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Case Report Open Access

Entrapment of the Lateral Plantar Nerve Distal to the Tarsal Tunnel: A Case Report

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Abstract

Tibial nerve entrapment is a common cause of foot pain. Identifying the location of the entrapment may be difficult. This case report describes the electrodiagnosis of the lateral plantar nerve branch of the tibial nerve in a 50 year-old woman who failed to respond to the local steroid injection for plantar fasciitis and subsequently a tarsal tunnel release. The etiology of the nerve entrapment is discussed as well as the role of electrodiagnostic studies to locate the nerve entrapment. This case highlights the role of meticulous clinical evaluation and electrodiagnosis for the diagnosis of this challenging condition and a simple in-office treatment to reduce patient's symptoms.

Keywords: Tibial nerve; Entrapment; Lateral plantar nerve; Electrodiagnostic study

Introduction

Foot pain is a common presenting symptom in an ambulatory clinic setting. The etiology of the foot pain may be hard to discern. This case report highlights the use of electrodiagnosis to evaluate the location of the nerve entrapment after unsuccessful steroid injection for plantar fasciitis and subsequently a tarsal tunnel release.

Case Report

The patient is a 50-year old woman with past medical history of lupus presented to the clinic with left foot pain and was referred for electrodiagnostic evaluation of a tibial nerve entrapment. She initially had left heel pain which was diagnosed as plantar fasciitis 2 years ago by an outside clinician. She was treated with several injections of local steroid to the left heel prior to the current clinic visit. Patient developed a new onset of burning, tingling, and numbness of the left foot 8 months prior to the current clinic visit which started within a few days after the last injection to her medial heel. Patient's heel pain improved but the tingling sensation and the radiating discomfort to the lateral side of the foot persisted. Tarsal tunnel syndrome was suspected and local cortisone injections to the tarsal tunnel were delivered twice without significant relief of the symptoms. Subsequently patient underwent tarsal tunnel release of the left foot in 2 months from the onset of her symptoms. However, she continued to experience the same level of symptoms. On the day of the electrodiagnostic study, her numbness, tingling, and burning were mainly on the 4th, 5th toes and lateral plantar aspect of the left foot sparing the dorsum of the foot. She had pain on the distal medial aspect of the left heel below the incision of the tarsal tunnel release (Figure 1). Her pain level was 6-7/10 on the visual analogue scale and worse with prolonged standing. The patient did not have much pain without weight-bearing and preferred walking over standing. She denied similar symptoms on the contralateral side, weakness, gait difficulty, or recent changes in bladder or bowel function. Her past medical history was significant for lupus and she was taking plaquenil and celecoxib. Patient denied smoking or alcohol abuse and worked as a staff in the warehouse.

Physical examination showed no significant foot deformities or atrophy of muscles in the bilateral lower limbs with normal vascular examination. Sensory examination showed reduced sensation to light touch, temperature, and vibration on the lateral plantar aspect of the left foot (Figure 2). The location of maximum tenderness was on the very distal part of the tarsal tunnel near the medial heel of the left foot (Figure 1). Positive Tinel's sign was noted on this location and tenderness further distally across the plantar heel (Valleix sign) [1]. Upon compression on the distal part of the tarsal tunnel near the medial heel, numbness and tingling were exacerbated. Manual muscle testing was normal for bilateral lower limbs, and the intrinsic foot

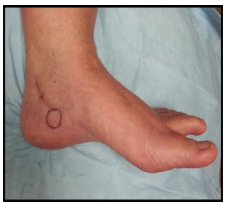

Figure 1: Location of maximum pain and tenderness.

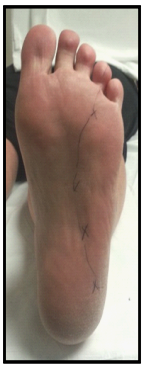

Figure 2: The border of the sensory loss was demarcated on the lateral plantar surface.

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muscles were palpable upon contraction. Muscle stretch reflexes of bilateral quadriceps and triceps surae muscles were 2+ bilaterally.

Electrodiagnostic Studies

Nerve conduction study (NCS) (Table 1) was performed with temperature of 30 degrees Celsius in the lower limbs. Monopolar needle was used for the needle electromyography (EMG) examination (Table 2). Mixed nerve conduction study of the left medial and lateral plantar nerve showed the amplitude and latency comparable to the right side. Sensory nerve conduction study of the left sural nerve showed normal amplitude and latency. Motor nerve conduction study of bilateral tibial nerves showed comparable amplitude of compound muscle action potentials (CMAP) on while recording the abductor hallucis (AH), flexor hallucis brevis (FHB), abductor digiti quinti minimi (ADQM), and flexor digiti minimi brevis (FDMB) muscles. Motor nerve conduction study of the left deep peroneal nerve was within normal limits. F wave study of bilateral tibial and left deep peroneal nerves was within normal limits (Table 3).

Needle EMG examination (Table 2) was performed in the above selected muscles of the left foot. Positive sharp waves and fibrillation potentials were noted in left 4th interosseous muscle. Normal motor unit action potentials were noted with reduced recruitment pattern in this muscle. There were no abnormal spontaneous activities noted in the left AH, FHB, ADQM, and gastrocnemius muscles. Normal motor unit action potentials were noted in these muscles with normal recruitment pattern.

