Ultrasound Guided Pain Interventions-breaking Barriers for Neuropathic Pain- insights from Case Series

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Abstract

Ultrasound imaging for interventional pain procedures is evolving at a rapid pace. Ultrasound guided peripheral nerve blocks (USG-PNB) has been increasingly been used and reported for acute pain management. Its role in the management of chronic pain patients has largely been under reported. In certain neuropathic pain conditions, posing diagnostic and management challenges, USG-PNB play a valuable role in improving precision, safety and clinical outcomes, as well as they are helpful in titrating pain medications and opioid overuse. This challenging case series emphasises our experience in management of certain neuropathic pain conditions through USG-PNB in day care settings. The purpose of this case series is to elucidate the accessibility and user-friendliness of USG-PNB compared to fluoroscopy-guided ones in the treatment of chronic pain.

Keywords: Chronic Pain Management; Day Care Procedures; Neuropathic Pain; Small Fibre Syndrome; Peroneal Neuropathy; Complex Regional Pain Syndrome; Ulnar Nerve Neurectomy; Superficial Peroneal Neurectomy.

Introduction

Peripheral neuropathy is often a debilitating condition that can lead to both sensory deficit and motor dysfunction. Clinical evaluation alongwith imaging modalities including magnetic resonance imaging (MRI) and ultrasonography can detect morphologic and signal abnormalities within the nerve and identify end-organ effects of muscle denervation.[1,2] Ultrasound (US) offers the additional benefits of dynamic imaging techniques, sonopalpation, and ease of contralateral side imaging for comparison. Because peripheral nerves are well visualized under US guidance, it is most frequently used modalities for image-guided interventions. US eliminates the need for contrast agents, which can pose risks of allergic reactions and renal impairment. It is also portable, cost-effective, and has no known contraindications for use[3]. In this case report we describes the role of ultrasound in unifying acute and chronic pain therapies in day care setting and integration for holistic pain management across time.

Case Report

Case one: Small fibre sensory neuropathy

A 16 year old male resident of Kashmir, weighing 70 kg, complaint of pain, paraesthesia and severe allodynia for past two years on the distal half of both soles. Patient reported inability to walk without support as he had severe pain on keeping feet on floor. Pain was spontaneous in onset with paroxysms of symptoms lasting for 3-4 months with spontaneous remission for 2-3 months. The severity of symptoms progressed with frequency increasing over time with shorter remission period. NRS ranged from 8-9/10 for all pain and paraesthesia. Pain affected his sleep, studies, social life and daily activities. All investigations including biochemistry, ANA, dsDNA, Rh factor, other immunological work up and epigenetic workup was within normal limits. The nerve conduction study was performed and the results were within normal limits. Patient was on four groups of drugs including gabapentin 300 mg BD, Duloxetine 60 mg BD, Amitriptyline 25 mg HS, Carbamazepine 300 mg TDS) without any much relief. On examination, patient had severe allodynia in distal halves of both soles, with no redness and had normal

temperature. The distribution was in the distal half of medial and lateral planter nerves. Ultrasound guided diagnostic tibial nerve block using linear probe was performed with 0.25% bupivacaine and 40 mg depomedrol 2.5 ml on each side just proximal to ankle [Figure 1] . Patient reported 90% and 100% symptom relief on right and left side respectively immediately after the posterior tibial MIPSI. Presently at 2 months of follow up, NRS for pain is 2/10, patient is able to walk without support and sleeps for 8-10 hours without interruptions.

