**Case Report**

**Medial calcaneal neuropathy: A rare cause of prolonged heel pain**

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**Summary**

Pain heel constitutes 15% of foot pain. Pain may be caused by plantar fasciitis, calcaneal fractures, calcaneal apophysitis, heel pad atrophy, inflammatory diseases or related with nerve involvement. Tibial, plantar and/or medial nerve entrapment are the neural causes of pain. Most of the heel soft tissue sensation is provided by medial calcaneal nerve. Diagnosis of heel pain due to neural causes depends on history and a careful examination. Surgery should not be undertaken before excluding other causes of heel pain. Diagnosis should be reconsidered following conservative therapy.

Keywords: Heel pain; medial calcaneal nerve.

**Introduction**

Plantar heel pain consists 15% of all foot pain. It may be classified as plantar, midfoot (medial and lateral) and posterior heel pain according to its location or sharp or burning (with electrical like feeling) according to the type of pain or adult or childhood pain according to age.[1] Pain maybe related to mechanical causes like abnormal pronation, plantar fasciitis, plantar fasciosis, calcaneal bone fracture, calcaneal apophysitis, atrophic or damaged heel pad or to inflammatory conditions presenting with arthritis. It may also be induced by nerve compression or entrapment.[2] While pain upon stepping immediately after a period of rest is mostly related with plantar fasciitis, pain following prolonged standing is usually associated with fat pad syndrome. Neurological causes include tarsal tunnel syndrome, entrapment of plantar nerve (medial or lateral), medial calcaneal branch of tibia nerve or sural nerve. In cases with unilateral heel pain, lumbar disc disease with radiculopathy should also be considered as one of the reasons. In bilateral pain, neuropathic pain associated with systemic causes like diabetes, alcoholism or vitamin deficiency may be the etiological factor.[3] In case of insufficient treatment of local or nociceptive pain, pain becomes chronic. In chronic pain stimulation of nociceptive reseptors with mechanical and inflammatory mediators increase the sensitivity of the somatosensory system. Resprouting of the free nerve endings also play an important role in the chronicity of pain.[4,5] Hence heel pain may become a form of central pain in cases with a long disease duration.
Case Report

A 40-year-old woman with a 2-year history of lumbar disc disease presented to the clinic with ongoing left foot pain. She was operated 1.5 months ago with the diagnosis of plantar fasciitis and lateral plantar nerve entrapment by an orthopedist. She has reported that preoperative EMG findings were not significant. She has received five sessions of physical therapy before the surgery. Following surgery local steroid injection was delivered without any significant relief. Amitriptyline 25 mg was also prescribed. The patient reported severe first step pain that may be termed as poststatic dyskinesia and pain with prolonged standing. She also had severe discomfort in wearing shoes. On physical examination no deformities, swelling or redness was observed. There was neither muscle atrophy or limited joint motion. Sensory examination showed severe alodinia over the vertical incision on the medial side. MRI (Magnetic Resonance Imaging) revealed postoperative changes of the plantar fascia and tarsal tunnel. She was reoperated and neurolysis of the lateral plantar nerve was done followed by local steroid injection. Scar massage, sensory re-education, mild resistive exercises and hydrotherapy were advised as complementary treatments. Pregabalin was interchanged with amitriptyline and increased to 450 mg/day. Pregabalin was stopped after 1 month due to the persistent pain while standing and walking. 2 months later the patient has referred to an algologist for ongoing left heel pain. Sympathetic blockade at L4, dorsal root ganglion blockade by radiofrequency at L4 and L5 were applied by the algologist who diagnosed the patient as complex regional pain syndrome. The patient reported no pain relief 8 months later and visited another orthopedist who asked for a second EMG investigation. The EMG result was compression of medial calcaneal branch of the left posterior tibial nerve. Due to the diminished sensory conduction velocities, the patient was diagnosed as having a medial calcaneal neuropathy and neurolysis of this branch was undertaken. The patient attended physical medicine and rehabilitation sessions consisting of superficial heat, analgesic currents, therapeutic ultrasound, soft tissue massage and various therapeutic exercises. Two months later, she reported that she could spend more time in the standing position. Her physical examination revealed no alodinia. Sensory testing by monofilament was unresponsive to 6.65 at the heel and 3.61 on the lateral and medial sides of the foot. 2 point discrimination test was also negative at the heel and more than 20 mm’s at the neighborhood of the heel. The patient was discharged from physical therapy to be followed up in 3 months.