Follow-up

Magnetic Resonance Imaging of the left foot did not reveal structures compressing on the branches of the tibial nerve. The patient was provided a temporary orthosis which provided relief at the location of maximum tenderness along the course of the lateral plantar nerve (Figure 3). Patient reported improvement in pain intensity from 6/10 to 2/10 with this temporary orthosis and is awaiting the custom made orthosis incorporating these features.

Mixed Nerve Summary Table

Site	Peak (ms)	Onset-Peak Amp (μV)
Left Medial -Lateral Plantar (Recording from Ankle)		
Med sole	3.14	9.9
Lat sole	3.38	3.4
Right Medial-Lateral Plantar (Recording from Ankle)		
Medial sole	3.52	6.5
Lateral sole	4.31	3.5

Table 1: Summary of nerve conduction study.

EMG

Side	Muscle	Nerve	Root	Ins Act	Fibs	Psw	Amp	Dur	Poly	Recrt
Left	ADMQ	Inferior calcaneal	S1-2	Nml*	Nml	Nml	Nml	Nml	Norm	Nml
Left	AH	Medial Plantar	S1-2	Nml	Nml	Nml	Nml	Nml	Norm	Nml
Left	FDB	Medial Plantar	S1-2	Nml	Nml	Nml	Nml	Nml	Norm	Nml
Left	Gastroc	Tibial	S1-2	Nml	Nml	Nml	Nml	Nml	Norm	Nml
Left	4th intosse	Lateral Plantar	S1-2	***Incr**	***2+**	***2+**	Nml	Nml	Norm	***Reduced**

*Nml; normal

Table 2: Summary of Needle Electromyography Examination.

Site (muscle)	Onset (ms)	O-P Amp (mV)	Delta of latency (ms)	Distance (cm)	Vel (m/s)	Norm Vel (m/s)
Left Peroneal Motor (Extensor Digitorum Brevis; EDB)						
Ankle	4.30	5.6	6.87	33.5	48.8	>40.0
B Fib	11.17	5.6				
F-wave	49.2					
Left Tibial Motor (same order in the wave form)						
Ankle (AH)	5.31	7.7	8.67	39.5	45.6	>40.0
Poplit (AH)	13.98	6.7				
Ankle (FHB)	6.56	8.9				
Ankle (ADQB)	6.48	3.9				
Ankle (FDMB)	6.56	0.5				
F-wave	53.3					
Right Tibial Motor						
Ankle (AH)	6.02	9.9	8.67	37.0	42.7	>40.0
Poplit (AH)	14.69	6.4				
Ankle (FHB)	7.34	7.7				
Ankle (ADQB)	7.34	5.1				
Ankle (FDMB)	4.84	1.0				
F-wave	53.3					

Table 3: Motor Summary Table.

Figure 3: Temporary insole fabricated using synthetic felt and medium density plastazote.

Discussion

These electrodiagnostic findings were suggestive of an isolated lesion of the lateral plantar branch of the left tibial nerve. Other motor branches of the left tibial nerve including medial plantar and inferior calcaneal nerve (also described as '1st branch of the lateral plantar nerve', 'Baxter's nerve') appeared to be intact in this patient. This selective involvement of the lateral plantar branch may indicate the location of the lesion being distal to the branching of the medial plantar and inferior calcaneal nerves from the tibial nerve although a proximal fascicular nerve lesion can theoretically mimic this type of distal nerve lesion. Classic presentation of tarsal tunnel syndrome include dysesthesia in the distribution of the medial and/or lateral plantar nerves, positive Tinel's sign, paresthesia with compression of the nerve at the tarsal tunnel and tenderness of the tibial nerve under the flexor retinaculum [1]. Motor or sensory conduction studies are relatively insensitive to diagnose nerve lesions involving the tibial nerve branches [2] and mixed nerve conduction study and needle electromyography are often used for diagnostic purposes. [3]. In the case described, the patient demonstrated clinical signs involving only the lateral plantar nerve which was confirmed by the electrodiagnostic findings. Branches other than the lateral plantar nerve including medial plantar and inferior calcaneal (Baxter's nerve) were not involved in this patient.

Since the patient did not improve after tarsal tunnel release, we suspect that the lesion of entrapment is possibly distal to the tarsal tunnel corresponding to the location of positive Tinel's and Valleix sign along the course of the nerve distal to the tarsal tunnel. The underlying etiology of the entrapment is not clear at this time. We hypothesize that possible soft tissue scarring from multiple injections and surgical procedure that she underwent may contribute to the nerve entrapment. Operative note was reviewed, and the four medial ankle tunnels were not clearly described. However, according to our conversation with the surgeon who performed the procedure, all four tunnels were release but there may still be a possibility that a full release of the four tunnels was not performed.

The patient had reduction of pain with relief with the temporary insole along the presumed course of the nerve, which supports the current diagnosis. Isolated involvement of the inferior calcaneal nerve has been reported previously [4]. Other than iatrogenic cases of lateral plantar nerve injury after endoscopy of the flexor hallucis longus [5], involvement of the lateral plantar nerve distal to the tarsal tunnel has not been reported previously. This case highlights the role of meticulous clinical evaluation and electrodiagnosis for the diagnosis of this challenging condition and simple in-office orthotic treatment may reduce patient's symptoms.

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