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Plantar Fasciitis with Chronic Baxter's Neuropathy Causing Hindfoot Pain - A Case Report

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Learning Point of the Article:

The radiologists should look for the involvement of Baxter's nerve while reporting an MRI foot for suspected plantar fasciitis. Acute nerve involvement is indicated by edema in the abductor digiti minimi muscle while its atrophy points toward its chronic denervation.

Abstract

Introduction: The main differentials of non-traumatic heel pain are plantar fasciitis (PF), plantar heel fat pad atrophy, worn-out footwear, especially asymmetric wear and tear, hyperuricemia, corns, callosities, tumors of the calcaneum, osteomyelitis, calcaneal stress fractures due to overweight or unaccustomed over usage, radiating pain from S1 nerve root compression, and seronegative spondyloarthropathies. Compression of the tibial nerve or the medial calcaneal nerve at or around the flexor retinaculum is the other possibility. In this case report, we want to highlight a sparsely known pathology, caused due to the entrapment of the first branch of the lateral plantar nerve or inferior calcaneal nerve, also known as Baxter's nerve that may present independently or accompany the common PF. Non-steroidal anti-inflammatory medications or injections of local steroids are typically used for conservative management. However, hydro-dissection or surgical release may be needed in non-responsive cases.

Case Report: We present the case of a 57-year-old female with complaints of chronic pain and tenderness in the middle of the heel radiating laterally. She underwent magnetic resonance imaging that revealed chronic denervation changes in the form of marked atrophy and near complete fatty replacement of abductor digiti minimi muscle suggesting chronic Baxter neuropathy. A mildly thickened and hyperintense plantar fascia adjacent to the calcaneal spur and significant heel fat pad edema were seen too. The patient responded well to a local steroid injection and remains pain-free at the 1-year follow-up.

Conclusion: When heel pain is present, Baxter's nerve impingement presents as a challenging clinical diagnosis that may accompany the common PF and is often overlooked. MRI can be used to assess the denervation effects of both the acute and chronic stages of Baxter's nerve impingement by identifying abnormalities of the abductor digiti minimi muscle belly.

Keywords: Baxter neuropathy, inferior calcaneal nerve, abductor digiti minimi, plantar fasciitis, heel pain, case report.

Introduction

Plantar fasciitis (PF) remains the most well-known cause of non-traumatic heel pain. Its other differential diagnoses are plantar heel fat pad atrophy, worn-out footwear, especially asymmetric wear and tear, hyperuricemia, corns, callosities, tumors of the calcaneum, osteomyelitis, calcaneal stress fractures due to overweight or unaccustomed over usage, radiating pain from S1 nerve root compression, and seronegative spondyloarthropathies [1]. Compression of the tibial nerve (TN) or the medial calcaneal nerve at or around the flexor retinaculum (FR) is the other possibility [1]. In this case report, we want to highlight a sparsely known pathology, caused due to the entrapment of the first branch of the lateral plantar nerve