Discussion

Plantar fasciitis and heel spur are the most common causes of mechanical heel pain.[1] If there is a sensation of burning, tingling or numbness in the plantar region than medial or lateral plantar nerve entrapment may be the responsible cause. Tibial nerve divides in the distal third of the leg into medial calcaneal nerve (MCN), medial plantar nerve (MPN) and lateral plantar nerve (LPN). The bifurcation of medial and plantar nerves may take place inside, proximal or distal to the osteofibrous tunnel (tarsal tunnel). 73–100% of the bifurcations are located inside the tarsal tunnel. Dellon and Mackinnon have further described a reference line called malleolar-calcanear axis to better define the limits of tarsal tunnel.[6] Lateral plantar nerve further gives its first branch or inferior calcaneal nerve which is called as Baxter’s nerve.[7] Entrapment of the 1st branch of LPN occur in 15–20% of the patients with chronic pain.[2] In 1940 entrapment of this branch was considered as one of the neural causes of heel pain.[8] It does not supply the sensory branches to skin but when entrapped, gives a burning sensation on the plantar side of the heel.[2,9] Initially the most significant complaint of the patient was heel pain that was worse with prolonged standing and walking. She also had first step pain which could be defined as poststatic diskinesia. Neither her complaints nor her first EMG didn’t suggest any kind of nerve entrapment. Yet she was operated and neurolysis has been done to the 1st branch of LPN. The surgical intervention has exacerbated her complaints and neuropathic pain has become the most significant source of pain. MRI of the left foot was undertaken to make a differential diagnosis. Differential diagnosis includes trauma, avascular necrosis, reganllion cyst, rheumatological involvement, lipoma and nerve sheath tumour.[10–12] In this case, no specific pathology of the bone or soft tissues was found with MRI. The reason why MRI investigation of the patient was not helpful may be the numerous anatomic variations that medial calcaneal nerve demonstrates. It has been found by Didia et al. that it may originate from tibial nerve (62.5%),
from the medial plantar and tibial nerves, from the lateral plantar and tibial nerves (18.75%) or from the tibial and medial calcaneal and lateral plantar nerves. It may also consist of one, two, three or four major branches.[13,14] Hence MRI is the method of choice in depicting space occupying lesions of the tarsal tunnel rather than examining the nerve itself.[11]

The allodynia has been so severe that examination by the physiatrist was only possible by observing and comparing with the other side the active joint ranges and by testing the muscle strength by asking the patient to walk on toes and her heels. No sensory testing related with light touch or vibration could be accomplished.

In our case we do not know whether heel pain was either present originally or caused secondarily by a neuroma or by the fibrotic scar tissue caused by the previous operation in this area. If heel pain was due to inferior calcaneal branch of plantar nerve than the sensibility of the medial heel would be normal. Abnormal sensibility of the heel suggests the nerve is compressed proximal to the origin of Baxter’s nerve.[15] Monofilament test and two point discrimination test are the two practical tests to test the loss of sensibility.[16] The patient couldn’t sense 6.65 monofilament which corresponds to a force of 300 mg. The sensory evaluation will be repeated 6 and 12 months after surgery to record the improvement compared to immediate postoperative values. During the first visit which was 3 months after the first operation, hyperalgesia and allodynia were the major sources of dysfunction. The intensity, quality and duration of pain were so severe and devastating that tricyclic antidepressants and antiepileptics were used for pharmacological treatment. It was not possible at the initial visit to identify the positive and negative sensory signs that accompanies neuropathic pain. It has been shown that thermal or mechanical hypoesthesia (41%) was more frequent than hyperalgesia (18%), mechanical hyperalgesia (36%) was more frequent than thermal hyperalgesia (19–24%) and mechanical allodynia was present in 20% of 1236 patients with different neuropathic pain syndromes.[17,18]

Although electrodiagnostic studies are usually requested to confirm nerve involvement, they carry a 50% false-negative result for large nerve compression syndrome.[19] They are even less accurate for smaller nerve fibers.[2] In our case, electrodagnostic tests were useful to rule out lumbosacral nerve root compression which the patient has experienced two years ago. While the first EMG was not significant, the second EMG investigation, showed latency to sensory response in the MCN area.

Since the etiology of plantar heel pain is multifactorial, there are different treatments offered by different healthcare providers. In this case the patient visited three orthopedic surgeon, two algologists and two physiatrists. Conservative measures like physical therapy including ultrasound, laser, heat or cold therapy, analgesic currents, iontophoresis with dexamethasone, extracorporeal shock wave therapy, stretching exercises, night splints, taping, soft tissue or nerve mobilisation (in case of heel pain of neural origin), local anesthetic or corticosteroid injections may be applied for a positive outcome.[20] According to APTA (American Physical Therapy Association) guideline surgery is not recommended for the first 6 months of treatment.[21] They also advice to evaluate the improvements at the 6th week, 6th month and after 1 year. Alshami et al. stated that treatment of heel pain due to nerve entrapment was similar to other types also emphasize that surgery should be considered if at least 6–12 months of conservative treatment has failed.[2]

As in our case, correct diagnosis of heel pain is not easy. Since heel pain that aggravated by standing and walking was the major complaint, appropriate treatment of the mechanically induced plantar fasciitis could have been considered first. Five sessions of physical therapy wouldn’t be enough to rule out other causes of heel pain. Medial calcaneal nerve entrapment could be a reason of heel pain or a result of of the scar tissue following surgery. Careful physical, radiological and electrophysiological investigation should be undertaken to understand if there is nerve involvement or if pain is caused by non neurological reasons. To our opinion, due to limited reliability of tests, a well constructed conservative treatment of heel pain for at least 6 weeks should be the first choice before considering surgery.

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