

Influence of ulnar styloid fracture with concurrent extra-articular distal radius fracture on forearm rotations

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Abstract

Introduction: This study was conducted to evaluate the relation between extra articular distal radius fracture associated with and without ulnar styloid fracture and the rotational movements of wrist and forearm. **Materials and Methods:** This retrospective study was performed on 86 unilateral, extra articular distal radius fracture, treated conservatively. Associated ulnar styloid fracture was present in 42 (48.8%) group A and 44 (51.2%) with intact ulnar styloid group B. Men were 54 (62.8%) and women 32 (37.2%). Distal radius fracture involving right, dominant side were 56 (65.1%). All patients were treated by one surgeon with close reduction under anaesthesia with plaster immobilisation. Long arm cast was applied with forearm in supination wrist in ulnar volar flexion and after 2 weeks changed to below elbow cast with wrist in neutral rotation. **Results:** The mean limitation of supination was 7.82 ± 5.19 for group 1 (intact styloid) and 23.82 ± 14.41 for group 2 (fractured styloid). The mean limitation of pronation was 4.72 ± 3.68 for group 1 (intact styloid) and 3.29 ± 2.79 for group 2 (fractured styloid). The difference between the two groups was statistically significant regarding the limitation of supination, but not about the limitation of pronation. The average pronation deformity was 120° (range 60° to 190°) in patients with dorsal malunion and 110° (range 50 to 210) in volar malunion. The supination deformity averaged at about 80° (range 40° to 140°) in dorsal and 120° (range 80° to 170°) in volarly angulated distal radius malunion. **Conclusion:** The association of extra articular distal radius fracture with fracture ulnar styloid at two year follow up causes restriction of supination and pronation of forearm.

Keywords: Ulnar styloid fracture, extra-articular distal radius fracture, supination, pronation, malunion

Introduction

Distal radius fracture is among the most common fractures in older adults and comprises one-sixth of fractures in the casualty emergency room in Sindhudurg⁽¹⁾. Extra-articular distal radius fracture with the dorsal tilt of distal fragment is one of the common fracture patterns in this region, affecting distal radioulnar joint congruency and forearm rotation⁽²⁾. Several studies have shown that an appreciable number of patients have experienced sub-optimal results from treatment of distal radius fracture⁽³⁾. This fracture is associated with many complications, including loss of reduction leading to malunion and resultant limitation of wrist and forearm rotational movements and eventual arthritis⁽⁴⁾. Patients can experience considerable disability due to loss of forearm rotation long before the development of arthritis⁽⁵⁾. Many patients do not regain the full range of rotations despite adherence to physiotherapy regimens. Possibly, this could be due to distal radius malalignment rather than soft tissue injury⁽⁶⁾. Hence, it is aimed in this retrospective study to determine the relationship between

concomitant ulnar styloid fracture with extra-articular distal radius fracture malalignment and forearm rotation. The specific objective was to compare a range of pronation and supination between two groups.

Materials and Methods

It was a retrospective study. The data for the year 2020-2021 was retrieved. We did not calculate the sample size. All eligible patients were included. The study population was all patients with unilateral, extra-articular distal radius fractures. All were treated conservatively. All the demographic criteria were obtained from the indoor register, radiology, and operation theatre records of the hospital. Inclusion criteria were patients above 18 years old, unilateral, unstable, extra-articular distal radius fracture, absence of systemic disease affecting joints such as rheumatoid arthritis, and absence of arthritic changes in the distal radioulnar joint.

The patients were divided into two groups: Distal radius fracture with intact ulnar styloid and concurrent fractured ulnar styloid, respectively, as groups 1 and 2. All patients

were treated by one surgeon with close reduction under anesthesia with plaster immobilization. A long arm cast was applied with the forearm in supination, wrist in ulnar volar flexion, and after two weeks, changed to below elbow cast with the wrist in neutral rotation. Physiotherapy was performed on all patients for ten sessions. Patients were called upon physically, and telephonically at two years follow-up clinical examination with wrist radiographs. The supination and pronation range of motion were measured by a goniometer. The patient was asked to hold a pen in each hand and rotate the wrist as much as possible while the elbows were held in 90 degrees of flexion and on the flanks. The angle between the pen and the vertical axis was recorded as the supination and pronation range of motion. All the

parameters were measured by a staff nurse unaware of the purpose of the study and of the patient's group.

We used Chi-square, unpaired t, and Mann-Whitney U test for analysis. A p-value of <0.05 was considered significant.

Results

In the study period, 236 patients presented with unilateral, extra-articular distal radius fractures. In group 1, there were 42 and 44 patients in group 2. All patients attended follow-up, and finally, we examined at an average of 2 years (range 1.8 to 2.7 years) after their fracture had occurred. Men were 54 (62.8%) and women 32 (37.2%). Distal radius fractures involving the right side were 56 (65.1%). The patients' demographics are shown in Table 1.

