CHAPTER **33**

Peroneal Treatment Options Following Failed Tenodesis: Two Staged Hunter Rod Technique

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INTRODUCTION

The purpose of this review is to examine the current literature on the surgical management of peroneal tendon pathology. The objectives are to discuss how to evaluate and manage these injuries, and present an algorithm on how to treat them. Surgical techniques and complications are also reviewed.

DIAGNOSIS

The lateral ankle is stabilized by the lateral collateral ligaments and the peroneal tendons. There are two peroneal tendons, the brevis and longus, which function to plantarflex and evert the foot. Acute and chronic ankle sprains can cause peroneal pathology. In order to diagnosis peroneal tendon pathology, the physician must take a good history including new onset versus chronic pain, activity, and position at the time of injury.

The physical examination can present with edema posterior to the malleolus, pain to the lateral ankle, pain with resisted eversion, pain with passive inversion stretch, and pain with plantar flexion. Also check for hindfoot varus and plantar fasciitis. Be sure to palpate the retromalleolar region, the distal tip of the fibula, the peroneal tubercle, cubital tunnel, and styloid process. Tendinitis caused by an overuse injury can manifest in the retromalleolar region. Stenosing tenosynovitis associated with a cavus foot type is palpated at the fibula tip. The peroneal tubercle can cause bony irritation. The cubital tunnel can be associated with os peroneum, associated with peroneus longus injury. The styloid process is associated with insertional peroneus brevis tendinitis. The differential diagnosis should include peroneal tendinitis or tenosynovitis, peroneal tendon subluxation, calcaneal stress fracture, cuboid stress fracture, inversion ankle sprain, avulsion fracture distal fibula, fifth metatarsal base avulsion fracture, and impingement lesions.

First line imaging includes standard plain film radiograph. It is important to evaluate for fibular fracture, hypertrophy of the tubercle, os peroneum, fifth metatarsal base fractures, and styloid process abnormalities. The magnetic resonance image (MRI) has been shown to provide better soft tissue, fine bone detail, and does not radiate the patient. On MRI, check for a low lying peroneus brevis muscle belly, hypertrophic tubercle, and peroneus quartus muscle (Figures 1, 2). Also evaluate for a tear, subluxation, or tenosynovitis.

CONSERVATIVE TREATMENT

Conservative treatment is the first line treatment before surgical intervention is considered. Rest, ice, immobilization, nonsteroidal antiinflammatory drugs, braces, and physical therapy are all appropriate. Use caution with cortisone injections; do not inject directly into the tendon. Once conservative management has been exhausted, surgery may be necessary.

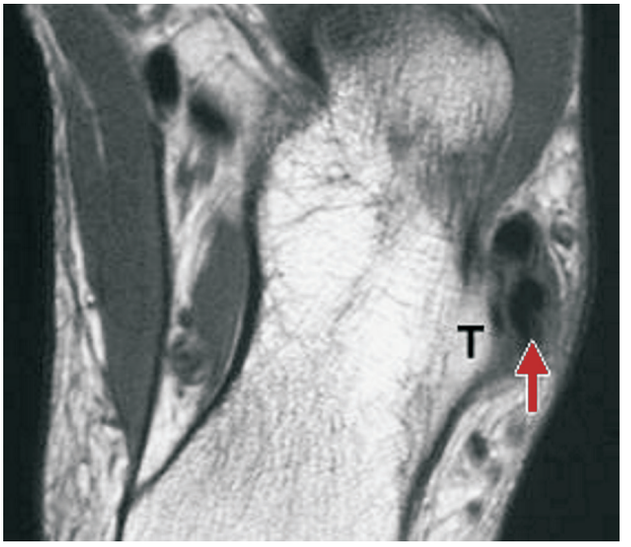

Figure 1. Hypertrophic peroneal tubercle.

