

SCLEROSING INJECTIONS IN THE TREATMENT OF INTERMETATARSAL NEUROMAS

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Intermetatarsal neuroma is a common foot condition resulting from mechanical irritation to the intermetatarsal nerve in the forefoot. The nerve is placed under tension as it passes plantar to the deep transverse intermetatarsal ligament, and a variety of foot conditions are implicated in producing this tension and resulting neuritis. This condition is not felt to be the result of a true neuroma formation and was originally described by Durlacher¹ in 1845 and later by Morton² in 1876. Many feel this entity is a type of neuritis and thus it is often treated with mechanical modifications. When conservative therapy fails, alternative methods are often implemented, including various injection and surgical interventions. The use of 4% alcohol sclerosing injections has shown promise as a conservative treatment for intermetatarsal neuromas prior to surgical release or excision.

DIAGNOSIS

Pain in the forefoot can be caused by a variety of conditions, therefore it is essential to correctly identify an intermetatarsal neuroma prior to embarking on any treatment plan. The typical presenting complaint includes pain in the ball of the foot with ambulation, with occasional radiation of the pain to the digits. Symptoms most commonly occur in the third interspace, followed by the second interspace, and infrequently in the first or fourth interspace. Patients relate an increase in symptoms with the use of dress shoes, especially high heels. Symptoms are often relieved by discontinuation of wearing these shoes or use of more supportive shoes. The pain is described in a variety of ways including burning, tingling, shooting or the feeling of a bruised region in the forefoot.

Clinical evaluation is the keystone in diagnosis, with the key clinical finding being pain in the interspace at the level of the deep transverse intermetatarsal ligament. Edema is sometimes associated in the region, and pain plantar to the metatarsal heads is usually absent. Dorsiflexion of the digits

with palpation at the deep intermetatarsal ligament is used to reproduce the symptoms. Dorsal-plantar palpation of the interspace with compression of the medial and lateral aspects of the foot often allows palpation of an inflamed nerve with a palpable "click," commonly called Mulder's sign.³

Diagnostic testing can be used as an adjunct to clinical diagnosis, or to rule out a variety of differential diagnoses. Weight-bearing radiographs should be taken to differentiate osseous or intra-articular pathology that can radiate to the region of the affected nerve. Sullivan's sign, (splaying of the adjacent toes), can indicate a space-occupying lesion.⁴ Ultrasound, magnetic resonance imaging with and without contrast, and nerve conduction studies can also be used in the further evaluation and diagnosis of intermetatarsal neuroma. Nerve blocks with local anesthetic may be performed to isolate pathology to an individual interspace, however, these may confuse the diagnosis by anesthetizing the adjacent structures and eliminating accurate diagnosis. Clinical impression is the most common tool used to initially diagnose intermetatarsal neuroma and should be employed prior to any additional testing.

TREATMENT OPTIONS

Treatment of intermetatarsal neuroma consists of both conservative and surgical management. Conservative management includes addressing mechanical etiologies through the use of padding, strapping, and orthotic fabrication to eliminate the pathologic forces that induce neuroma formation. Shoe selection and modification are essential in decreasing the tension on the nerve structures. Physical therapy modalities may be used to decrease inflammation in the region.

Injection therapy may be employed in various fashions to allow resolution of symptoms. Conservative measures are used initially, and may be supplemented with injections should relief not be obtained. Injections with corticosteroids,^{5,6} vitamin

B12⁷ and ethyl alcohol^{8,9} have been used with varying success in the treatment of intermetatarsal neuroma.

Surgical intervention consists of excision of the involved nerve via neurectomy, release of the deep intermetatarsal ligament and internal and external neurolysis. The success rates of these treatment options vary from 76% to 97% with most rates ranging closer to 76%.⁹⁻¹² Common complications can include infection, hematoma/seroma formation, and recurrent or stump neuromas. Recurrent neuroma are diagnosed in a similar manner, but the treatment considerations include much more involved surgical intervention. Treatment includes conservative options such as massage and desensitization modalities in combination with the use of local steroid infiltration. Surgical management attempts to prevent nerve regrowth and eliminate symptoms. Neurectomy, epineuroplasty and nerve implantation have all been used with varying success in the treatment of recurrent neuroma. There is a potential for complications with any surgical intervention, therefore it is important to consider all conservative options prior to surgery.

