

## Case report

# Bilateral anterior tarsal tunnel syndrome variant secondary to extensor hallucis brevis muscle hypertrophy in a ballet dancer: A case report



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## ABSTRACT

We present a case of bilateral anterior tarsal tunnel syndrome secondary EHB hypertrophy in a dancer, with successful treatment with bilateral EHB muscle excisions for decompression. The bilateral presentation of this case with the treatment of EHB muscle excision is the first of its type reported in the literature.

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## 1. Introduction

Compression neuropathy of the deep peroneal nerve (DPN) under the extensor retinaculum at dorsum of the foot was first reported by Kopell and Thompson in 1963 [1]. In 1968 Marinacci further described the etiology of the specific condition, naming it anterior tarsal tunnel syndrome (ATTS), and establishing an electrodiagnostic technique to assist the diagnosis [2]. ATTS is a rare condition occurring more commonly in women, and it can be a difficult clinical diagnosis. Symptoms may include dorsal foot and anterior ankle pain with radiation to the first webspace, exacerbated by plantarflexion, including while sleeping.

The anterior tarsal tunnel (ATT) lies between the inferior extensor retinaculum and fascia overlying the talus and navicular. Within it are the tendons of the peroneus tertius, extensor digitorum longus (EDL), extensor hallucis longus (EHL), and tibialis anterior; dorsalis pedis artery and vein; and DPN. The DPN and its branches pass longitudinally through the fibro-osseous tunnel, deep to the tendons of EHL and EDL. At the ankle joint, the DPN travels under the inferior extensor retinaculum and divides into two terminal branches: the lateral branch, which innervates the extensor digitorum brevis muscle; and the medial cutaneous branch, which is responsible for sensation in the first webspace [3]. Entrapment of the DPN at the anterior ankle or under the inferior

extensor retinaculum can lead to the symptoms associated with ATTS.

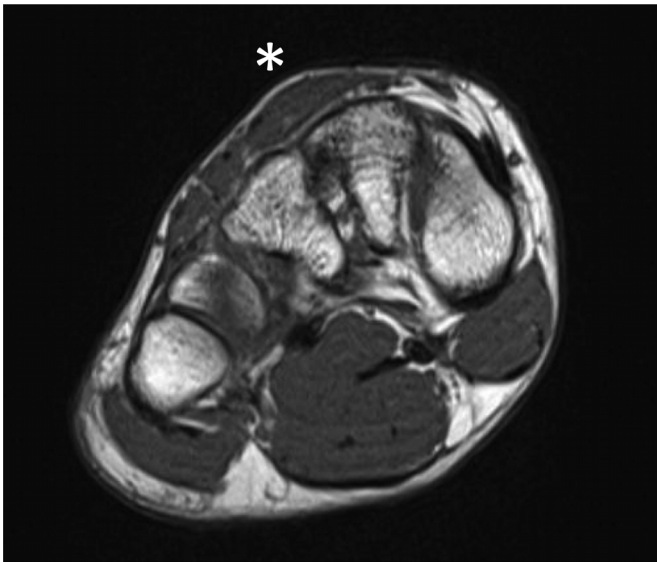
We report an unusual variation of bilateral ATTS at the medial terminal sensory branch of the DPN, caused by bilateral hypertrophy of the extensor hallucis brevis muscle in a pre-professional ballet dancer.

## 2. Case report

An otherwise healthy eighteen year-old female ballet dancer presented to clinic with bilateral masses and pain at dorsal aspects of her feet. The masses were non-tender at rest and located just distal to the ankle joint, but the patient described both decreased sensation to light touch and a radiating pain with palpation to the first webspaces. The symptoms had been present for twenty months and had begun to interfere with her ability to complete ballet practices and performances. Symptoms persisted despite periods of rest and dancing shoe modifications, including practicing barefoot. The symptoms and size of the mass on the right foot were slightly greater than those of the left foot.

On physical examination, the right dorsomedial midfoot mass measured 2.5 × 2.5 cm and the left 2 × 2 cm masses. Transillumination test was negative for both sides, suggesting that the masses were not cystic. Palpation and Tinel sign at the masses of the both feet reproduced the patient's radiating pain and numbness symptoms in the first webspace, similar to her daily activity-related pain. The neurologic examination revealed no other

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**Fig. 1.** T1 weighted MRI coronal cut at midfoot showing hypertrophy of EHB (asterisk immediately dorsal to EHB).

abnormalities and vascular examination was normal. Plain radiography revealed no abnormal findings with the exception of mild hallux valgus. Magnetic resonance imaging showed no significant signal intensity changes on T2 sequences, but T1 and T2 sequences showed hypertrophy of the EHB muscle belly lying directly adjacent to the DPN within the anterior tarsal tunnel (Fig. 1).

