

Outcomes of Open Reduction and Internal Fixation of Bilateral Fractures of the Distal Radius

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Abstract

Background Bilateral distal radius fracture (DRF) is an uncommon injury. We described the outcomes of 10 consecutive cases of bilateral DRF treated with open reduction and internal fixation (ORIF) at our institution.

Materials and Methods We retrospectively searched our electronic medical records data for all patients 18 years of age or older treated surgically for bilateral DRF over a 6-year period (2011–2016). Patient demographics, fracture classification, fixation method, postoperative complications, QuickDASH (Quick Disabilities of the Arm, Shoulder and Hand) questionnaire scores, wrist range of motion (ROM), and radiographic measurements of X-rays at final follow-up were collected and analyzed.

Results Ten patients (8 women; 2 men; mean age: 63 years) with 20 fractures were assessed. A volar approach for ORIF was used in 90% of cases. Six of 20 (30%) wrists experienced postoperative complications and required hardware removal. Mean QuickDASH score was 24.8 at final follow-up. On average, ROM reached 58-degree extension, 52-degree flexion, 75-degree pronation, and 75-degree supination. Mean measurements of radial shortening, radial inclination, and volar tilt taken from final postoperative radiographs were 1.3 mm, 21.2 degrees, and 7.8 degrees, respectively.

Conclusion In bilateral DRF treated with concomitant ORIF, functional outcomes, recovery of wrist ROM, and restoration of radiographic parameters are comparable to those seen in patients with ipsilateral DRF.

Keywords

- ▶ distal radius
- ▶ fracture
- ▶ bilateral
- ▶ wrist trauma
- ▶ fixation
- ▶ volar plating
- ▶ outcomes
- ▶ recovery
- ▶ complications

Introduction

Distal radius fracture (DRF) is an increasingly common injury and one of the most frequently treated fractures in emergency departments throughout the country.^{1–4} However, concurrent fracture of both distal radii in adults is rare, and its incidence is unknown. Whereas the treatment and outcomes of unilateral DRF are well known, there is limited information regarding bilateral DRF. The current available literature comprises primarily a handful of case reports, and therefore it lacks any outcomes or complication data.^{5–10}

We present a series of 10 consecutive cases of bilateral DRF treated with open reduction and internal fixation (ORIF)

at our institution. We evaluated functional and radiographic outcomes as well as incidence of complications. We hypothesized that patients with bilateral DRF treated surgically would have an increased incidence of complications relative to their unilateral counterparts.

Materials and Methods

This study was approved by the institutional review board of the Thomas Jefferson University. The patient cohort was generated by searching the electronic medical records data for patients treated surgically for bilateral DRF over a 6-year period, as identified by Current Procedural Terminology

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(CPT) codes 25607, 25608, and 25609. Data were collected from January 1, 2011 through December 31, 2016. Patients with less than 1 year of follow-up, incomplete medical records, and those younger than 18 years were excluded. Twelve patients were excluded.

Demographic information recorded included age, sex, body mass index (BMI), past medical history (PMH), medications, date of injury, mechanism of injury (high vs. low energy), date of surgery, postoperative complications, QuickDASH (Quick Disability of the Arm, Shoulder and Hand) questionnaire score, and clinical measurements of wrist and forearm range of motion (ROM) obtained at last follow-up. Injury fractures were classified according to the AO Foundation/Orthopaedic Trauma Association fracture classification.¹¹

X-rays of the fractures at latest follow-up were evaluated for radiographic parameters, including radial shortening, inclination, and volar tilt, per the methods of Mann et al.¹² The method of fixation varied on a case-by case-basis based on surgeon preference. With regard to injury mechanism, motor vehicle accidents and falls from a height were considered high-energy trauma, and falls onto an outstretched hand (FOOSH) from standing height were denoted low-energy trauma.