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Author's Photo Gallery


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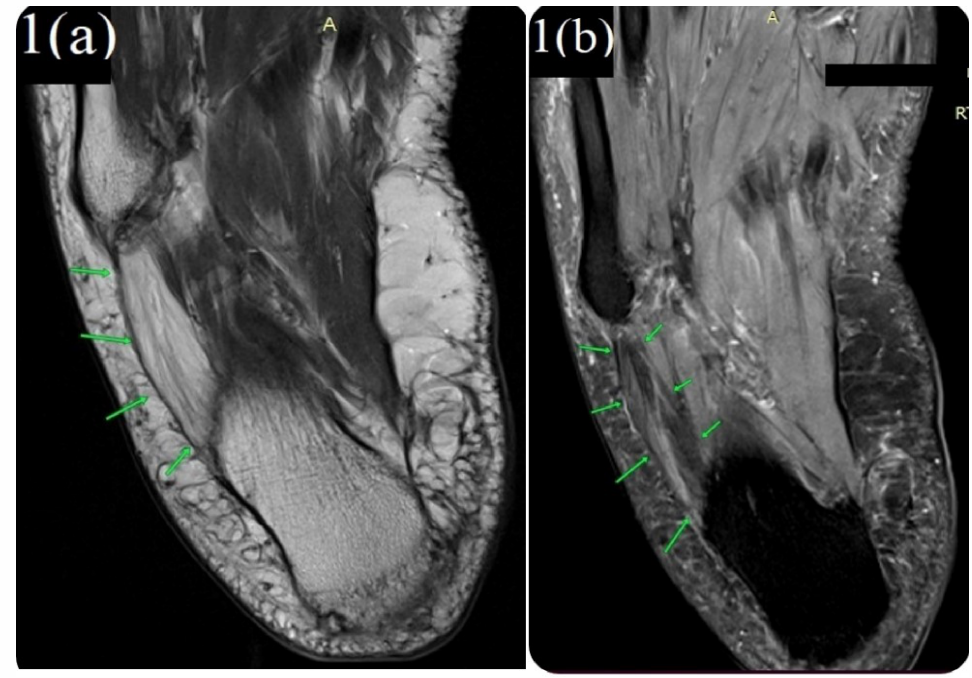

Figure 1: (a) Axial T2 weighted, (b) axial proton density fat saturated (PDFS) magnetic resonance images of the sole show severe atrophy and fatty infiltration selectively involving the abductor digiti minimi muscle belly, representing chronic Baxter's nerve impingement (green arrows). Note that the signal intensity of the abductor digiti minimi is similar to that of adjacent subcutaneous fat with no muscle edema.

(LPN) or inferior calcaneal nerve (ICN), also known as Baxter's nerve (BN) that may present independently or accompany the common PF.

Case Report

A 57-year-old female moderately built patient was referred to the radiodiagnosis unit from the orthopedic clinic of our hospital with complaints of intractable heel pain for the past year. No relevant medical or family history could be elicited. The pain was insidious in onset, sharp, burning, and radiating in nature, aggravated with walking, and relieved by rest. The patient had been managed by the previous treating physicians with shoe and activity modification, stretching, physiotherapy, and non-steroidal anti-inflammatory drugs (NSAIDs). However, all these measures were unsuccessful. On examination, the skin of the heel region looked normal without any swelling, redness, sinus, visible cracking, etc. The arches and the alignment of the foot were found to be normal. The range of motion of the foot was painless and within normal limits. On palpation, tenderness could be elicited in the middle of the heel and it radiated laterally. No gap in the continuity of the Achilles Tendon (AT) was elicited, and it was non-tender.

X-ray findings were inconclusive, so magnetic resonance imaging (MRI) was sought for the patient. MRI of the right ankle was performed on a 3 Tesla MR scanner (Siemens Skyra) using a dedicated ankle/foot coil (Fig. 1 and 2), which revealed a prominent plantar calcaneal enthesophyte, mildly thickened and hyperintense plantar fascia (~5 mm) adjacent to the calcaneal spur, and significant heel fat pad edema. Chronic denervation changes in the form of marked atrophy and near complete fatty replacement of abductor digiti minimi (ADM) muscle were well evident on axial T1 and PDFS sequences, suggesting chronic Baxter neuropathy. A partial tear of the Achilles Tendon was also present approximately 5 cm proximal to the insertion with multiple intra-tendinous osseous bodies. Based on the above findings, our patient was diagnosed with long-standing inferior calcaneal impingement neuropathy (chronic Baxter neuropathy) secondary to PF and plantar calcaneal enthesophyte.

After the confirmation of diagnosis on imaging, it was decided to give a trial of local steroid injection (1 ml of methylprednisolone of strength 40 mg/ml + 2 ml of lignocaine 1%) at the origin of plantar fascia adjacent to the calcaneal spur. The patient responded well and remained pain free at the 1-year follow-up.

