is presented in (Table III). All patients in orthofix group achieved union and maintained good reduction after closed reduction of the fracture. Complications were seen among both the groups; Mal-union, Stiff hand, Non union, Pressure sore, Shoulder stiffness were also not significant between two groups (Table IV).

FIGURE I: MODE OF INJURY BETWEEN THE GROUPS (n = 40)

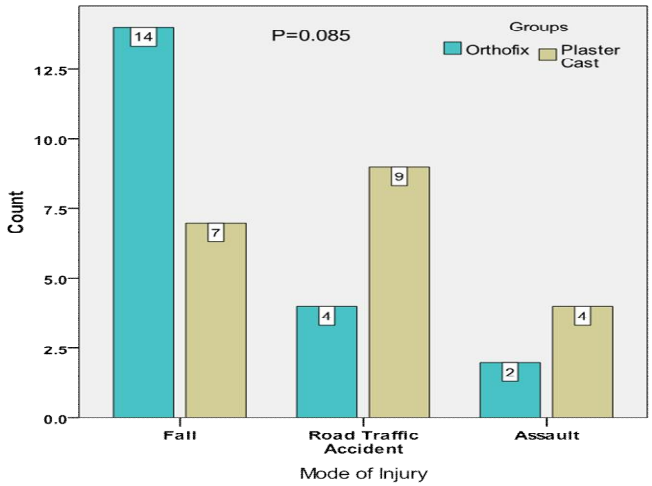

TABLE I: SIGN AND SYMPTOMS WITH RESPECT TO GROUPS

Sign and Symptoms	Orthofix n=20	Plaster Cast n=20	P-Value
Pain	16(80%)	18(90%)	0.37
Deformity	18(90%)	17(85%)	0.63
Swelling	15(75%)	19(95%)	0.18‡
Inability to move	19(95%)	15(75%)	0.18‡

Chi-Square test and
‡Fisher Exact test

FIGURE II: FRACTURE TYPE WITH RESPECT TO GROUPS

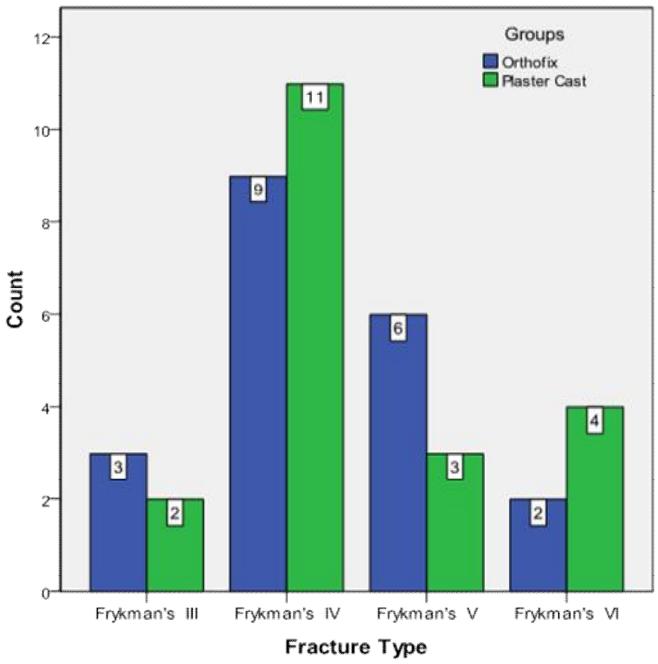

TABLE II: COMPARISON OF ANATOMICAL MEASUREMENT BETWEEN GROUPS

Measurement	Ortho fix n=20	Plaster Cast n=20	P-Value
Radial length (mm)	9.3±2.10	8.25±0.96	0.05
Radial angle (degree)	14.17^0±1.57^0	12.75^0±1.41^0	0.004
Palmar Tilt (degree)	7.90^0±0.72^0	11^0±2.22^0	0.0005

Independent sample t test used
Results are showing as mean and standard deviation

TABLE III: COMPARISON OF FUNCTIONAL OUTCOME BETWEEN GROUPS

Functional	Ortho fix (n=20)	Plaster Cast (n=20)
Grip Strength	80.87%	72.89%
Volarfelxion (degree)	62.5^0	51.7^0
Dorsiflexion (degree)	65.4^0	52.5^0
Pronation (degree)	76.8^0	65.8^0
Supination (degree)	62.39^0	57.2^0

