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Failed treatment of peroneal tendon injuries

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Lateral ankle pain is a common chief complaint of patients who are evaluated by orthopedic surgeons. Lateral ankle sprains are the most common traumatic joint disorder, therefore, other causes of lateral ankle pain may be overlooked [1]. Peroneal tendon disorders are not common; however, if their treatment is neglected or inappropriate, they frequently can cause persistent lateral ankle pain and functional problems. Peroneal tendon injury needs to be high on the differential diagnosis list of patients who are seen with persistent pain after an "ankle sprain."

As with most musculoskeletal disorders, understanding the anatomy and function of the peroneus longus and brevis tendons is paramount to the appropriate diagnosis and treatment of their pathologic conditions. This article helps the reader prevent treatment failures by reviewing the anatomy, function, and common treatment options for various disorders of the peroneal tendons. Finally, a discussion of common treatment failures will highlight pitfalls to be avoided.

Anatomy

The peroneus brevis lies in the lateral compartment of the leg. It originates from the lower two thirds of the fibula and the intermuscular septum and is innervated by the superficial peroneal nerve. There is a long musculotendinous junction with muscle fibers that insert on the tendon starting at midcalf and extending down to, and often past, the level of the lateral malleolus. At the level of the lateral malleolus, the peroneus brevis lies adjacent to a groove on the posterior fibula; it is held there by the peroneus longus tendon and the superior peroneal retinaculum (SPR).

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The peroneus longus muscle also lies in the lateral compartment of the leg. It originates in the calf from the intermuscular septum and the lateral surface of the head and proximal two thirds of the fibula; it is also innervated by the superficial peroneal nerve. The peroneus longus also has a long musculotendinous junction that ends just proximal to the lateral malleolus. The SPR is the structure that is most responsible for holding the tendons reduced.

The peroneus longus and brevis tendons possess a rich blood supply. Each tendon is supplied through separate vincula that arise from the posterior peroneal artery. These vincula penetrate the posterolateral aspect of both tendons throughout their course behind the fibula at the fibular groove [2].

The peroneus brevis tendon lies anterior to the peroneus longus tendon. Both tendons enter the common peroneal synovial sheath approximately 4 cm proximal to the lateral malleolus. The synovial sheath passes through a fibro-osseous tunnel that is stabilized by the SPR, posterolaterally, and by the posterior talofibular ligament, calcaneofibular ligament, and posterior inferior tibiofibular ligament, medially. Anteriorly, it is stabilized by the distal fibula.

The SPR is important in maintaining the stability of the peroneal tendons and prevents subluxation and dislocation. It originates from the lateral aspect of the distal fibula. The insertion is variable; at least five distinct types have been identified [3]. The most commonly identified type (47%) has two bands; the superior band inserts on the anterior Achilles tendon sheath and the inferior band inserts on the lateral wall of the calcaneus at the peroneal tubercle.

After the peroneal tendons pass distal to the inferior portion of the SPR, the tendon sheath bifurcates into separate sheaths beginning at the level of the peroneal tubercle of the calcaneus. The tendons and their sheaths then pass through the inferior peroneal retinaculum approximately 2 cm to 3 cm distal to the tip of the fibula.

The peroneus brevis crosses the cuboid and emerges from its sheath just before inserting onto the base of the fifth metatarsal. The peroneus longus tendon emerges from its sheath and passes inferior to the cuboid in a canal formed by the cuboid groove, superiorly, and the long plantar ligament, inferiorly. After passing inferior to the cuboid, the peroneus longus is enveloped by a second sheath that ends just before the tendon inserts onto the first cuneiform and the base of the first metatarsal, plantarly (Fig. 1).

The os peroneum is a round, accessory bone that is found in the substance of the peroneus longus tendon. It is ossified in approximately 20% of feet [4]. It is located plantar to the cuboid at the calcaneocuboid articulation.

In addition to the peroneus longus and brevis, an accessory muscle in the lateral compartment, the peroneus quartus, may be present in 13% to 22% of the population [5]. The peroneus quartus usually originates from the peroneus brevis and inserts on the peroneal tubercle of the calcaneus (Fig. 2).