Results

Ten patients with 20 fractures met our inclusion criteria. The mean age at the time of injury was 63 (range: 31–87), and the group comprised predominantly women (80%). The mean duration of follow-up was 2.4 years (range: 1–6.6). The mean BMI was 24.1, and all patients fell into the normal or overweight categories (range: 20.2–28.9). Eight fractures (40%) with bilateral DRFs were due to high-energy trauma (one motorcycle accident, three falls from a height). The remaining 12 fractures were due to FOOSH. Comorbidities included osteopenia and osteoporosis in three patients and type 2 diabetes in two. Two of 10 patients had additional injuries. One suffered associated rib and ankle fractures with a ruptured spleen whereas the other had a finger dislocation.

The fracture types encountered were articular fractures with associated simple metaphyseal (C1) or multifragmentary metaphyseal (C2) fractures (16 wrists, 80%). The remaining 20% of the fractures were extra-articular and multifragmentary (A3). During ORIF, the treating surgeon chose a volar approach for plating in 90% (18 of 20) of wrists. One patient had dorsal plating only (5%). Another underwent combined volar and dorsal plating of one wrist (5%).

Patient outcomes are depicted in **Table 1**. Self-reported hand and wrist functional status was evaluated using the QuickDASH questionnaire. Among the ten patients, mean QuickDASH score was 24.8 (range: 2.5–37) out of a maximum of 100. ROM of the wrist and forearm at latest follow-up was available in eight patients (16 wrists). Mean extension was 58 degrees, flexion 52 degrees, mean radial deviation was 18 degrees, and mean ulnar deviation was 27 degrees. Mean forearm pronation and supination were each 75 degrees. Due to the nature of this series, ROM measurements could not be compared with those of a contralateral uninjured wrist.

Measurements in each wrist were taken from final postoperative radiographs in all 10 patients. Mean radial shortening was 1.3 mm (range: 0.6–2.3 mm). Mean radial inclination was measured at 21.2 degrees (range: 12.2–27.2 degrees). The mean volar tilt for all 20 wrists was 7.8 degrees (range: –4.4 to 17.8 degrees).

We identified complications in 6 (30%) of 20 wrists, affecting 5 patients in the group (50%). A total of six surgical procedures were performed as a result of these complications. Prominent and/or painful hardware was removed in six wrists at an average 7.8 months after the index surgical procedure (range: 4–12). Other complications included flexor tenosynovitis in four patients necessitating tenosynovectomy, carpal tunnel syndrome in two patients requiring release, and a neuroma of the palmar cutaneous branch of the median nerve in one patient.

Discussion

Bilateral DRFs are an uncommon, yet debilitating, injury. The overall goal is to optimize reduction, mobilization, and future function. In this case series, we describe 10 patients treated surgically for bilateral DRF over a 6-year timeframe.

Surgical fixation is preferred to cast fixation for management of DRF with postreduction radial shortening more than 3 mm, dorsal tilt greater than 10 degrees, or intra-articular displacement or step-off degrees 2 mm (moderate strength recommendation).¹³ A recent survey of orthopaedic surgeons indicated that 85% considered all three of these post reduction criteria when choosing between operative and cast fixation.¹⁴ However, there does not appear to be an evidence-based conclusion for the optimal operative treatment method for DRF.¹³ Thus, our surgeons chose the surgical fixation method they felt most confident with on a case-by-case basis. Out of the 20 surgically repaired wrists, 18 (90%) received a volar plate whereas 1 (5%) received a dorsal plate. One (5%) patient with volar plating required an additional dorsal plate to fix the dorsal articular surface of the right wrist. Comparable to our patient cohort, it seems that surgeons' preferred fixation method has recently trended toward ORIF with volar locking plates.¹⁵

Similar to the reported demographics of ipsilateral DRFs, the average age of our cohort was 63 and it was predominantly female (80%).¹ Our primary outcome, the self-reported QuickDASH questionnaire,¹⁶ has consistently demonstrated good validity in DRF patients in previous studies.¹⁷ The mean score in our cohort was 24.8 (range: 2.5–37; standard deviation: 13.2). For comparison, a recent retrospective cohort study compared QuickDASH scores for 57 patients (mean age: 52) at their initial and final hand therapy sessions following surgical fixation of DRF. Their mean scores at the initial therapy visit and final visit were 62 and 15, respectively.¹⁸ Considering the compounded difficulty of bilateral involvement and the current cohort mean age of more than a decade older, these scores are comparable.