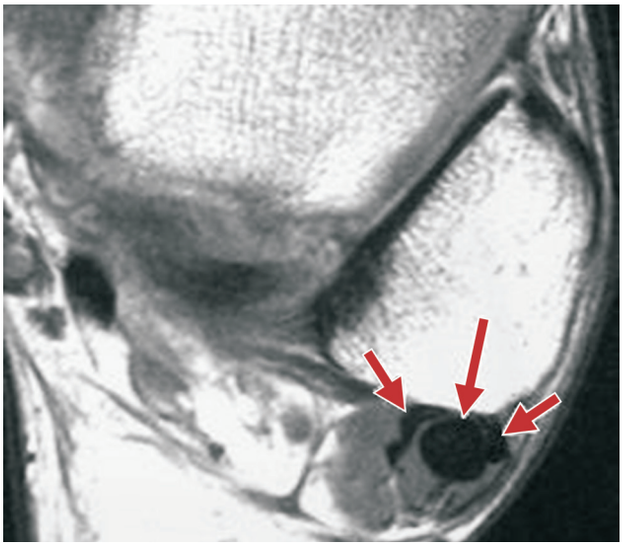

Figure 2. Longitudinal tear of the peroneus brevis.

SURGICAL MANAGEMENT

Peroneal tears can be staged surgically into 3 levels. Level 1 is a longitudinal split without attenuation. The treatment is to excise the longitudinal tear and tubularize the tendon. Level 2 is a longitudinal splint or partial tear with attenuation. The management is to repair the tear and perform a tenodesis. Level 3 is a complete tear in which an allograft or tendon transfer would be the appropriate management.

A longitudinal splint without attenuation is managed with debridement. Tubularization is typically performed if less than 50% of the cross sectional area of the tendon is damaged. If more the 50% of the tendon is torn or if there is severe degeneration, then a peroneus brevis to longus tenodesis can be performed. Various suture techniques exist to perform the tenodesis including end-to-end repair, side-to-side anastomosis, end-weave anastomosis, and fish mouth anastomosis of Pulvertaft (Figures 3,4).

Postoperative protocol includes 3 weeks of nonweight-bearing. Week 1, the patient is nonweight-bearing in a posterior splint or cast. Then week 2 and 3, the patient is nonweight-bearing in a walking boot. The following 3 weeks, the patient is in a protected weight-bearing status in a walking boot or air-cast. During week 4 and 5, physical therapy can be started and is continued twice per week for 6 weeks. At week 6, the patient is transitioned to an athletic shoe. There are no limitations starting around week 9 to10 and the patient can progress then to impact activities.

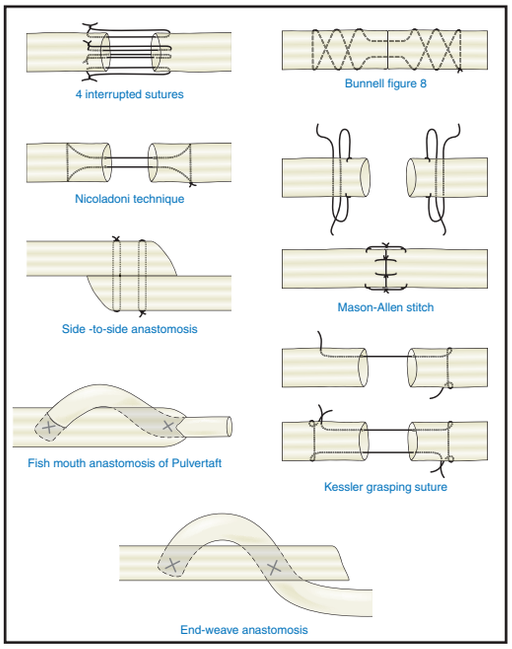

Figure 3. Tenodesis suture techniques.

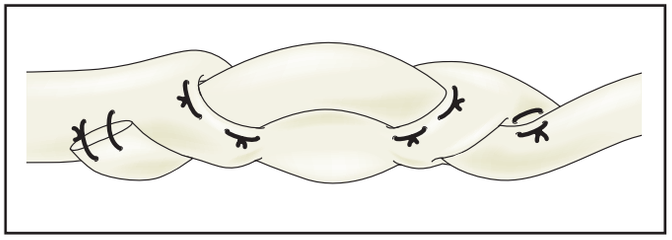

Figure 4. Pulvertaft weave.

