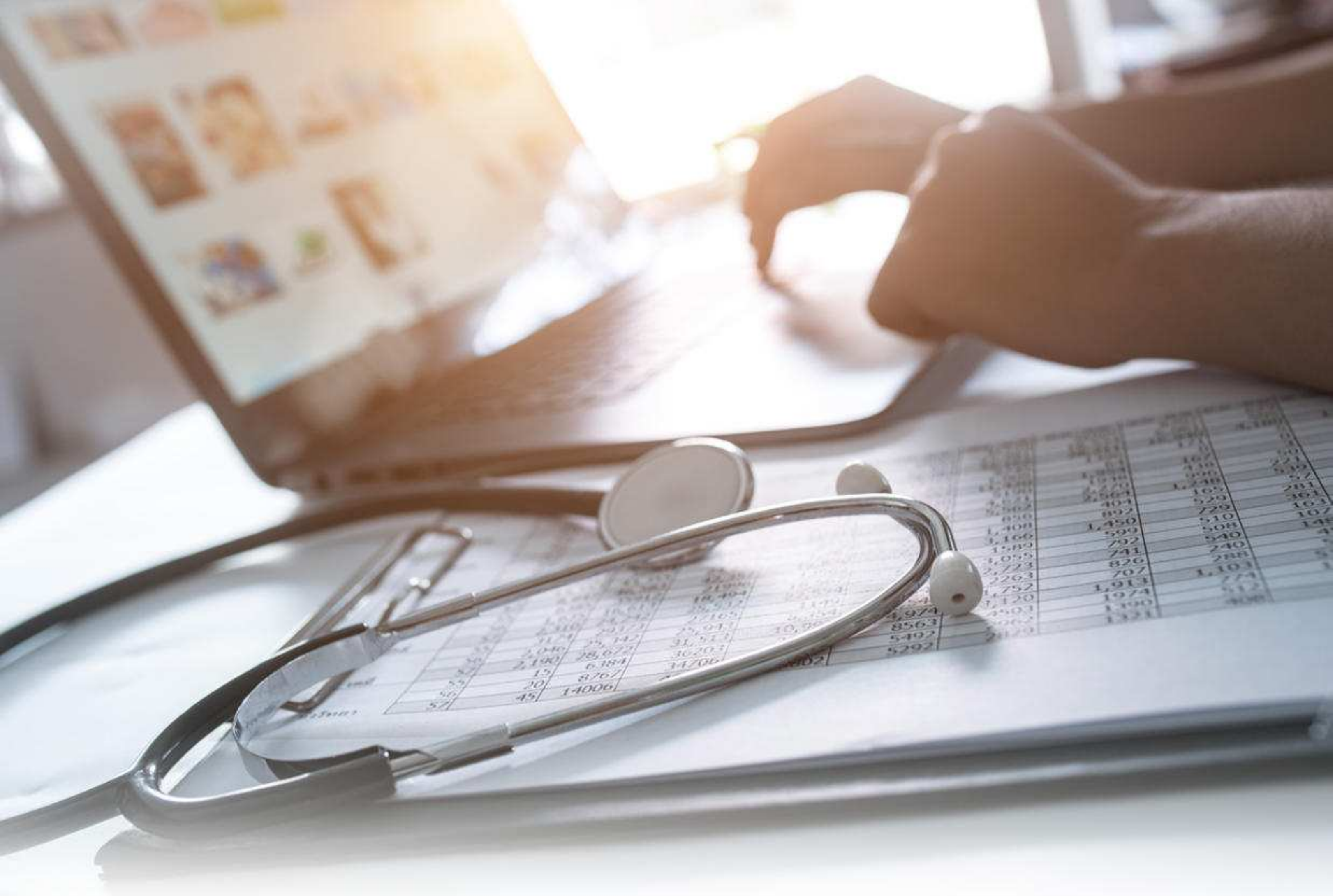


Unusual Cause of Anterior Tarsal Tunnel Syndrome: Ultrasound Findings

We describe a unique case of a trauma-induced deep peroneal intraneural ganglion emerging from the ankle joint causing anterior tarsal tunnel syndrome that was diagnosed and to our knowledge treated for the first time with the help of ultrasound imaging.

A 51-year-old woman presented with swelling and pain in the area of the left anterior shin and dorsum of the foot. The patient had sustained a lateral inversion injury of her left ankle 6 months earlier. After the trauma, a slowly growing swelling appeared around the lateral malleolus. In the following 3 months, she also developed paresthesia at the dorsum of the foot and pain at the anterior shin. She was not able to wear tight shoes or shoes with laces, nor could she tolerate even a slightest touch in the affected region. Clinical examination showed a nontender swelling at the left lateral malleolus, numbness between the first and second toes, and weakness in extending the first toe.

