

Original Article

Non-operative treatment for distal ulna fractures associated with distal radius fractures

Kiyohito Naito¹, Kentaro Aritomi¹, Yoichi Sugiyama¹, Hiroyuki Obata², Osamu Obayashi², Kazuo Kaneko¹

¹Department of Orthopaedics, Juntendo University School of Medicine, Tokyo, Japan; ²Department of Orthopaedic Surgery, Shizuoka Hospital of Juntendo University, Shizuoka, Japan

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Abstract: Distal ulna fractures often concomitantly occur with distal radius fractures, and their treatment method is still controversial. We hypothesized that osteosynthesis is not necessary for distal radius fracture-associated distal ulna fracture without DRUJ surface fracture. In this study, non-operative treatment was selected for fractures not extending to the distal end of the ulna of the DRUJ based on the Biyani classification, and the therapeutic outcomes were investigated. Retrospective review of 8 patients who had treated with volar locking plate for distal radius fractures and without surgery for distal ulna fractures was performed. The average age of the patients was 74.1 years (range 65-86), and the mean follow up period was 13 months (range 12-15). The exclusion criterion was ulnar styloid fracture. Fracture union and functional outcomes included range of motion of the wrist, Visual Analogue Scale (VAS), Quick Disabilities of the Arm, Shoulder, and Hand (Q-DASH) score, and Mayo wrist score were investigated. At the last follow-up, all patients showed bony union. The mean wrist flexion was 65°, extension 66°, pronation 73°, and supination 81°. None of the patients complained of ulna wrist pain, and the average VAS was 1.4/10 and Q-DASH score was 12.7 points. The average Mayo wrist score was 90.3. According to the findings of this study, the Biyani classification based on plain radiograms was suggested to be very useful to decide the indications of treatment. If preoperative evaluation of fracture types is possible, these fractures without DRUJ surface fracture may be sufficiently conservatively treatable.

Keywords: Distal ulna fractures, Biyani classification, non-operative treatment, distal radius fractures

Introduction

Distal ulna fractures often concomitantly occur with distal radius fractures [1-3]. The incidence of distal ulna fractures is lower than that of distal radius fractures, and their treatment method is still controversial.

At present, sufficiently favorable outcomes of distal ulna fractures are achieved by non-operative treatment after reduction and osteosynthesis of distal radius fractures [4-7]. On the other hand, in distal ulna fractures with residual dislocation, the distal radio-ulnar joint (DRUJ) function is negatively influenced [1, 3, 8, 9], or injury of the distal radio-ulnar ligament is an accompanying factor and causes residual pain on the ulnar side of the wrist joint [10-12]. Therefore, many studies have reported that surgical treatment is necessary for unstable distal ulna fractures with residual dislocation.

Regarding the treatment of distal radius fracture-associated distal ulna fractures, traumatic arthropathy can be prevented by reducing the DRUJ surface to fit the joint and acquiring favorable wrist joint function by obtaining neutral ulnar variance [13]. In this context, we hypothesized that osteosynthesis is not necessary for distal radius fracture-associated distal ulna fracture without DRUJ surface fracture.

In this study, non-operative treatment was selected for type 1 and 3 fractures not extending to the distal end of the ulna of the DRUJ based on the Biyani classification [1], and the therapeutic outcomes were investigated.

Materials and methods

This study was approved by the Ethics Committee for Medical Research of our university, and informed consent was obtained from all

