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Distal Radius Fracture, a Comparison Between Closed Reduction and Long Arm Cast Vs. Closed Reduction and Percutaneous Pinning and Short Arm Cast.

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Abstract:

Background: Distal radius fracture represent approximately one-sixth of all fractures treated in emergency departments. According to high incidence rate, different mechanisms of injury and new treatments for this fracture, it is becoming one of the most challenging of all kinds of fractures.

Objective: to compare treatment outcome of traditional cast immobilization versus modern percutaneous pinning procedure in patients with distal radius fractures.

Methods: In this randomized clinical trial study, 198 patients with "displaced but stable distal radius fracture without joint incongruity", were split into two groups and each group was treated by one of the following standard protocols: A- Closed reduction + Long arm cast; B- Closed reduction and Percutaneous pinning and Short arm cast. The patients were followed up after operation for three months from the point of view of: 1- satisfaction(based on Saito chart) 2-Loss of Reduction 3- Finger stiffness 4- Pin tract infection and 5-The mean of post operation follow up visits. For statistical analysis the Fisher's exact test and chi-square test were used by SPSS software16

Results: In group A, six cases of loss of reduction were detected in the first week who were treated by re-reduction and P.C pinning procedure; But no cases of loss of reduction were diagnosed in group B. Satisfaction percentage for Excellent value was 81.8% in group A and 93.9% in group B (p= 0.131). Finger stiffness incidence rate in group B was meaningfully lower than group A (p=0.039). Pin tract infection incidence rate was 15.1% in group B; all of them were treated by pin removal and oral antibiotic therapy. The mean of post operation visits was 4.4 in group B and 3.6 in group A out of five sessions (p<0.0001).

Conclusion: It seems that closed reduction and P.C pinning is a safer and less complicated procedure, especially in decreasing finger stiffness in these fractures.

Keywords: Distal radius fractures, Percutaneous pinning, Treatment outcome

Key Messages: Distal radius fractures; Percutaneous pinning fixation Vs. Cast Immobilization.

Introduction:

The optimal treatment of distal radius fractures has changed dramatically over the last two decades. Although Cast immobilization was almost the only universal treatment, today it is progressing to operative interventions.

Distal radius fracture consists approximately of one-sixth of all fractures treated in Emergency departments.[1-3] Although most injured people are elderly, but recent researches revealed that there is an increasing incidence rate of this fracture in all age range.[4,5] More importantly, studies suggest that there are two different mechanisms of injury: one, an insufficiency fracture in elderly patients due to osteoporosis, and the other is a traumatic injury in young males secondary to motor-vehicle accidents.[6-9] The differences in these injuries and corresponding groups may account for some of the discrepancies in treatments. Decreased bone mineral density, Female gender, Ethnicity, Heredity and early menopause are the risk factors for this injury.[10-12]

Although closed reduction and casting is the main treatment in children [13], there are several different interventions for treating adults, including: Open reduction and internal fixation, Pin and Plaster, External fixation, Percutaneous pinning Fixation, and the combination of the mentioned procedures.[1,4,14-17]

In this study, patients with displaced but stable distal radius fractures with congruous joint (step<2mm) have been randomly treated with one of these procedures: (A: Closed reduction and Long arm cast, B: Percutaneous pinning and Short arm cast) and treatment outcome has been documented over a period of three months.

Material and Methods:

This study is a randomized clinical trial. 198 musculoskeletally mature patients between 16-75 years of age with displaced but stable distal radius fracture with congruous joint with less than 2mm joint gap [type I of Fernandez classification [18]] who had been admitted to Rasht emergency hospital, were included. All other patients with open physis, open fracture, dorsal comminution, dorsal tilt more than 20 degree, history of previous wrist or forearm fractures, congenital or other forearm or other anomalies, previous history of wrist operation, history of psychiatric problems, and fractures in other parts of injured upper limb were excluded. After taking consent, patients were divided into two groups randomly. After general anesthesia, in the first group, patients were operated with closed reduction and long arm cast. The second group of patients was operated with closed reduction, percutaneous pinning with smooth without threaded 1.5mm or 2mm pin and then immobilized with short arm cast by the same orthopedist. The pin was shortened, curved and then remained out of the skin and the splint of near pin was removed for monitoring pin tract infection. Procedures and outcomes were done by ignoring left or right limb dominancy.

For all patients, AP-view and Lateral-view of wrist radiographs were taken and the patients were discharged if they had been qualified by four reduction criteria

(1- radial shortening less than 5mm, 2- radial inclination more than 15 degree, 3- volar tilt between 0-15 degree, and 4- joint gap less than 2mm). Otherwise, they were taken under re-reduction and excluded from the study.