The peroneus longus and brevis function as plantar flexors and evertors of the foot. These muscles act to balance the forces of the tibialis posterior, flexor hallucis longus, and flexor digitorum longus tendons. These muscles are relatively weak ankle plantar flexors, but contribute a significant amount of

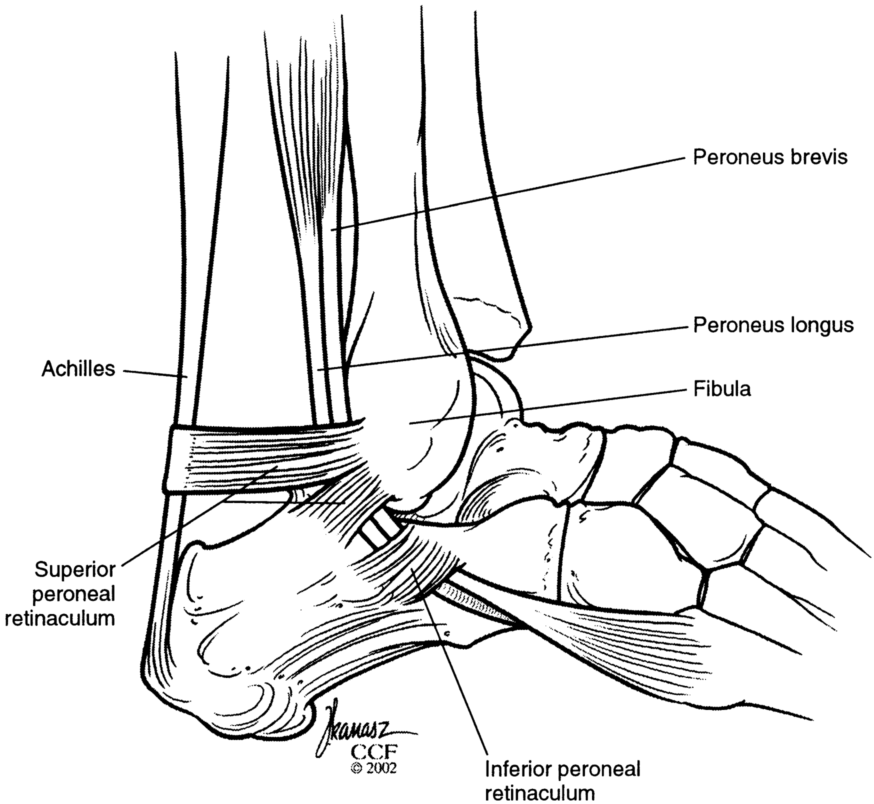

Fig. 1. Normal anatomy of the lateral ankle.

force to the work of hindfoot eversion. The peroneus longus also plantarflexes the first metatarsal, whereas the peroneus brevis functions as the strongest abductor of the forefoot. The peroneal muscles work in concert as stabilizers of the foot during ambulation, particularly during the last portion of the stance phase. They also offer dynamic support to the lateral ankle ligament complex.

Peroneal tendon injuries and their common treatment

Peroneal tendinitis

Peroneal tendinitis often is the result of prolonged or repetitive activity, especially after a period of relative inactivity; also, it may be the result of direct trauma, chronic lateral ankle instability, displaced ankle or calcaneal fractures, or severe ankle sprains. In addition, anatomic factors may lead to stenosis within the tendon sheath and predispose the patient to this condition. These factors may include the presence of a peroneus quartus muscle, hypertrophy of the peroneal

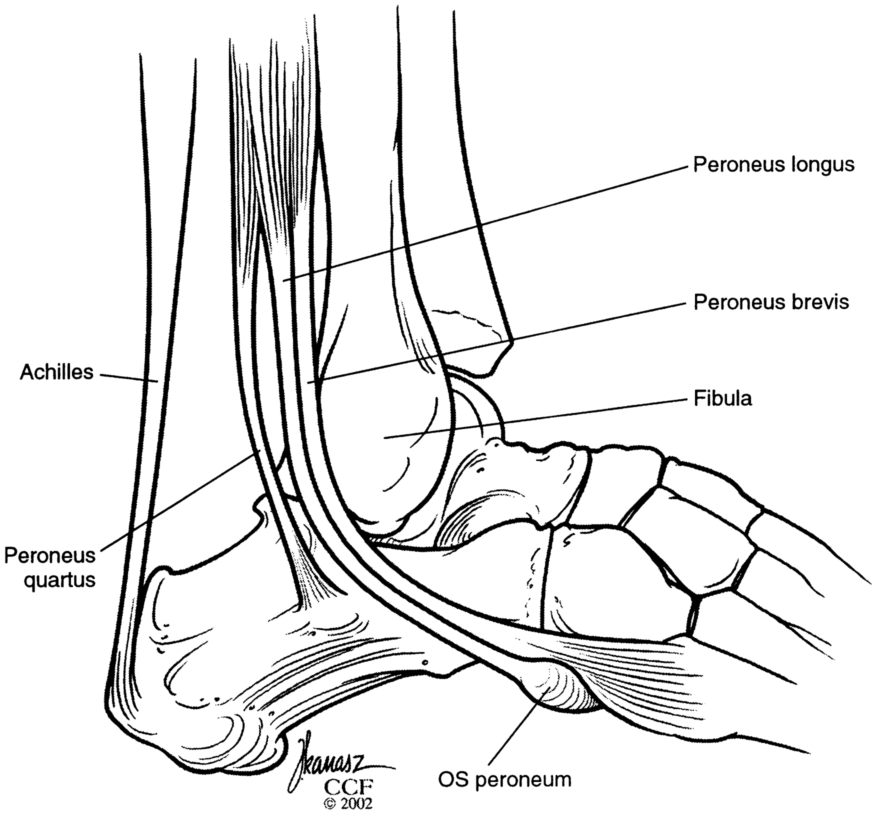

Fig. 2. Anatomic variables of the lateral ankle.