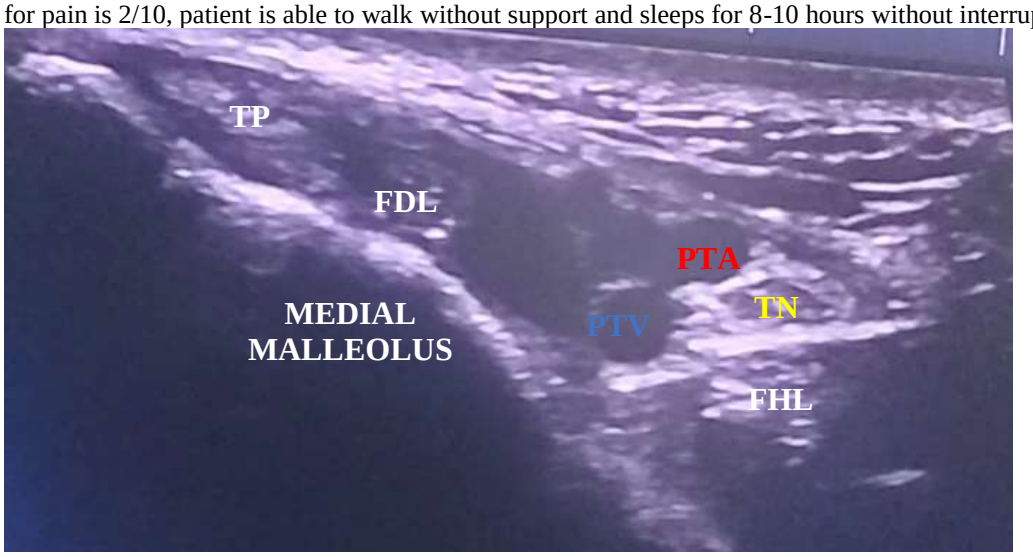

Figure 1: Sonoanatomy of Tibial Nerve at Ankle medial aspect. TP: Tibialis Posterior, FDL: Flexor Digitorum Longus, PTV: Posterior Tibial Vein, PTA: Posterior Tibial Artery, TN: Tibial Nerve, FHL: Flexor Hallucis Longus.

Case two: Peroneal neuralgia following fracture lower limb

The patient is a 38 year old female, resident of Manipur, India, belonging to a middle class business family, business woman, presenting with chief complaints of severe, neuralgic pain in left lower limb since 2 years post left lower limb orthopaedic surgery. The patient had history of fractured left distal tibia and fibula due to fall at home 2 years back and underwent intramedullary nailing of tibia and open reduction internal fixation (ORIF) of fibula 3 years back. The pain was localized just below patella at the level of screw and in anterolateral side of left calf corresponding to distribution of superficial peroneal nerve. Touch/tap/pressure at the upper site provoked pain in the anterolateral side of calf. Pain was electric shock like in character which was aggravated on flexion of knee and touching the left leg.

Patient underwent proximal interlocking screw removal 1 year back, however there was no pain relief. We planned to perform a USG-guided superficial peroneal nerve block using a linear probe, administered with 5 ml of 0.5% Bupivacaine and 60 mg of methylprednisolone. [Figure 2] . Post procedure, she had 99% pain relief. NRS reduced to 3/10 at fractured nailing site. Now patient could easily flex left knee that she was unable to perform due to nerve pain. She had relief from heaviness that was felt while walking.