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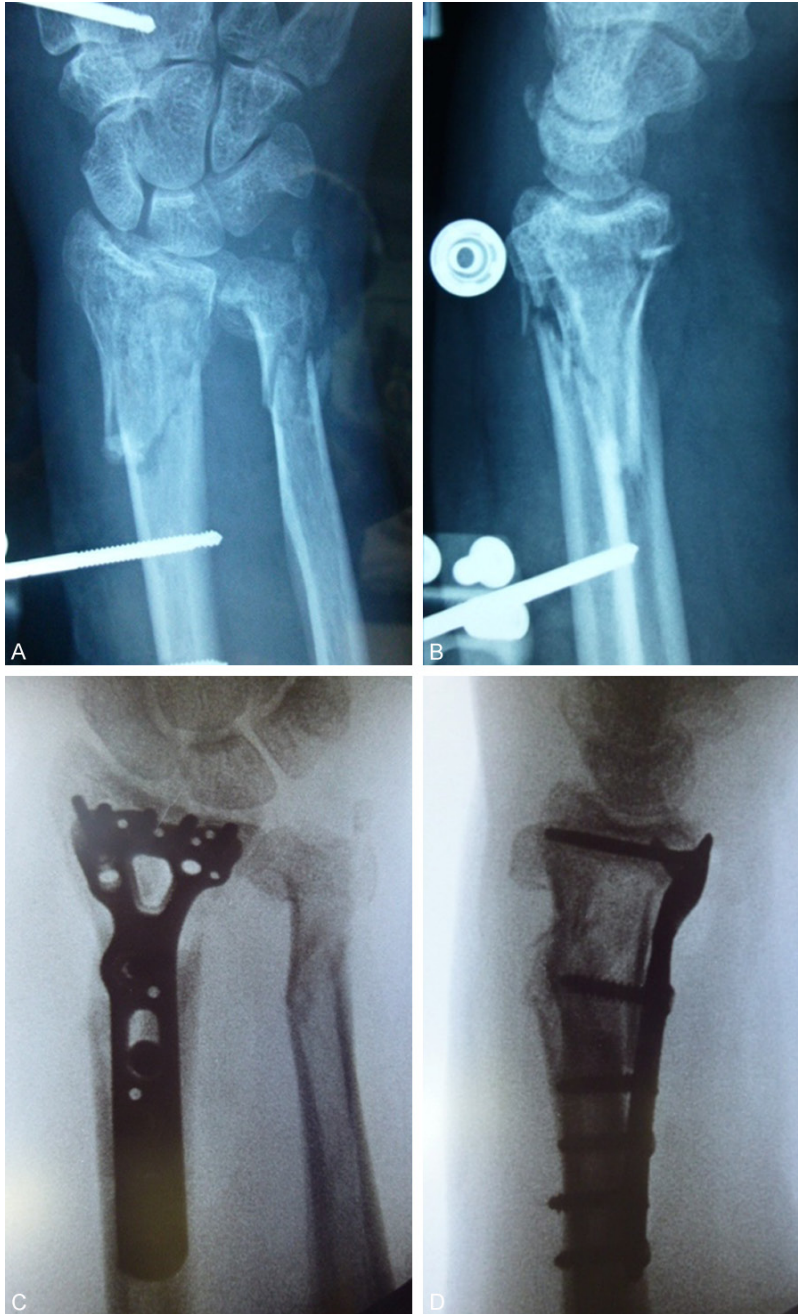


Figure 1. Conservative treatment of distal radius fracture-associated distal ulna fractures. A: Preoperative frontal view on plain radiography. The patient was a 73-year-old female with left distal radius and ulna fractures that occurred due to a fall. The distal radius fracture was type C3 on the AO classification, and the distal ulna fracture was type 3 on the Biyani classification. B: Preoperative lateral view on plain radiography. Comminuted fractures were noted at the distal ends of the radius and ulna. C: Frontal view of the radius on plain radiography after osteosynthesis. D: Lateral view of the radius on plain radiography after osteosynthesis. The DRUJ alignment was favorable, and no intervention was applied to the distal ulna fracture.

patients. A retrospective review was performed on patients who had been treated without sur-

gery for distal ulna fractures. All patients had concomitant distal radius fractures that were fixed with a volar locking plate. Medical records and radiographs were reviewed to identify patient demographics, fracture type, union, wrist range of motion and complications. The exclusion criterion was ulnar styloid fracture. All surgical procedures were performed by a single surgeon (N.K.).

The study included 7 women and 1 man with an average age of 74.1 years (range 65-86), and the average follow-up duration was 13 months (range 12-15). All patients were right-handed; 5 patients had left-side injuries and 3 had right-side injuries. All of the associated distal radius fractures were treated with a volar locking plate (**Figure 1A-D**). Among the distal ulna fractures, 6 cases were type 1 fracture according to the Biyani classification [1] and 2 cases were type 3. Active wrist motion out of the short arm splint was started 3 weeks postoperatively.

At final follow-up, bone healing of distal ulna fracture was determined by bony bridging formation or obliteration of the fracture lines of at least three cortices on anteroposterior and lateral radiographs. Functional outcomes included range of motion of the wrist, Visual Analogue Scale (VAS), Quick Disabilities of the Arm, Shoulder, and Hand (Q-DASH) score, and Mayo wrist score were investigated.