All patients were asked to attend clinic in 1st, 3rd, 6th, 8th, and 12th weeks after intervention for follow up. The control radiographs were taken in 1st, 3rdand 6th weeks, and if they didn't have acceptable reduction (according to four mentioned criteria), another intervention for reduction was done and if they had acceptable reduction, the splints were opened in 6th or 8th weeks and pins were removed as outpatient and wrist physiotherapy was started.

The following factors were evaluated in follow up visits: the mean of post operational visits in each group, loss of reduction pin tract infection frequency, and subjective satisfaction of every patient according to Saito chart [20] (Table1).

A questionnaire for gathering necessary information was sent out and completed for each individual from the beginning of treatment and during follow up visits. At last for statistical analysis the Fisher's exact test and chi-square test were used by SPSS software 16.

Table 1. Saito Chart.

Excellent	Good	Fair	Poor
No Pain	Occasional Pain	Occasional pain	Pain
No disability	No disability	Noparticular disability if careful	disability
No limitation of motion	Slightly limitation of motion	Some limitation of motion	limitation of motion
		Activities Slightly Restricted	Activities Markedly Restricted
		Feeling of Weakness in Wrist	

Findings:

The mean age of all cases was 50.8 ± 15. The majority of the patients were between 50-70 years old (40.9%). The mean age of the first group was 49.15 and it was 52.45 for the second group (p= 0.313). 111 cases (56.1%) were male and 87 of patients were female (p= 0.804).Gender frequency in both group is shown in (Figure 1).

The mean of all patients' follow up visits is 4.04 from 5 sessions which is shown in (Table 2).

Data analysis revealed that the quantity of follow ups in percutaneous pinning group is significantly more than cast immobilization group (p<0.0001).

We have discovered that 30 cases of all 198 patients suffered from finger stiffness after three months of intervention, as is shown in (Figure 2).

It is revealed that finger stiffness is statistically lowered in percutaneous pinning fixation group rather than the other group (p=0.039)

We have found 15 cases (15.1%) with pin tract infection in P.C pinning fixation

group who all were treated thoroughly with pin removal and oral anti-biotic therapy.

In cast immobilization group, there were 6 patients who had lost reduction during the first week. For all of them Re-reduction and P.C pinning fixation were performed. It is revealed that we have better satisfaction issues in P.C pinning Fixation group rather than cast immobilization group, but it didn't reach the statistical significance (p=0.131). Subjective patient satisfaction is shown in (Table 3).

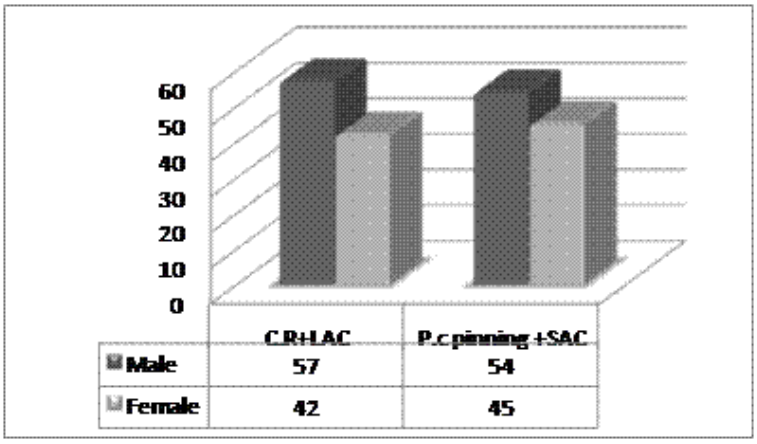

Figure 1. Gender frequency

Table 2. The mean of patients' follow ups.

Statistical evaluation	T value	Standard Deviation	Mean of visits	No.	Group
0001/0 P<	5/4	86/0	6/3	99	C.R + LAC
		71/0	4/4	99	P.C Pining + SAC