tubercle with or without an enlarged os peroneum, or a low-lying peroneus brevis muscle insertion. Peroneal tendon disorders are also associated with a varus hindfoot or cavus foot type. Peroneal tendinitis is defined as acute if present for less than 2 weeks, subacute if present for 2 to 6 weeks, or chronic if present for more than 6 weeks.

Patients with acute tendinitis present with pain posterior or distal to the lateral malleolus, usually within 2 days of injury. Often this is seen in athletes who have begun an exercise regimen or who have increased the intensity of their workouts in preparation for an upcoming event. Radiographs reveal no abnormality, but are useful for excluding fracture. Pain is magnified by passive plantar flexion and inversion or by active resisted dorsiflexion and eversion. On examination, swelling along the course of the peroneal tendons is a hallmark of tendinitis.

Chronic tendinitis develops over the course of weeks to months and is the result of overuse. Swelling and pain is often less severe than is seen in patients with acute tendinitis. Tenosynovitis may be a precursor to longitudinal tears within the tendon. Diagnostic injections of local anesthesia into the tendon sheath can help distinguish peroneal tendinitis from other causes of lateral ankle pain.

The results of this injection, however, can be confusing if the anesthetic extravasates from within the tendon sheath. Simultaneously injecting contrast under fluoroscopic visualization can restrict the localization of anesthetic to within the tendon sheath [6]. In cases that are difficult to diagnose, or in those cases that must be differentiated from associated lateral ankle injuries, MRI may be helpful [7]. MRI that demonstrates fluid accumulation on T2 images within the tendon sheath is indicative of peroneal tendinitis.

Treatment of peroneal tendinitis consists of rest, ice, compression, and elevation. NSAIDs are often prescribed to reduce inflammation. After symptoms subside, the patient is gradually allowed to return to activity and is educated about the importance of proper stretching and warm-up exercises. Taping of the ankle or the use of an ankle brace during vigorous activity is recommended. For more difficult cases, immobilization in a short-leg cast, ankle foot orthosis, or a walking boot for 6 to 12 weeks may be helpful. For cases that are refractory to nonoperative management, surgery may be considered. Surgical debridement and tenosynovectomy, along with correction of any associated anatomic or biomechanical disorders, often provide excellent clinical relief.

Peroneal tendon tears

Because the peroneus brevis is located in the fibular groove posterior to the lateral malleolus and anterior to the peroneus longus tendon, it predisposes the tendon to impingement in the fibular groove, which may lead to tendon tears. The incidence of peroneal tendon tears was studied in cadavers by Sobel et al [8,9] and was found to be between 11.3% and 37%. These longitudinal peroneus brevis tears consistently begin within the posterior fibular groove which indicates that the tears are most likely due to mechanical trauma (acute or repetitive). Acute or chronic conditions, as well as anatomic factors, can lead to incompetence of the SPR and its ability to restrain the peroneus brevis behind the sharp posterolateral edge of the fibula. Injury to the SPR can elevate its attachment off the periosteum of the fibula, thereby allowing the anterior edge of the peroneus brevis to subluxate forward over the fibula. Thus, the pull of the peroneus longus with eversion of the foot compresses the peroneus brevis at the fibular groove. The flattened peroneus brevis tendon then splays out, with the anterior portion of the tendon slipping forward out of the groove and over the sharp posterior edge of the fibula. This permits the initiation, propagation, and persistence of peroneus brevis tears (Fig. 3) [10].

Other factors that contribute to peroneal tendon splits include tenosynovitis, peroneus longus or brevis hypertrophy, anomalous distal insertion of the peroneus brevis muscle belly, and the presence of a peroneus quartus tendon. This leads to overcrowding of the peroneus tendon sheath and fibular groove and predisposes to subluxation or dislocation. Also, the anatomy of the posterior ridge of the fibula may be a factor. The presence of a sharp posterior ridge, as opposed to a blunt or rounded edge, enhances the ability of the fibula to split the peroneus brevis tendon.

