

Comparison of Clinical Outcomes in Distal Radius Extra-articular Fractures with or without Ulnar Styloid Fracture

Mir Bahram Safari^{1*}, Ali Tabrizi¹, Naghi Ahangar Kiasi²

¹Department of Orthopedics, School of Medicine, Urmia University of Medical Sciences, Urmia, Iran

²Department of Medicine, School of Medicine, Urmia University of Medical Sciences, Urmia, Iran

ABSTRACT

Introduction: Distal radius fracture is the most common fracture in adults. The studies conducted on the effect of ulnar styloid fracture along with extra-articular fracture have yielded different results. Thus, the objective of this research was to evaluate the clinical outcomes in distal radius extra-articular fractures with or without ulnar styloid fracture.

Method and Materials: In a cross-sectional analytical study, all patients aged 20-60 years with distal radius extra-articular fractures were evaluated and divided into two groups based on presence or absence of simultaneous fracture of the ulnar styloid process fracture. All patients underwent one type of surgery. Six months after treatment, all wrist movements, and hand gripping strength and pain score were measured and compared. Chi-square and independent t-test were used to analyze the data.

Results: In this research, 49 patients with distal radius extra-articular fractures were included in the study. The mean percent in flexion, dorsiflexion, supination, pronation, radial deviation, ulnar deviation and pinching and gripping power in healthy hands with fractures in two groups of distal radius fracture along with simultaneous ulnar styloid process fracture and without this fracture did not show significant difference. Moreover, pain score in the VAS scale did not show significant difference between the two groups during the follow up period.

Conclusion: Association of ulnar styloid process fracture with distal radius fractures in adults did not have effect on motor limitation and pain experienced by patients in the 6-month follow up period after treatment, so there is no need for orthopedic surgeons to take special therapeutic measures in dealing with this problem.

Key words: Ulnar styloid fracture, Distal radius fracture, Hand gripping strength, Hand movements, Pain score

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Corresponding author: Mir Bahram Safari
e-mail ✉: safarimirbahram2000@gmail.com
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INTRODUCTION

Distal Radius Fracture (DRF) is considered the most common bone fracture in the world, with the highest frequency of incidence seen in young active men given the high-energy trauma and in old women due to low-energy trauma resulting from osteoporosis [1,2]. Colles' fracture, one of the most common types of DRF, happens due to the extra-articular distal radius metaphyseal with displacement toward dorsal axis. Given the different ideas over defining and treating it, great precision must be exercised in diagnosis and treatment of it, so that both diseases treated properly and the side effects of the disease are reduced [3,4].

DRF is usually accompanied with ulnar styloid fracture (USF) [5,6], but most of the studies conducted, except a few cases (showing the negative effect of USF on the treatment of DRF patients) [7,8], have no evidence of the

effect of accompanying USF and DRF in the result of the treatment [9,10]. The need for internal fixation of USFs is still controversial. The Triangular Fibrocartilage Complex (TFC) starts from ulnar side lunate distal radius then connects to ulnar and styloid ulnar, then to medial collateral ligament and ultimately to the trichioitrom, hamate, and the fifth metacarpal bases. The ulna head is located in pronation is in dorsal and distal and in supination in volar and proximal. Moreover, 80% of the axial force is inserted upon the distal radius and 20% to the distal ulna [11]. Previous studies have indicated that ulnar styloid attachment is an important connecting point for Triangular Fibrocartilage Complex, so that the dorsal and volar radioulnar ligaments are the main fixators of distal radioulnar joint and connect to the fovea and the base of the styloid attachment [11,12]. This can have some effects on the stability of distal radioulnar joint, and the fractures of the base of the styloid attachment and the peripheral ruptures of TFC may increase this instability [13,14]. Despite the idea that the fractures in this area may have a negative effect on the stability of the radioulnar joint, most studies have reported no negative effects considering ulnar styloid fractures on the ultimate

outcome, in cases where DRF is preferably fixed by a Locking Plate [15]. However, some studies have reported non-connection of ulnar styloid in multiple patients, instability of distal radioulnar joint, TFC rupture, and other complications that may cause wrist pain, decreased mobility, and reduced hand ability [16-18]. Thus, the results regarding the effect of accompanying ulnar styloid fracture with DRF on the consequences of the treatment of this problem are unanimous.