If the primary procedure of debridement is not sufficient, a tenodesis is performed. If the tenodesis fails, then the situation is more difficult because there is already loss of part of the tendon. Both tendons may be torn or nonfunctional, adhesions and scarring can be present, and there may be a lack of muscle excursion. At this point, the surgical options are tendon allograft, FDL or FHL transfer, or an acellular dermal matrix allograft.

The most commonly used allograft is the hamstring (semi-tendinous) or peroneal tendon. One possible complication of doing a single-staged procedure with a tendon allograft, is potential scarring down of the tendon. This can affect tendon gliding. There is a technique utilizing a silicone rod in a two-staged procedure to prevent this complication. The Hunter rod technique was originally described by Hunter in 1971 for two-staged reconstruction of tendons in the hand. This can be used as an alternative approach for surgical reconstruction of the peroneal tendons, in patients when repair might no longer be effective. The two-staged surgical technique uses a Hunter rod as a temporary implant to stimulate generation of a healthy peroneal tendon sheath. This sheath is then used to host a FDL or FHL tendon transfer. There is no need for tendon wrap or allograft, therefore, eliminating potential for graft rejection. There is little reported morbidity with autologous graft harvest. This is a successful treatment option for patients with severe peroneal tendon damage and scarring along the peroneal tendon sheath.

HUNTER ROD TECHNIQUE

In the author's experience the patient gives preoperative consent for a peroneal debridement, reconstruction with allograft and possible insertion of Hunter rod for a staged flexor transfer. The decision is made intra-operatively after evaluation of the tendons. Check for scarring and adhesions, tendon hypertrophy, calcifications, and tears. Next check for muscle excursion by grasping the proximal tendon and pulling it distally. If it does not move, it is scarred. The decision is made to not perform allograft if both tendons are nonfunctional and nonviable, there is a lack of muscle excursion, or severe fibrosis and scarring is present.

In the technique, stage 1 consists of debridement of the peroneal tendons, insertion of the Hunter rod and amniotic membrane-umbilical cord (Clarix, Amniox). Insert a 6-mm Hunter rod into the peroneal sheath, and suture the Hunter rod to the remaining peroneus brevis stump distally, typically with absorbable suture (2-0 or 3-0

Vicryl). Leave the Hunter rod free proximally. Next, insert the prepared amniotic membrane . The amniotic membrane with umbilical cord is used because it is a thicker piece of amniotic tissue. The matrix proteins regulate inflammation, prevent scar formation (of the sheath) and reduce fibrosis (so the transferred tendon moves). The membrane promotes regeneration of normal tissue and aids in healing, which reduces wound compromise. The technique for membrane preparation uses a kidney basin as hard surface to cut the membrane into strips. The strips are then inserted under the Hunter Rod. The sheath is repaired, trimming any redundancy, and more tissue is inserted on top of the sheath. Close the subcutaneous layer with 3-0 Vicryl and insert more membrane under the skin prior to final closure of the skin with non-absorbable, 4-0 Nylon (Figures 5-12).

In the interim, the patient is immobilized in a posterior below-knee splint for the first week. Then the patient is nonweight-bearing in a boot until the incision is healed. Sutures are typically removed at 2-3 weeks. The patient can bear weight in the boot for 4 weeks, which allows for active gliding of the tendon, allows the sheath to develop, allows for adequate nourishing lubrication and provides a channel for graft implantation. Possible complications of this technique include skin necrosis, infection, synovitis, rod buckling, rupture of distal end of the implant, and rod migration.

In stage 2, the flexor tendon is harvested and the Hunter rod is exchanged for the flexor tendon. The technique has been performed with both the flexor digitorum longus and flexor hallucis longus tendons. The FHL transfer is more commonly utilized than the FDL. However, the FHL dissection is more difficult due to the deeper dissection and NVB. Both tendons have a similar extent of muscle excursion to the peroneus brevis, near the axis of pull, similar phase muscle, with a similar work percentage. There is adequate length to allow for successful transfer. There is evidence of mild morbidity post-transfer. The flexor tendon is harvested in typical fashion. The Hunter rod is then exchanged for the tendon. The proximal part of the previous lateral incision over the rod is opened. The tendon is identified in the deep compartment at its origin and is pulled into the incision. The tendon is attached to the proximal aspect of the rod. Another incision is made distally over the peroneus brevis stump, leaving the central lateral skin closed. The rod is

Figure 5. Hunter rod, nonviable tendons.

