Closed Management of a Distal Radius Refracture Through a Bent Volar Plate: Can an Open Procedure be Avoided?

A Case Report

Christopher Hall, MD, BHSc, Anton Lambers, MB, BS, BMSc, Dip Mgt, and Satyen Gohil, FRACS (Ortho), MBBS (Lond)

Investigation performed at Fiona Stanley Hospital, Perth, Western Australia

Abstract

Case: A 55-year-old man sustained a distal radius fracture, which was fixed with a volar plate 20 years ago. He then fell from 2 m and sustained a refracture with a bent but intact volar plate. A manipulation under anaesthetic/anaesthesia was attempted. Satisfactory reduction was confirmed and maintained, with bony union confirmed at 6 months. Regular follow-up showed continuing functional improvement.

Conclusion: This rare case avoided surgical intervention and its associated risks and costs. Attempted closed reduction can be considered a treatment option before open revision fixation, with demonstrated ability for fracture healing in an acceptable position.

It is rare for a radius to refracture after volar plate fixation without plate breakage. Damage to an implant depends on the mechanism of injury, patient weight, weight-bearing status, and surgical technique at index procedure[1]. The amount and duration of force applied and the design and metallurgical properties of the plate will determine whether it will fracture or deform[2]. With increasing levels of international travel, a wide variety of implants may be seen in local practice, rendering removal of screws and plates for revision fixation challenging[2].

The general recommendation for a damaged implant with refracture is to remove and replace[3]. On the other hand, a closed reduction has reduced risk to the patient and fiscal benefits to the healthcare system[3,4]. Repeat operative management carries a higher risk of surgical complication than primary surgery and can be technically challenging[4,5]. If avoided, there is a reduced risk of infection, neurovascular injury, and possibly a quicker recovery because of less soft-tissue disruption[4,5]. The direct and indirect cost savings need to be considered including implant and instrument costs, theater time, labor, and inpatient care expenses[6]. A study of 23,453 distal radius fractures indicated the surgical cost made up 61% to 91% of the patient's cost of care (ranging from $6,577 to $8,181)[6].

After a review of the published literature, we found a similar case describing a distal radius refracture with a bent volar plate that was also treated by closed means. The fracture, however, was not anatomically reduced, and limited clinical information is provided in follow-up[7]. Kanji et al. described open treatment of such a fracture, perhaps missing the opportunity for noninvasive treatment[8,9] Other authors describe successful closed reduction of pediatric forearm shaft fractures with flexible nails in situ[10,11].

The patient was informed that data concerning the case would be submitted for publication, and he provided consent.

Case Report

A 55-year-old white man presented to the emergency department after a 2 m fall from height. The impact was taken on both wrists. The patient had previously undergone open reduction with internal fixation in the same wrist for a distal radius fracture approximately 20 years earlier with a volar plate, screws, and demineralized bone matrix. Postoperatively, the patient reported return of wrist range of motion and sensation. Radiology reports state that the fracture was unidentifiable 3 months postoperatively.

Clinical examination on refracture noted a closed injury, gross deformity over the left wrist, and loss of sensation in the median nerve distribution. Plain radiographs and computed tomography confirmed a distal radius fracture with minimally displaced intra-articular extension and impaction. The plate was bent but remained intact. There was no evidence of screw loosening or breakage, and none of the screws had penetrated the radiocarpal joint (Fig. 1).

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJSCC/B240).

Fig. 1
Pre-reduction plain radiographs.

The decision to attempt a closed was 2-fold. First, the original plate was inserted overseas and not easily identifiable at the time (now known to be an Implants for Trauma Surgery (ITS) titanium plate: *Implants for Trauma Surgery, Graz, Styria, Austria*). Therefore, removal of hardware and revision fixation would have expected difficulties. Second, the plate remained intact

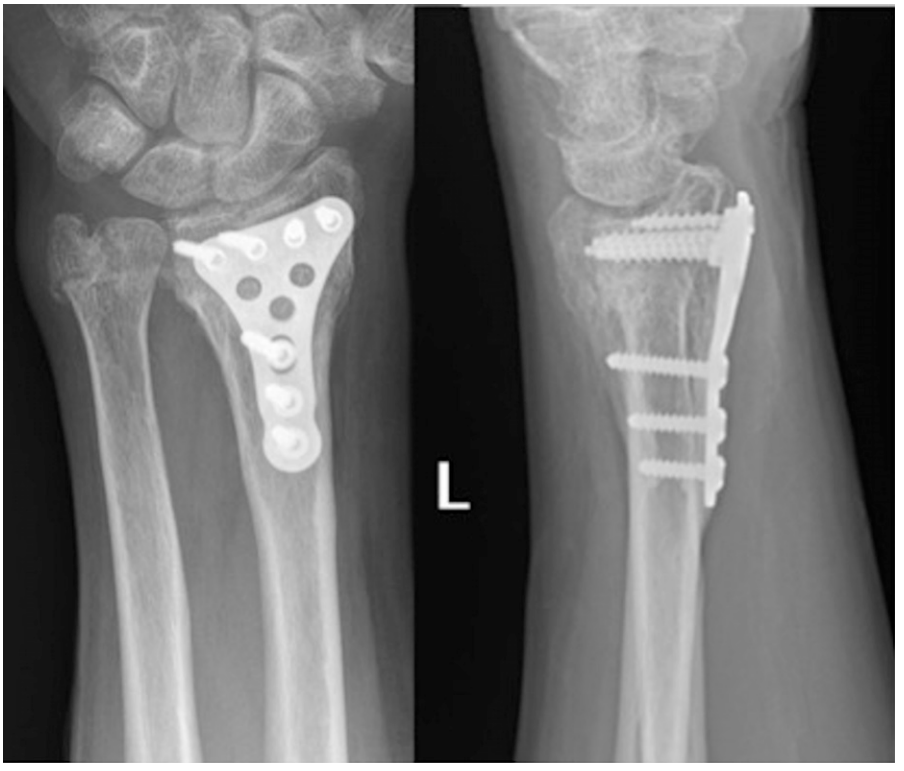

Fig. 2
Six-month postreduction plain radiographs.