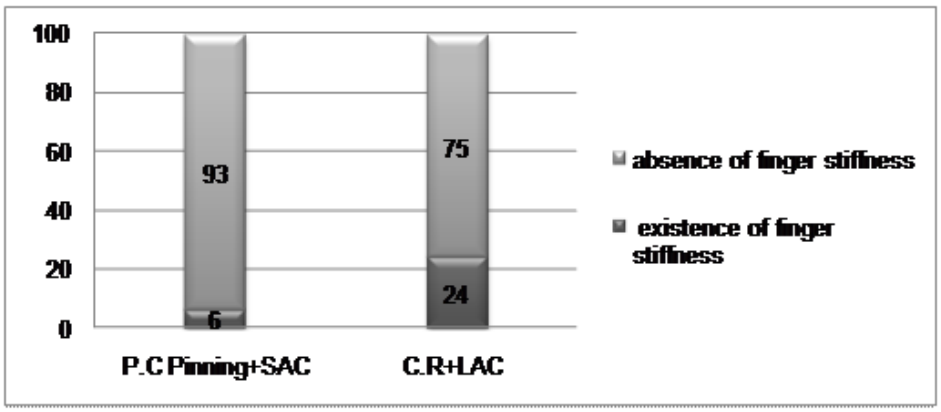

Figure 2. Finger stiffness frequency

Table 3. Subjective satisfaction frequency

Total		P.C Pining + SAC		C.R + LAC		Group Satisfaction
Percentage	No.	Percentage	No.	Percentage	No.	
87.9	174	93.9	93	81.8	81	**Excellent**
12.1	24	6.1	6	18.2	18	**Good & Fair**
100	198	100	99	100	99	**Total**

Discussion:

Incidence rate of distal radius fracture increases with aging, which is associated with all of the risk factors for osteoporo

sis.[4,8,10 and 21] Likewise, peak of incidence was between 50-70 years of age in this study. Patient satisfaction has been studied in several series. "Rodriguez" in Spain and "Chen" et al. in Taiwan stated that almost 90% of their patients were satisfied about their procedures.[23,24] "Kreder" et al. in a 2 year prospective study on 113 patients suggested that external fixation and P.C pinning fixation had better radiological and functional results compared to traditional cast immobilization [25]; even though, "Stofelen" in a randomized clinical trial showed that there is no relationship between functional results in patients treated with casting and those who had P.C pinning procedures.[26] There exists a trend for better functional and subjective satisfaction in more than 90% of cases treated with P.C pinning fixation in our study, but it didn't reach statistical significance (p= 0.131). Advantages of P.C pinning fixation of distal radius fracture are that it is a quicker and less technically demanding technique compared to more complex forms of fixation.[27] Additionally, there is less soft tissue disruption than open reduction and it can be used to supplement cast immobilization.[27] Disadvantages include the complications of pin site infection, potentially less accurate fracture reduction than open techniques and potentially less stable fixation compared to plating techniques.[27] Pin tract infection has been reported from 6% to 38% in other studies [25, 28]; likewise, this parameter was 15.1% in our study. In another study of "Kreder" et al, they found patients with displaced intra-articular distal radius fractures undergoing P.C pinning fixation had a more rapid return of function and had a better functional outcome.[29] "Fuji" et al. stated that P.C pinning fixation is a simple and minimally-invasive procedure, which is useful in preventing re-displacement of fragments.[20] However a few opponents of this technique claim that these fractures tend to collapse even after pin removal.[30] But "Kurup" in a retrospective study over three years found that distal radius fractures treated by P.C pinning fixation did not suffer significant loss of reduction of fracture position after pin removals and this remains true regardless of age, sex, and fracture type or duration of pin fixation.[31] In our study, there was no case of re-displacement in P.C pinning fixation group, and we found six patients with re-displaced fracture fragments in cast immobilization group. Also it was revealed that P.C fixation significantly decreases finger stiffness in these fractures (p=0.039)

"Rosental" et al. in a prospective follow up of 18 cases with dorsally angulated distal radius fracture found that intrafocal pinning significantly provides better maintenance of volar tilt and ulnar variance during 11 weeks post intervention when compared with closed reduction and cast treatment alone.[32] Also it has been shown that with the use of intrafocal pinning, maintenance of radial length is the most important factor in providing superior functional outcomes when compared with maintenance of radial tilt or palmar tilt.[33]

For any orthopedic surgeons, follow-ups and post interventional visits have important roles in any treatment procedures. There are various clinical and demographic factors affecting poor follow up rates. Compared with patients who complained about follow up, those who lost to follow up had lower physical and mental health scores on the SF-36 forms, more often were treated non-operatively, and more likely had not surpassed secondary education.[34-36] Likewise, we found that there were better follow up rates in P.C pinning fixation group (mean of visits=4.4) than patients who were treated non-operatively (mean of visits= 3.6)

Conclusion:

It seems that Percutaneous pinning fixation is a safer and less complicative intervention with less lost-to-follow up rates than traditional non operative cast immobilization treatment.

Conflicts of interest:

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