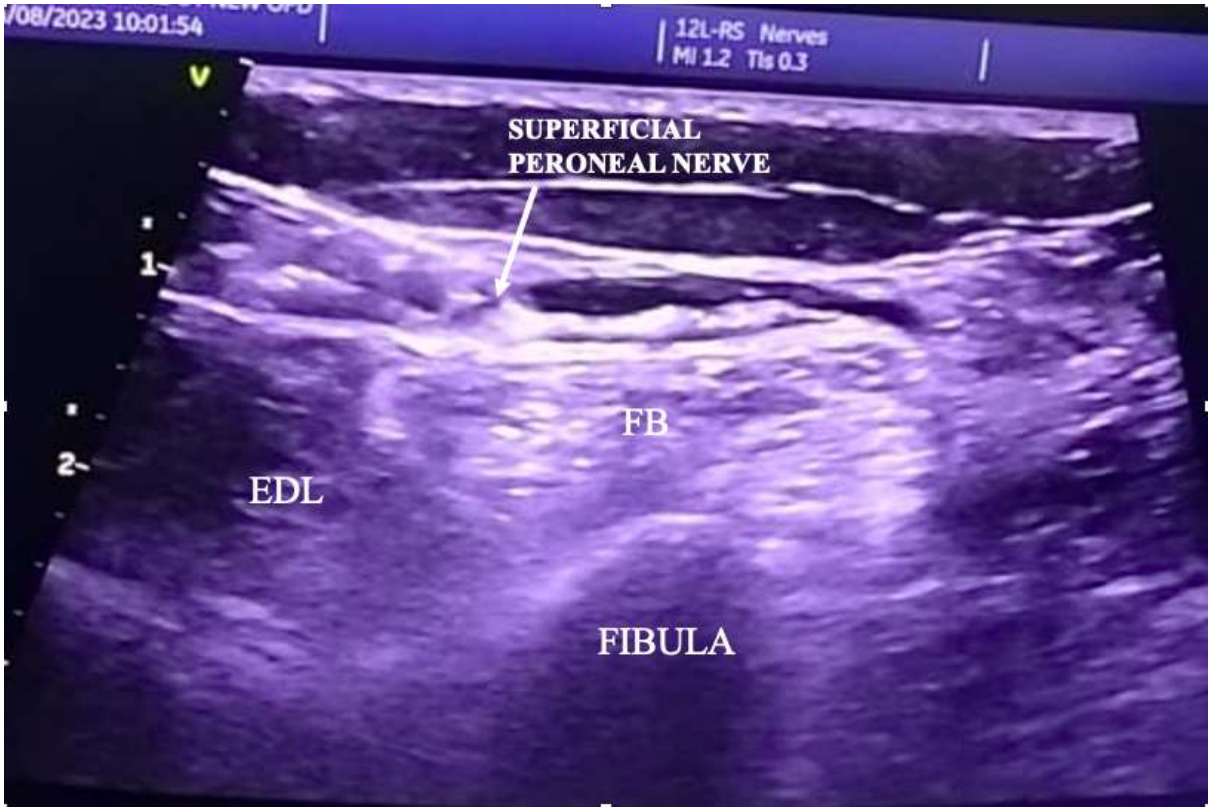

Figure 2: Sonoanatomy of Superficial Peroneal Nerve at level of proximal leg. EDL: Extensor Digitorum Longus; FB: Fibularis Brevis.

Case three: Peroneal neuralgia following superficial peroneal neurectomy

A 50 year complaint of severe left sided lower limb pain. MRI showed L5-S1 disc protrusion with nerve root compression. He underwent discectomy following which pain in dorsum of left foot and anterior aspect of left lower leg still persisted. He also underwent superficial peroneal neurectomy for the same, however there was no relief. Due to severe pain he was unable to walk. Thereafter he was referred to our pain clinic for further management. On examination, there was allodynia extending from dorsal aspect of left foot to mid tibial region anterior aspect. Motor examination revealed no weakness in toes, ankles and leg movement. Ultrasound guided diagnostic superficial peroneal block using linear probe with 5ml of 0.25% Bupivacaine and 80mg of methyl prednisolone was administered which provided good pain relief and improved his gait [Figure 3] . Therafter we performed pulsed radiofrequency ablation of the same. Now the patient NRS of 2/10 from baseline score of 10/10.