According to the aforementioned, the results concerning the effect of accompanying ulnar styloid fracture with DRF on the consequences of the treatment are not the same. Thus, the purpose of the study is to determine the clinical outcomes in extra-articular fractures of distal radius with or without accompanying USF in Imam Khomeini Hospital in Urmia in January to December 2016.

MATERIALS AND METHODS

In a cross-sectional analytical study, all the patients aged 20 to 60 years with extra-articular fractures of distal radius enter the study and then they were divided into two groups according to their accompanying or lack of accompanying ulnar styloid fracture. The inclusion criteria of the patients were unilateral extra-articular fractures of distal radius of stable type (no crushing in the cortical dorsal, shortness of radius less than 10 mm and angle less than 25 degrees between distal and radius body), maximum 48 hours' interval between fracture and treatment, lack of arthritis in distal radioulnar joint, no fracture in the upper limb of the patients and no damage (no intraarticular fracture of distal radioulnar joint) to distal radioulnar joint. The patients were treated by one surgery method and under general anesthesia. Since MRI was not done, soft tissue damage cannot be assessed. After closed reduction and fixing with two pins under C-arm, and an ensuring acceptable fixation in all patients, short arm cast (neutral state in terms of supination and pronation) was used and after 6 weeks, it was opened and the wrist and forearm motors started (preop and postop X-rays was done). Six months after the treatment, all motors of the wrist (flexion, dorsal flexion, radial deviation, ulnar deviation, and supination and pronation), and grip strength and pain scores were measured. The range of motion, grip strength and pain scores in all patients were measured by a resident. The difference between the extremities of the two groups in terms of motion range was the base for calculations. After data collection, data was analyzed statistically. It should be noted that gripping, pinching, and griping were evaluated and compared by tonometer and the range of hand motors with orthopedic conveyor. The scoring of the pain was evaluated and compared using Visual Analogue Scale (VAS). Chi-Square and independent t-test were used for data analysis.

RESULTS

In this study, 49 patients with extra-articular distal radius fractures were enrolled, of whom 25 (51%) were males and 24 (49%) females. The mean age of these the

patients was 43.53 ± 14.01 years old, with the minimum age of 20 and the maximum 62 years. Among the extra-articular fracture of distal radius cases studied, 27 cases (55.1%) had fractures of ulnar styloid attachment, and 22 (44.9%) did not have fractures of ulnar styloid attachment. Fracture in 29 (59.2%) patients was in the right hand and in 20 (40.8%) in the left hand. The pain rate felt by all patients according to VAS scale was as follows: 5 patients (10.2%) were in the painless range, 38 (77.6%) mild pain, 6 (12.2%) moderate, and none of the patients was in severe pain range. Regarding the mean range of motion in all patients, the results were as follows: mean flexion range in the hand with fracture was 50.55 ± 14.98 degrees and in the healthy hand 62.55 ± 14.96 degrees, and the mean dorsiflexion range in the hand with fracture was 63.71 ± 14.38 degrees and in the healthy hand and 76.53 ± 12.04 degrees. The mean supination range in the hand with fracture was 77.59 ± 11.56 degrees in the healthy one 89.14 ± 3.28 degrees. The mean pronation range in the hand with fracture was 71.79 ± 13.97 degrees and 86.2 ± 7.91 degrees in the healthy one. The mean radius of radial deviation in the hand with a fracture was 16.79 ± 9.05 degrees and in the healthy one 20.79 ± 7.51 degrees and the mean ulnar deviation in the hand with with fracture was $24.68\% \pm 18.97\%$.

