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CASE REPORT

Ultrasound block of first branch of the lateral plantar nerve (baxter nerve): case report of a promising and effective treatment for heel chronic pain☆

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Abstract Chronic heel pain is a challenging diagnosis and although it is a common and disabling condition frequently mistreated. Baxter Nerve (BN) entrapment is responsible for 20% of heel pain and can be managed by an ultrasound guide nerve block, a simple, safe, and durable technique. A 67-year-old woman complained of paraesthesia on the left heel and a ''stepping on glass'' feeling. Various techniques were performed to manage her symptoms without any results. An ultrasound BN block was finally performed with an instant relief and satisfactory pain control for the follow-up period of six months. This clinical report highlights the success of the ultrasound BN block as an effective and lasting solution for chronic heel pain.

Background and objectives

Chronic heel pain is a common problem with an estimated incidence of 10–15%.[1] Despite being a cause of moderate disability, because it is often associated with other osteoarticular symptoms it is frequently neglected.

The differential diagnosis of plantar heel pain is broad and particularly challenging since the clinical presentation may be multifaceted and similar for different clinical aetiologies, leading frequently to misdiagnosis and therefore to erroneous treatment attempts.

The First Branch of the Lateral Plantar Nerve (FBLPN), also known as inferior calcaneal nerve or, more commonly, as the Baxter Nerve (BN), is a small (aprox. 2 mm) mixed motor and sensory nerve. It provides sensory innervation to the calcaneal periosteum and long plantar ligament. Its first ultrasound visualization was described by Presley and colleagues in 2013,[2] and since then it role as a therapeutic target has been recognized.

☆ Study conducted at the Chronic Pain Unit in Hospital Pedro Hispano, Matosinhos, Portugal.

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Baxter's entrapment is thought to be responsible for up to 20% of heel pain symptomatology. Entrapment of nervous tissue within the foot has multiple etiologies, and it can be secondary to space-occupying lesions, tenosynovitis, accessory or hypertrophic musculature, bony spurs, trauma, and even systemic diseases such as diabetes.

With this case report the authors aim to empathise the entrapment of the Baxter nerve as a possible and treatable cause of plantar heel chronic pain and highlight the role of ultrasound guide block as a diagnostic tool and an effective and durable treatment.

Case report

A 67-year-old woman with a personal history of depressive syndrome and degenerative osteoarticular pathology. The patient was followed up by the Chronic Pain Unit (CPU) since 2013 due to low back pain with left leg irradiation. She also presented paresthesia and a warm thermic sensation in her left heel. A magnetic resonance imaging was performed and a L3–L4 spinal canal stenosis was confirmed. Patient was chronically medicated with tramadol Extended-Release (ER) 150 mg once a day (qd), pregabalin 50 mg 2-times a day, amitriptyline 10 mg/qd, trazodone 150 mg/qd and dipotassium chlorazepate 10 mg/qd, tramadol + paracetamol, cyclobenzaprine and NSAID in SOS.

Over the years, the patient experienced periods of significant exacerbation of the algic and paresthesia complaints. Due to incomplete clinical control, a left cluneal nerve infiltration was performed without relive of the symptoms. Then a lumbar epidural block with ropivacaine and clonidine was performed with a brief clinical improvement, and it was repeated four months later with the same result. Over the last year, the patient's main complaint was low back pain with irradiation to the left leg and to the plantar region of the left foot. Patient also referred paresthesia on the left heel and a ''stepping on glass'' feeling. Pulsed Radiofrequency (PRF) of S1 root was tried with a relief of low back pain but without difference on the foot symptoms. Usual medication was adjusted to tramadol ER 150 mg/qd, pregabalin 50 mg bid and tramadol + paracetamol SOS. A second PRF was performed without further improvements. By this time, the patient focused her attention on a sharp heel pain, describing an 8 in Numeric pain Rating Scale (NRS), with numbness and weakness of the heel, so an ultrasound (US) Baxter nerve block was proposed, and a written informed consent was obtained from the patient.