Diagnosis of bilateral anterior tarsal tunnel syndrome secondary to EHB hypertrophy was made. Conservative treatment was successful as long as the patient was not dancing, but symptoms returned when she had longer practices or performances. The patient desired a return to dancing without these symptoms. Thus the surgical option of open anterior tarsal tunnel release, partial excision of the EHB, and decompression of the DPN was offered. The right side would be performed first and the left side three months subsequently.

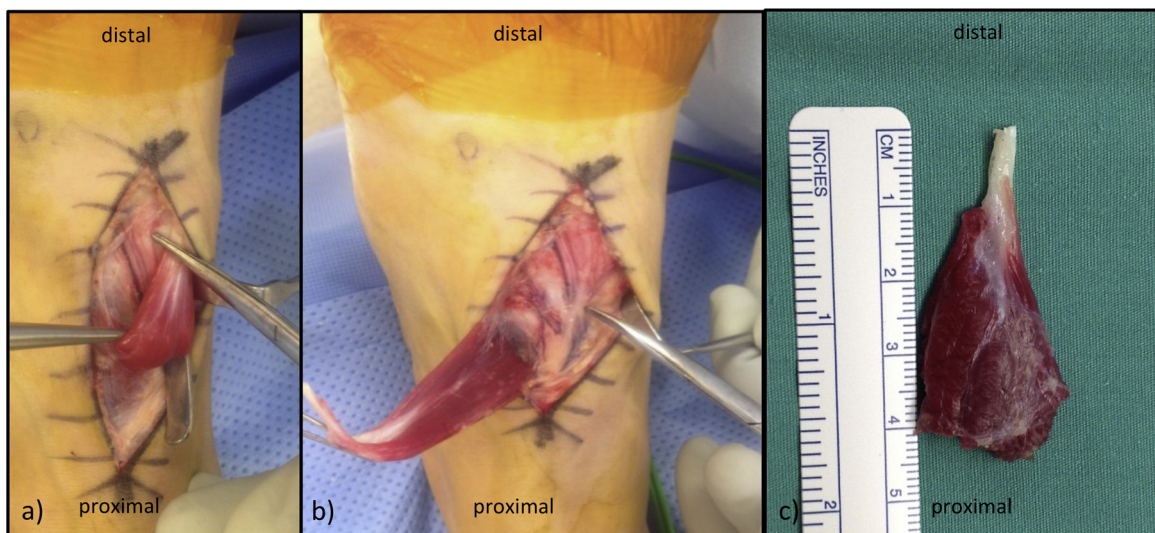
## 2.1. Operative technique

After standard supine positioning with thigh tourniquet and general anesthesia, a longitudinal incision was made over the center of the mass at dorsomedial aspect of the foot. Tenotomy scissors and bipolar electrocautery were then used to dissect carefully through the subcutaneous tissues. The EHB muscle was clearly identified in its hypertrophied state, with the dorsomedial cutaneous branch of the superficial peroneal nerve (SPN) overlying it. After gently retracting the SPN, the EHB muscle was swept laterally and dorsalis pedis vessel and DPN were clearly identified. The DPN was visibly flattened by compression from its site of traversing under the EHB. The hypertrophied EHB also became clearly constricted within the distal tunnel with plantarflexion of the foot and great toe. The retinaculum was released and the adequacy of DPN decompression was reevaluated. Decision was made to excise the EHB muscle because of the mass effect on the nerve, especially when the great toe was plantarflexed. The EHB muscle was excised at its most proximally visible extent (Fig. 2). The neurovascular bundle at this point was free of all compression. The wound was irrigated and closed with skin sutures in a standard fashion, with a soft gently compressive dressing.