In comparison of the radial distal fractures fracture was 27.79 ± 14.09 degrees and in the healthy one 35.02 ± 13.24 degrees. The mean gripping power in hand with fracture was 18.55 ± 10.20 kg in the healthy one 27.44 ± 11.57 kg in the healthy hands, and the mean pinching power in hand with a fracture was 14.59 ± 6 kg and in the healthy one 19.44 ± 6.14 kg. The mean difference in flexion between the healthy hand and the one with fracture was $17.45\% \pm 21.75\%$, the mean difference in dorsiflexion between the healthy hand and the one with fracture was $17.05\% \pm 17.05\%$. The mean difference in supination in healthy and fractured hands was $12.9\% \pm 12.85\%$, mean of the difference percentage in pronation in healthy hands and the one with fracture was $16.45\% \pm 15.61\%$. The mean difference percentage of radial deviation in the healthy hand and the one with fracture was $19.88\% \pm 29.78\%$ and mean difference percentage in ulnar deviation in the healthy hand and the one with fracture was $22.45\% \pm 20.82\%$. The mean difference percentage in gripping power in the healthy hand and the one with fracture was $33.20\% \pm 19.74\%$, and the mean difference percentage pinching power in the healthy hand and the one accompanied by ulnar styloid and without it, the mean difference percentage of flexion between the healthy hands and the one with fracture in patients with fractures of ulnar styloid was $16.52\% \pm 22.89\%$ and in patients without it was $18.6\% \pm 20.75\%$. This difference was not statistically significant according to independent t-test ($p=0.881$). Additionally, the mean difference of dorsiflexion between healthy and fractured hands in patients with ulnar styloid fracture was $16.54\% \pm 15.67\%$ and in patients without fracture was $19.48\% \pm 15.44\%$. This difference was not statistically significant based on independent t-test ($p=0.424$). The mean percentage difference of supination between healthy and

fractured hands in patients with ulnar styloid fracture was $14.54\% \pm 12.25\%$ and in patients without it as $13.69\% \pm 10.70\%$. This difference was not statistically significant based on independent t-test ($p=0.116$). The mean difference percentage of pronation between the healthy and the patients with fracture of ulnar styloid was $17.37\% \pm 19.00\%$ and in patients without fractures was $13.31\% \pm 12.84\%$. This difference was not statistically significant based on independent t-test ($p=0.209$). The mean percentage difference in radial deviation between healthy and the ones with ulnar styloid fracture was $33.57\% \pm 18.30\%$ and in patients without fracture was $21.82\% \pm 25.00\%$. This difference was not statistically significant based on independent t-test ($p=0.101$). The mean difference in ulnar deviation between the healthy and fractured hands in patients with

ulnar styloid fracture was $25.65\% \pm 24.1\%$ and in patients without fractures was $18.52\% \pm 15.55\%$. This difference was not statistically significant based on independent t-test ($p=0.330$). The mean difference percentage of gripping power between healthy and fractured hands in patients with ulnar styloid fractures was $34.37\% \pm 18.72\%$ and in patients without the fracture was $31.76\% \pm 21.18\%$. This difference was not statistically significant based on independent t-test ($p=0.435$). The mean percentage difference in pinching power in the healthy and fractured hands in patients with ulnar styloid fracture was $25.75\% \pm 18.16\%$ and in the ones without is $24.68\% \pm 18.97\%$. This difference was not statistically significant based on independent t-test ($p=0.645$) (Table 1).

Table 1: Comparison of limitation in the motors between DRF groups with and without accompanying ulnar styloid fracture

Type of motor	With ulnar styloid fracture (%)	Without ulnar styloid fracture (%)	p-value
Flexion	16.52 ± 2.89	18.6 ± 20.75	0.881
Dorsiflexion	16.54 ± 5.67	15.44 ± 19.38	0.424
Supination	12.25 ± 4.54	13.69 ± 0.70	0.116
Pronation	19 ± 7.37	13.31 ± 2.84	0.209
Radial deviation	18.30 ± 3.57	21.82 ± 25.00	0.101
Ulnar deviation	25.65 ± 4.1	18.52 ± 5.55	0.33
Gripping	34.37 ± 8.82	31.76 ± 21.18	0.435
Pinching	25.75 ± 8.16	24.68 ± 8.97	0.645

Furthermore, in the comparison between the pain felt using VAS after treatment in patients with extra-articular distal radius fracture accompanied by ulnar styloid fractures and without it, 5 patients (10.2%) were in the painless range, 1 patient (2%) was in the group of patients with styloid fractures and 4 patients (8.2%) in the patients without styloid fractures. From among the 38 patients (77.6%) with mild pain, 23 (46.9%) were in the patients with styloid fractures and 15 patients (30.6%) in the patients without accompanying styloid fracture. Out of 6 patients (12.2%) with moderate pain, 3 (6.1%) were in the patients with styloid fractures and 3 patients (6.1%) in the patients without accompanying fracture of styloid. This difference was not statistically significant based on Chi-square test ($p=0.223$).