and was only bent. Manipulation was performed under general anesthesia by applying moderate pressure to correct the distal radius angulation. The patient was consented for an open reduction internal fixation if the closed procedure was unsuccessful.

Fluoroscopy confirmed satisfactory fracture reduction and improvement in angulation of the plate. The wrist was radiologically stable in flexion and extension. An open carpal tunnel release was concomitantly performed. The wrist was for immobilized in a short-arm cast for 6 weeks, followed by a course of hand therapy.

The six-month follow-up revealed improvements in flexibility, pain, and functionality. Wrist measurements showed 70° extension, 44° flexion, 65° pronation, and 54° supination. Bony union was noted on repeat biplanar radiographs (Fig. 2).

The twelve-month follow-up revealed a marked improvement in functionality, primarily because of resolution of median nerve parasthesia and pain. A Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire yielded a score of 21.6, indicating a mild level of functional disability. Ongoing problem tasks included moderate difficulties with heavy loads and mild difficulties with everyday tasks. These issues have been attributed to moderate ongoing radial-sided wrist pain attributed to an ultrasound confirmed flexor carpi radialis tendonitis. Ranges of motion of the forearm were full. Wrist extension was 75° and flexion 65°.

Discussion

To our knowledge, this is the first published case of an anatomical closed reduction for a distal radius refracture through a bent volar plate.

Given the plate was not broken, we successfully performed a closed reduction leading to a satisfactory outcome. There is one similar published case; however, reduction was not anatomic, and the follow-up was incomplete[7]. Despite lack of comparison to operatively managed cases, one would envision reduced risk to the patient and cost savings[3,4].

The authors suggest that indications for attempting closed management are having the ability to restore anatomical relationships, intact implant including well-fixed screws, an agreeable patient, and the ability to progress to open treatment if unsuccessful. Currently, very limited evidence exists, and further cases are needed to compare data and assess long-term functional outcomes. Adding this therapeutic option may avoid an open surgical procedure involving hardware removal and replating. ■

Christopher Hall, MD, BHSc[1]
Anton Lambers, MB, BS, BMSc, Dip Mgt[1]
Satyen Gohil, FRACS (Ortho), MBBS (Lond)[1]

[1]Department of Orthopaedics, Fiona Stanley Hospital, Murdoch, Washington

E-mail address for C. Hall: chrishall6056@gmail.com

ORCID iD for C. Hall: 0000-0002-8162-0687
ORCID iD for A. Lambers: 0000-0001-7796-6047
ORCID iD for S. Gohil: 0000-0002-6809-6665

References

1. Peivandi MT, Yusof-Sani MR, Amel-Farzad H. Exploring the reasons for orthopedic implant failure in traumatic fractures of the lower limb. Arch Iran Med. 2013;16(8):478-82.

2. Gummesson C, Atroshi I, Ekdahl C. The disabilities of the arm, shoulder and hand (DASH) outcome questionnaire: longitudinal construct validity and measuring self-rated health change after surgery. BMC Musculoskelet Disord. 2003;4:11.

3. Haseeb M, Butt MF, Altaf T, Muzaffar K, Gupta A, Jallu A. Indications of implant removal: a study of 83 cases. Int J Health Sci (Qassim). 2017;11(1):1-7.

4. Busam ML, Esther RJ, Obremskey WT. Hardware removal: indications and expectations. J Am Acad Orthop Surg. 2006;14(2):113-20.

5. Hak DJ, McElvany M. Removal of broken hardware. J Am Acad Orthop Surg. 2008; 16(2):113-20.

6. Huetteman HE, Zhong L, Chung KC. Cost of surgical treatment for distal radius fractures and the implications of episode-based bundled payments. J Hand Surg Am. 2018;43(8):720-30.

7. Geurts GF, Van Riet RP, Verstreken F. Successful closed reduction of refractured wrist with a bent volar distal radius plate. Acta Orthop Belg. 2012;78(1):126-8.

8. Kanji R, Nutt J, Stavropoulos S, Elmorsy A, Schneider HJ. Distal radius re-fracture with bending of implant and neurovascular compromise. J Clin Orthop Trauma. 2017;8(suppl 2):S40-2.

9. Beaton DE, Katz JN, Fossel AH, Wright JG, Tarasuk V, Bombardier C. Measuring the whole or the parts? Validity, reliability, and responsiveness of the disabilities of the arm, shoulder and hand outcome measure in different regions of the upper extremity. J Hand Ther. 2001;14(2):128-46.

10. Shahid M, Yeo M, Smibert JG. Closed reduction of radius refracture: a case report. Int J Surg Case Rep. 2011;2(8):275-7.

11. Kelly BA, Shore BJ, Bae DS, Hedequist DJ, Glotzbecker MP. Pediatric forearm fractures with in situ intramedullary implants. J Child Orthop. 2016; 10(4):321-7.