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Case report

Allograft reconstruction of *Peroneus longus* and *brevis tendons* tears arising from a single muscular belly. Case report and surgical technique

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ABSTRACT

Anatomic variants of the peroneal tendons may cause tendon disorders. Moreover, there is a lack of evidence on how to address chronic tendon pathology when a variant of the peroneal tendons is causing the patient's symptoms. We present a patient with an uncommon peroneal muscle presentation: a single muscular belly dividing into both the peroneus longus and brevis tendons. After extensive debridement of tendinopathic tissue, primary repair or tenodesis was not possible; therefore a unique solution for this problem was performed, reconstructing both peroneal tendons using a semitendinosus allograft.

1. Introduction

Anatomic variants of the peroneal tendons may cause tendon disorders. A low-lying peroneus brevis muscle belly [1,2] or a peroneus quartus [3] can crowd the retromalleolar space and attenuate the superior peroneal retinaculum, leading to tendon pathology [4,5].

Multiple variations of the lateral peroneus muscles have been described in the literature leading to a considerable confusion [6–8]. Although controversial, several authors [6,7] have attempted to classify this problem into a broad category under the name of peroneus digiti quinti. They proposed that this muscle may have two forms of presentation: complete, when its insertion is in the fifth toe; and incomplete, when its insertion lays somewhere between the lateral malleolus and the fifth metatarsal bone [9]. Classic description of the peroneus quartus muscle inserting in the lateral surface of the calcaneus fits into this latter group [10,11]. The peroneus quartus typically originates from the peroneus brevis and inserts into the retrotrochlear eminence of the calcaneus. The reported incidence of this muscle is between 13.9 and 21.8% [12] in cadaver specimens.

Although there are numerous anatomical descriptions, there is a lack of evidence on how to address chronic tendon pathology when a variant of the peroneal tendons is causing the patient's problem. Therefore, we present a patient with an uncommon peroneal muscle variant and a unique solution for this problem.

2. Case presentation

A 35-year-old active female patient presented to the office complaining from right lateral ankle pain and a sensation of giving-way during the past 24 months. At that moment, she was unable to exercise or ambulate for prolonged periods of time.

She had a history of prior ankle sprains to her right ankle and one remarkable acute injury, 2 years prior to the visit, of falling from a skateboard. However, any history of fracture was denied. Since this event, she had developed multiple episodes of right ankle pain and instability, which appeared to be an acute over a chronic ankle injury. Recurrent sprains with effusion followed several times a week, frequently with minimal activity, such as pivoting on the right foot. Moreover, the patient had never had any formal physiotherapy.

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A normal gait pattern was observed and no hindfoot or forefoot malalignment was appreciated during physical examination. She presented with moderate edema in the anterolateral region of the ankle, painful when examined. Direct palpation over the peroneal tendons and the posterior region of the deltoid ligament elicited severe tenderness as well. Full range of motion from the tibiotalar, subtalar and first metatarsophalangeal joints was obtained bilaterally, however plantarflexion of the right ankle joint was painful. Eversion testing produced pain, without subluxation of the peroneus tendons. No crepitation or contractures were present. Bilateral anterior drawer test was present in plantarflexion but negative in neutral during testing maneuvers.