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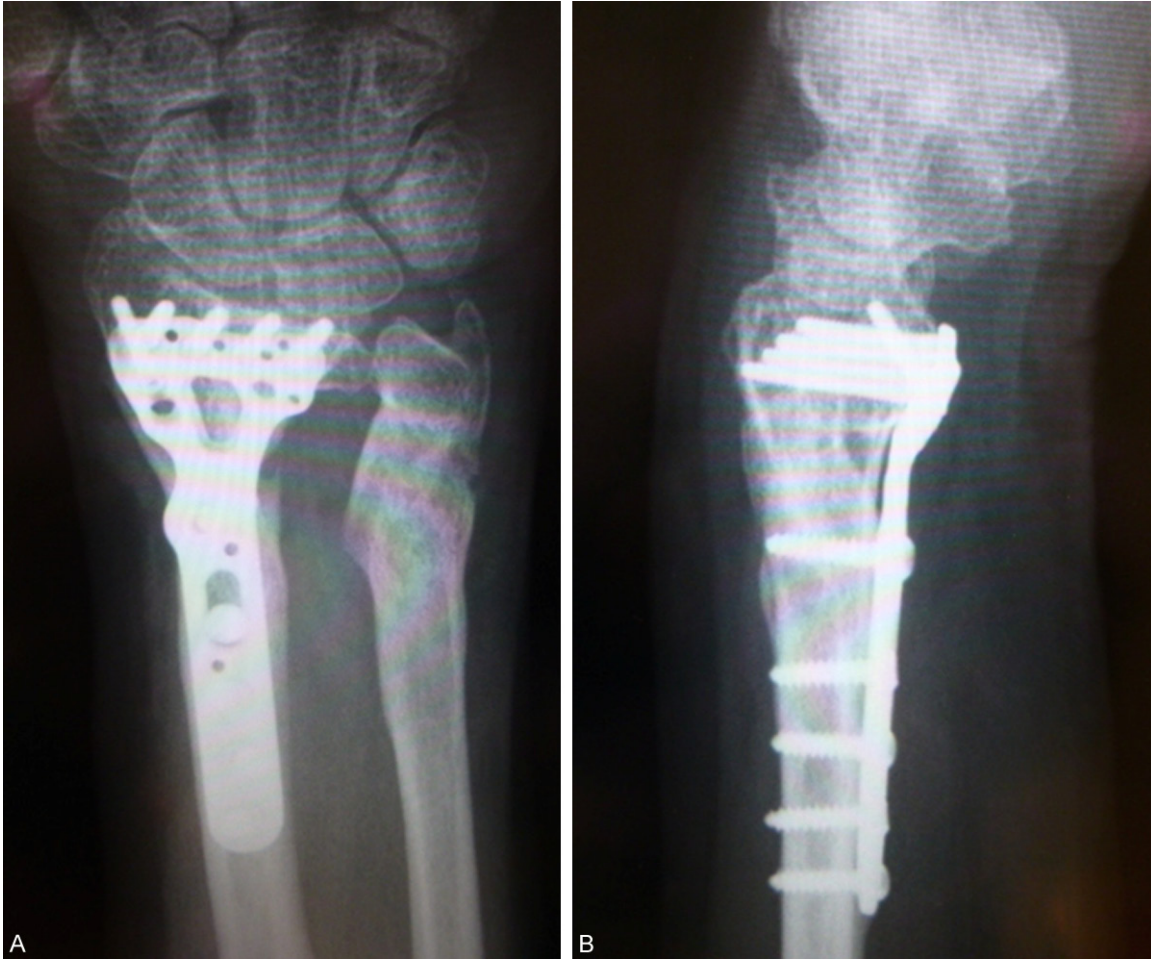


Figure 2. Plain radiography on the final follow-up. A: Frontal view on plain radiography. B: Lateral view on plain radiography. Favorable bone union was achieved in both the radius and the ulna, and the DRUJ alignment was also favorable.

Complications and any subsequent operations related to either the ulna or the radius fracture were also investigated.

Results

On the final radiograph, radiocarpal joint congruency was restored and solid bony union of the distal ulna fracture was obtained in all patients (**Figure 2A** and **2B**). On the clinical examination at the last follow-up, the mean wrist flexion was 65°, extension 66°, pronation 73°, and supination 81° (**Figure 3A-D**). None of the patients complained of ulna wrist pain at the last follow-up, and the average VAS was 1.4/10 and Q-DASH score was 12.7 points. The average Mayo wrist score was 90.3 and all patients showed excellent results (**Table 1**). There were no operation-related complications

such as infections, neurological problems, or hardware failure.