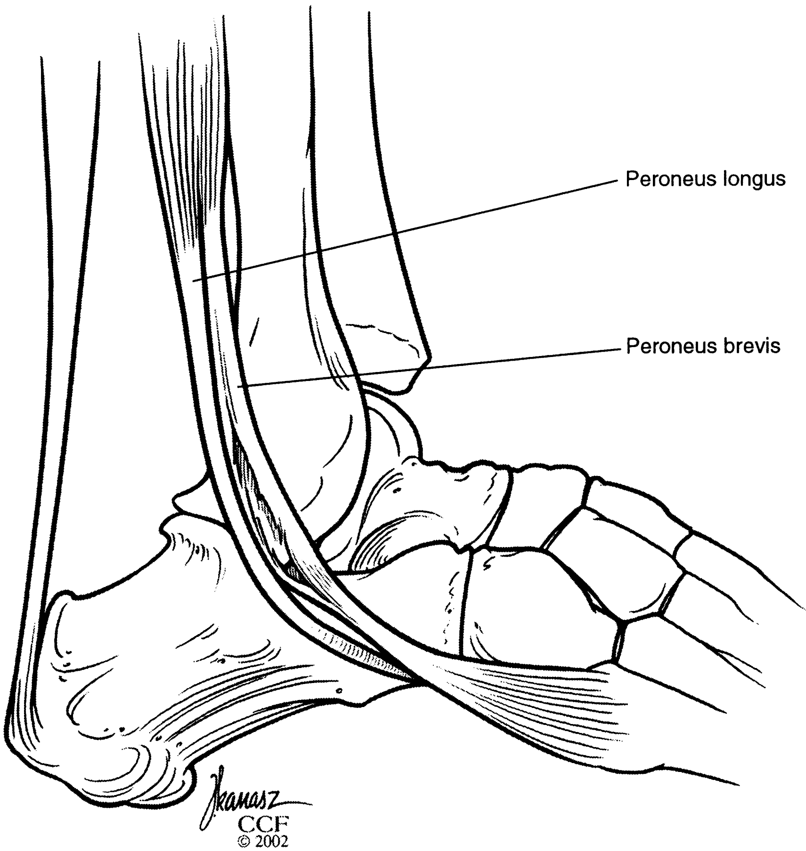

Fig. 3. Anatomy of peroneal brevis tendon tear.

Symptoms of peroneal tendon tears include the insidious onset of lateral ankle pain. Patients with associated ankle instability seem to have pain that is out of proportion to the level of instability. Clinical swelling over the peroneal tendons is the most consistent clinical finding and is present in as much as 90% of patients with peroneal tendon splits. Tenderness over the tendons and pain with resisted eversion are also common findings. These findings may be seen in patients with tenosynovitis in the absence of tendon tears, but the presence of swelling is indicative of a more florid synovitis as seen with a torn tendon. MRI may be a helpful diagnostic tool in equivocal cases.

Treatment of peroneal tendon tears is largely surgical. Conservative treatment consisting of NSAIDs and immobilization in a short-leg walking cast or removable cast boot is largely disappointing. Krause and Brodsky [11] proposed a simple classification system to help guide surgical treatment of peroneus brevis tears. After a synovectomy and debridement of nonviable tissue, the remaining tendon was graded based on the amount of cross-sectional area that was still present. If 50% or more of the tendon was viable and remained after debridement (grade 1) the tendon was repaired longitudinally with an absorbable suture. If less than 50% of viable tendon remained after debridement (grade 2), the tendon was resected in the area of damage and a tenodesis to the peroneus longus tendon was performed proximally and distally with absorbable suture. Absorbable suture is used to avoid chronic irritation in the tendon sheath. To avoid fibular impingement, the proximal tenodesis is placed at least 3 cm proximal, and the distal tenodesis at least 5 cm below, the tip of the lateral malleolus. The fibular groove should also be inspected. If the groove is shallow, flat, or convex, then the groove should be deepened. Finally, the SPR should be advanced to prevent further tendon subluxation. Postoperatively, the patient should be immobilized in a short-leg cast for 4 to 6 weeks, followed by 2 to 4 weeks of additional immobilization in a removable, walking cast boot.

Peroneal tendon dislocation

Monteggia [12] originally described a peroneal tendon dislocation in a ballet dancer in 1803. These injuries are frequently misdiagnosed as ankle sprains. Anatomic variations may predispose a patient to dislocation of the peroneal tendons. Laxity of the SPR was secondary to calcaneovalgus feet [13], or acquired secondary to trauma or neuromuscular disease (Figs. 4, 5) [14]. The peroneal retinaculum may also be congenitally absent [15]. The presence of an anomalous bifid peroneus brevis may lead to recurrent dislocations [16]. A convex or flat fibular groove may also be a contributing factor. Although these anatomic variants may predispose a patient to peroneal tendon dislocation, none of these variants is required to be present.

