Case Report

Bridge Plate Failure with Extensor Tendon Injury: A Case Report and Literature Review

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Background. Dorsal spanning plate fixation is an increasingly popular method of fixation for certain distal radius fractures. Published outcomes are encouraging, but complications are still reported. Methods. We present a case report of a 26-year-old woman with spanning plate breakage and extensor pollicis longus (EPL) metallosis, fraying, and near-complete rupture. The patient’s unsuccessful follow-up led to this complication. Metallosis and damage to the extensor indices (EI) and distal extensor carpi radialis longus (ECRL) were intraoperative obstacles for tendon transfer to restore EPL function. Results. Tendon transfer in the setting of bridge plate failure has not yet been described in the literature. There are reports of spanning plate failure indicating that breakage often happens through the plate’s holes and after fracture healing. Conclusions. The compounded complication of plate failure with extensor tendon injury emphasizes the important relationship between the local anatomy, barriers to patient care, and potential problems after spanning plate fixation.

1. Introduction

Tendon injury and hardware failure after dorsal spanning plate fixation are not common, but have been reported as independent complications [1, 2]. We present a case of extensor tendon damage including extensor pollicis longus (EPL) near-rupture in the setting of a retained, broken dorsal bridge plate. Intraoperative findings suggest that hardware breakage led to tendon injury. We review the patient’s presentation, intraoperative findings, and the literature about complications of dorsal spanning plate fixation.

2. Case Report

A 25-year-old, right-hand-dominant woman presented to clinic nine days after she fell from a bunk bed. The patient was otherwise healthy, but had a history of intravenous drug abuse and incarceration. X-rays of the left wrist were taken through a splint applied the day before at another facility (Figure 1). Since this fracture was highly comminuted with small, intra-articular fragments, we elected to restore overall radiographic parameters and relative stability using ligamentotaxis with a 2.4/2.7 mm Synthes dorsal bridge plate. Additional, percutaneously placed K wires offered additional stabilization of the radial styloid and lunate facet (Figure 2). To allow staged hardware removal without multiple trips to the operating room, K wire ends were left outside the skin. The bridge plate was placed with two incisions—one over the index metacarpal and one over the radial shaft. The third dorsal extensor compartment at the level of the wrist was not opened, in contrast to descriptions of others’ technique [3]. However, the plate was visualized deep to extensor tendons in the proximal, radial shaft incision. Full passive finger motion was confirmed after plate placement indicating that the wrist had not been overdistracted. Postoperative X-rays showed improved radial inclination and articular congruity, but residual slight dorsal tilt (Figure 2).

The patient returned regularly for her initial follow-up visits; the two K wires were removed in clinic 4 weeks after surgery. At 4 weeks postoperatively, she was able to extend her thumb at the interphalangeal joint. Plate removal was
discussed with the patient, but unfortunately, she was lost to follow-up and did not return for the next twelve and a half months.

When she returned to clinic more than a year after surgery, she felt a clicking sensation with wrist motion. She estimated that this began three months ago. She was unable to extend her thumb for the past month. She denied any new trauma to the wrist or hand. The plate edges were prominent on physical exam, particularly with wrist flexion. She was unable to extend the distal phalanx of her thumb. X-rays showed that the dorsal bridge plate had broken at the level of the radiocarpal joint, through an empty screw hole (Figure 3). We recommended operative removal of hardware and EPL reconstruction. She did not have a palmaris longus (PL) on physical exam.

In the operating room, we exposed the dorsal bridge plate through the two incisions used for plate placement. We made a third incision over the EPL at the level of the distal radius. We visualized the bridge plate deep to the extensor tendons in all incisions. Metallosis, severe attenuation, fraying, and a near-complete rupture of the EPL tendon was found at the same level the plate was broken (Figure 4(a)). We excised the damaged portion of the EPL tendon (Figure 5). We saw extensive metallosis and damaged-appearing extensor indices (EI) and distal extensor carpi radialis longus (ECRL) tendons over the index metacarpal (Figure 4(b)). We transferred ECRL to the EPL in an end-to-end fashion after resecting the damaged, distal portion of the ECRL tendon (Figure 6).

3. Discussion

Dorsal spanning plate fatigue is reported in the literature, but it is not common. In one series of 62 patients, a single
patient’s bridge plate broke [2]. In a larger study of 144 distal radius fractures treated with dorsal bridge plates, five cases of hardware breakage were reported [1]. In three of those five broken plates, the site of plate fatigue was through an empty screw hole at the level of the radiocarpal joint [1]. Authors have also postulated that a thicker plate of 3.5 mm may

Figure 3: Return to clinic. X-rays on return to clinic, 12.5 months after dorsal bridge plate placement.