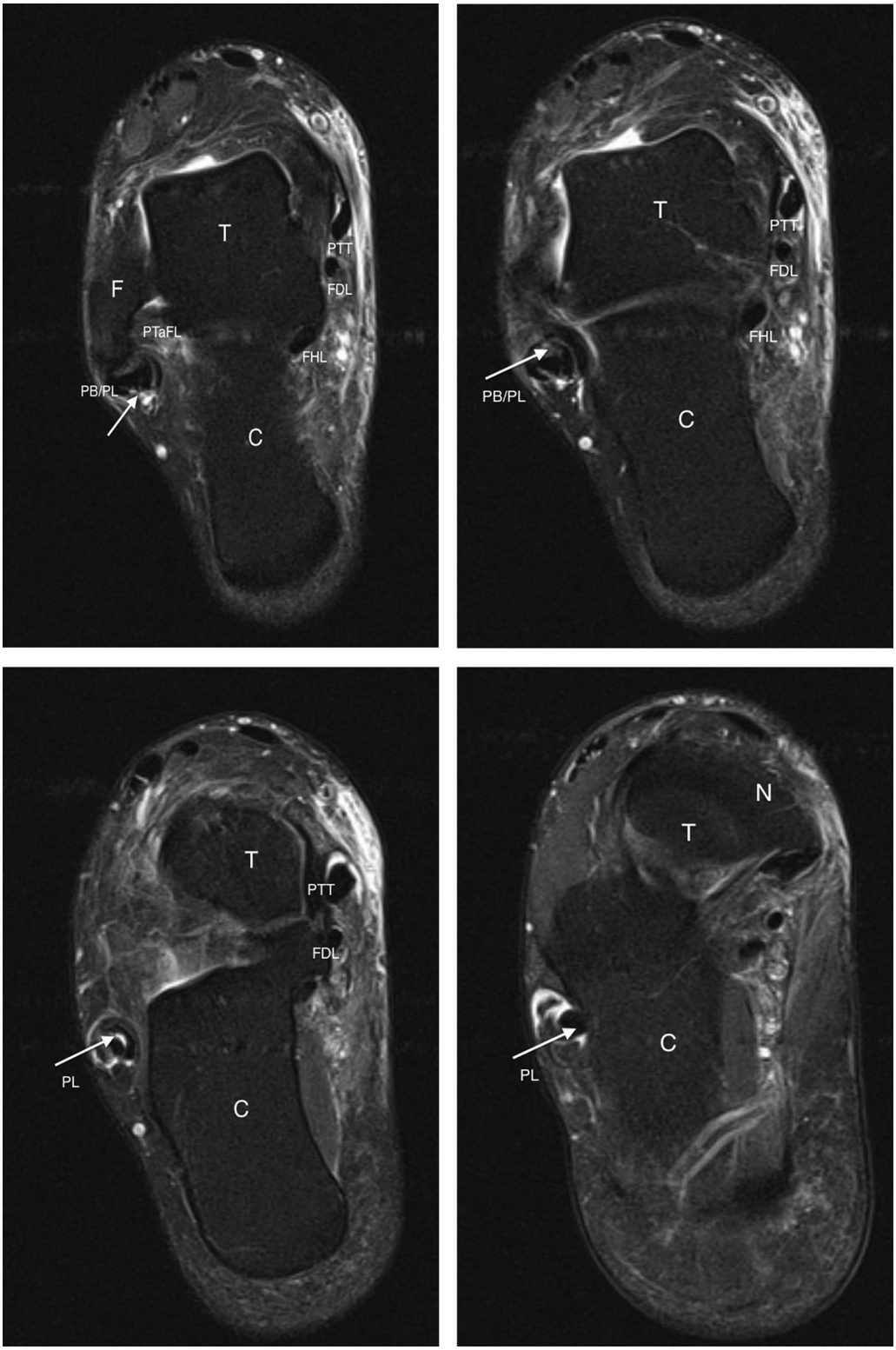

Fig. 1. (A–D) T2 weighted axial MRI images demonstrating extensive tearing of both peroneal tendons, with tendinopathic changes and fluid accumulation (white arrows) in the peroneal tendon sheath. T, talus; C, calcaneus; N, navicular; PTT, posterior tibial tendon; FDL, flexor digitorum longus; FHL, flexor hallucis longus; PTaFL, posterior talofibular ligament.

Musculoskeletal examination categorized as by the Medical Research Council [13] documented that the strength of the anterior tibial, posterior tibial and gastrocnemius–soleus complex were 5/5 bilateral. Peroneal muscles muscular strength was 4/5 bilateral. The patient was able to perform a single heel rise with each foot. Neurological examination revealed no sensory deficit with normal reflexes bilaterally. Radiographs were unremarkable.

An MRI was performed which revealed a peroneal brevis tendon tear, an os trigonum and tearing of the anterior talofibular and the calcaneofibular ligaments (Fig. 1A–D). Operative and non-operative treatment options were discussed with the patient, but given her severe limitations and symptomatology, she elected to proceed with surgery. Lateral ligament reconstruction through a modified Brostrom procedure, exploration of the peroneal tendons with possible allograft reconstruction and exploration of the posterior ankle joint with resection of the os trigonum were offered to the patient.