Traumatic dislocation of the peroneal tendon was described in association with a variety of activities. During the injury, the peroneal muscles contract reflexively and overcome their fibro-osseous sheath. The foot is usually in the position of

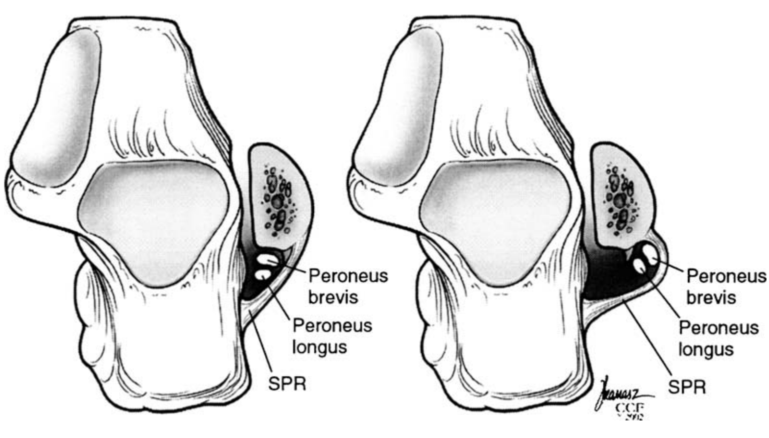

Fig. 4. Attenuated SPR leading to peroneal tendon subluxation/dislocation.

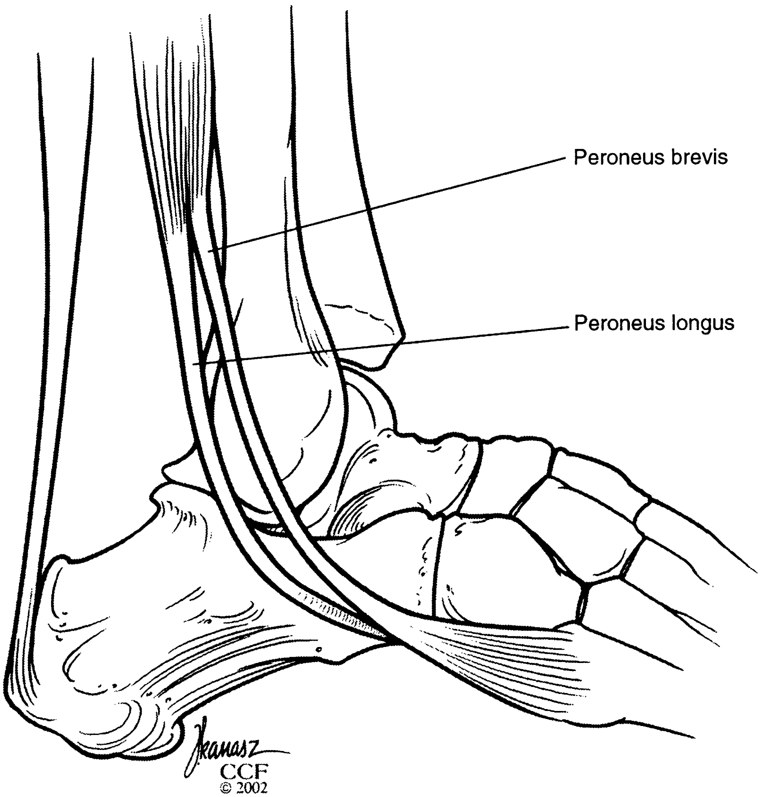

Fig. 5. Peroneal tendon dislocation.

dorsiflexion and eversion. This places the tendons at maximal tension and mechanical advantage to allow for soft tissue rupture. This mechanism of injury can produce concomitant injury, including lateral ankle instability, fracture of the lateral process of the talus, Achilles tendon rupture, and ankle fracture with posterior tibial tendon subluxation [17].

Diagnosis of subluxating/dislocating tendons differs depending on the chronicity of the lesion. In the acute setting, the diagnosis may be obvious, but often it is obscured by spontaneous reduction of the tendons with resulting hemorrhage and edema [18]. A high index of suspicion is necessary. The patient may report that a snap was heard during the injury. There will be significant swelling and tenderness along the sulcus of the distal fibula and on the lateral malleolus. Active eversion with the ankle dorsiflexed reproduces the pain. Recurrent dislocation is not tolerated in the acute setting, and is a rare clinical finding. Examination of the other foot should be performed to detect predisposing factors for dislocation.