Figure 4: Extensor tendon damage. Metallosis, fraying, and near-complete rupture of the EPL tendon, shown on top of the tenotomy scissors (a). Close-up view of the metallosis as well as the distal E1 and ECRL tendon damage over the index metacarpal (b).

Figure 5: Damaged EPL and bridge plate. The excised portion of the frayed EPL tendon is photographed next to the broken dorsal spanning plate. This damaged portion of the EPL tendon was at the level of the broken plate in situ.
soft tissue injury and fracture pattern in
flation in minimizing the risk of bridge plate fatigue. While
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risk for tendon entrapment [5]. However, it is important to
metacarpal versus the long
height. There is also evidence that placement on the index
ulnar deviation and restoration of radial inclination and
the index metacarpal because this assisted with radiocarpal
improves follow-up.
Location of distal plate fixation is yet another consider-
ination in minimizing the risk of bridge plate fatigue. While
soft tissue injury and fracture pattern influence the decision
regarding distal plate placement, studies have shown that
distal fixation to the long finger metacarpal is biomechani-
cally stronger [4]. Our patient’s bridge plate was placed on
the index metacarpal because this assisted with radiocarpal
ulnar deviation and restoration of radial inclination and
height. There is also evidence that placement on the index
metacarpal versus the long finger metacarpal poses a lower
risk for tendon entrapment [5]. However, it is important to
consider that our choice of index metacarpal location for
distal fixation may have placed our patient at increased risk
for plate fatigue.

The second complication in our case is extensor tendon
injury. There are reports of extensor tendon rupture with
dorsal spanning fixation of distal radius fractures. In one
case, rupture of the ECRL tendon occurred with plate
removal [2]. In another case, fracture callus contributed to
rupture of an EPL tendon [1]. Extensor tendon ruptures,
particularly of the EPL, have more commonly been reported
with nonoperative treatment or palmar fixation of distal
radius fractures [6, 7]. Extensor tendon injury can be sponta-
neous, or it can be a result of trauma, fracture callus, or hard-
ware [7–10]. There has not yet been a report in the literature
of immediate tendon transfer for tendon rupture in the set-
ing of a broken bridge plate.

Cadaveric studies support the suspected relationship
between our patient’s hardware failure and EPL injury.
Extensor tendon entrapment during plate placement is
possible [5, 11]. However, this did not seem to be a contrib-
uting factor in our case. Even when tendons are not
entrapped, contact between tendons and hardware occurs.
A study of dorsal spanning plates in 12 fresh frozen upper
extremities fixed both to the index and long finger metacar-
pals showed that all plates were directly touching EPL
tendons [11]. Contact between distal radius fixation and
tendons has a recognized role in both flexor and extensor
tendon injury [12–14]. Although less well described in the
context of spanning fixation, it follows that friction between
a spanning plate and extensor tendons could contribute to
tendon damage. Furthermore, with hardware breakage, the
smooth edges of a spanning plate become sharp and irritating
to nearby tendons. In our case, metallosis and fraying of the
EPL tendon at the same level as hardware fatigue gives
compelling evidence that the two complications were related.

In our patient, additional metallosis and tendon damage
were seen over the index metacarpal. This meant that the
distal portions of the EI and ECRL tendons were not good
candidates for tendon transfer to restore EPL function. We
resected the distal, damaged portion of the ECRL and trans-
ferred the proximal, normal-appearing portion of the tendon
to the EPL in an end-to-end fashion. Other tendon transfers,
for example, from palmaris longus (if present) or an interca-
lary tendon graft are alternative motion-preserving surgical
options. There is no published literature examining the degree of metallosis and potential EI and ECRL tendon damage in patients with retained spanning plates. In our clinical experience, there can be metallosis over the metacarpal, particularly if removal is delayed.

Routine removal of dorsal spanning fixation is recommended after plate placement [2, 15, 16]. In our institution, we remove dorsal bridge plates after fracture consolidation. Thorough education and access to care is necessary for patients to have timely removal of bridge plates. This can be especially challenging in trauma patients with severe wrist injuries in the setting of complex social situations. We caution careful use of spanning internal wrist fixation in patients with psychosocial issues or anticipated difficulty with follow-up. Our case suggests that neglected dorsal spanning plate failure may directly contribute to further tendon complications. In patients who have retained hardware and plate failure, we recommend immediate hardware removal to prevent or halt possible extensor tendon damage.

Ethical Approval

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Consent

Informed consent was obtained from the patient included in the study.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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