Discussion

The abductor halluces (AH) muscle, located on the medial side of the foot, originates from the tuberosity of the calcaneus, the FR, and the plantar aponeurosis [2].

The TN divides into medial and lateral plantar nerves (Fig. 3) deep to the flexor retinaculum at the origin of the AH [2].

The medial plantar nerve (MPN) also called the internal plantar nerve (IPN), which is larger as compared to its lateral counterpart, passes between the AH and flexor digitorum brevis (FDB). It gives rise to a proper digital plantar nerve of the great toe and ultimately trifurcates into three common digital plantar nerves at the bases of the metatarsals. It also gives muscular branches supplying the AH, the FDB, the flexor hallucis brevis (FHB), and the first lumbrical muscle [2].

The LPN also called external plantar nerve (EPN) passes between the FDB and QP (quadratus plantae). Near the head of

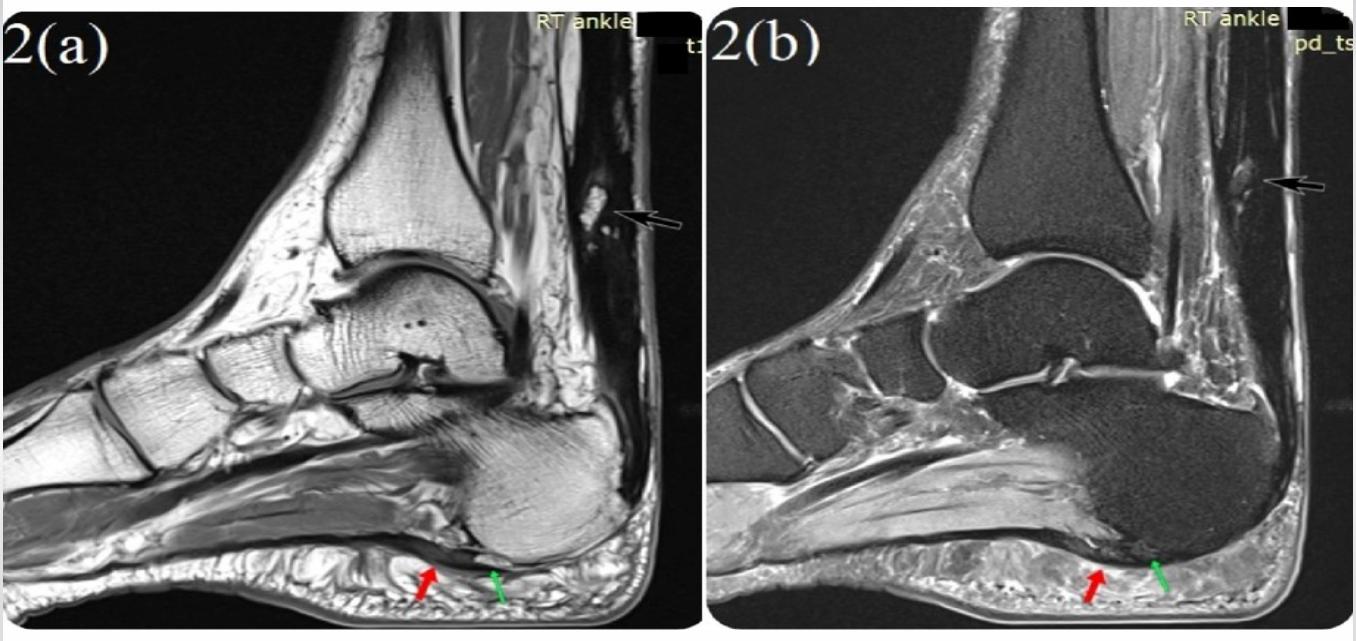

Figure 2: (a) Sagittal T1 weighted, (b) proton density fat saturated (PDFS) magnetic resonance images of the ankle reveal a prominent plantar calcaneal enthesophyte (green arrows), and thickened plantar fascia measuring about approximately 5 mm adjacent to the calcaneal spur (red arrow), showing hyperintensity on the PDFS image. Significant heel fat pad edema and a partial tear of the Achilles tendon approximately 5 cm proximal to the insertion with multiple intra-tendinous osseous bodies (black arrow) is also evident in the image.

