The Journal of Foot & Ankle Surgery ■■ (2018) ■■–■■

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Original Research

Mechanical Metatarsalgia as a Risk Factor for Relapse of Morton's Neuroma After Ultrasound-Guided Alcohol Injection

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ARTICLE INFO

Level of Clinical Evidence: 3

Keywords:
forefoot disorders
interdigital neuroma
Morton's disease
peripheral nerve disorders
sclerosant injections
ultrasonography

ABSTRACT

Although many treatment modalities are available for Morton's neuroma, the injection of the neuroma with alcohol has gained popularity. However, recently, some investigators have observed a progressive deterioration in pain scores for patients initially pain free after the treatment. The purpose of the present retrospective comparative study was to determine whether mechanical metatarsalgia is related to symptom recurrence. We included 104 consecutive cases of ultrasound-guided alcohol injection for Morton's neuroma in 92 patients. Of these 104 cases, 51 were in group A (49%; Morton's neuroma) and 53 in group B (51%; Morton's neuroma associated with mechanical metatarsalgia). We evaluated each patient using a visual analog scale and American Orthopaedic Foot and Ankle Society forefoot scale, and Johnson satisfaction scale, with a mean follow-up period of 24 (range 12 to 39) months. Concomitant functional and mechanical disorders have been identified and treated with orthopedic inserts. The present study compared the clinical results and recurrence of symptoms in patients with isolated Morton's disease or Morton's disease associated with mechanical metatarsalgia. Of the 104 cases, the patients for 93 cases (89%) were completely satisfied or satisfied with minor reservations. No major complications developed. Symptoms recurred in 6 patients (6%), in whom neuroma was associated with mechanical disorders ($p = .0269$). Ultrasound-guided alcohol injection of Morton's neuroma is a relatively safe and well-tolerated treatment. Symptom recurrence is often associated with mechanical metatarsalgia. The treatment of the concomitant anatomical and functional disorders that target the genesis of the neuroma has an important role in the prevention of recurrence of this pathology.

Morton's disease is a common cause of forefoot pain that is considered to be an entrapment neuropathy, secondary to compression of the common interdigital nerve under the transverse metatarsal ligament. It concerns almost exclusively in the third and second interspaces. The pathoetiology of this condition is related to repetitive microtraumas and ischemic factors. These microtraumas can be related to many different causes. It is well known that the anatomic conformation of the nerve of the third intermetatarsal space can provoke them. Moreover, many clinicians consider the biomechanical overload of the common digital nerve where the anterior margin of the deep transverse intermetatarsal ligament engages the nerve, in particular, in the hyperpronating foot, as another relevant microtraumatic factor. Morton's neuroma is not actually a neuroma but rather a condition of nerve degeneration associated with perineural and intraneural reactions (1). The diagnosis of Morton's neuroma is principally based on the patient's history and clinical findings. Pain can radiate from the forefoot to the toes, and activities such as walking, standing, or wearing tight shoes often exacerbate the symptoms. Physicians can provoke the characteristic burning pain by palpation of the relevant metatarsal interspace. Examination might reveal Mulder's click (2). Currently, the diagnosis of Morton's disease is also validated using imaging studies. Ultrasonography can reveal an enlargement of the nerve and confirm the clinical diagnosis with the use of high-frequency linear probes (≥7.5 MHz) and the dynamic maneuver of squeezing the neuroma outside the metatarsal space as proposed by Kankanala and Singh Jain (3) and Perini et al (4). Magnetic resonance imaging is an expensive examination but can be useful for excluding other causes of forefoot pain. Clinical examinations are useful, not only to confirm the diagnosis of Morton's neuroma, but also to provide evidence of concomitant mechanical metatarsalgia. It is a common experience to find the coexistence of Morton's neuroma and

Financial Disclosure: None reported.
Conflict of Interest: None reported.
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https://doi.org/10.1053/j.jfas.2018.03.003

mechanical metatarsalgia. We defined mechanical metatarsalgia as a condition secondary to anatomic or functional abnormalities, related to an abnormal pressure loading at the level of the metatarsal heads. These abnormalities can have a regional origin, related to the length and flexibility of the metatarsal bones, or they can result from neuromuscular pathologies or alterations of the joint stability and torsion of the leg. From a clinical viewpoint, this disease is shown by pain at the metatarsophalangeal joint. In the initial phase, the pain will start after prolonged standing or walking, but it can become permanent. Generally, hyperkeratosis develops below the affected metatarsal heads and always recurs if removed. Finally, patients can develop metatarsophalangeal joint bursitis, synovitis, or instability. Evaluation of this pathology includes visual examination using podoscopy or photopodography, standard and weightbearing radiographs, and computerized baropodometry. The treatment should initially be conservative. However, if ineffective, we would perform surgical treatment such as metatarsal osteotomy.

Also, if these conditions coexist, the symptoms from hyperpressure under the metatarsal heads will be similar to those associated with Morton's neuroma. When this occurs in the same foot, it is critical to combine the treatments for Morton's neuroma and mechanical metatarsalgia (5–7).