ALCOHOL SCLEROSING INJECTIONS

The use of absolute ethyl alcohol (dehydrated sterile alcohol) injections affects nerves through damage at the cellular level. The cellular effect involves dehydration, necrosis and precipitation of protoplasm. Dehydrated alcohol is soluble in local anesthetic and when introduced near nerve tissue causes neuritis and chemical neurolysis via Wallerian nerve degeneration.¹³ The injected solution has a high affinity for nerve tissue and has the established effect on these tissues. The low concentration has not been shown to have any systemic effect, with 90% to 98% of ethyl alcohol oxidized by the body.¹⁴

Results from a 1999 study indicated an 89% improvement, with complete relief attained in 82 of 100 patients treated with the sclerosing injections. The follow-up period ranged from 6 months to 2 years.⁹ These patients were treated with injections alone, with no other treatment implemented. This study used an initial baseline of three injections, as some patients had recurrence with less than three injections, and saw no significant improvement after 7 injections if symptoms had not resolved.⁹ No soft tissue complications were identified in the 11 patients who failed injection therapy and had their

neuroma surgically removed. The author identified atrophy of the nerve tissue in the patients who failed a series of sclerosing injections and underwent surgical excision.⁹

Technique

The injection is performed with a 4% sclerosing solution that is prepared by mixing 48 ml of 0.5% bupivacaine HCl with epinephrine, and 2 ml of dehydrated alcohol (not less than 98% by volume) for injection, USP to produce a 50 ml solution of 4% sclerosing solution. Injection technique includes marking the point of maximum tenderness at the region of the neuroma "bulb" and using 0.5 cc of 4% sclerosing solution deposited with a 1.25 inch, 27 gauge needle injected on the intermetatarsal nerve. (Fig. 1) The needle is introduced dorsally and is manipulated until pain and radiation to one or both toes is established, at which point the solution is deposited. Injections are performed every 5 to 10 days (averaging 7 days in the author's experience). Patients are instructed prior to the initiation of therapy that 3 serial injections will be given and success will be evaluated based on clinical response, with patients receiving a maximum of 7 injections. Pain is often associated with the initial injection due to the induced damage to the nerve, but this typically resolves with subsequent injections. If skin or soft tissue atrophy is appreciated plantarily, the injections are discontinued. Patients are then seen 1 month after the final injection to determine short-term success. At this time, they are given instructions to follow-up if symptoms should persist from that point on. Functional support is encouraged throughout the injection and post-injection process. Failure of sclerosing injections results in discussion with the patient

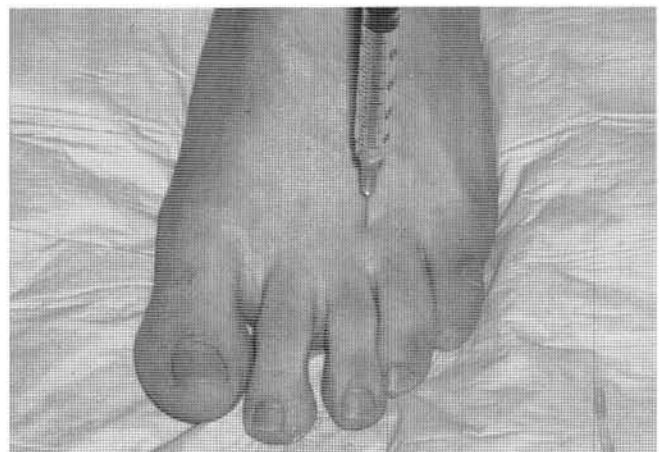


Figure 1. Target for injections proximal to "bulb" of the neuroma.

regarding surgical intervention to alleviate the symptoms.

The use of sclerosing injections with 4% dehydrated alcohol is another conservative option in the treatment of intermetatarsal neuromas. It is performed without significant risk to the patient and does not compromise tissues, should later surgical intervention be required. This technique is an excellent alternative to surgical excision or release. The author has used this technique successfully in the treatment of both primary and recurrent neuromas.

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