She was placed in a lateral decubitus position with the medial side of the foot facing up. A 12-MHz linear transducer was placed in a transverse anatomical position, posterior to the internal malleolus, allowing identification in the short axis of the Tibial Nerve (TN) (Figure 1). A caudal scan was performed to identify the division of the TN into Medial Plantar Nerve (MPN) (anteriorly) and the Lateral Plantar Nerve (LPN) (posteriorly) (Figure 2). After centering the image on the LPN we moved the probe caudally until we identified the FBLPN or BN (Figure 3). We then slid caudally to confirm the entry of BN into the fascia between the Abductor Hallucis (AbH) (more superficial) and the Quadratus Plantae (QP) (deeper). An in-plane posterior-to-anterior approach with a 27G 38-mm needle was performed and a mixture of lidocaine 2% (1.5 mL) with ropivacaine 0.2% (1.5 mL) was injected. The dispersion of local aaesthetic was confirmed, and the patient referred an almost instant relieve. No complications were reported. On the follow-up consultation, after six months, the patient remained with satisfactory pain control, classifying the pain with a 2 or 3 in NRS, without need for analgesic rescue medication.

Discussion

Heel pain is a common complaint in CPU but due to its broad spectrum of etiologies it can be often misdiagnosed. An accurate diagnostic approach relies on a comprehensive clinical anamnesis, an exhaustive physical examination and diagnostic imaging exams. Physicians should be aware of typical presentations of neural involvement which includes burning, sharp, and shooting pain that can be accompanied by weakness and sensory changes. The widespread use of ultrasound in anesthesiology, including in CPU, allows a more accurate diagnosis and a rapid and effective treatment.

Presley et al. and Brown's et al.[2,3] detailed the topographical description and ultrasound mapping of the tibial nerve branches and their osteofibrous tubes. These researches were essential to the understanding of neural distribution and contributed to a more accurate diagnosis of plantar heel chronic pain etiology. Rodrigues et al.[4] presented an overview of first branch of the lateral plantar neuropathy causes and its correlation with magnetic resonance imaging findings. These researches suggest the key role of Baxter nerve entrapment as a cause of chronic heel pain.

Although several studies have previously demonstrated the efficacy of solving the nerve entrapment with hydrodissection and local anesthetic infiltration in cadavers,[5] to our knowledge, this clinical report is the first to highlight the clinical success of the US BN block in the effective and lasting resolution of chronic heel pain in humans. Small amounts of local anesthetic are needed to clinically resolve nerve entrapment by hydrodissection, as previously described by Beard and Gousse[6] and now confirmed in vivo by our work. This is a possible explanation for how just 3 mL of local anesthetic lead to clinical improvement and to long term results. Despite previous descriptions suggesting that US BN can aid in accurate diagnosing and treatment plans, our work also demonstrates the safety of this technique and its association with patient satisfaction and long-term results.

In this case we use an in-plane technique described by Presley et al. There are two advantages of this approach: first we can scan caudally the tibial nerve until the FBLPN and secondly, we can clearly see the fascial plane under the AbH to direct the needle over the muscle until needle tip is beyond the AbH. Successful BN block produces an almost instant pain relief which provides diagnostic information and treatment. This minimally invasive technique ultimately avoids more invasively and unnecessary procedures like neuraxial approaches, surgical decompression, or years of ineffective conservative treatments.