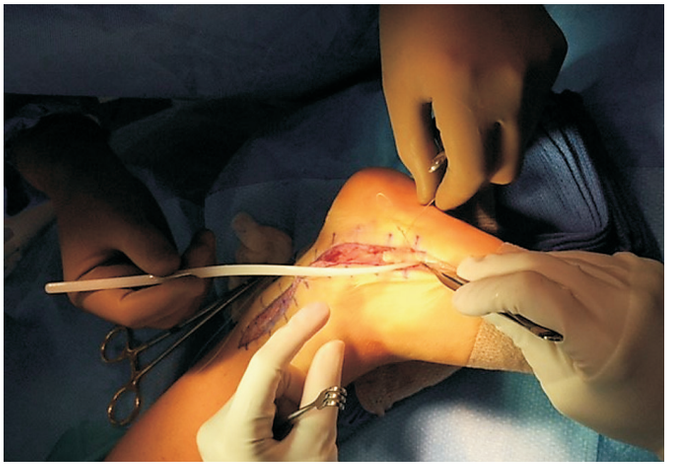

Figure 6. Insertion of the Hunter rod.

Figure 7. The Hunter rod is sutured to the peroneus brevis.

Figure 8. The amniotic membrane-umbilical cord.

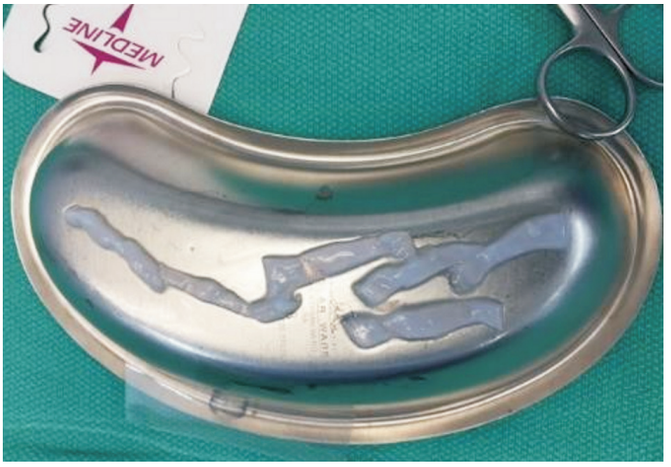

Figure 9. The amniotic membrane cut into strips.

Figure 10. Membrane inserted under the subcutaneous tissue.

Figure 11. Membrane is inserted under the skin.

Figure 12. Final skin closure.

then released from the peroneus brevis stump, the rod is pulled distally, allowing the tendon to slide into the newly formed tendon sheath. The transferred tendon is attached to the remaining stump of the brevis, using a Pulvertaft weave (Figures 13-17).

Postoperative protocol includes a below-knee posterior splint for 1 week. Sutures are removed at 2 to 3 weeks. The patient is then nonweight-bearing in a walking boot for 6 weeks, to allow for healing of the transfer. At the end of 6 weeks, start physical therapy with dorsiflexion and plantarflexion exercises. Then allow for progressive protected weight-bearing in a boot for 2 months, with increased physical therapy focused on strengthening. Then transition to an ankle stabilizing brace for 3 months.

In conclusion, peroneal tendon pathology should be treated conservatively. Once conservative treatment fails, surgery is considered. The surgical treatment algorithm consists of 3 levels. Level 1 is a longitudinal tear without attenuation, in which a debridement and tubularization is performed. If the debridement fails or in the case of level 2, there is a longitudinal splint or partial tear with attenuation, a repair and tenodesis is performed. If this fails or there is a complete tendon tear, a tendon allograft or tendon transfer can be utilized. The highlighted technique is the use of a Hunter Rod for two-staged reconstruction of the peroneal tendons.

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Figure 13. Harvest the FDL (FHL) tendon.

Figure 14. Incision proximal used to attach tendon to the Hunter rod.

Figure 15. Hunter rod attached to the transferred tendon.

Figure 16. Release the Hunter rod from the PB stump and pull distally.

Figure 17. Attach the FDL (FHL) tendon to the PB stump.

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