Incidence of Peroneal Tendinopathy After Application of a Posterior Antiglide Plate for Repair of Supination External Rotation Lateral Malleolar Fractures

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A R T I C L E   I N F O

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A B S T R A C T

Posterior antiglide plating is widely used to treat lateral malleolar fractures caused by supination-external rotation injuries. Despite its widespread use, this technique can be associated with postoperative peroneal tendinopathy. The purpose of the present observational review was to report the incidence of peroneal tendinopathy after the use of posterior antiglide plating to treat lateral malleolar fractures caused by a supination-external rotation injury. A total of 70 patients were followed up for a minimum of 12 (mean 55, range 12 to 109) months. Bony union was obtained in all cases after a mean of 57 (range 37 to 81) days. The median number of screw holes in the plate was 4.9 (range 4 to 7), and the median number of screws used to fixate the fibula was 6.58 (range 5 to 10). The mean American Orthopaedic Foot and Ankle Society hindfoot-ankle score at the final follow-up examination was 90.8 (range 55 to 100). Clinically, 3 (4.29%) of the 70 patients had lateral or posterolateral ankle pain indicative of peroneal tendinopathy after the index surgery, without any objective evidence. Of the 70 patients, 41 (58.57%) underwent surgical removal of the fibular hardware, 2 (4.87%) because of lateral ankle discomfort. At removal, inspection of the peroneal tendon sheath and/or tendons showed no gross evidence of tendinopathy in any of the patients. We concluded that the incidence of clinically evident peroneal tendon symptoms associated with posterior antiglide plating is low (4.3%), and direct operative inspection revealed no gross evidence of tendinopathy.

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Ankle fracture due to a supination-external rotation (SER) injury is common. The fracture line is located at the distal tibiofibular syndesmosis level (Danis-Weber type B), and propagates from anteroinferiorly to posterosuperiorly. One conventional method used to treat these fractures involves lateral, neutralization plating combined with interfragmentary screw fixation. However, posterior antiglide plating, first introduced by Brunner and Weber (1), is now used frequently, because it provides more rigid fixation and less skin irritation than lateral plating (2).

Various results have been reported in terms of the complications after posterior antiglide plating, including peroneal tendinopathy. Ostrom (3) performed antiglide plating in 32 patients, including those with lateral malleolar fractures because of a SER injury, and reported 4 (12.5%) cases of transient peroneal tendinopathy, Treadwell and Fallat (4) identified peroneal tendinopathy in 2 (2.81%) of 71 cases of posterior antiglide plating used to stabilize Danis-Weber type B lateral malleolar fractures. Lamontagne et al. (5) and Wissing et al. (6) both reported that the results of posterior antiglide plating were not significantly different from those of conventional lateral plating. In contrast to these reports, Weber and Krause (7) found that 30 (43%) of 70 patients who had undergone posterior antiglide plating experienced postoperative discomfort because of peroneal tendinitis, requiring hardware removal. Nine of the 30 (30%) patients who required hardware removal displayed gross intraoperative evidence of peroneal tendinopathy.

The purpose of the present retrospective, observational cohort study was to review cases that had involved the use of a posterior antiglide plate and to report the clinical results, including the postoperative complications, associated with this form of lateral malleolar fracture fixation. We placed a particular focus on the incidence of peroneal tendinopathy experienced during the postoperative observational period.