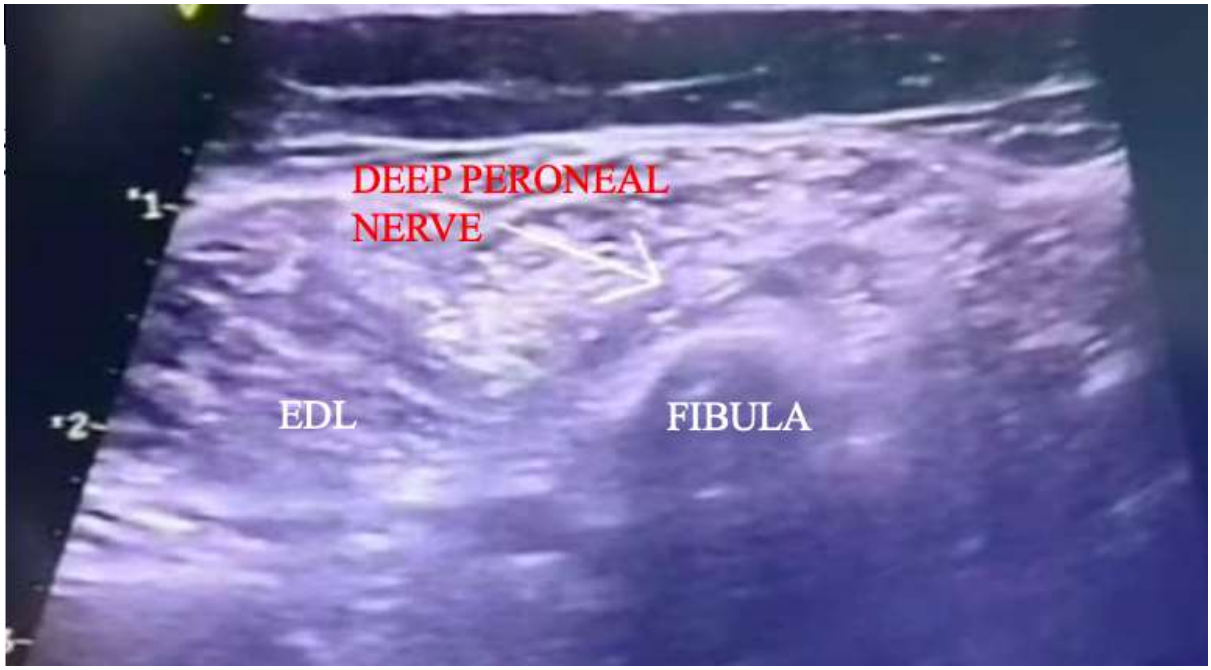

Figure 3: Sonoanatomy of Deep Peroneal Nerve at level of proximal leg. EDL: Extensor Digitorum Longus.

Case four: Remnant ulnar nerve neurectomy followed by upper limb complex regional pain syndrome (CRPS)

61 year old male had history of fall on right shoulder, following which he sustained right supraspinatus tear. Arthoscopic repair was done. However 2 months post-surgery, patient experienced severe pain, edema, redness and decreased temperature in the right second, third, fourth and fifth digits. Suspecting CRPS, patient was administered stellate ganglion block. Following block, the patient's oedema and redness subsided, alongwith pain in lateral three fingers. However pain in little finger and medial aspect of thenar eminence still continued. He also complaint of pain in superior and anterior aspects of the left shoulder, for which lateral pectoral and suprascapular nerve radio frequency ablation was performed. The shoulder pain was relieved, however, little finger pain persisted. A diagnostic injection for USG ulnar nerve block using linear probe with 8ml of 0.2% Ropivacaine and 80mg of methyl prednisolone was administered [Figure 4] . Following ulnar nerve block, patient had complete pain relief with NRS decreasing from 9 to 3 out of 10.