Conventional x-ray images of the foot and ankle revealed no bony abnormalities. Magnetic resonance imaging (1.5 Tesla) of the ankle showed only a small cyst emerging behind the fibula from the ankle joint, but no other abnormalities. Thereafter, she underwent an ultrasound investigation to rule out muscle tear, chronic compartment syndrome, or deep venous thrombosis.

The ultrasound investigation revealed an anechoic cystic lesion within the deep peroneal nerve measuring 7 mm in transverse diameter and 11 mm in length at the level of the extensor retinaculum. It displaced the nerve fascicles inside the nerve more peripherally and closer to the inner side of the nerve sheath (Figure 1). More distally, the cystic lesion extended laterally over the fibula and connected to a ganglion emerging from the ankle joint (Figure 2). Within this cystic extension was a small tubular structure suggestive of an articular nerve branch. All of this led to the diagnosis of an intraneural ganglion of the deep peroneal nerve. After obtaining the patient's written informed consent, the patient underwent ultrasound-guided fine-needle aspiration of the deep peroneal nerve ganglion, and 1 mL of viscous fluid was aspirated (Figure 3) that laboratory analysis later confirmed to be synovial fluid. In addition, the nerve sheath of the articular branch was dry-needled to avoid refilling of the nerve sheath ganglion. The patient's symptoms disappeared within 1 week after the procedure. Moreover, a follow-up ultrasound indicated that the ganglion within the deep peroneal nerve did not recur. However, during the following 3 months, the ganglion more laterally near the joint significantly increased in size, and surgical resection of the ganglion without articular nerve dissection was performed. The patient has remained symptom-free for 1 year now.

Anterior tarsal tunnel syndrome is a rare condition characterized by compression of the deep peroneal nerve at the level of the extensor retinaculum. Direct trauma, repetitive mechanical irritation, and compression by ganglia are the most common causes of this type of neuropathy.[1,2]

Figure 1. Transverse ultrasound scan (**A**) and its explanatory graph (**B**) at the level of the anterior tarsal tunnel show an enlarged deep peroneal nerve. Inside the nerve lies a cystic structure that pushes the nerve fascicles to the periphery of the nerve. ATA, anterior tibial artery; DPN, deep peroneal nerve with intraneural ganglion; EDL, extensor digitorum longus muscle; EHL, extensor hallucis longus muscle; F, fibula.

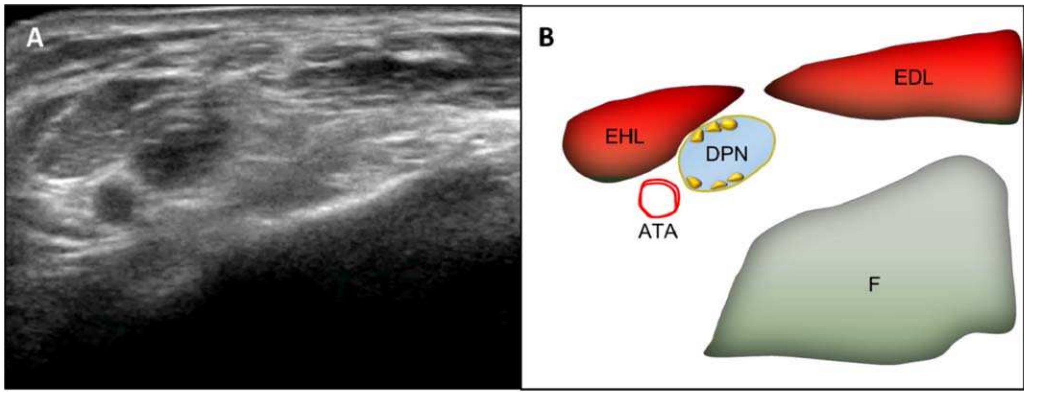
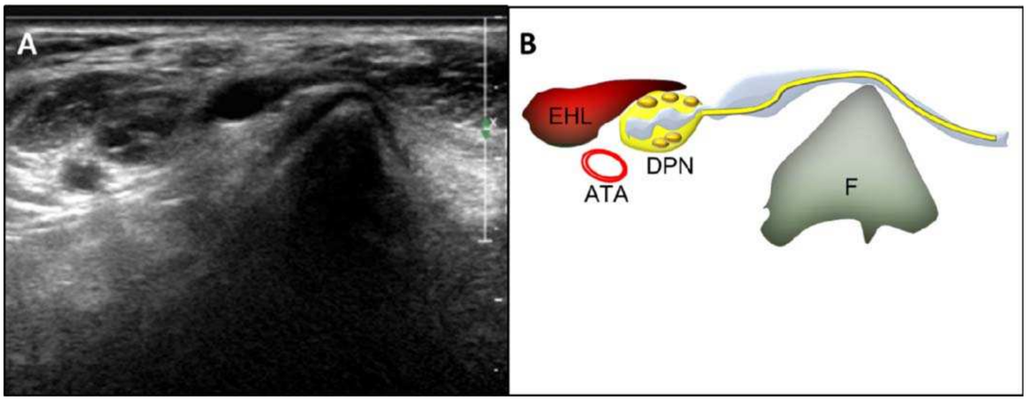
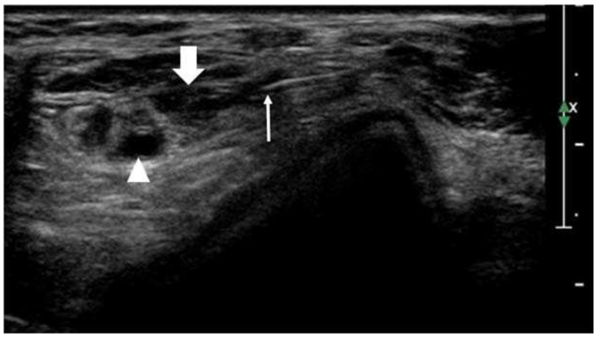