The patient was positioned in the lateral decubitus position. Preoperative antibiotics were administered. A thigh tourniquet was utilized and the right lower extremity was prepped and draped in the usual sterile fashion. A lateral approach just posterior to the fibula was performed and curved anteriorly to follow the course of the peroneus brevis. The incision was taken to the peroneal sheath which was opened. A single peroneal tendon was visualized proximally, which then divided into a separate peroneus brevis and longus tendon distally (Fig. 2). Extensive intrasubstance degeneration and tearing were present in both of the tendons, which precluded any repair attempt. It was then decided that an allograft reconstruction of the brevis and longus would be needed.

The diseased portion was resected away back to healthy tendon proximally and distally. A Pulvertaft weave [14] was used with semitendinosus allograft at the distal peroneus brevis insertion site. This was then weaved in Pulvertaft fashion proximally to the tendon and then distally to the peroneus longus stump (Fig. 3). Construct was tensioned with the ankle under slight eversion. Non-absorbable suture was used to repair the Pulvertaft weave areas. A tenodesis between the Peroneus brevis and longus allograft was then performed using braided, ultra high molecular weight polyethylene non-absorbable suture.

The posterior part of the ankle was accessed through the deep peroneus longus fascia. The os trigonum was palpated and carefully resected after identifying the flexor hallucis longus tendon. The incision was elevated anteriorly to perform a modified Brostrom–Gould procedure with repair of both anterior talofibular and calcaneo fibular ligaments.

Absorbable 2-0 sutures were used to close the peroneal tendon sheath. Wound closure was realized in layers. The patient was placed in a bulky Jones splint in the neutral position for 2 weeks.

Thereafter, the patient was placed in a short leg non-weight-bearing cast for 4 additional weeks. Physical therapy and full weight bearing in an orthopedic removable boot was allowed at the sixth postoperative week. Ten weeks after surgery, the patient was transitioned into regular shoes without any bracing and continued physical therapy. Eighteen months after surgery, she is pleased with the results from surgery, having minimal pain and resuming all her previous activities.

3. Discussion

We have successfully reconstructed both peroneal tendons using semitendinosus allograft in a young active patient who presented with posterolateral ankle pain for 24 months. Surgical exploration demonstrated an overcrowded retromalleolar groove with a single tendon originating both peroneus brevis and longus tendons, both being extensively degenerated. Although anatomical variations of the peroneal tendons are numerous, evidence based

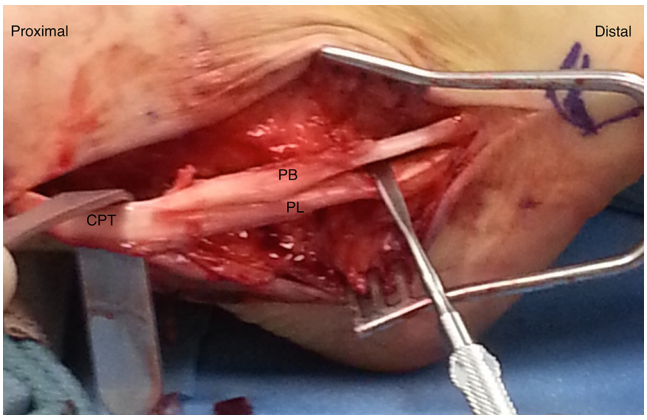

Fig. 2. Anatomic variation of the peroneal tendons overcrowding the retromalleolar space, leading to tendon degeneration. A common peroneal tendon (CPT) originates from one single muscular belly, dividing into two distinct tendons: Peroneus brevis (PB) and peroneus longus (PL) and mimicking a longitudinal split tear of a single tendon.

guidelines on how to address this clinical problem are lacking and are mainly based on personal experiences or case reports. Similarly to our case, a bifid peroneal brevis muscle and tendons with a dual insertion on the fifth metatarsal producing chronic subluxation of the peroneal tendons has been reported [8]. However, their treatment was to excise the duplicated tendon and suture the proximal stump to the remaining peroneal brevis, decompressing the fibro-osseous canal. Double peroneal muscles and bellies have also been reported in anatomic cadaveric studies. In this report, the peroneus longus and brevis muscles with their respective tendons were duplicated and inserted on the lateral surface of the calcaneus [15].

Another case was reported on a patient operated on for chronic lateral ankle pain, which presented with a peroneus quartus and two separated tendons arising from a single muscular belly [16]. Resection of the supernumerary muscle was curative, given that no tear was appreciated in both of the tendons and the patient exhibited no eversion weakness pre or postoperatively. Recently, a variant of the peroneus brevis insertion, distal to the peroneus tubercle at the lateral wall of the calcaneus, mimicking a peroneal tear and retracted tendon was described [11].