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Patients and Methods

The institutional review board of the hospital (Samsung Medical Center, Seoul, Korea) approved the present study. Each participant provided informed consent. The review was restricted to patients with posterior tibial plating used for the treatment of a lateral malleolar fracture caused by a SER injury. Potentially eligible cases were identified by an electronic search of our medical records, using the following diagnosis codes from the International Classification of Diseases, 10th revision (World Health Organization, Geneva, Switzerland): S82.5, S82.6, and S82.8. Of 180 patients who underwent operative treatment by a single surgeon (K.S.S.) from April 2004 to May 2012, 124 (68.89%) had Denis-Weber type B ankle fractures due to a SER injury. Of these patients, posterior tibial plating was performed in 89 (71.77%). Of these 89 patients, 5 (5.62%) had emigrated overseas and 1 (1.12%) had died within 1 year of the intervention; therefore, these 6 (6.74%) patients were excluded from the present analysis. Moreover, because of the status of the physio, 2 (2.25%) patients aged <16 years were also excluded. Another 11 (12.36%) patients had a follow-up period of <12 months and were also excluded. Thus, 70 (78.65%) patients with a unilateral lateral malleolar fracture fixated with a posterior tibial plate were included in our analysis. All 70 patients had been followed up for a minimum of 12 (mean 55, range 12 to 109) months after surgery. No patient had bilateral ankle fractures. Of the 70 patients, 34 (48.57%) were adult males and 36 (51.43%) were adult females. Seven (10%) patients had SER 2 injuries with displaced fractures, 10 (14.29%) had SER 3 injuries accompanied by a deltoid ligament injury or medial malleolar fracture was 4.9 (range 4 to 7); 19 (27.14%) fibulas were fixated with a 4-hole plate, 38 (54.29%) with a 5-hole plate, 10 (14.29%) with a 6-hole plate, and 3 (4.29%) with a 7-hole plate. The median number of screws in the antiglide plate that purchased the proximal fibular segment was 2.2 (range 2 to 3), and the number of plate screws used to purchase the distal segment of the fibula was 1.7 (range 1 to 2). The median number of cortices that the screws used to fixate the antiglide plate engaged was 6.6 (range 5 to 10). At the final follow-up examination, the mean AOFAS ankle score was 90.8 (range 55 to 100); 47 (67.14%) patients had a score of ≥90 points, 15 (21.43%) a score of 80 to 89 points, 4 (5.71%) a score of 70 to 79, 3 (4.29%) a score of 60 to 69, and 1 patient (1.43%) had a score of 50 to 59. The Table presents a comparison of the independent variables stratified by outcome (the absence or presence of peroneal tendinopathy).

Results

The cohort consisted of 70 unilateral ankle fractures in 70 patients who had met our inclusion and exclusion criteria. Clinical and radio-logic bony union occurred in all patients at a mean of 57 (range 37 to 81) days. The median number of screw holes in the antiglide plate used to fixate the fibular malleolar fracture was 4.9 (range 4 to 7); 19 (27.14%) fibulas were fixated with a 4-hole plate, 38 (54.29%) with a 5-hole plate, 10 (14.29%) with a 6-hole plate, and 3 (4.29%) with a 7-hole plate. The median number of screws in the antiglide plate that pur- chased the proximal fibular segment was 2.2 (range 2 to 3), and the number of plate screws used to purchase the distal segment of the fibula was 1.7 (range 1 to 2). The median number of cortices that the screws used to fixate the antiglide plate engaged was 6.6 (range 5 to 10). The cohort consisted of 70 unilateral ankle fractures in 70 patients who had met our inclusion and exclusion criteria. Clinical and radio-logic bony union occurred in all patients at a mean of 57 (range 37 to 81) days. The median number of screw holes in the antiglide plate used to fixate the fibular malleolar fracture was 4.9 (range 4 to 7); 19 (27.14%) fibulas were fixated with a 4-hole plate, 38 (54.29%) with a 5-hole plate, 10 (14.29%) with a 6-hole plate, and 3 (4.29%) with a 7-hole plate. The median number of screws in the antiglide plate that pur- chased the proximal fibular segment was 2.2 (range 2 to 3), and the number of plate screws used to purchase the distal segment of the fibula was 1.7 (range 1 to 2). The median number of cortices that the screws used to fixate the antiglide plate engaged was 6.6 (range 5 to 10).

