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Bipolar Radiofrequency Ablation for Neuropathic Pain in a Patient with a Morton Neuroma of Atypical Location

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Abstract

Introduction: Morton's Neuroma is a common cause of forefoot pain, often resulting from excessive force and compressive footwear, especially in highly active patients. The treatment typically begins with physical therapy and modifications in activity or footwear, progresses to corticosteroid and alcohol injections, and ultimately may involve surgical management. Bipolar radiofrequency ablation (RFA) is an emerging treatment that might delay or prevent surgery and may be more effective than its monopolar counterpart. The aim of this case report is to highlight bipolar radiofrequency ablation as a potential treatment option for Morton's neuroma (MN).

Case presentation: The author's present a 70-year-old male with a clinical diagnosis of Morton's neuroma in an unusual location who underwent bipolar RFA on the medial side of the

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left great toe after conservative therapy proved unsuccessful. Following the procedure, the patient showed substantial improvement both functionally and symptomatically, with a notable reduction in pain by 70% at his 3-week check-up.

Conclusion: Radiofrequency ablation is increasingly being recognized as a valuable option in the pain management toolkit for Morton's Neuroma. The benefits of delaying or avoiding surgery are particularly significant for athletes and dancers. Compared to monopolar RFA, bipolar RFA may provide a more effective treatment.

Keywords: World Health Organization; Surgical safety; Pain; Rehabilitation; Anesthesiologist.

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Introduction

Morton's neuroma (MN), also known as intermetatarsal neuroma or Morton's metatarsalgia, is a prevalent foot condition. It is characterized by the thickening and inflammation of tissue surrounding the medial and lateral plantar nerves, primarily affecting the third and fourth intermetatarsal spaces. Despite its name, MN is a mechanical entrapment neuropathy of the interdigital nerve that does not result in the formation of a true neuroma [1].

The condition often manifests as sharp, burning forefoot pain in the metatarsal area, accompanied by the sensation of a "pebble in the shoe". These symptoms exacerbate with weight bearing and wearing restrictive footwear [2]. Typically, a palpable click can be compressing the involved felt upon interspace. While the precise epidemiology remains unknown, the estimated prevalence is around 30%, predominantly in females, with a female to male incidence ratio of at least 4:1 [3-5]. The average age of occurrence is 55 years. MN is diagnosed through a comprehensive physical examination and history. Radiographic patient imaging techniques such as ultrasound and MRI can ascertain the size of the lesion and help rule out other potential diagnoses like stress fractures or arthritis. However, clinical assessments conducted by experienced clinicians have demonstrated up to 98% accuracy in comparison with ultrasound exams [6]. The treatment protocol for MN commences with conservative measures such as modifications in footwear, orthotic inserts, and alterations in activity [2]. Nonsteroidal anti-inflammatory drugs (NSAIDs) may also

be administered to alleviate pain and inflammation. Second-line treatments encompass corticosteroid injections to reduce inflammation around the neuroma (although the effects typically last for approximately 6 months) and sclerosing alcohol injections to induce neurolysis [7,8]. In severe cases, operative management is considered, with a reported success rate of 85% in long-term follow-up studies [9]. Neurectomy is the most frequently performed procedure, though some surgeons favor neurolysis with the release of the deep transverse metatarsal ligament (DTML) to avoid nerve resection [10]. Radiofrequency ablation (RFA) is a therapeutic relatively novel approach demonstrating promising potential in several reported cases [11].

Case report

We report the case of a 70-year-old male with no significant past medical history, who had been experiencing medial left great toe pain for the preceding 4.5 years. The pain was intermittent, non-radiating, and burning, characterized by stabbing electric pulses, and exacerbated by any tactile stimulus. Despite trying oral and topical medications, footwear modifications, physical therapy, and cortisone injections, and even after a bunion removal, the patient's symptoms persisted. The patient's previous gout workup was unremarkable. Physical examination revealed a lateral deviation of the first toe at the left interphalangeal joint and mild tenderness on the medial side of the left great toe. There was no tenderness over the tarsal and metatarsal bones, and the patient exhibited intact strength throughout, without pain, palpable pulses, and preserved sensation. Given the

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clinical presentation, a diagnosis of Morton's Neuroma (MN) at an atypical location was made.

The patient was referred to the interventional pain clinic after conservative methods failed to relieve his symptoms, which significantly interfered with his daily activities, including sleeping, walking, wearing footwear, and standing. A decision was made to proceed with radiofrequency ablation treatment. Two sterile 20-gauge 100mm radiofrequency needles were positioned at the medial and lateral digital nerves of the first great toe. A radiofrequency probe was inserted into each cannula and 1 mL of 1% preservative-free lidocaine was injected. A continuous lesion was applied for ninety seconds at eighty degrees Celsius. The patient remained stable during the postoperative period, with no complications, and experienced a significant (>80%) reduction in pain.