Some conservative methods for the treatment of Morton's neuroma, such as the use of wider footwear and metatarsal pads, are well known. As suggested by Holmes (8), the use of a metatarsal projection pad proximal to the metatarsal heads can resolve the initial neuritic symptoms of Morton's neuroma. This was confirmed in our experience, as reported in the Patients and Methods section. Steroid and local anesthetic injections have also been used with variable results, especially in the medium and long term (9–12). When medical treatment fails, surgery is indicated (13). Surgery has been found to be effective and to elicit positive results in 80% to 90% of cases (14–17).

A reasonable alternative to surgery is ultrasound-guided alcohol injection. In this procedure, a mixture of ethyl alcohol and mepivacaine is injected under real-time ultrasound guidance such that the spread of the fluid within the lesion can be observed (18–23). However, recently, some investigators have observed that although the short-term results have been encouraging, a statistically significant and progressive deterioration can occur in the patient-reported pain score during long-term follow-up periods (24).

We were interested in determining the causes of the failure of ultrasound-guided alcohol injection, with special regard to the recurrence of symptoms. We hypothesized that this could result from the coexistence of mechanical metatarsalgia, which is often associated with Morton's disease. Our primary aim was to measure patient satisfaction after alcohol injection. Thus, we divided the patients into 2 groups, with and without associated metatarsalgia, and performed a retrospective study to compare the outcomes.

Patients and Methods

The present study was a retrospective analysis of prospectively collected data at a single hospital from March 2012 through June 2014. In accordance with Italian law on biomedical research and current regulation, all included patients provided written informed consent, and all data were treated in accordance with Caldicott principles.

Inclusion and Exclusion Criteria

The patients were enrolled consecutively. The inclusion criteria were the presence of Morton's symptoms and the presence of a nerve enlargement found on the imaging examination. We did not exclude any neuroma for its dimensions, and we treated all cases with alcohol injections. Comorbid forefoot pathologies, such as mechanical metatarsalgia, coexistent associated hallux valgus, hammer toe, forefoot shape, and varus or valgus hindfoot alignment were recorded. The exclusion criteria were previous surgical treatment (including stump neuromas), rheumatologic disease, trauma to the feet, dislocation of the metatarsophalangeal joint, Freiberg disease, and a history of vascular disorders or neuropathies. Only symptomatic neuromas were treated; asymptomatic nerve enlargements were not considered pathologic findings, as reported by many investigators (25).

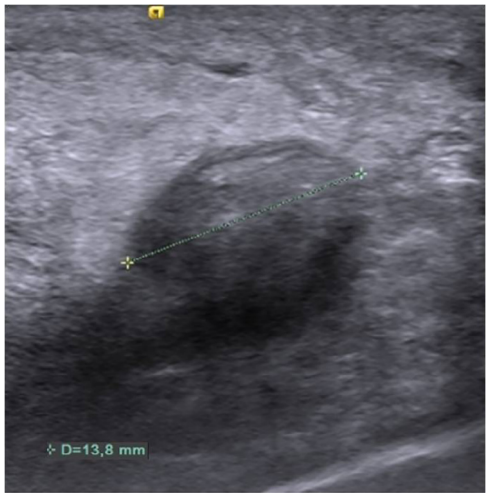

Fig. 1. Ultrasound scan showing a rounded hypoechoic mass consistent with Morton's neuroma (13.8 mm) located within the third interspace before treatment.

Technique

After clinical and ultrasound (dorsal and plantar) examinations with a high-frequency (range 14 to 16 MHz) superficial transducer (Fig. 1) and application of an antiseptic solution to the skin, a mixture of 30% ethyl alcohol (96% vol/vol) and 70% mepivacaine was inserted using a dorsal approach with real-time ultrasonography guidance (Fig. 2). The quantity of injected solution varied from 0.5 to 1 mL, depending on the size of the neuroma. Multiple neuromas in the same foot were treated at the same procedure, but bilateral neuromas in the same patient were treated using separate procedures (26). Three injections at 0, 15, and 45 days were performed for each neuroma.

Patients

A total of 96 consecutive patients (mean age 57, range 38 to 82 years) underwent alcohol injection treatments. Thirteen of these patients underwent treatment of each

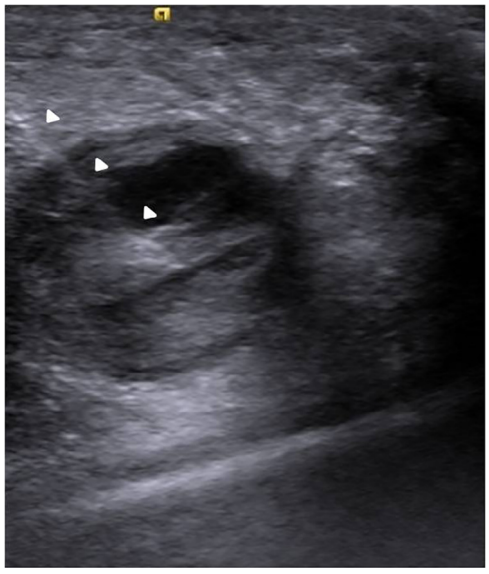

Fig. 2. A linear echogenic needle (*white arrows*) entering the neuroma for therapeutic injections.