



## EMG CASE No. 66, November 2003

### Presenting Symptom(s):

A 40-year-old woman presents with right leg pain of three month's duration. She describes aching over the dorsum of the foot radiating into the first and second toes, worse with walking. She now occasionally is being awakened in the night with these symptoms. She also reports numbness in the distribution of the pain.

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**Appropriate Audience:** Residents and practicing physicians

**Learning Objectives:** After completing this educational activity, participant will be able to:  
1) identify signs and symptoms of distal deep peroneal neuropathy, 2) evaluate the electrodiagnostic findings associated with this syndrome, and 3) summarize etiology and treatment of distal deep peroneal neuropathy.

**This case is no longer available for CME credit.**

### History

A 40 y/o white woman presents with 3 months of right foot pain. She has a history of bilateral carpal tunnel syndrome, plantar fasciitis, and chronic neck pain. Previous EMG evaluation revealed severe bilateral compressive median neuropathies and no evidence of cervical radiculopathy. She reports an aching pain with associated numbness over the dorsum of her foot. Pain is worse with prolonged walking and somewhat relieved with rest. She denies recent trauma, excessive activity or exercise. She denies any noticeable weakness in that leg or foot. She has no history of diabetes or peripheral vascular disease. There is no associated back pain or radiation of pain proximal to the ankle, and no swelling or erythema. She has a sedentary lifestyle and is currently unemployed.

- Prior to continuing, please develop a differential diagnosis and list each possible diagnosis in order of likelihood.
- Is there any additional information regarding the clinical history that might be helpful in clarifying your differential list or changing its order of priority?

### Commentary I

The differential diagnosis for foot pain is quite broad and includes musculoskeletal pathology of the ankle and foot (fractures, tendinitis, bursitis, strains, sprains, compartment syndrome), neuropathic etiologies (peripheral nerve entrapments, proximal nerve root injury, lumbosacral plexopathies, cortical or subcortical lesions), and vascular pathologies. Distal nerve entrapment or peroneal neuropathy is the most likely cause of these symptoms, based on localized findings and sensory disturbances. Musculoskeletal problems usually do present with localized pain, but typically have a history of trauma, without sensory complaints. Proximal nerve injuries can have associated sensory loss but would likely have more widespread symptoms, including weakness, and would likely not cause such localized pain complaints. Vascular claudication is typically brought on by activity and



relieved with rest, but usually does not involve sensory disturbances. The patient has no history of diabetes or other known causes of generalized peripheral neuropathy, making this an unlikely etiology. Also, the findings are unilateral, unlike peripheral neuropathy.

### **History, continued**

Further questioning about trauma yields that she was an unrestrained passenger in a minor MVA in which she slammed both of her distal shins against the car dashboard. There was some initial bruising, but felt her injuries were insignificant at the time. However, the accident did occur shortly before the onset of her current foot symptoms. Also, although she mentioned no right foot weakness, she did describe occasional limping.

- If necessary, revise your differential diagnosis based on the additional clinical history.
- On which details of the physical examination should you focus at this point?

### **Commentary II**

With additional history of trauma, a musculoskeletal injury must be reconsidered. The limping may suggest a mild foot drop. This means multiple other etiologies must be examined more closely. An anterior compartment syndrome, subacute in this case, could cause weakness of the foot and toe dorsiflexors, as well as sensory disturbances. However, swelling of the region would be expected as well as a more acute presentation. Compressive neuropathy, especially of the peroneal nerve, certainly could explain mild weakness, pain, and numbness. However, these symptoms are also possible with plexopathies or L5 and S1 radiculopathies. Cortical or subcortical cerebral lesions still cannot be excluded.