Nine weeks later, the patient returned for bipolar ablation. Four sterile 20-gauge 100mm radiofrequency cannulas were positioned, two each at the left medial and lateral digital nerves of the first great toe. A radiofrequency probe, set to the bipolar mode, was inserted into each cannula, and a mixture of 1 mL of 1% preservative-free lidocaine and 0.25% bupivacaine was injected. A continuous lesion was then applied for ninety seconds at eighty degrees Celsius. The procedure was welltolerated with no complications observed during post-operative monitoring, and the patient was discharged home. Postprocedure, the patient demonstrated significant functional improvement and marked pain relief, which enabled him to sleep better, walk more comfortably, wear shoes without discomfort, and stand with ease. The patient was recommended to maintain close follow-up and was instructed to contact the interventional pain clinic if his pain increased in the future.

Discussion

Minimally invasive techniques, including radiofrequency ablation (RFA), have shown potential to significantly reduce the need for surgical interventions in patients with Morton's neuroma (MN) refractory to conservative treatment measures [12]. RFA, by way of its lateral heat dissipation from the electrode, generates heat and subsequently destroys peripheral nerve endings and myelin sheaths in the vicinity [13]. Studies, including those by Moore et al. and Masala et al., have reported successful outcomes following RFA treatment of MN, with substantial reductions in pain and improvement in the Visual Analog Scale scores [13,14]. Additionally, evidence suggests that the administration of three cycles of RFA yields better medium-term pain reduction postoperatively compared to two cycles, a finding consolidated through a median follow-up period of 12.9 months [15].

Nonetheless, literature pertaining to the treatment of MN with bipolar RFA is sparse. Unlike monopolar ablation, the energy in bipolar RFA is produced between the active and grounding electrodes of the needle tip, which results in a larger lesion size [16]. Although bipolar RFA has proven superior to monopolar RFA in managing knee osteoarthritis pain, spine metastatic lesions, and hepatocellular carcinoma ablation, its efficacy in managing neuroma pain is less well-studied [16-18].

Morton's neuroma is a common foot condition that results in forefoot pain exacerbated by weight-bearing and constrictive footwear, typically in the third and fourth intermetatarsal spaces. It is particularly prevalent in populations involved in high-impact sports, such as long-distance running, and activities involving explosive 'start-stop' and multidirectional movements [1,19]. This might be attributable to the narrow confines of running footwear and the hyperextended position at the metatarsophalangeal (MTP) joints, which increase impact forces on the forefoot, triggering traction of the interdigital nerve and consequent MN development [1-20]. Dancers, particularly those who train intensively, are also prone to MN. This is attributable to the fact that pointe shoes, which dancers wear for hours during their training, tightly wrap and compress the foot. As a result, the entire body weight of the dancer rests on the tips of their metatarsals, overloading the front foot [21,22]. MN management in dancers and athletes necessitates unique considerations due to their high pain tolerance, their determination to continue practicing, and the likelihood that they may ignore early symptoms of MN, thereby increasing the risk of clinical severity progression. Early identification of MN symptoms and initiation of conservative treatment can help manage the mechanical overload of the metatarsals, thus reducing the risk of further complications. Both the running athlete and dancer, due to their reliance on a high functional status for their careers, necessitate special consideration during foot injury treatment, rehabilitation, and return to participation. Effective clinical and symptomatic management of MN in these patients is paramount, and there is a pressing need for non-invasive treatment options offering sustained pain relief. This would postpone or prevent the need for corticosteroid injections, alcohol injections, and surgical management, all of which have associated risks.

This study presents the case of a patient with a history of MN in an atypical location (medial aspect of the left great toe) who achieved 70% pain relief at 3-week follow up after bipolar RFA treatment. While MN is typically located in the 3rd-4th intermetatarsal space, it is crucial to keep in mind that this condition is a clinical diagnosis and can develop anywhere along the nerves in the forefoot [23].

Conclusion

In conclusion, our experience, along with the existing literature on the efficacy of bipolar RFA and the ongoing need for non-Surgical management of refractory MN, suggests that the utilization of bipolar RFA in MN management warrants further exploration. This technique could serve as an exciting new option in the treatment paradigm, particularly for patients dependent on painfree functionality of their feet-such as athletes and dancers. Therefore, our study extends the current understanding of MN management, demonstrating that bipolar RFA may serve as an effective treatment for MN, even in atypical locations.

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Chhatre A | Volume 1; Issue 2 (2023) | Mapsci- JRPM-1(2)-013 | Case Report

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Chhatre A | Volume 1; Issue 2 (2023) | Mapsci- JRPM-1(2)-013 | Case Report

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