Figure 2. Transverse ultrasound scan (**A**) and its explanatory graph (**B**) at a slightly lower level than that shown in Figure 1. From the deep peroneal nerve appears a tubular cystic structure that connects to the ganglion arising from the ankle joint (not shown). ATA, anterior tibial artery; DPN, deep peroneal nerve; EHL, extensor hallucis longus muscle; F, fibula.



More recently, some studies have suggested that intraneural ganglia may be a potential cause of peripheral nerve compression.[3] Although the pathomechanisms of intraneural ganglia formation remain controversial, they appear to originate as ganglia from neighboring joints that extend to the nerve along the small articular nerve branches.[4] In our case, it developed along the articular nerve branch innervating the lateral part of the ankle joint capsule (Figure 4). Direct or indirect trauma has been suggested as a potential cause for intraneural ganglia formation of the fibular nerve.[5] Modern imaging modalities such as magnetic resonance imaging and high resolution ultrasound are capable of visualizing peripheral nerves.[6] Ultrasound imaging has shown excellent correlation with actual anatomical dissections in the visualization of peripheral nerves of the lower extremities.[7] In addition, the feasibility of ultrasound in identifying intraneural peroneal ganglia has previously been suggested.[8]

Figure 3. Ultrasound scan after fine-needle aspiration. Thin arrow shows the needle in the emptied ganglion (thick arrow, deep peroneal nerve; arrow head, anterior tibial artery).



Treatment of the ganglion cysts is either conservative (eg, with cortisone injections or physical therapy) or, if unsatisfying, surgical (eg, through decompression and removal of the cystic structures and dissection of the articular nerve branch). The recurrence of ganglion cysts caused by high intra-articular pressure remains a challenging problem.

Figure 4. Graph showing schematically how the intraneural ganglion (blue) of the deep peroneal nerve (yellow) emerges from the articular branch of the nerve (red, anterior tibial artery).

Contemporary ultrasound machines can provide safe imaging guidance because of their excellent resolution and real-time capabilities.[9] Fine-needle aspiration to empty the ganglion under ultrasound control appears to offer new opportunity to treat conditions involving the intraneural ganglion. In our case, no substance was injected into the intraneural ganglion, but additional dry-needling with a 22-G needle was used to fenestrate the ganglion and especially the connective stalk to the nerve. No recurrence of the ganglion inside the deep peroneal nerve was seen during the follow-up period. Such a minor injury that the needling causes with the ensuing repair and possible small scar formation may help to further occlude the connection and reduce the possibility for recurrences. The literature has reported a quite similar technique in treating the intraneural ganglion of the tibial nerve to avoid a surgical resection, although with the additional introduction of a small amount of steroid to the epineurium.[10] To our knowledge, this is the first case report describing such a treatment for an intraneural ganglion emerging from the ankle joint using a lateral articular nerve-branch ganglion. In contrast to surgery, we suggest that this treatment is rather safe and less traumatic for patients. Surgery still seems to carry a higher risk for complications, including permanent nerve damage, vessel injuries, and infections. Thus, the use of ultrasound-guided aspiration of the ganglion to reduce or eliminate the nerve compression and the dry-needling of the communicating articular branch to minimize the recurrence could serve as the initial treatment option in such cases before proceeding to more invasive surgical treatment.

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