Incidence of Hardware Removal Following Volar Plate Fixation of Distal Radius Fracture

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Purpose To assess the risk of tendon rupture or plate removal after volar plate fixation of distal radius fractures and to determine the incidence of hardware removal.

Methods We searched the surgical database of 5 attending hand surgeons at a single institution from 2009 to 2014. All patients who had undergone volar plate fixation were included. Patients were excluded if they underwent an alternate form of fixation, had less than 1 year of follow-up, or could not be reached for follow-up. Postoperative radiographs were examined for Soong grade, plate distance to the critical line, and plate distance to the volar rim. If patients had hardware removed, the reason for plate removal was identified. For all patients who did not have documented hardware removal at our institution, we placed a follow-up call to determine whether they had hardware removed elsewhere.

Results A total of 517 patients underwent volar plate fixation, 143 of whom did not have their hardware removed at our institution but could not be reached for follow-up. Of the remaining 374 patients, 37 (10%) had hardware removed. For group 1 (hardware retained), Soong grades were 13% grade 0, 85% grade 1, and 2% grade 2. For group 2 (hardware removed) the proportions were 11%, 76%, and 5%, respectively, and 8% undetermined. Mean plate distance to the critical line was significantly greater for group 2 (1.9 mm) compared with group 1 (1.2 mm). Mean plate distance to the volar rim did not differ (5.1 mm vs 5.3 mm).

Conclusions The incidence of hardware removal in our series was 10%. The vast majority of patients had Soong grade 1 prominence. Patients who had hardware removed had a greater plate prominence volar to the critical line. Plate distance to the volar rim was not associated with removal. *(J Hand Surg Am. 2015;40(12):2410–2415.*

Type of study/level of evidence Prognostic II.

Key words Critical line, distal radius fracture, hardware removal, prominence, volar line.

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Received for publication July 15, 2015; accepted in revised form September 30, 2015.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

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0363-5023/15/4012-0013$36.00/0
http://dx.doi.org/10.1016/j.jhsa.2015.09.017

VOLAR PLATE FIXATION HAS become standard surgical treatment for distal radius fractures. The volar, concave surface of the distal radius is suited to minimize hardware-related complications compared with the dorsal, convex surface.[1] Despite this potential benefit, complications have been commonly reported, including flexor tendon irritation or rupture.[2–14] As a result, many hand surgeons recommend removing the plate if it is prominent or if a patient has symptoms suggestive of flexor tendon

irritation. However, other reasons exist for plate removal, and few data are available to counsel patients undergoing volar plate fixation regarding rates of subsequent hardware removal.

Several investigators have tried to identify risk factors for tendon rupture after volar plate fixation. Soong et al[11] compared 2 commonly used volar plates and assessed the rates of tendon ruptures in a cohort of patients treated with each device. They developed a grading system based on the prominence of the volar plate, which is now commonly used to evaluate plate position after fixation. Kitay et al[8] assessed whether there were differences in plate position in a series of patients who had tendon rupture compared with patients who did not. These studies have made noteworthy contributions to our understanding of how to minimize hardware-related complications after volar plate fixation of distal radius fractures. However, these investigations have not determined the incidence of hardware removal after volar plate fixation.

The purpose of the current study was to determine the incidence of hardware removal in a large cohort of patients treated with volar plate fixation of distal radius fractures. Furthermore, we sought to determine whether the parameters identified by prior investigators as risk factors for tendon rupture were also related to the need for hardware removal. Specifically, we assessed whether plate prominence as indicated by Soong grade[11] or the parameters measured by Kitay et al[8] correlated to hardware removal.

MATERIALS AND METHODS

We obtained institutional review board approval for this study. We searched the surgical database of 5 attending hand surgeons at a single institution from 2009 to 2014 for Current Procedural Terminology codes 25607, 25608, and 25609 to identify all patients who had open reduction internal fixation of a distal radius fracture. All patients who had undergone volar plate fixation were included in the study. Patients were excluded if they underwent an alternate form of internal fixation (dorsal plate, pins, or spanning plate), if they had volar rim fixation with planned hardware removal, if they had not had hardware removed and had less than 1 year of follow-up, or if they could not be reached for follow-up.

We examined postoperative radiographs using a digital picture archiving and communication system (SECTRA, Linköping, Sweden) to determine Soong grade[11] and measure the distance of plate to the critical line (PCL) and distance of plate to the volar rim (PVR) as suggested by Kitay et al.[8] Figures 1 through 4 demonstrate these measurements. The senior authors specifically trained a fourth-year orthopedic surgery resident who was not involved in any of the surgical procedures to perform these measurements. All measurements were obtained by the same resident. A chart review was performed to identify all patients who had undergone removal of hardware, and the reason for plate removal was determined. Timing and need for removal of hardware were based on the discretion of the attending surgeon. For all patients who did not have documented hardware removal at our institution, we placed a follow-up phone call to determine whether they had undergone hardware removal elsewhere.

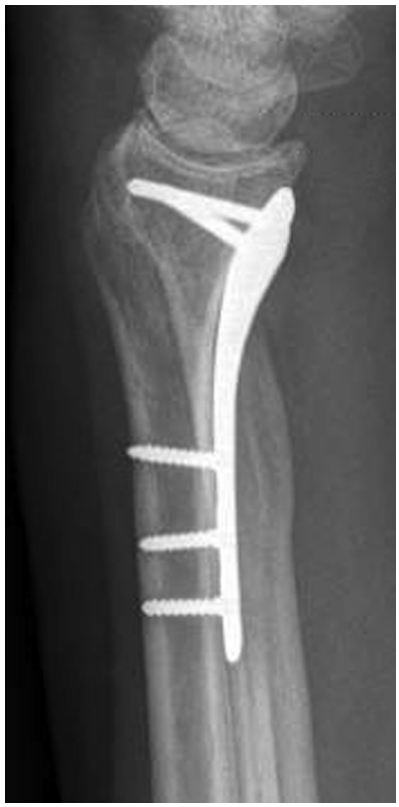

FIGURE 1: Example of a Soong grade 0 plate.

Patients were divided into 2 groups: those with retained hardware (group 1) and those with removed hardware (group 2). Z test for proportions (with continuity correction) was performed to compare each possible pair of removal incidence. To control the overall rate of type I error, P values were adjusted using the Holm-Bonferroni method. $P < .05$ was considered statistically significant. No a priori power analysis was done because all available data were used. Post hoc, based on our results and assuming a 2-tailed Mann-Whitney test with an underlying normal distribution, we had 21% power with the existing sample size.