

# Complications of Volar Locked Plating for Distal Radius Fractures

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## Introduction

Volar locked plating has become popular as a way to fix displaced distal radius fractures with a technique that decreases the risk of extensor tendon irritation that has been seen with dorsal plating. Despite this improvement a wide variety of complications after volar locked plating have been reported [1, 2] and the complication rates have ranged from 5% [1] to 27% [2, 3].

The purpose of our study was to evaluate the incidence and characterize the types of complications that occur with locked volar plating of distal radius fractures at one institution.

## Methods

We performed a retrospective review of the surgical database at one academic institution and identified patients 18 years and older who underwent volar locked plating for distal radius fractures from 2001-2009. We randomly selected 153 of these patients' records for review based on the numeric value of their medical record number. Patients were included if they were 18 years or older with a distal radius fracture. The fractures were open or closed, intra-articular or extra-articular with surgical treatment within two weeks of initial injury. We excluded patients with concomitant dorsal plating or fragment-specific plating but included those with additional K-wire fixation and those with ulnar styloid or head fracture fixation. AO type A, B and C fractures were included. The group consisted of 112 females and 41 males. The median age was 59 (range 18-93). Median follow-up was 3.5 months (range 1 week to 3 years).

All surgeries were performed by a fellowship trained hand surgeon. Multiple different plate systems were used at the discretion of the surgeon with the Hand Innovations DVR plate (DePuy, Inc., Warsaw, IN) being the most common (92 of 153).

We reviewed the operative reports and clinical notes to identify complications. We also reviewed all available radiographs. We defined major complications as those to include hardware-related (intra-articular, loosening, pain), tendon rupture or irritation, carpal tunnel syndrome requiring release, infection requiring reoperation, major medical complications and non-union. We identified all other complications as minor complications. Intra-articular hardware was counted as a complication only when identified in the surgeon's clinical notes. Delayed union was defined as incomplete healing at 6 months. Nonunion was defined as incomplete or absence of healing at 12 months. Stiffness was identified only when noted in the surgeon's notes and not by the objective range of motion measurement. We did not evaluate radiographs for loss of reduction or malunion.

## Results

There were 16 major and 27 minor complications for a total of 43 complications, yielding a 10% incidence of major complications and a 28% incidence of complications overall (see Figure 1). Of the 16 major complications, 9 of these were hardware related complications (3 intra-articular hardware, 2 loosening, 4 pain) making this the most common major complication. There were 4 patients with EPL tendon complications: 1 rupture and 3 irritation. There were 2 patients with carpal tunnel syndrome requiring surgery. One patient experienced a saddle pulmonary embolism in the postoperative period. There were no cases of non-union or infection requiring reoperation.

Of the 27 minor complications, 17 patients had sensory disturbances however, all but 2 of these had resolved at the time of final follow-up. Two patients were diagnosed with complex regional pain syndrome (CRPS) during their post-operative follow-up. One patient had a delayed union and two patients had superficial wound infections treated with antibiotics. Two patients had complications of pin and one patient had significant stiffness and PIP contractures which improved with therapy. One patient had distal radioulnar joint instability which became asymptomatic at 3 months. One patient developed long finger triggering and required release.

Of the 43 patients with complications, 14 underwent further surgery which included 6 limited or full hardware removal, 1 extensor pollicis longus (EPL) reconstruction, 1 EPL rerouting, 1 open carpal tunnel release, 1 trigger finger release, 1 pin removal. One patient had a Darrach procedure and carpal tunnel release followed by plate removal. Two patients had triangular fibrocartilage complex reconstructions in addition to plate removal. Two patients had intra-articular hardware but declined surgery for removal as they were asymptomatic.



Case example: Plate removal for intra-articular hardware

## Discussion

The rate of complications in our study was 28%, which is similar to that seen in previous studies [2, 3]. The most common complication overall (17/43) was sensory disturbances which is also in line with previous studies reviewing complications of volar plating [4].

In contrast—distinction to previously published reports, we had no flexor tendon ruptures or irritation [3, 5, 6]. There are many potential explanations for the discrepancy between our results and published literature. We would suggest that the most likely reason for this difference is the use of less prominent plates in recent years and positioning of the plate proximal to the watershed line [7].

While many of the noted complications were minor and resolved without further intervention, 14 of 43 (9%) patients did require a second operation. It should be noted that some of these procedures were minor; however this fact may be beneficial in counseling patients about the potential need for future surgeries.

We acknowledge several limitations of our study. As is the case with many retrospective studies, the follow-up data was variable and some complications may have gone unreported. Presumably, patients with major complications would seek follow-up, however, our institution is a level one trauma center and tertiary referral center in a semi-rural location. As such, many patients present to our ED from a long distance away and may seek follow-up closer to home. We were also limited by the variability of clinical documentation depending on the treating surgeon. Due to the relatively small sample size, we did not perform a multivariate regression analysis to attempt to identify factors that increased the risk of complications. We also did not analyze follow-up radiographs for loss of reduction or malunion which could be counted as complications. Both of these represent areas for future exploration. Also, it should be noted that we did not include patient's subjective outcome measures, such as the Disabilities of the Arm, Shoulder and Hand (DASH) score. Inclusion of this data may be useful in the future to identify more subtle areas of complications or patient dissatisfaction which are not routinely recorded in office visits.

## Conclusion

Volar locking plates are often used in the open reduction and internal fixation of distal radius fractures. A review of a randomly selected subset of data taken from 10 years of experience at our institution showed a 10% incidence of major complications, and an overall complication rate of 28%. This is a relatively low but not insignificant figure, and is in line with published data. Knowledge of the incidence of major and minor complications should assist surgeons in pre-operative counseling of their patients.

## Figure 1: Complications

Major Complications = 16		
<b>Hardware-related</b>	intra-articular	3
	loosening	2
	pain	4
<b>Tendon-related</b>	EPL rupture	1
	EPL irritation	3
<b>Carpal tunnel syndrome requiring surgery</b>		2
<b>Nonunion</b>		0
<b>Infection requiring re-operation</b>		0
<b>Major medical</b>	saddle pulmonary embolism	1
Minor Complications = 27		
<b>CRPS</b>		2
<b>Delayed union</b>		1
<b>Sensory disturbances</b>	Median nerve	8
	Superficial branch radial nerve	3
	Other	6
<b>Superficial wound infection treated with antibiotics</b>		2
<b>Transient distal radioulnar joint (DRUJ) instability</b>		1
<b>Stiffness</b>		1
<b>DRUJ pin migration</b>		1
<b>Ulnar pin migration requiring reoperation</b>		1
<b>Trigger finger requiring release</b>		1

## References

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