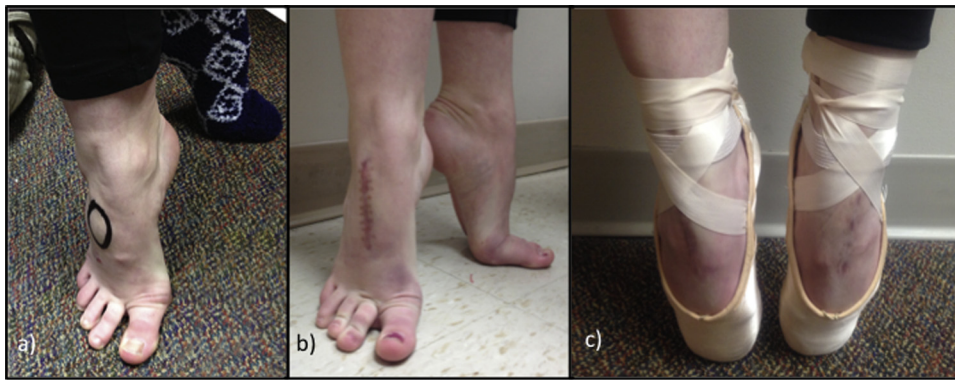
Postoperatively, the patient wore a compression stocking and a black Cam walker boot, with a restriction of non-weight bearing on the operative extremity with crutches for two weeks. The patient started progressive weight bearing at two weeks postoperatively. The same procedure was performed for the contralateral (left) foot three months later.

At seven and ten month follow-up for the left and right sides, respectively, the patient reported full return to collegiate level ballet dancing and running activities. She reported no subjective weakness with dance. Physical examination showed no tenderness about the scars and no neurological deficits with well-healed, painless incisions (Fig. 3). She was completely satisfied with the results.

Pre-operative Foot Function Index (FFI), Short Form-36 (SF-36), and Visual Analog Scale (VAS) pain score were recorded and compared with seven and ten months postoperative scores on left and right side, respectively. Pre-operative SF-36 Physical Component Score was 38.5 and postoperatively was 55.1. SF-36 Mental Component Score was 40.2 preoperatively 53.6 postoperatively. Pre-operative FFI (total, pain, disability, and activity limitation)



**Fig. 2.** (a) Hypertrophy of extensor hallucis brevis muscle (held by retractor) and compressed deep peroneal nerve passing deep. (b) Released distal portion of extensor hallucis brevis muscle. (c) Excised extensor hallucis brevis muscle.



**Fig. 3.** (a) Preoperative right foot with identified dorsal hypertrophy of EHB; (b), clinical photograph during *grand pli  * at two (left) and five (right) months postoperatively and (c) clinical photograph *en pointe* after return to dance at seven (left) and ten (right) months postoperatively.

was 90.73, 89.28, 97.22, and 85.71, which improved to 22.5, 22.1, 23.2, and 23.2 postoperatively.

### 3. Discussion

Anterior tarsal tunnel syndrome is an uncommon condition which can be related with ganglion cyst [4], talus fracture [5], osteophyte [4,6], abnormal or hypertrophied muscle [7], severe contusion, or tightly fitting or tightly laced shoe wear [4]. Conservative treatment measures of activity modification, shoe modification, oral medication, and local corticosteroid injection have been shown to give relief of symptoms from ATTS [4,8,9]. In cases of failed conservation management, surgical treatment has been shown to be a reasonable option [4,8–11]. The surgical goal is complete decompression of the nerve, with careful division of adhesions to allow the nerve to rest in an uncompressed position. An epineurial incision may be required where dense scar surrounds the nerve. Closure of the inferior extensor retinaculum has been shown to be unnecessary, with no reported tendon bowstringing at follow-up [8].

Entrapment of the medial branch of the deep peroneal nerve can occur as the nerve passes under the extensor hallucis brevis tendon. This variation of DPN compression neuropathy by the EHB has been previously reported in two separate case reports. Kanbe et al. described a case of anterior tarsal tunnel syndrome without notable EHB hypertrophy in a unilateral case, for which surgical treatment involved only release of the inferior extensor retinaculum and partial release of the EHB tendon. No EHB muscle or tendon was excised [7]. Reed and Wright reported similar pathology in a unilateral case but performed decompression by excision of the hypertrophied EHB muscle belly. The patient in this case had some remaining sensory deficit postoperatively [12]. Similarly, in our patient, the excision of the EHB muscle was considered necessary due to its mass effect on the DPN especially when the great toe was plantarflexed.

Dancers present a unique challenge to the treatment of foot and ankle pathology. In the case presented of a uniquely high demand athlete, excellent return to function and competitive dance was achieved six months after surgical treatment. This case demonstrates

an unusual presentation of bilateral EHB hypertrophy with compressive neuropathy of the DPN in a ballet dancer with a successful last resort option of surgical excision of the EHB.

### 4. Summary/conclusion

We present a case of bilateral anterior tarsal tunnel syndrome secondary EHB hypertrophy in a dancer, with successful treatment with bilateral EHB muscle excisions for decompression. The bilateral presentation of this case with the successful treatment of EHB muscle excision is the first of its type reported in the literature.

### Conflict of interests

None.

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