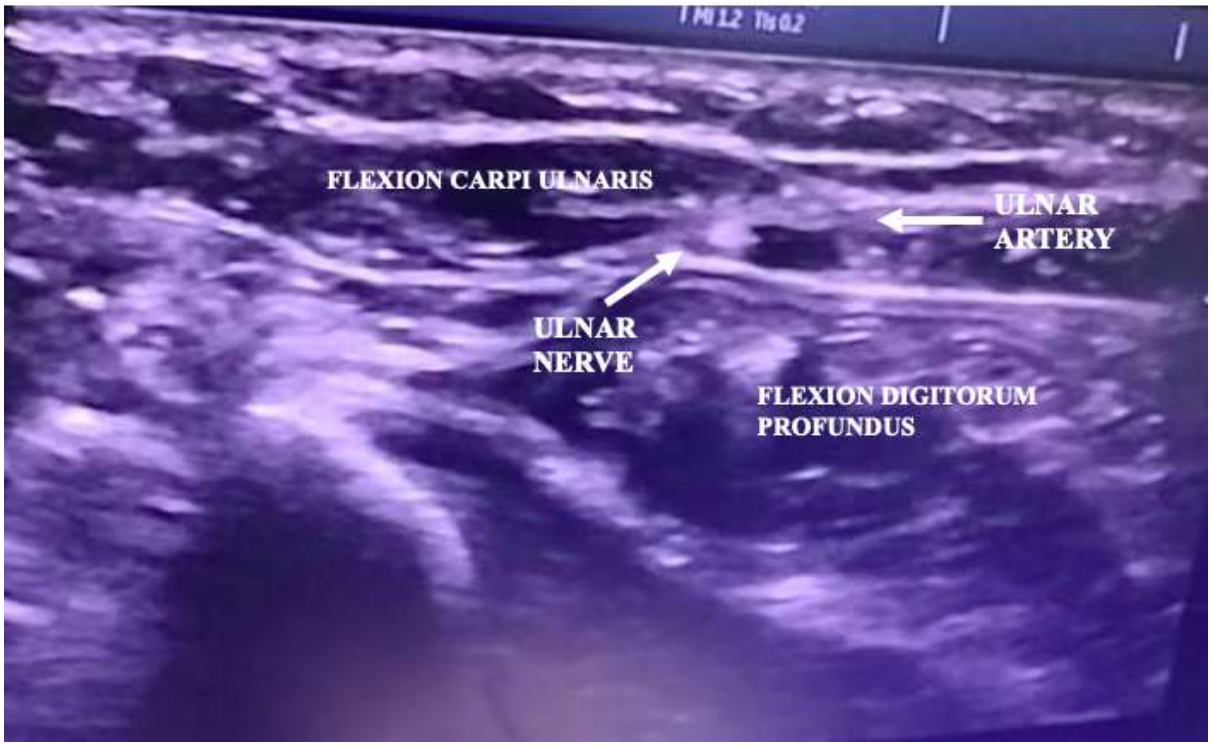

Figure 4: Sonoanatomy of Ulnar Nerve at level of proximal forearm.

Discussion

This case series highlights the role of ultrasound guided peripheral nerve blocks as a rescuer in certain challenging chronic pain cases. In all these cases, a variety of neuropathic pain medications were tried, definitive pain interventional procedures were also practiced. However when they did not provide adequate pain relief or in cases of residual pain after the main procedure, ultrasound guided peripheral nerve blocks were performed. Consent was obtained from all patients, both informed and written. Ultrasound guidance enhances nerve block accuracy by enabling real-time visualization for precise, safe needle placement, essential in chronic pain management. Studies show it improves pain relief, reduces complications, and may lower opioid reliance. The method is minimally invasive, versatile across pain types, and suitable for repeated use[4,5]. We would like to clarify that no patient identifiers were used in the research, in accordance with ethical guidelines. Our first patient had small fibre neuropathy, causing severe pain in the bilateral soles. In 50% of individuals with small fiber neuropathy, no definitive diagnosis is established[6]. In cases of small fiber neuropathy, patients commonly report burning pain, frequently beginning in the distal extremities, with a notable prevalence in the feet. This symptomatology is attributed to the involvement of A-delta and C fibers.[7] Regardless of the underlying aetiology, pain is a common and often problematic feature of small fiber neuropathies as in our patient. The use of ultrasound guided peripheral nerve block has not been reported as a modality for pain relief till date in these patients. We administered bilateral tibial nerve block which provided substantial relief in pain. Our second and third had severe pain along anterolateral aspect of leg and dorsum of foot. Superficial peroneal nerve block was administered in the proximal leg region, close to fibular head. Following the block, pain and allodynia subsided. Our fourth patient had type II CRPS developing after shoulder injury. Stellate ganglion block provided relief in lateral aspect of wrist with residual pain along ulnar nerve distribution. Thereafter ulnar nerve block was performed in the proximal forearm which lead to complete relief in pain.

Thus, we conclude that the role of ultrasound in interventional pain management cannot be undermined. By enabling direct visualization of nerves and needle placement in real-time, ultrasound facilitates the accurate delivery of local anesthetics while minimizing complications. Ultrasound guidance has emerged as a valuable tool for enhancing peripheral nerve blocks beyond joint injections, offering improved precision, safety, and clinical outcomes.[8-10] As the field of regional anaesthesia continues to evolve, ultrasound-guided peripheral nerve blocks will play an increasingly prominent role in perioperative care, acute pain management, and chronic pain interventions. For this study, a comprehensive literature search was conducted to gather relevant articles and

publications. The search was performed using widely recognized and accessible databases, including Google Scholar and PubMed.

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