Fig. 1. (A to D) Plain radiographs of a 55-year-old female patient. Posterior tibial plating was performed to treat a supination-external rotation-type lateral malleolar fracture.
Table
Risk factor (exposure) variables stratified by outcome group (N = 70 unilateral fibular fractures in 70 patients)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Peroneal Tendinopathy</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No (n = 67)</td>
<td>Yes (n = 3)</td>
</tr>
<tr>
<td>Age (y)</td>
<td>53 (17 to 81)</td>
<td>51 (44 to 68)</td>
</tr>
<tr>
<td>Sex</td>
<td>Male 33 (49.25)</td>
<td>1 (33.33)</td>
</tr>
<tr>
<td></td>
<td>Female 34</td>
<td>2</td>
</tr>
<tr>
<td>Fracture type</td>
<td>Supination-external rotation 1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Supination-external rotation 2</td>
<td>7 (10.45)</td>
</tr>
<tr>
<td></td>
<td>Supination-external rotation 3</td>
<td>10 (14.93)</td>
</tr>
<tr>
<td></td>
<td>Supination-external rotation 4</td>
<td>50 (74.63)</td>
</tr>
<tr>
<td>Screw holes (n)</td>
<td>5 (4 to 7)</td>
<td>5 (4 to 5)</td>
</tr>
<tr>
<td>Cortices (n)</td>
<td>6 (5 to 10)</td>
<td>7 (6 to 7)</td>
</tr>
<tr>
<td>Hardware removal</td>
<td>No 39 (58.21)</td>
<td>2 (66.67)</td>
</tr>
<tr>
<td></td>
<td>Yes 28 (41.79)</td>
<td>1 (33.33)</td>
</tr>
<tr>
<td>Other complications (except for peroneal tendinopathy)</td>
<td>14 (20.90)</td>
<td>1 (33.33)</td>
</tr>
<tr>
<td>AOFAS hindfoot-ankle score at final follow-up visit</td>
<td>95 (55 to 100)</td>
<td>87 (81 to 98)</td>
</tr>
<tr>
<td>Subjective satisfaction</td>
<td>1, Poor 4 (5.97)</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2, Fair 13 (19.40)</td>
<td>1 (33.33)</td>
</tr>
<tr>
<td></td>
<td>3, Good 16 (23.88)</td>
<td>1 (33.33)</td>
</tr>
<tr>
<td></td>
<td>4, Excellent 34 (50.75)</td>
<td>1 (33.33)</td>
</tr>
<tr>
<td>Follow-up duration (mo)</td>
<td>59 (12 to 109)</td>
<td>28 (28 to 56)</td>
</tr>
</tbody>
</table>

Abbreviation: AOFAS, American Orthopaedic Foot and Ankle Society.
Data presented as n (%) or median (range).

Discussion

Ankle fractures require accurate reduction and rigid fixation because a slight displacement or shortening can lead to the development of traumatic ankle arthrosis (10–13). In general, conservative treatment can be considered for stable fractures with no or minimal displacement; however, operative treatment is recommended for displaced or unstable fractures. Various operative treatments have been introduced, but it remains important to increase the fixation strength and perform ankle range of motion exercises in the early postoperative phase (14). Traditionally, Rush rods with cerclage wiring or lateral plating with conventional tubular plates and interfragmental lag screws have been used; however, wound healing can be delayed with this technique owing to insufficient soft tissue coverage, skin irritation by the underlying hardware, and superficial infection related to wound dehiscence. Moreover, purchase of only the lateral fibular cortex by the screws used to fixate a lateral, neutralization plate, to avoid protrusion of the screw tips into the ankle in the presence of osteoporotic bone, diminishes the strength of the fixation. The use of the antiglide plate avoids this complication without sacrificing the strength of the fixation (15).

Brunner and Weber (1) described fibular fracture fixation using the antiglide plate. Schaffer and Manoli (2) compared the mechanical strength of lateral plating using a tubular plate to that of fixation using a posterior antiglide plate. They found no difference in fixation strength in healthy bones, although posterior antiglide plating showed greater fixation strength in osteoporotic bones (2). In a cadaver study, Minihane et al (16) found that posterior antiglide plating with a short, tubular plate is biomechanically stronger in osteoporotic bone than lateral plating using a long, one-third tubular locking compression plate.

Schaffer and Manoli (2) fixed cadaveric lateral malleolar fractures with 4-hole or 5-hole posterior antiglide plates, and Treadwell and Fallat (4) typically used 5-hole posterior antiglide plates. Lamontagne et al (5) used 5-hole or 6-hole posterior antiglide plates in 86 (81.1%) of 108 lateral malleolar fractures, and Walling et al (17) recommended the use of 5-hole or 6-hole posterior antiglide plating for distal fibular fractures. In the present study, we used 4- or 5-hole plates in 51 (72.9%) of 70 patients and achieved good bony union, although longer (7-hole) plates are usually recommended for lateral plating (18).