the fifth metatarsal, it divides into a superficial and a deep branch. The superficial branch gives rise to the lateral proper plantar digital nerve and the common plantar digital nerve, and through these nerves mainly innervates the skin of the lateral aspect of the 5th toe, the Flexor digiti quinti brevis, and the interossei of the fourth intermetatarsal space. The deep branch supplies the first three interossei, the adductor hallucis muscle, and the 2nd, 3rd, and 4th lumbrical muscles.

The first branch of the LPN (also known as inferior calcaneal nerve/Baxter nerve) usually arises from the lateral plantar nerve near the bifurcation of the tibial nerve, but variations in its place of origin are present. It courses from the medial to the lateral direction between the abductor hallucis muscle and the medial calcaneal tuberosity till the base of the fifth metatarsal bone where it reaches the abductor digiti minimi (ADM). It gives motor innervation primarily and consistently to the ADM, occasionally and variably to the FDB and the QP [2].

The possible sites of entrapment of the BN (inferior calcaneal nerve), are in the tight fascial planes between the AH muscle and the QP (quadratus plantae), or at the anterior aspect of the medial calcaneal tuberosity between the FDB and QP [3, 4].

It is responsible for approximately 1/5th of cases of hindfoot pain but has not gained adequate attention in the medical literature and is often missed because of a lack of awareness. Clinically, it can be differentiated from its closest differential PF by the presence of numbness, tingling, or pain on pressure along the course of the first branch of the LPN [5].

The heel spurs may be painless themselves, but they may indirectly cause pain by pressing upon the intimate structures [6].

MRI plays an important role in detecting even subtle tissue changes in muscle related to denervation. Nerve impingement progresses from an acute to subacute to a chronic state, similar to many other disease processes. Acute and subacute changes in muscle are best demonstrated on fluid-sensitive sequences of MRI, such as T2-weighted imaging with fat suppression, short tau inversion recovery, and proton-density sequences as bright signals representing denervation muscle edema. Depending on the patient's innervation anatomy, muscle edema in the presence of Baxter's nerve impingement will occur mostly in the ADM muscle and maybe in the FDB and QP as well. While in the setting of chronic Baxter's nerve impingement, denervated muscle will eventually undergo atrophy, and subsequent irreversible fatty infiltration, for which the fat-sensitive sequences of MRI, such as T1-weighted imaging, remain the gold diagnostic standard [7].

Management is conservative with NSAIDs and some local steroids. However, hydro-dissection or surgical release may be needed in non-responsive cases [8-10].

Conclusion

When heel pain is present, Baxter's nerve impingement presents as a challenging clinical diagnosis that may accompany the