In patients with chronic subluxation or dislocation of the peroneal tendons, the presenting complaint is often lateral instability or painful snapping of the lateral ankle with activities. On examination, crepitance may be palpable along the course of the peroneal tendons. Active eversion in dorsiflexion may dislocate the peroneal tendons, which is more tolerable than forced subluxation of acutely injured tendons. Concomitant lateral instability indicates that the ankle ligaments, in addition to the SPR, are injured.

The role of nonoperative treatment of peroneal dislocations remains controversial. Numerous studies have been published that described various treatment modalities ranging from a short-leg, nonweight-bearing cast to simple, soft compression dressings. The overall results were disappointing. The best results were achieved by Stover and Bryan [14] who casted eight patients with acute dislocations in slight plantarflexion to facilitate tendon reduction. Five casts were nonweight bearing and were left in place for 6 weeks. All had excellent results. One patient was immobilized for only 2 weeks and had recurrent dislocations that required surgical repair. The other two patients had walking casts. One of these was lost to follow-up, whereas the other had recurrent dislocations that required surgical repair. Therefore, if nonoperative treatment is to be attempted for an acute peroneal tendon dislocation, a short-leg, nonweight-bearing cast that is left on for 6 weeks is recommended. Although many investigators recommend attempting nonoperative treatment first, many others recommend surgical repair for acute injuries [19,20] because of the high failure rate of nonoperative treatment and the greater difficulty that is associated with treating old injuries.

Surgical treatment of the acute dislocation has yielded excellent long-term results. For acute injuries without avulsed bony fragments, the most commonly reported method is reefing of the SPR with or without deepening of the fibular groove [21–26]. When the acute injury includes an avulsed rim of cortical bone from the insertion of the SPR, the fragment should be openly reduced and internally fixated.

Unlike the acute injury, symptomatic, chronic dislocations must be treated surgically. Numerous procedures have been described, but they fall into three main categories: bony procedures to deepen the peroneal groove, rerouting of the tendons, and soft tissue repair/reconstruction of the peroneal retinaculum.

The most common method of rerouting the peroneal tendons involves substituting the calcaneofibular ligament for the incompetent SPR. Steinbock and Pinsinger [27] described their results from using this method. At a minimum follow-up of 1.8 years, there were no recurrent dislocations in 13 feet in 11 patients. All had excellent results except two feet (on one patient) that had a good result because of occasional pain.

Deepening of the peroneal groove can be accomplished in two ways. The first is by using a bone block, that is created from the distal fibula, to obtain coverage and containment of the peroneal tendons as described by Kelly [28], and later modified by Duvries [29] and Watson-Jones [30]. A deeper groove is created, but the potential for hardware and graft-related problems exist. Alternatively, the fibular groove can be deepened by raising a flap of bone with a medial hinge from the posterior fibula. The cancellous bone underneath is then removed, and the flap is reinserted in the deepened bed. Zoellner and Clancy [31] used this procedure in 10 patients and all achieved excellent results.

Soft tissue reconstructions may involve direct repair of the retinaculum if it is torn as in acute cases, or may involve using transplanted local tissue to reconstruct a new retinaculum. If the SPR is attenuated, but not torn, it may be repaired by reefing the retinaculum. The outer surface of the lateral malleolus is decorticated, and the retinaculum is tacked down through drill holes or small suture anchors. Das De and Balasubramanian [32] reported on their series of seven patients using this technique. Six patients returned to sports and one had mild restriction of ankle movement and did not return to sports [32].

If the SPR cannot be stabilized by direct repair, then local tissue must be transplanted to reconstruct the incompetent structure. The classic procedure was described by Jones [33]. This procedure involves fashioning a tendon slip from the tendoachilles and leaving the calcaneal insertion intact. This tendon slip is inserted on the lateral malleolus to recreate the SPR. Other tenoplasties were described in case reports, including the use of a plantaris sling [34] or a portion of the peroneus brevis itself [35]. If accessory tissue is present, such as a bifid peroneus brevis [36] or peroneus quartus [37], it may be used as well. Using accessory tissue obviates the sacrifice or weakening of normal tissue that is used for routine function of the foot and ankle.

Finally, when a peroneal tendon dislocation occurs in conjunction with ankle instability, the peroneal retinaculum can be reconstructed by modifying procedures that are designed to augment the lateral ankle ligaments. Sobel et al [38] reported excellent results using a modified Chrisman-Snook procedure.

Failure of peroneal tendon treatment

One of the most common reasons why patients present to an orthopedic surgeon is for the evaluation of lateral ankle pain after trauma. Although a lateral ankle sprain can frequently be the source of symptoms, lateral ankle pain and swelling can present a difficult clinical problem with several causes. Peroneal tendon injuries are often overlooked as a cause of pain. When treating patients with peroneal tendon injuries, many complications may arise.