DISCUSSION AND CONCLUSION

The most frequent bone fracture among the adults is DRF, where the broken piece is pulled upward. This type of fracture at the end of the bone is about 1 cm [19]. If DRF remains untreated, it can lead to soft tissue damage and gradual build-up of carpal tunnel syndrome, which is a painful condition of compression on the peripheral nerve [20,21]. DRF treatment includes various treatments such as casting, closed reduction, skin pinning and external fixation device [22-24]. Studies on the effect of the accompanying ulnar styloid fracture with extra-articular fractures of distal radius have reached a definite

conclusion in the final treatment of the patients. Thus, the present study was conducted to examine the consequence of ulnar styloid fracture along with DRF. In the present study, the mean percentage difference in flexion motors, dorsiflexion, supination, pronation, radial deviation and ulnar deviation, as well as the percentage difference in gripping and pinching power between the two groups of extra-articular distal radius fracture with and without ulnar styloid fracture was not significant in any cases. In addition, in this study, the difference in pain experienced by patients after VAS scale was not significant in the two groups of patients with extra-articular fractures of distal radius with or without accompanying ulnar styloid fracture. Continuous loss of supination and pronation in 2-4 years after surgery usually results in loss of strength of the wrist and forearm [25]. However, in this study, although there was limitation in supination and pronation motors in the hands with fracture compared to healthy hands, this limitation was not related to damage to the distal radius area with the simultaneous fractures of ulnar styloid. Usually more than 50% of the distal radius fracture is associated with fracture of ulnar styloid [26]. In the study by Saeed et al., the mean limitation of wrist and forearm supination in patients with DRF with ulnar styloid fracture (25.44) was significantly higher than that of DRF patients without ulnar styloid (8.91) [27]. However, in the present study, the mean of the limitation in DRFs accompanied by ulnar styloid fracture in the supination

motors (12.25) was significantly different from the limitation created in case without ulnar styloid fracture (13.69), and in contrast to Saeed's et al. [27], in the case without fracture, the limitations created (although insignificantly) was more. In other motor studied in Saeed et al. [27], there were no significant differences among the limitations in the two groups. However, in justifying the differences between the two studies, one can stated that although in Saeed et al. [27], the authors found this difference in the study; they acknowledged that there are no rational justifications for the cause of this difference. In the present study, despite the difference in motor limitations, patients did not have a specific functional problem due to the amount of supination motors in the functional range. In addition, the reason for the difference in the two studies can be seen in the follow up rate in the two studies, where in the present study, the longer follow up period can be a justification for the two groups regarding the motor limitations.

In a study by Yuan et al. [6] on 1403 RDF, they concluded no significant differences in the wrist motor, gripping power, radial elevation, deviation angle, ulnar variance, pain score, and PRWE score, or SF-36 score between RDF with and without accompanying styloid fracture. Thus, they concluded that styloid fracture with radial distortion fractures did not affect the treatment of patients, the results of which were in line with the results of our study. However, in the studies conducted by Ayalon et al. [7] and Turan et al. [8], they reported that USF along with DRF had a negative effect on DRF treatment, the results of which were inconsistent with our study. Unlike the studies by Ayalon et al. [7] and Turan et al. [8], most of the studies were in line with the results of our study. In a review study by Almedghio et al., it was reported that accompanying USF does not affect the clinical and functional outcomes of RDF [26]. In another study by Mulders et al. on 2243 patients, no differences were found in the one-year post-surgical outcomes or maintenance treatment for styloid fracture accompanied with extra-articular fractures of distal radius [28]. The results of this study are also in complete confirmation of our study. Thus, considering this scale, the results of this study can be justified. It can be concluded that the ulnar fracture accompanying RDF in adults has no effect on motor limitations and the pain experienced by patients in the 6-month follow-up after treatment, so there is no need for special treatment measures in dealing with this problem for orthopaedic surgeons.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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