### **Physical Examination**

There was trace weakness (4/5) of all right toe extension, limited by pain. Toe extension on the left was normal. Resisted ankle dorsiflexion and plantarflexion were also normal, as was great toe extension tested separately. Achilles and patellar muscle stretch reflexes were within normal limits (2/4) and symmetric. Sensation was impaired to light touch over the skin of the dorsal first intermetatarsal space and the dorsum of the hallux and second toe. No impairment to sensation was noted in the same area on the left. The remainder of the sensory examination was normal bilaterally. There was no laxity of the ankle joint or tenderness to palpation, pain with compression of the anterior compartment or calf, and no swelling or erythema. Mild pain was produced over the dorsum of foot with extreme plantarflexion of the foot.

- At this point, review your differential diagnosis and revise as appropriate.
- Are there additional observations on physical examination that might be helpful in narrowing your differential list?

### **Commentary III**

Weakness of toe extension can connote a distal deep peroneal neuropathy or an L5 (or less likely S1) radiculopathy. The specific sensory loss pattern makes the diagnosis of distal deep peroneal neuropathy more likely, rather than a more dermatomal sensory loss associated with a radiculopathy. Lack of tenderness with leg compression and with palpation of



ligaments, bones, and joints makes a musculoskeletal etiology, including compartment syndrome, unlikely. Pain produced with extreme plantarflexion of the foot suggests possible irritation or entrapment of the deep peroneal nerve.

**Physical Examination, continued**

Plain X-rays of the foot, ankle, and leg were normal. An EMG/NCS study was performed. The goal was to rule out a radiculopathy, mononeuropathy, plexopathy, or peripheral neuropathy. .

- If necessary, revise your differential diagnosis based on the additional physical findings.
- Design your approach to the electrophysiologic examination based on the existing data.

**Commentary IV**

Electrodiagnostic findings were normal in all muscles tested in the right lower limb, except in the extensor digitorum brevis where increased insertional activity, fast firing units, and 2+ fibrillations were recorded. Tibial and sural nerves were within normal limits on nerve conduction studies on the right. Peroneal motor nerve conduction across the fibular head was within normal limits on both the right and left, as was the superficial peroneal sensory nerve on the right. However, the peroneal nerve tested at the ankle on the right showed a prolonged distal latency.

**Electrophysiologic Data**

SENSORY NERVE CONDUCTION STUDIES							
NERVE	SIDE	STIM SITE	RECORD	cm	AMPL	LAT	CV
Sural	Right	Calf	Ankle	14	25	3.7	
Superficial peroneal	Right	Leg	Foot	14	18	3.2	
Medial plantar	Right	Sole	Ankle	14	13.4	2.8	



<b>MOTOR NERVE CONDUCTION STUDIES</b>							
<b>NERVE</b>	<b>SIDE</b>	<b>STIM SITE</b>	<b>RECORD</b>	<b>cm</b>	<b>AMPL</b>	<b>LAT</b>	<b>CV</b>
Peroneal	Right	Dorsum of ankle	EDB	8	3.0	7.2	41 (below fib head to ankle)
Peroneal	Left	Dorsum of ankle	EDB	8	3.4	4.7	46 (below fib head to ankle)
Peroneal	Right	Across fib head	EDB	10	3.1	11.8	43 (above to below the knee)
Peroneal	Left	Across fib head	EDB	10	3.3	9.7	48 (above to below the knee)
Tibial	Right	Ankle behind med malleolus	AH	8	8.4	4.9	46 (below knee to ankle)



**NEEDLE ELECTROMYOGRAPHY**

INSERtional activity: N, sust, unsust

FIB: 0, 1+, 2+, 3+, 4+

OTHer: 0 or fascic, myotonia, myokymia

EFFort: N, decr

RECruitment: N, inc or dec 1+, 2+, 3+, 4+

AMPLitude: N, inc or dec 1+, 2+, 3+, 4+

DURation: N, inc or dec 1+, 2+, 3+, 4+

POLyphasia: N, inc or dec 1+, 2+, 3+, 4+

R/L	MUSCLE	INSER	FIB	OTH	EFF	REC	AMP	DUR	POL
R	Lumbar paraspinal	N	0	0	N	N	N	N	N
R	Gluteus Max	N	0	0	N	N	N	N	N
R	Gluteus Med	N	0	0	N	N	N	N	N
R	Vastus Med	N	0	0	N	N	N	N	N
R	Tib Ant	N	0	0	N	N	N	N	N
R	Medial Gastroc	N	0	0	N	N	N	N	N
R	Ext Hall Longus	N	0	0	N	N	N	N	N
R	Flex Hall Longus	N	0	0	N	N	N	N	N
R	Flex Hall Longus	N	0	0	N	N	N	N	N