The most common complication of treating peroneal tendon injuries is failure to make the proper diagnosis. Often patients with lateral ankle pain and swelling are diagnosed as having a lateral ankle sprain and are treated as such. This often leads to a delay in the diagnosis and treatment of a peroneal tendon disorder. Persistent inflammation may progress from peroneal tenosynovitis to peroneal tendon rupture which limits the benefit of nonsurgical treatment options. When evaluating patients with lateral ankle pain, the differential diagnosis should be considered. This includes lateral ankle sprains and peroneal tendon injuries, as well as joint disorders, instability, and fractures (Box 1).

After the correct diagnosis is made and conservative treatment has failed, surgical intervention may be warranted. In addition to the customary risks of surgery, there are many potential pitfalls that are specific to peroneal tendon

Box 1. Differential diagnosis of lateral ankle pain

- Lateral ankle sprain
- Lateral ankle instability
- Peroneal tendon disorders
- ''Sinus tarsi'' syndrome
- Degenerative arthritis of the subtalar joint
- Degenerative arthritis of the ankle joint
- Anterior ankle soft tissue impingement
- Osteochondritis dessicans of the talus
- Ankle joint osteophyte or loose body
- Lateral malleolar fracture
- Lateral talar process fracture
- Anterior process of the calcaneus fracture
- Cuboid fracture
- Painful os peroneum
- Traction neuroma of the sural nerve
- Traction neuroma of the superficial peroneal nerve
- Lumbar radicular pain

surgery. Careful preoperative planning and knowledge of common problems that lead to failure of treatment can help to avoid complications.

Before any surgery, a complete physical examination of the patient should reveal any hindfoot alignment disorders (calcaneovalgus or varus) that may also need to be surgically addressed. A significant hindfoot varus that is not corrected at the time of a surgical repair of a peroneal tendon disorder may lead to persistent ankle and hindfoot inversion instability and a recurrence of peroneal tendon pathology. One should not overlook the benefits of orthotic management of foot alignment disorders in the pre- or postoperative treatment of peroneal tendon disorders.

When planning a surgical approach to the peroneal tendons, knowledge of the anatomy is crucial. One of the most common mistakes is incising the skin along the course of the sural nerve. Transection or incisional entrapment of the nerve may result in painful neuromas and lateral foot and ankle sensory loss. The nerve is typically located midway between the lateral malleolus and the Achilles tendon in the retromalleolar area. If it is incidentally damaged at the time of surgery, the sural nerve should be transected, and the proximal stump should be implanted deep into the peroneal muscle belly (Fig. 6).

After a careful incision is made and the peroneal tendon sheath is carefully exposed, the sheath and SPR must be identified and released to visualize and inspect the peroneal tendons. Placing suture tags on the cut ends of the retinaculum will help identify it for later closure. Only when complete exposure has been accomplished can the underlying pathology be addressed. When addressing the primary disorder, one must be careful to inspect for other

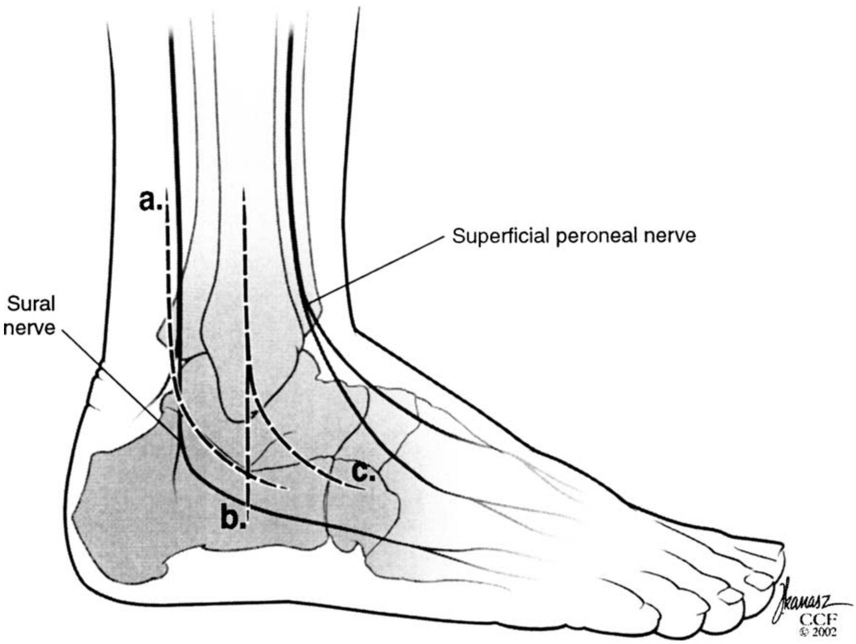

Fig. 6. Surgical approach for exposure of peroneal tendons. (a, *b*) sural nerve is at risk for injury. (*c*) preferred incision.

associated pathology or anatomic variants. Failure to do so may result in continuing lateral ankle pain. Associated pathologies that are often missed at the time of surgery include a hypertrophic peroneal tubercle; a painful os peroneum; extra contents present in the peroneal sheath; such as a peroneus quartus or a low-lying peroneus brevis muscle belly; and a peroneus brevis or longus split. Instability of the ankle may be the underlying cause of the peroneal pathology and must be addressed at the time of surgery. Failure to do so will certainly lead to incomplete relief of pain or persistent instability.