Discussion

No consensus viewpoint has been reached with regard to the treatment of distal ulna fractures associated with distal radius fractures. The subjects in this study were a case series of distal ulna fractures excluding fracture of the styloid process of the ulna, for which the treatment methods were investigated. Ring et al. reported that surgical treatment is not necessarily required when the alignment of the distal end of the ulna is favorable after reduction of distal radius fractures, and distal ulna fractures without DRUJ surface fracture may be conservatively treated [5], suggesting that when a fracture is accompanied by DRUJ surface dislo-

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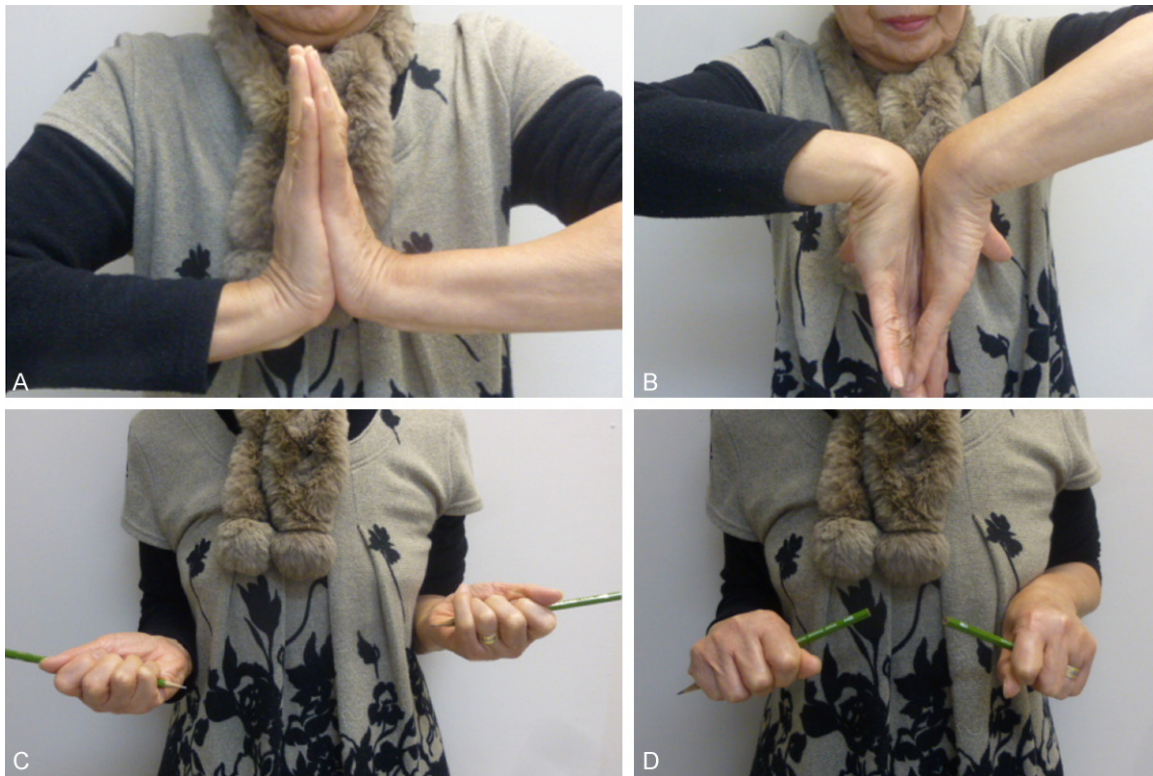


Figure 3. Clinical outcome on the final follow-up. The ranges of motion of the wrist joint in this 72-year-old female on the final follow-up were as follows: wrist joint flexion and extension, 70 and 80°, and supination and pronation of the forearm, 85 and 70°, respectively. VAS was 0/10, the Q-DASH score was 0/100, and the Mayo wrist score was 95/100. A: Wrist joint flexion. B: Wrist joint extension. C: Supination of the forearm. D: Pronation of the forearm.