The presence of accessory peroneal muscles may have a crowding effect in the fibro-osseous canal, leading to chronic irritation of the peroneal sheaths and stretching of the peroneal retinaculum, thus producing instability and tearing by mechanical attrition against the posterior border of the fibula [4,8,17]. Attrition of the peroneus brevis tendon occurs between the sharp fibular ridge and the peroneal longus, producing shear stress and facilitating injury [18]. We postulate that this situation may have been enhanced in this patient by an unstable ankle and because both tendons were found together in the same peroneal sheath.

We routinely obtain and carefully examine MRIs of patients being considered for peroneal tendon surgery. Before considering a peroneus brevis tear, a normal bifurcation of the peroneus brevis should be excluded by examining the muscle tendon unit proximal to the ankle on axial MRI images, where the torn peroneus brevis has a C shape configuration, with lateral and medial limbs [10].

A plentiful anatomic variability of these muscles has been described, and is somewhat, confusing. In an attempt to simplify the classification, three muscles in the lateral compartment of the leg were described. Besides to the almost invariantly found peroneus longus and brevis, they added the peroneus digiti quinti muscle. This muscle can be further subclassified in a complete variant if the tendon insertion is found in the phalanx of the fifth toe. On the other hand, the incomplete variant inserts somewhere

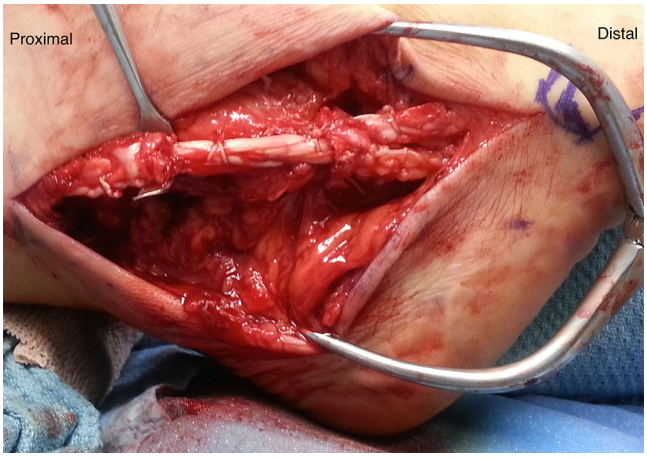

Fig. 3. Allograft reconstruction of the peroneus brevis and longus equivalent tendons with tenodesis of the allograft limbs. Extensive degeneration of both tendons lead to the intraoperative decision of resecting all tendinopathic tissue, leaving no residual healthy tissue to attempt a primary tenodesis and therefore, the decision to reconstruct each tendon separately was made. As this patient presented a unique situation, with a single muscular unit for both tendons, a tenodesis of the allograft limbs was performed, increasing the repair strength while preserving eversion power. Likewise, excursion of the reconstructed tendons was successfully demonstrated prior to retinaculum closure.

between the lateral malleolus and the fifth metatarsal. Four subtypes from distal to proximal are described in this group: peroneo–metatarsal muscle (Type I), peroneo–cuboidal muscle (Type II), external peroneo–calcaneus muscle (Type III or peroneus quartus of Otto) and peroneo–malleolar (Type IV) [6,7].

To the best of our knowledge, this variation in the anatomy of the peroneal muscles has not been previously reported in the literature. Clinicians should be aware of these potential variations forms which may affect their treatment strategy. Although the MRI image of this patient demonstrated a peroneal brevis tear and a brevis to longus tenodesis could have been considered preoperatively, the extensive tendinopathic degeneration of the peroneus longus tendon would have impeded this procedure and yielded an eversion deficit. We decided to reconstruct both tendons in an attempt to recreate both eversion and plantarflexion functions of the peroneal tendons [19]. One may argue that if the peroneus longus had been healthy, a direct brevis to longus tenodesis would have been a suitable treatment option, as either tendon originates from a single muscle belly and, theoretically, no eversion deficit would have been generated.

For the aforementioned reasons, we consider allograft reconstruction an important part of our peroneal tendon tear's treatment armamentarium.

Conflict of interest

The authors declare that they have no conflicts of interest.

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