R	Peroneus Longus	N	0	0	N	N	N	N	N
R	Peroneus Brevis	N	0	0	N	N	N	N	N
R	Ext Dig Brevis	sust	2+	0	N	Fast firing	N	N	N

- On the basis of both the clinical and electrophysiologic evaluations, formulate your diagnostic impression. List the most likely diagnosis first and follow in order with the other possibilities that are not excluded by the data. Eliminate those diagnoses not supported by the data.
- Are there additional electrophysiologic data that you feel would further delineate the diagnosis? (Remember, collecting data that are not needed for the diagnosis is costly and uncomfortable for the patient.)

**Electrophysiologic Data, continued**

- Make the final revisions of your diagnostic impression(s).

**Disgnostic Impression**

This is a case of deep peroneal neuropathy at the ankle.

- What other diagnostic procedures (laboratory tests, etc.), if any, are needed?
- What treatment would you recommend?

**Commentary V**

This is a case of compression of the deep peroneal nerve as it passes under the inferior extensor retinaculum on the dorsum of the foot and ankle. It was designated “anterior tarsal tunnel syndrome” by Marinacci (1968) to differentiate from the better-known syndrome of tibial nerve compression behind the medial malleolus. This case exhibits typical signs and symptoms of this syndrome. Paresthesias with aching pain over the dorsum of the foot into the hallux and second toe are characteristic. Impaired sensation in the sensory distribution of the deep peroneal nerve in the first web space, as well as weakness of muscles innervated by the distal deep peroneal nerve, specifically the EDB, are also to be expected. Percussion over the lateral side of the extensor hallucis longus tendon can reproduce the pain and is considered a positive Tinel’s sign in this syndrome. Pain with plantarflexion is also possible due to stretching of the deep peroneal nerve as it passes through the fibro-osseous tunnel of the inferior extensor retinaculum.

The EMG/NCS evidence in this case confirms the diagnosis of a distal deep peroneal neuropathy. Presence of abnormal spontaneous activity in the EDB combined with slowing of the distal latency of the peroneal nerve at the ankle support the diagnosis. Studies of the peroneal nerve across the fibular head were normal, indicating the level of compression is likely at the anterior tarsal tunnel. A normal superficial peroneal sensory study with a normal sural and medial plantar nerve (tibial sensory) rule out a generalized peripheral neuropathy. Absence of increased insertional activity or abnormal spontaneous activity in other muscles in the leg, especially in muscles in the same root level, make radiculopathy or plexopathy unlikely.



Causes of deep peroneal nerve compression, as it passes through the anterior tarsal tunnel, include trauma (such as the dashboard contusion sustained by this patient), repetitive motion of plantarflexion (ballet dancers), and tight-laced footwear or ski boots. There have been multiple documented cases of "combat boot palsy" reported in the literature. Other causes include osteophyte formation secondary to degenerative arthritis or ganglion protruding into the tunnel.

Treatment for anterior tarsal tunnel syndrome includes discontinuation of aggravating factors such as ballet dancing, high heel shoes, tight-laced boots, and ski boot wear. Conservative treatment includes rest and NSAIDs. Corticosteroid injections have been used with mixed results. Although more invasive, surgical release and decompression of the extensor retinaculum has been documented in the literature with favorable results.

The patient in this case was followed in clinic 3 months later and symptoms had resolved significantly with nonoperative treatment. She declined surgical consultation and chose to continue with medical management.

## **Bibliography**

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