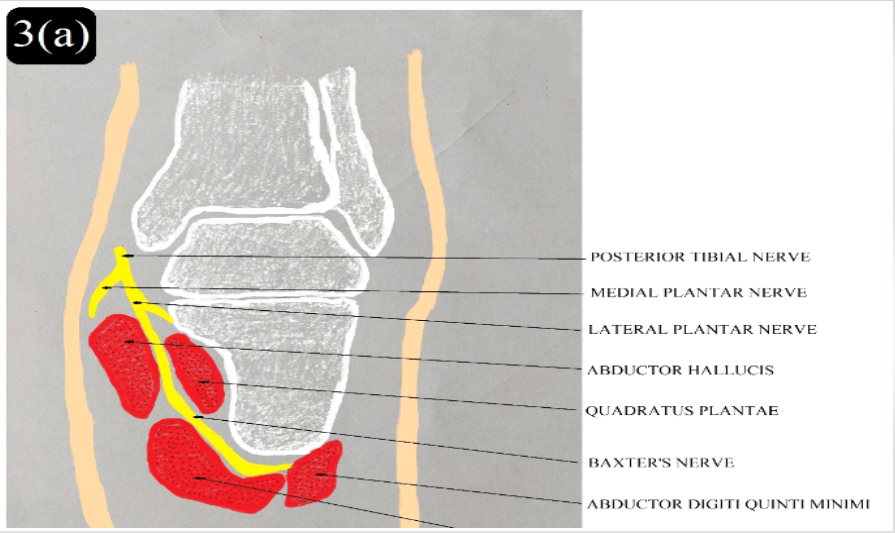

Figure 3a: Diagrammatic illustration of the right foot focusing on plantar nerves as seen (a).

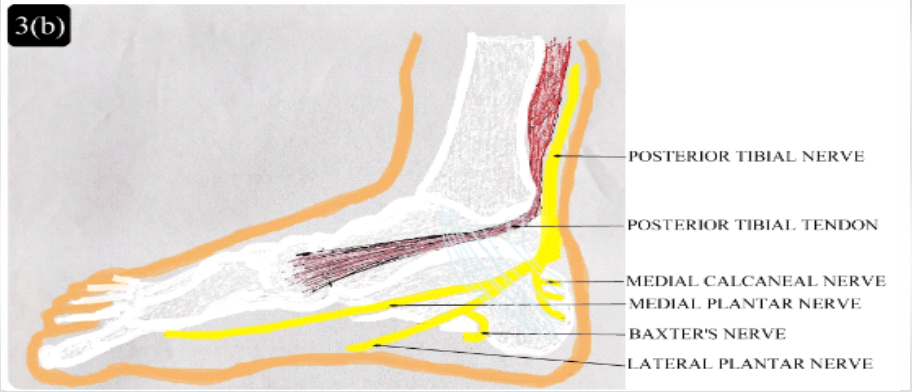

Figure 3b: from the medial aspect of the foot.

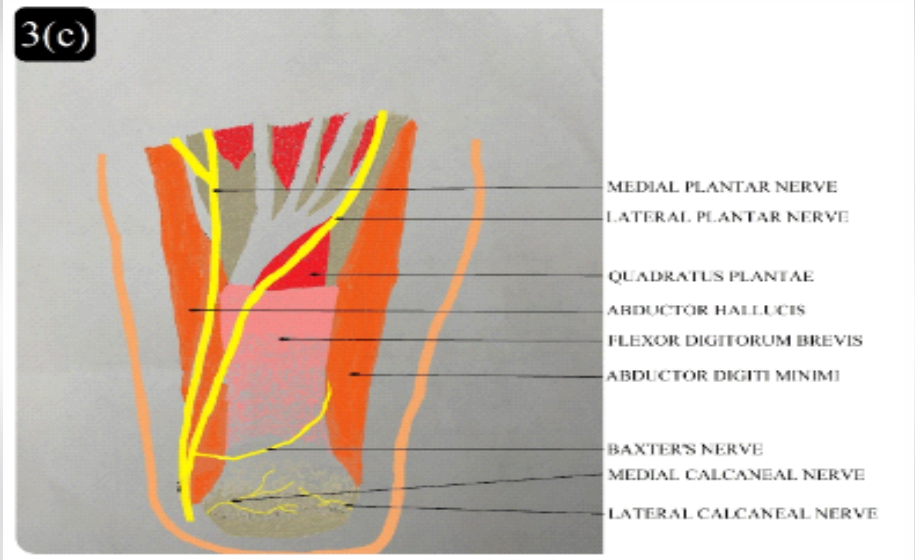

Figure 3c: From the plantar aspect of the foot.

common PF and is often overlooked. MRI can be used to assess the denervation effects of both the acute and chronic stages of Baxter's nerve impingement by identifying abnormalities of the ADM muscle belly.

Clinical Message

The orthopedic surgeons should keep the possibility of Baxter's nerve involvement in refractory cases of suspected PF and should not hesitate to rule out the same with radiological imaging of the foot.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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