Table 1. Results of the distal ulna fractures associated with distal radius fractures

Case	Age	Sex	AO classifica- tion (DRF)	Biyani classifi- cation (DUF)	F/U (mo)	Bone healing of DUF	ROM						
							F	E	P	S	VAS	Q-DASH	Mayo
1	80	F	A2	Type 1	14	Yes	75	60	90	90	1	11.36	94
2	70	F	C3	Type 1	12	Yes	70	70	80	90	1	6.82	90
3	73	F	C3	Type 3	12	Yes	70	80	85	70	0	0	95
4	75	F	C2	Type 3	15	Yes	75	60	45	90	0	18.18	89
5	65	F	A3	Type 1	15	Yes	70	70	70	90	3	13.64	85
6	69	F	A2	Type 1	12	Yes	40	80	90	50	2	18.18	94
7	75	M	C1	Type 1	12	Yes	50	40	60	90	1	2.27	95
8	86	F	A2	Type 1	12	Yes	70	70	80	80	3	31.82	80

M: male, F: female, AO: Arbeitsgemeinschaft für Osteosynthesefragen, DRF: distal radius fracture, DUF: distal ulna fracture, F/U: follow-up, ROM: range of motion, F: flexion, E: extension, P: pronation, S: supination, VAS: Visual Analogue Scale, Q-DASH: Quick Disabilities of the Arm, Shoulder, and Hand (Q-DASH) score, Mayo: Mayo wrist score.

cation, the dislocation should be reduced. Many studies have reported that open reduction and internal fixation are necessary to treat dislocated distal ulna fractures [2, 3, 14]. According to these reports, the following interpretation may be made, supporting our hypothesis: Open reduction and internal fixation are

necessary for dislocated distal ulna fractures, but surgical treatment is not necessarily required for distal ulna fractures without dislocation or those without DRUJ surface fracture.

In 1995, Biyani reported the presence of concomitant distal ulna fractures in 19 (6%) of 320

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patients with distal radius fractures [1], in which all patients were conservatively treated and followed for 2 years, lack of fit of DRUJ was noted in 46%, and favorable clinical outcomes were achieved in 60%. False joint was formed in 2 cases of comminuted distal ulna fracture, and bone fusion was achieved in simple fracture cases, but callus interfered with the surroundings of the DRUJ, limiting supination and pronation of the forearm in 3 cases. Biyani et al. classified distal ulna fractures into 4 types in this report [1]. We selected non-operative treatment for Biyani types 1 and 3 in which the dorsal metacarpal ligament of the DRUJ is conserved without DRUJ surface fracture [15].

Various surgical procedures for distal ulna fractures have been reported. Each procedure has advantages and disadvantages, and is selected based on the fracture pattern and judgment by surgeons. Percutaneous pinning is a simple method, but the fixation ability is weaker, and migration and loosening of pin may often occur in comminuted fracture and osteoporotic bone [16]. Mini-condylar locking plates are capable of fixing comminuted distal ulna fractures, but reduction of intra-articular bone fragments is difficult [4, 5]. Low-profile locked plates are capable of strongly fixing fractures and facilitate early range of motion training. Favorable outcomes of distal radius fracture-associated distal ulna fractures have been reported [4, 5], but problems with screw arrangement and tenosynovitis induced by irritation between the plate and tendon have been reported [4]. The risks of various complications accompanying surgical treatment of distal ulna fractures are well known.

We recognize that our study has limitations. First, it is retrospective, and second, the small number of patients reflects the rarity of these injuries. Our findings do not suggest that all distal ulnar fractures associated with distal radius fractures should be treated conservatively. However, non-operative treatment is an alternative to K-wire fixation, internal fixation with locking plates, or a primary Sauvé-Kapandji or Darrach procedure [17]. Because of good clinical and radiological results and no major complications, we believe that non-operative treatment is a reasonable option for elderly patients with Biyani type 1 and 3 fractures.

According to the findings of this study, it was suggested that the following hypothesis is

appropriate: Osteosynthesis is not necessary for distal radius fracture-associated distal ulna fractures without DRUJ surface fracture. The Biyani classification based on plain radiograms was suggested to be very useful to investigate the indications of non-operative treatment. However, detailed evaluations of fracture types of distal ulna fractures and ulnar head DRUJ surface are necessary. Evaluation of the distal end of the ulna and DRUJ surface by CT may be necessary for further verification. Actually, it has been clarified that preoperative evaluation using CT is important to select a treatment method for distal radius fractures [18]. If close preoperative evaluation of fracture types is possible, distal radius fracture-associated distal ulna fractures without DRUJ surface fracture may be sufficiently conservatively treatable.

Disclosure of conflict of interest

None.

Address correspondence to: Kiyohito Naito, Department of Orthopaedics, Juntendo University, 2-1-1 Hongo, Bunkyo-ku, Tokyo 113-8421, Japan. Tel: +81-3-3813-3111; Fax: +81-3-3813-3428; E-mail: knaito@juntendo.ac.jp

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