In an epidemiological study of 93 patients, Ehsan and Stevanovic noted that most bilateral DRFs in skeletally immature patients resulted from low-energy trauma and were managed nonoperatively.¹⁰ Conversely, this injury to

Table 1 Patient outcomes

Assessment		Mean	Range
QuickDASH score		24.8	(2.5–37)
Range of motion			
Wrist	Extension	58.3 deg	(35–70 deg)
	Flexion	52 deg	(30–85 deg)
	Radial deviation	17.8 deg	(13–30 deg)
	Ulnar deviation	26.7 deg	(9–45 deg)
Forearm	Pronation	74.7 deg	(45–90 deg)
	Supination	75 deg	(45–80 deg)
Radiographic measurements			
	Radial shortening	1.3 mm	(0.6–2.3)
	Radial inclination	21.2 deg	(12.2–27.2 deg)
	Volar tilt	7.8 deg	(–4.4 to 17.8 deg)

Abbreviation: QuickDASH, Quick Disabilities of the Arm, Shoulder and Hand.

skeletally mature individuals more often occurred due to high-energy trauma and was treated operatively. Bilateral DRFs in skeletally mature patients were associated with additional injuries 38% of the time versus 4% in their skeletally immature counterparts. Greater than one-half of the fractures in skeletally mature individuals were of the intra-articular type. All 10 of our patients were skeletally mature, and 16 wrists (80%) had an intra-articular fracture. Two (20%) patients in our series suffered additional injuries. There are no data presented in that study pertaining to complications and patient outcomes.

ROM in this cohort was comparable to that noted in previous studies of DRF patients after volar plating with a minimum 1-year follow-up.^{19–21} Mean measurements in this series for wrist extension (58 degrees) and flexion (52 degrees) were similar to those in prior studies (extension: 53–65 degrees; flexion: 46–65 degrees).^{19–21} Our patients' mean forearm pronation (75 degrees) and supination (75°) were each within the range of previously reported averages (pronation: 73–83 degrees; supination: 71–85 degrees).^{19–21} Similarly, the outcomes were comparable to data in the literature evaluating the radiographic outcome of unilateral injuries.^{20,22–24}

One-half of the patients in our group experienced a complication. On a “per-wrist” basis, 30% (6 of 20) suffered a complication, which is comparable to the overall complication rate in ipsilateral DRFs treated with volar plating (21–31%).^{19–21,23–27} Our reoperation rate and hardware removal rates were each 30%. During four reoperations to remove hardware, tenosynovectomy was also performed. Additionally, two patients underwent carpal tunnel release concomitant with their hardware removal. In the current literature, reoperation rates after volar plate fixation for DRF range from 9 to 36.5%.^{20,23–25} Hardware removal has been necessary at a similar rate (9–29%) across similar studies.^{19–21,24–26,28}

This study is subject to the limitations inherent in all case series. The retrospective, observational nature of this series allows for potential selection and measurement biases. Additionally, our sample size is small due to the rarity of bilateral DRF. Finally, treatment for these fractures was not standardized, but rather left at the discretion of each individual surgeon.

We present the outcomes of patients with bilateral DRF treated with concomitant ORIF. These fractures were treated mostly with ORIF using volar plate fixation (90% of cases). We found a complication in one-half of the patients in the study, and hardware was removed in all 6 of 20 wrists. Whereas the per-patient complication rate appears to be increased, functional outcomes, recovery of wrist ROM, and restoration of radiographic parameters were comparable to those seen in ipsilateral DRF.

Conflict of Interest

None declared.

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