TABLE IV: COMPARISON OF COMPLICATION BETWEEN GROUPS

Complication	Ortho fix n=20	Plaster Cast n=20	P-Value
Mal-union	n=1(5%)	n=5 (25%)	0.18
Stiff hand	n=2(10%)	n=3 (15%)	0.63
Non union	0%	n=3 (15%)	0.23
Pressure sore	n=1(5%)	n=2 (10%)	0.98
Shoulder stiffness	0%	n=4 (20%)	0.11

Chi-Square Test and Fisher's Exact Test applied
Data are presented as number and percentage

DISCUSSION

Intra-articular fractures of the distal radius are commonly encountered complex fractures. These fractures usually occur as a result of high-energy trauma and are often unstable. Current treatment goals are centered on restitution of bony anatomy of the distal radius (radial angle, radial length and volar tilt), with specific attention to restoration of articular surfaces of radio-carpal and radio-ulnar joints[5, 6].

In our study regarding mode of injury, 21 (52.5%) patients suffered from fall, in which 14 (70%), and 7 (35%) patients were in orthofix group patients in plaster case group respectively; out of 13 (32.5%) patients of RTA, 4 (20%), and 9 (45.0%) were in orthofix group and in plaster case group respectively and 6 (15%) patients were assaulted in which 2 (10%),4 (20%) were in orthofix group and in plaster case group respectively. In this study there were statistically significant differences between the orthofix group and plaster cast group on the average, regarding radial length, radial angle, palmar tilt. All patients in orthofix group achieved union and maintained good reduction after closed reduction of the fracture. Klein et al[13] have reported on a series of 103 distal radial fractures that were treated by external fixator. In 61% of the cases, adjuvant procedures were required to obtain and maintain satisfactory reduction. Similarly, Rikli et al[14] achieved satisfactory reduction in 74% of cases treated exclusively by external fixator however 26% required additional intervention in the form of K-wires, bone grafting, screw fixation or volar plate. Functional score and final outcome also depends upon the initial severity of injury and compounding[15]. Three fractures were compound of which, two had poor results while one had fair functional outcome. This study shows that functional results and restoration of anatomical parameters were significantly better in the group treated by external fixator as compared to POP immobilization. However results of external fixation in our series were not comparable to those reported in literature. Klien et al[13] and Rikli et al[14] reported that more than 80% of patients treated by external fixator achieved excellent or good results.

In this study Complications were seen among both the groups; Mal-union, Stiff hand, Non union, Pressure sore, Shoulder stiffness were also not significant between groups. Most complications have been previously reported and were related to pin tracts[16]. They included superficial pin tract infection, chronic osteomyelitis, iatrogenic fracture and reflex sympathetic dystrophy. Since radial pins were inserted through a 2 -3 cm incision after identifying structures, we did not encounter any damage to superficial branch of radial nerve or adjacent tendons. One patient with AO type-B fracture with a volar fragment (reversed Barton) did not achieve anatomical reduction and subsequently lost position leading to an intra-articular step of 2 mm. External fixations for this fracture pattern has been found to be inadequate in achieving and maintaining reduction, and it is best treated by a volar buttress plate[15]. Raskin and Melone[17] reported no pin track infections in their study. They attributed this to their method of pin site care. Instead of exposing the pin sites daily, they covered the external fixator frame with sterile gauze at the skin contact interface, which obviated the need for daily pin site care. Rather, the pins were exposed only during scheduled dressing changes at the surgeon's office, approximately four times during an eight-week period.

Other complications include: 1) radial shortening (one case); 2) collapse of ulnar border (one case); and 3) loss of radial tilt (one case). In the cases involving radial shortening and ulnar border collapse, the defect was noted prior to removal of the external fixator. In both cases, no augmentation was used. Perhaps these complications may have been avoided by employing the use of Kirschner wires, bone graft or some form of internal fixation such as suggested by Pennig and Gausepohl[18], who commented that supplementary internal fixation is justified whenever there is significant comminution of two or more cortices in the antero-posterior and lateral radiographs. Seitz[19] recommends supportive bone grafting when shortening exceeds 5mm, and according to Leung et al[20] the use of bone grafting prevents late collapse of the fracture site.

In Arora et al[21] study the outcome of external fixation was significantly better as compared to cast immobilization ($p < .05$). Incidence of loss of reduction was significantly improved by external fixation as compared to cast immobilization ($p< .001$). There was a strong positive correlation between restoration of normal anatomy (radiological results) and functional outcome ($r= .811$). Complications were seen in 43% of patients in POP group and 33% of patients in external fixator group.

CONCLUSION

It is concluded from this study that orthofix is a better modality of treatment as compared to plaster cast for intra-articular distal radial fractures, however it is inadequate in attaining anatomical reduction in many cases when used exclusively.

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