Posterior Tibial Artery Compressing the Medial Plantar Nerve: Tarsal Tunnel Syndrome Secondary to Neurovascular Conflict

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Abstract

Introduction:
Tarsal tunnel syndrome (TTS) is a compressive neuropathy involving the posterior tibial nerve or its branches within the fibro-osseous tarsal tunnel. Vascular etiologies are under-recognized and may be overlooked in clinical assessment.
Objective:
To illustrate the diagnostic value of dynamic ultrasound in identifying clinically significant neurovascular compression in TTS.
Case report:
A 32-year-old woman presented with right ankle pain associated with intermittent electric shock–like sensations over the medial plantar aspect of the foot, exacerbated by prolonged walking. Physical examination revealed a positive Tinel sign along the medial plantar nerve. Ultrasound demonstrated close contact between the posterior tibial artery and the medial plantar nerve without other structural abnormalities, suggesting neurovascular compression.
Conclusion:
Vascular causes of TTS should be considered in patients presenting with plantar neuropathic symptoms. High-resolution ultrasound with color Doppler plays a key role in identifying neurovascular conflict and guiding clinical management.

Keywords: tarsal tunnel syndrome, posterior tibial artery, medial plantar nerve, neurovascular compression, ultrasound.

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Introduction

Tarsal tunnel syndrome (TTS) is a compressive neuropathy caused by entrapment of the posterior tibial nerve or its branches (medial plantar, lateral plantar, and medial calcaneal nerves) within the fibro-osseous tarsal tunnel beneath the flexor retinaculum (1, 2). It is frequently under-diagnosed because its nonspecific symptoms may mimic other foot and ankle conditions, such as plantar fasciitis, peripheral neuropathy, or lumbar radiculopathy (2, 3).

The tarsal tunnel contains the flexor tendons, the posterior tibial neurovascular bundle, and the tibial nerve, which bifurcates distally into its plantar branches (3). Any condition that reduces available space or promotes abnormal contact between adjacent structures may result in nerve compression.
Vascular etiologies deserve particular attention. Varicosities and posterior tibial artery tortuosity or kinking may produce direct or pulsatile compression, resulting in symptomatic neurovascular conflict (1, 2). Ultrasound, especially with color Doppler, enables

dynamic and detailed evaluation of this relationship (1, 3).
This report describes a case of TTS secondary to neurovascular conflict and emphasizes the importance of ultrasound in etiologic diagnosis.

Case report

A 32-year-old woman presented with right ankle pain associated with intermittent electric shock–like sensations radiating to the medial plantar aspect of the ipsilateral foot. Symptoms had been present for approximately three months and were exacerbated by prolonged walking and orthostatism. She denied any history of recent trauma, systemic disease, or previous ankle surgery.
The patient described the pain as burning and sharp, with transient episodes lasting a few seconds, occurring several times per day. She did not report persistent numbness, continuous paresthesia, or motor weakness. There were no symptoms suggestive of lumbar radiculopathy.
Physical examination revealed localized tenderness along the medial hind-foot and mid-foot. A positive Tinel sign was elicited over the medial plantar nerve trajectory. No edema, skin discoloration, deformities, or signs of peripheral vascular insufficiency were observed. Ankle and foot range of motion were preserved, and muscle strength was normal.
Ultrasound examination demonstrated intimate contact between the posterior tibial artery and the medial plantar nerve within the tarsal tunnel. The artery exhibited tortuosity and pulsatile contact adjacent to the nerve. No tendon abnormalities, ganglion cysts, masses, or retinacular thickening were identified. Color Doppler confirmed arterial pulsatility at the site of nerve contact (Figure 1 here). These findings were consistent with neurovascular compression correlating with the patient's symptoms.
Conservative management was initiated, including physiotherapy focused on intrinsic foot muscle strengthening, stretching exercises, and use of compression stockings. The patient also reported discontinuing the use of tight-fitting shoes that she had previously worn regularly.
At three-week follow-up, the patient reported complete resolution of symptoms, with no recurrence of pain or electric shock–like sensations. Clinical reassessment demonstrated absence of tenderness and negative Tinel sign. The favorable response to conservative management further supported the diagnosis of symptomatic neurovascular conflict.

