

THE USE OF SCLEROSING INJECTIONS IN THE TREATMENT OF NEUROMAS

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Sclerosing injections with dehydrated alcohol are being used with increasing frequency in the treatment of intermetatarsal neuroma and in the treatment of recurrent or "stump" neuroma. 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 the resulting neuritis. This condition is not believed 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. Recurrent or "stump" neuromas are the result of regeneration of the nerve after surgical excision (iatrogenic) or following trauma. When conservative therapy fails, alternative methods are often implemented, including various injections and surgical approaches. The use of 4% alcohol sclerosing injections has shown promise as a conservative intervention for intermetatarsal or recurrent neuromas prior to surgical release or excision.

DIAGNOSIS

Pain in the forefoot can be caused by a variety of conditions and it is essential to correctly identify an intermetatarsal neuroma prior to starting any treatment plan. The typical presenting complaint includes pain or tingling in the ball of the foot with ambulation with occasional radiation to the digits. Symptoms are most commonly identified 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, with symptoms often relieved by discontinuation of these shoes or use of more supportive shoes. The pain is described in a variety of forms from burning, tingling, shooting, cramping or the feeling of a bruised region in the forefoot. Similar symptoms may return after the removal of a previously treated neuroma or following trauma to a nerve.

Clinical evaluation is the key to diagnosis, with the primary 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 directly 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. This palpable "click" is called Mulder's sign.³

Diagnostic testing can be used as an adjunct to clinical diagnosis or to rule out a variety of differential diagnosis. Weight-bearing radiographs should be taken to differentiate osseous or intraarticular pathology that may 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 to further evaluate and differentiate other conditions versus intermetatarsal neuroma. These examinations are very beneficial in evaluating recurrent nerve injuries especially if the original surgery did not provide any relief. Nerve blocks with local anesthetic may be performed to isolate pathology to an individual interspace but may confuse diagnosis by anesthetizing the adjacent structures and eliminating accurate diagnosis. Clinical impression is the most common tool used to 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 and relieving neural tension from more proximal etiologies.

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

vitamin B12⁷ and ethyl alcohol (discussed below)⁸⁻¹⁰ 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 or external neurolysis. The success rates of these treatment options vary from 76-97%, with most ranging closer to 76%.⁹⁻¹³ 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 with success rates being lower than the treatment successes for primary neuroma. Treatment options include conservative approaches including 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 attempted with varying success in the treatment of recurrent neuroma. There is a potential for complications with any surgical intervention therefore it is important to exhaust all conservative options prior to surgical intervention.

ALCOHOL SCLEROSING INJECTIONS

The use of absolute ethyl alcohol (dehydrated sterile alcohol) injections effects 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.¹⁴ The injected solution has a high affinity for nerve tissue and has the established effect on these tissues. The low concentration was not shown to have any systemic effect with 90-98% of ethyl alcohol oxidized by the body.¹⁵

Results from a 1999 study indicated 89% improvement with complete relief in 82 of 100 patients treated with the sclerosing injections with follow-up ranging 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 because 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 conservative

treatment and a series of sclerosing injections.⁹

The same technique has been used by this author in the treatment of intermetatarsal and recurrent neuromas and the results were presented in April 2001.¹⁰ Twenty-nine neuromas (18 primary, 11 recurrent) were treated with sclerosing therapy with injections given an average of 7 days apart (range 5-10 days). All injections were given proximal to the entrapped or damaged nerve, and the site of maximum tenderness was marked prior to injection. Patients were given a minimum of three injections and not more than seven injections. Therapy was discontinued if there was complete resolution of symptoms or no relief after 3 injections. Patients were seen 1 month after the final injection and again at 6 months after the final injection to determine success of therapy, with some patients seen back for other podiatric complaints up to 15 months after sclerosing therapy. Success was defined based on patients' subjective assessment that greater than 90% relief had been obtained. In the primary treatment group 78% of neuromas (14/18) were treated successfully with sclerosing therapy, while in the recurrent neuroma group, 82% of neuromas (9/11) were treated successfully. One side-effect of local irritation to plantar foot distal to the injection site was noted and resolved after one day. Patients who did not have successful therapy were given the option of surgical intervention and no injection related complications were identified intra-operatively or postoperatively.

Technique

The injection is performed with 4% sclerosing solution that is prepared by mixing 48 ml of 0.5% bupivacaine HCl with epinephrine, with 2 ml of dehydrated alcohol for injection to produce a 50 ml solution of 4% sclerosing solution (Figure 1). The sclerosing solution is fabricated fresh each month. 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 (Figure 2). 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 5-10 days (averaging 7 days in author's experience) with patients instructed prior to the initiation of therapy that 3 serial injections will be given and success evaluated based on clinical response with patients receiving up to 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.



Figure 1. A combination of 0.5% Marcaine with epinephrine and dehydrated Alcohol (98% by volume) with Tuberculin syringe.

Patients are then seen 1 month after final injections to determine short-term success and 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 result in discussions with the patient 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 and recurrent neuromas. It is performed without significant risk to the patient and does not compromise tissues should surgical intervention be required. This technique is an excellent alternative to surgical excision or release and the author has used this technique successfully in the treatment of neuromas, both primary and recurrent.

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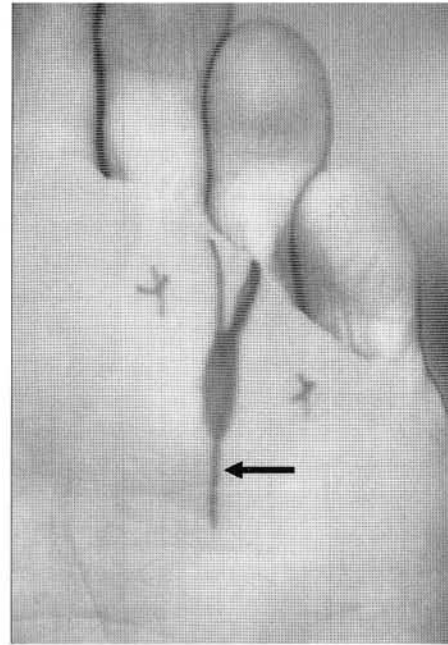


Figure 2. Target for injections, proximal to "bulb" of neuroma.