This promising technique seems to be an effective and safe treatment for chronic heel pain. However, further studies will be needed to prove the duration of symptoms relief,

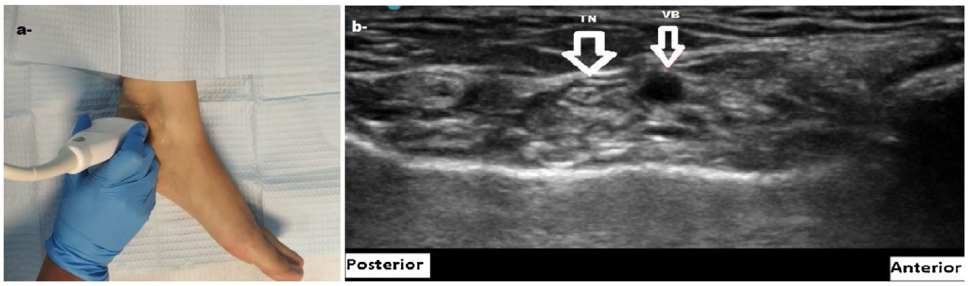

Figure 1 (a) We showed how to place the transducer in a transverse anatomical position, posterior to the internal malleolus. (b) In this scan, it is possible identify the short axis of the tibial nerve (TN arrow) posterior to the vascular bundle (VB arrow).

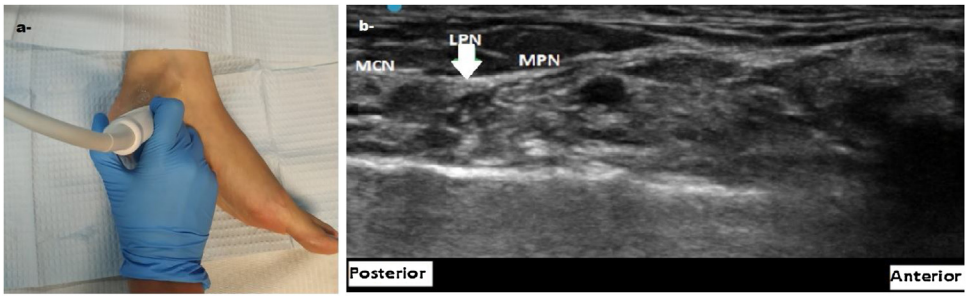

Figure 2 (a) Then, we perform a caudal scan, as showed in this image. (b) In this position it is possible to identify the division of the tibial nerve into Medial Plantar Nerve (MPN) (anteriorly) and the Lateral Plantar Nerve (LPN) (posteriorly). Note that at this point, the Medial Calcaneal Nerve (MCN) is also visible, placed posteriorly to the LPN.

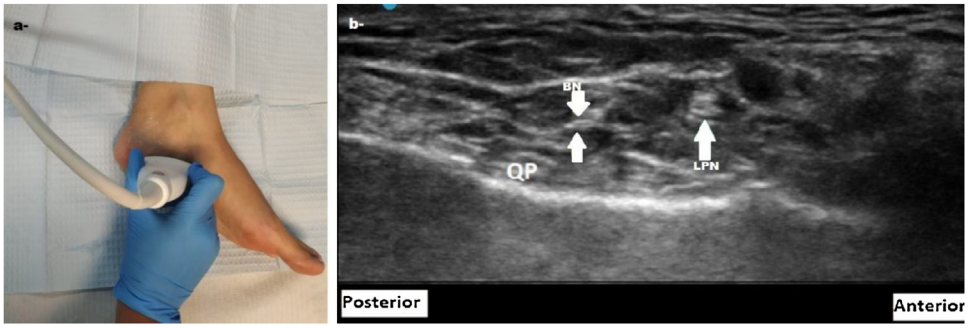

Figure 3 (a) Note that in this image the transducer is further caudally. (b) After centring the image on the LPN, we move the probe caudally until we identify the First Branch Lateral Plantar Nerve or Baxter Nerve (BN). Then slide caudally to confirm the entry of Baxter Nerve into the fascia between the abductor hallucis (more superficial) and the quadratus plantae (QP) (deeper), at this point the nerve is very small and will be loss in fascial plane.

the applicability to other clinical situations, and the existence of possible long-term side effects.

Conflicts of interest

The authors declare no conflicts of interest.

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