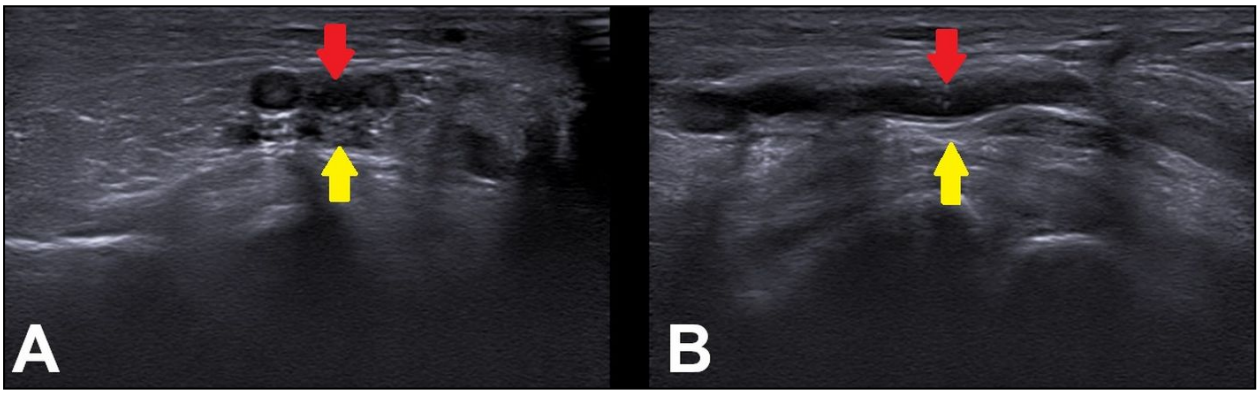

Figure 1: Axial (A) and longitudinal (B) ultrasound images demonstrating tortuosity of the posterior tibial artery (red arrow) in close contact with the medial plantar nerve (yellow arrow), consistent with neurovascular compression.

Discussion

The diagnosis of tarsal tunnel syndrome (TTS) requires confirmation of compression of the tibial nerve or its branches within the tarsal tunnel (2, 4). Clinical assessment alone has limited diagnostic accuracy, particularly in patients presenting with intermittent or atypical symptoms, as observed in this case (4). The variability of symptoms and overlap with other foot pathologies often delay diagnosis.
Ultrasound is considered a first-line imaging modality due to its high spatial resolution for superficial structures, accessibility, and capacity for dynamic assessment. In selected cases, it may offer advantages over MRI by allowing real-time evaluation of nerve–vessel relationships and symptom reproduction during examination (4).

Posterior tibial artery tortuosity and close neurovascular contact may represent incidental findings. However, only cases demonstrating direct neural displacement, compression, or dynamic pulsatile interaction are clinically significant (3). Therefore, imaging findings must always be interpreted in conjunction with clinical presentation to avoid over-diagnosis.

In the present case, no structural space-occupying lesion was identified. The absence of masses, retinacular thickening, or tendinous abnormalities strengthens the hypothesis of functional compression secondary to neurovascular conflict. Moreover, the rapid and complete symptom resolution after conservative management — including muscle strengthening, physiotherapy, footwear modification, and compression therapy — strongly supports a dynamic compressive mechanism rather than a fixed structural entrapment.

Dynamic vascular contact may generate intermittent neural irritation, particularly during prolonged orthostatism or mechanical overload, when increased local pressure and vascular pulsatility enhance nerve–artery interaction. The favorable response to non-surgical treatment further indicates that the neurovascular relationship was functionally symptomatic and potentially reversible.

These findings highlight the importance of recognizing vascular etiologies in TTS and differentiating incidental anatomical proximity from clinically relevant neurovascular conflict. High-resolution ultrasound with color Doppler is uniquely suited for this purpose, as it enables both structural and functional evaluation in real time.

Early identification of dynamic neurovascular compression may allow effective conservative management, potentially preventing progression to chronic neuropathic pain and avoiding unnecessary surgical intervention.

Conclusion

Tarsal tunnel syndrome remains a diagnostic challenge, particularly in patients with atypical or intermittent symptoms. Vascular etiologies should be actively investigated. High-resolution ultrasound with color Doppler enables detailed and dynamic assessment of neurovascular relationships, facilitating accurate clinico-radiological correlation and appropriate therapeutic planning.

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Declarations

Consent for publication: The author clarifies that written informed consent was obtained and the anonymity of the patient was ensured. This study submitted to Swiss J. Rad. Nucl. Med. has been conducted in accordance with the Declaration of Helsinki and according to requirements of all applicable local and international standards. All authors contributed to the conception and design of the manuscript, participated in drafting and revising the content critically for important intellectual input, and approved the final version for publication. Each author agrees to be accountable for all aspects of the work, ensuring its accuracy and integrity.

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