SCIENTIFIC ARTICLE

Fracture of the Distal Radius: Risk Factors for Complications After Locked Volar Plate Fixation

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Purpose To identify risk factors for complications after volar locking plate fixation of distal radius fractures.

Methods We assessed early postoperative complications in 594 patients with fracture of the distal radius repaired with a volar locking plate and a minimum 1-month evaluation in the medical record. Later complications were assessed among 321 patients as a subset of the original cohort with a minimum 6 months' evaluation. We compared patient demographics, fracture characteristics, and aspects of management between patients with and without complications in bivariate analysis. Multivariable logistic regression analysis was applied to identify the factors independently associated with complications.

Results A total of 47 complications were documented in the medical record. Early complications occurred in 24 of 594, including 8 intra-articular screws and 7 patients with loss of fixation. Late complications occurred in 23 of 321, including 14 patients diagnosed with tendon irritation (one rupture of the flexor pollicis longus tendon) and 5 patients who had subsequent surgery to address dysfunction of the distal radioulnar joint (malunion, synostosis, and arthrofibrosis). Of the 47 complications, 26 were attributed to the plate, of which 9 were considered major (intra-articular screws and tendon rupture; 1.3% (8 out of 594) and less than 1% (1 out of 321) of the early and late groups, respectively). In the logistic regression models, fall from a height and an ipsilateral elbow injury were positive independent predictors of early complications, whereas high-volume surgeons and plates other than the most commonly used plate were positive independent predictors of later complications.

Conclusions Volar locking plate fixation of distal radius fractures was associated with relatively few plate-related complications in our institutions. Factors indicating higher energy or complexity predicted early complications. The most common late complication was tendon irritation, which is less discrete and perhaps variably diagnosed. Further study is warranted regarding plate design and familiarity, which may help reduce complications. *(J Hand Surg 2011;36A:3–9. © 2011 Published by Elsevier Inc. on behalf of the American Society for Surgery of the Hand.)*

Type of study/level of evidence Prognostic IV.

Key words Complications, distal radius fracture, volar plate.

Volar locking plate fixation is an increasingly popular method for surgical treatment of a fracture of the distal radius.[1,2] A volar locking plate can stabilize a dorsally displaced fracture and potentially avoids the extensor tendon problems reported with dorsal plate fixation. Recent clinical trials have demonstrated more rapid return of function with volar locking plates compared with external fixation or

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fixation with percutaneously inserted pins.[3,4] On the other hand, volar plate fixation risks complications specific to internal fixation, such as flexor and extensor tendon injury, and intra-articular screw placement.[5] Reported unstratified complication rates are as high as 22% and 27%.[6,7] We investigated the prevalence of and risk factors for specific types of complications after volar locking plate fixation of distal radius fractures with particular interest in complications directly related to this type of internal fixation. Our hypothesis was that certain injury-related factors such as AO fracture type, as well as surgeon factors such as volume and specialization, might contribute to complications.

MATERIALS AND METHODS

Patients

We performed a retrospective study at two level 1 trauma centers including all distal radius fractures treated with a single precontoured anatomic volar locking plate. Patients treated with more than one plate were excluded. We identified 630 patients by searching billing data for Current Procedural Terminology codes 25620 and 25607 through 25609 during the years 2002 through 2007. Six patients had bilateral distal radius fractures treated with bilateral volar locking plates, creating a cohort of 636 plated distal radii. Patients with less than 1 month of follow-up were excluded. We recorded the characteristics of each patient and injury including age, gender, mechanism of injury, AO fracture type, open or closed injury, ulna fracture, ipsilateral injury, surgeon specialization, surgeon volume, surgeon years since residency, ancillary fixation, and median or ulnar nerve injury (Table 1).

TABLE 1. Description of Cohorts With Early and Late Follow-Up

	Early	Late
Number of radii	594	321
Average age, y (range)	52 (16–92)	52 (16–88)
Female	350 (59%)	191 (60%)
Open	34 (6%)	21 (7%)
Mechanism		
Simple fall	415 (70%)	214 (67%)
Motor vehicle accident	77 (13%)	45 (14%)
Fall from height	48 (8%)	36 (11%)
Athletic/assault	32 (5%)	17 (5%)
GSW/blast/crush/saw	6 (1%)	3 (1%)
Other	16 (3%)	6 (2%)
AO/OTA classification		
Type A	157 (26%)	86 (27%)
Type B	123 (21%)	56 (17%)
Type C	314 (53%)	179 (56%)
Plate type		
Hand Innovations DVR	465 (78%)	248 (77%)
Synthes, various	98 (16%)	48 (15%)
KMI Viper	22 (4%)	16 (5%)
Stryker VariAx	8 (1%)	8 (2%)
Smith & Nephew	1 (<1%)	1 (<1%)
Ancillary fixation		
K-wire(s)	27 (5%)	16 (5%)
External fixator	5 (1%)	2 (1%)
K-wire(s) and external fixator	5 (1%)	4 (1%)
Screw(s)	7 (1%)	5 (2%)
Calcium phosphate	2 (<1%)	1 (<1%)
Nerve decompression		
Carpal tunnel	31 (5%)	24 (7%)
Guyon's canal	1 (<1%)	1 (<1%)
Both	2 (<1%)	1 (<1%)

GSW, gunshot wound; OTA, Orthopaedic Trauma Association.

Associated injuries

We recorded associated fractures (Table 2). There were no significant differences between the 2 groups with regard to any fracture. In addition, in the cohort with early follow-up, 9 patients were diagnosed with concomitant scapholunate dissociation. Ipsilateral dislocations included 1 proximal interphalangeal joint, 3 elbows, and 1 shoulder. One patient with a concomitant elbow injury developed forearm compartment syndrome. An additional patient had a brachial artery laceration associated with humeral shaft fracture that was treated with vascular repair and prophylactic fasciotomy. There were 11 major chest and abdominal injuries, and 6 major intracranial injuries.

In the cohort with later follow-up, 5 cases were diagnosed with concomitant scapholunate dissociation. Ipsilateral dislocations included 3 elbows and 1 shoulder. An additional patient had a brachial artery laceration associated with humeral shaft fracture that was treated with vascular repair and prophylactic fasciotomy. There were 8 major chest and abdominal injuries and 2 major intracranial injuries.

Surgical treatment

The Hand Innovations DVR (DePuy, Inc., Warsaw, IN) was the predominant plate used in this series, accounting for 465 of 594 in the group with early follow-up and 248 of 321 in the group with later follow-up. Other plates used included several types of Synthes plates