Several investigators have reported complications after posterior antiglide plating, including peroneal tendinopathy. Many pathologic conditions can cause pain or discomfort that mimics peroneal tendinopathy, including lateral ankle ligament sprains, lateral talar process fractures, ankle capsular impingement syndrome, distal tibiofibular syndesmotic ligament injury, lateral osteochondral lesions of the talus, subtalar joint pathology, os trigonum syndrome, sural neuropathy, and anterior process fractures of the calcaneus (19). Thus, a careful examination is needed for the proper diagnosis. If swelling, tenderness, and pain are present along the peroneal tendon, and if the pain becomes worse with the pain provocation test, or when peroneal muscle power decreases, peroneal tendinopathy can be suspected. In general, additional imaging studies, such as ultrasonography or magnetic resonance imaging, are not essential to this diagnosis (19), although they can be helpful. In our cohort of patients, it was not precisely clear from the clinical examination findings whether the pain in the lateral aspect of the ankle was caused by the initial surgical insult or by direct posterior plate irritation of the peroneal tendons, although we believed that the findings from the focused examination of the tendons was strongly suggestive of the condition.

Little et al (20) described removal of implants in 8 (7.1%) of 112 patients with symptomatic lateral hardware after posterior antiglide plating for the treatment of SER injuries. Ostrum (3) reported that 2 of 32 (6.25%) patients who had undergone posterior fixation after an ankle fracture experienced transient peroneal tendinitis, and removal of the implants was not necessary. Weber and Krause (7) reported that, in the absence of structural problems, the pain and discomfort experienced after fracture fixation can be vague and the precise etiology difficult to ascertain. They reported that 21 (70%) of 30 patients with no specific structural problems requested implant removal, after which the symptoms generally improved, although pain remained in some cases (7). In our cohort of patients, we removed the hardware when patients reported hardware-related symptoms or requested removal. Of the 70 patients, 41 (58.57%) underwent hardware removal, and no damage to the peroneal tendons or tendon sheaths was found in any of these 41 patients (Fig. 2).

In some studies of the outcomes of operative treatment of ankle fractures, various factors, such as pain, loss of function, deformity, and
decreased ankle motion, have been shown to affect patient satisfaction. Ponzer et al.\(^{(21)}\) used the Olerud Molander ankle score and Short Form-36 Health Survey after operative treatment of type B ankle fractures and found that only 13 (36\%) of 36 recovered completely; 16 (44\%) experienced work-related problems, and 22 (61\%) had some problems with sports activities. Belcher et al.\(^{(22)}\) examined the outcomes of surgery for ankle fractures (excluding highly comminuted fractures and pilon fractures) using the Olerud and Molander score and the University of California, Los Angeles, activity score at 8 to 24 months postoperatively and found significant decreases in these scores compared with those of healthy controls. In our cohort study, patient satisfaction was excellent or good by 52 (74.28\%) of the 70 patients who had undergone placement of a fibular posterior antiglide plate.

Similar to most retrospective cohort studies, our investigation was subject to a number of methodological limitations. We did not routinely perform advanced diagnostic imaging, such as magnetic resonance imaging with contrast enhancement or ultrasonography, to routinely perform advanced diagnostic imaging, such as magnetic resonance imaging with contrast enhancement or ultrasonography, to determine the diagnosis of peroneal tendinopathy. Also, we depended primarily on clinical findings suggestive of peroneal tendinopathy. Finally, the patient satisfaction categories we used have not been tested for inter- and intrarater reliability and, as such, might not have produced valid results.

In conclusion, from our findings in the present report, the incidence of clinical peroneal tendinopathy is rather low (4.29\%, 3 of 70) after placement of a posterior antiglide plate for the treatment of fibular malleolar fractures. This incidence suggests this is an acceptable risk. We believe that sharp periosteal dissection, accurate measurement of the screw length, and the use of a low-profile plate could all contribute to a reduced risk of symptomatic peroneal tendon irritation or injury after ankle fracture repair. We also believe that the use of relatively short, 4-hole or 5-hole plates that do not traversed the peroneal groove or reach the distal tip of the fibular malleolus can further minimize the risk of symptomatic peroneal tendinopathy after open reduction and internal fixation of the fibular malleolus.

References