Table 1: Demographic characteristics of the patients

Parameters	Group 1 n (%)	Group 2 n (%)		p-value
Age	53.2 ± 5.3	49.5 ± 0.8	t-test	0.762
Female	14 (33.3)	18 (40.9)	Chi-Square	0.594
Male	28 (66.7)	26 (59.1)		
Dominant side fracture	25 (59.5)	31 (70.5)	Chi-Square	0.488

The mean limitation of supination was 7.82 ± 5.19 for group 1 (intact styloid) and 23.82 ± 14.41 for group 2 (fractured styloid). The mean limitation of pronation was 4.72 ± 3.68 for group 1 (intact styloid) and 3.29 ± 2.79 for group 2 (fractured

styloid). The difference between the two groups was statistically significant regarding the limitation of supination but not about the limitation of pronation (Tables 2 and 3).

Table 2: Rotation of the forearm at two years follow-up

	Pronation	Supination
Group 1, Distal radius fracture with intact ulnar styloid	86.94 ± 2.01	87.69 ± 1.85
Group 2, Distal radius fracture with ulnar styloid fracture	86.35 ± 3.09	78.39 ± 8.67

Table 3: Comparison of range of motion in two groups

	Amount of decrease in group 1	Amount of decrease in group 2	p-value
Supination	9.77 ± 7.19	23.21 ± 11.89	<0.001
Pronation	5.14 ± 2.87	4.92 ± 3.61	<0.429

The most common and significant complaint of the patients was about pain in their wrist in 16 (38.1%) group 1 and 32 (72.7%) from group 2 during supination and pronation. Radiographs revealed nonunion of the ulnar styloid in 21 (47.7%) patients in group 2.

The radiographs identified 16 (38.1%) dorsally angulated malunions in group 1 and 18 (40.9%) in group 2. The volarly angulated malunions were seen in 6 (14.3%) in group 1 and 5 (11.4%) in group 2. The average pronation deformity was 12° (range 6° to 19°) in patients with dorsal malunion and 11°

(range 5° to 21°) in volar malunion. The supination deformity averaged at about 8° (range 4° to 14°) in dorsal and 12° (range 8° to 17°) in volarly angulated distal radius malunion. There were no significant differences between dorsal and volar malunion with respect to a range of pronation and supination deformity (Mann-Whitney U test, p=0.24). Pronation deformities were found relatively more frequently in volar malunion (48%) than in dorsal malunion (26%). However, the difference between both was not statistically significant, p<0.01 (exact Chi-square test).

Discussion

The present study was conducted to assess the effect of the presence of ulnar styloid fracture on the rotation of the forearm in extra-articular distal radius fractures who developed malunions. Usually, the limitation of supination and pronation in patients with distal radius fractures is attributed to fracture line extension to the distal radioulnar joint⁽⁷⁾.

However, in some cases, limitation occurs even in the absence of fracture line extension to the distal radioulnar joint, which may be attributable to triangular fibro cartilage complex injury⁽⁸⁾. The limitation of supination in group 2 probably cannot be attributed to triangular fibro cartilage complex injury as generally a more than 3 mm displacement and/or fracture line extension to the ulnar head are considered as signs of this injury. Actually, in every distal radioulnar joint dissociation, the ulnar styloid was fractured, though the reverse was not true⁽⁹⁾. In fact, severe displacement and extension of the fracture line to the distal radioulnar joint and ulnar head were evidence of joint instability⁽¹⁰⁾. Hence, distal radioulnar joint instability, too, is not the reason for the limitation of forearm rotations. However, the distal radioulnar joint may also be impaired as a result of angular deformity and shortening of the radius, thus producing incongruity of sigmoid notch articulation with the ulnar head⁽¹¹⁾. This can lead to the tightening of the triangular fibrocartilage complex and impedance in the area of forearm rotation.

This finding that ulnar styloid nonunion was asymptomatic in all of our patients is in agreement with other studies⁽¹²⁾. It has been noted that ulnar styloid fractures in association with distal radius fractures frequently lead to nonunion, and most of them are asymptomatic, though this is controversial⁽¹³⁾. The limitation of supination in group 2 patients related to ulnar styloid nonunion could not be answered in this present study⁽¹⁴⁾.

The limitation of this report is that it is a retrospective study, and all the patients are treated by only one modality of treatment. Perhaps the most convincing explanation for the findings of the present study would be the distal radioulnar joint capsule contracture, which can lead to limitation of supination after extra-articular distal radius fractures.

Conclusion

Based upon the findings of the present study, it is evident that the association of ulnar styloid fracture with extra-articular distal radius fracture is accompanied by limitation of supination and pronation of the forearm.

Conflict of interest: Nil

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Ethical considerations

Ethics approval was taken from Institutional Ethics Committee of District Hospital, Sindhudurg

Authors' contribution

RSK: Conceptualization, methodology, data curation, writing; SK: Software, validation, editing, visualization, investigation, Original draft preparation.

Data availability Statement

Data will be available with corresponding author on request

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