Peroneal tendon tears are typically degenerative in nature and often are not repairable. In addition, if the peroneals have already been repaired, a revision repair is nearly always fruitless. We agree with tendon transfer and tenodesis techniques as described by Krause and Brodsky [11] and others to salvage these segments of tendinosis. Proper side-to-side tendon suture techniques should be used to prevent postoperative complaints of a painful mass effect secondary to suture knots or tendon bunching. Avoidance of a tenodesis within the fibular groove is essential to prevent stenosis or subluxation. There have been anecdotal reports of lesser metatarsal stress fractures and dorsal bunion deformities when the peroneus longus is transferred to the brevis; however, the senior author has not seen these in his patients. It is hoped that further biomechanical testing of the effects of peroneal tendon transfers will support their usefulness in these procedures. Losing the first ray plantar flexion component of the peroneus longus should benefit patients with cavovarus foot deformities. Maintaining strong, active hindfoot eversion in our patients with lateral ankle problems is an achievable goal when treating disorders of the peroneal tendons with tendoesis techniques.

If peroneal tendon subluxation/dislocation is the primary disorder that is being addressed, then fibular grooving is often part of the surgical treatment. Larson et al [39] reported a 31% complication rate in their series [39]. Common complications included fracture of the lateral malleolus, intra-articular screw placement, loose screws, and painful hardware. When addressing peroneal tendon subluxation surgically, one needs to decide if a soft tissue reconstruction alone will achieve adequate stability, or if a fibular grooving procedure needs to be added. A direct visualization of the peroneal groove is essential; if it is noted to be flat or convex, then fibular groove deepening should be performed. Axial cuts on a preoperative CT scan can help to better define this anatomy. We recommend the fibular grooving procedure as described by Zoellner and Clancy [31]; it reproduces the desired "normal" anatomy with the least amount of surgical morbidity. Avoiding rerouting and bone block procedures, if possible, lessens the risks of hardware failures, nonunions, fractures, and tendon stenosis [39]. Use of a tendon slip of the Achilles to reconstruct a SPR, as described by Jones [33], led to a painful equinus contracture in one of the senior author's referred patients. Overtightening and scar contracture probably contributed to this complication, and required a take-down of the scar with tendoachilles lengthening.

Another troubling complication is recurrent subluxation/dislocation in the postoperative period. This is often the result of incomplete or failure of the repair of the SPR, or a failure to recognize subluxation as part of the initial preoperative diagnosis. We routinely advance or imbricate the SPR during the closure of the peroneal tendon sheath, regardless of the index surgical procedure. Raising a periosteal flap to support the retinacular repair is helpful; preventing dorsiflexion-eversion stresses to the ankle for at least 6 weeks postoperatively can prevent this discouraging complication.

Adding a triplanar calcaneal osteotomy (modified Dwyer procedure) to peroneal tendon reconstructive surgery may be necessary to correct a significant hindfoot varus. These combined procedures can cause skin flap necrosis or sural nerve injuries. Using one incision along the course of the sural nerve may be the best surgical approach to carefully identify the nerve and protect it with rubber loops and surrounding fat. Working on both sides of the nerve will be necessary to perform the osteotomy and dissect out the peroneal tendons. Alternatively, two incisions could be used, but one must use caution to preserve a generous skin bridge and not undermine thin flaps. Any surgical dissection of the peroneal tendons should be done with care and attention to the skin and subcutaneous tissues. There is little subcutaneous fat and muscle in the region to protect underlying bone and tendon structures. Postoperative wound necrosis may require local or free-flap coverage to preserve functional underlying tissue and prevent limb-threatening infections.

As with any elective orthopedic surgical procedure, preoperative associated conditions may be contraindications to a surgical approach. If possible, one should avoid reconstructive surgery in patients with local ongoing infections, vascular compromise, or a loss of protective sensation, (eg, diabetic peripheral neuropathy). Patients with congential hyperelasticity (eg, Ehlers Danlos, Marfans) should obtain preoperative cardiac clearance and be warned of a significant recurrence rate when treating tendon or ankle instability disorders. Because of local epidermolysis problems, the senior author has discontinued the use of steristrips and benzoin as part of the wound closure in these patients.

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