

# CRYOGENIC NEUROABLATION FOR THE TREATMENT OF MORTONS NEUROMA

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Morton's Neuroma (perineural fibroma) is a common painful forefoot disorder that can present treatment challenges to all Podiatric Physicians. The common digital nerves, usually in the 2nd and 3rd intermetatarsal spaces become enlarged in the area of the deep transverse metatarsal ligament resulting in pain in the ball of the foot with cramping, pain and numbness to the toes. Histological findings of the nerve include endoneural edema with perineural, epineural and endoneural fibrosis. Endarterial thickening occurs along with axonal loss and demyelination. These findings are consistent with a degenerative process and it is generally accepted that this occurs as a result of entrapment of the nerve.

The mainstay of conservative treatment consists of shoe modification, orthotics, NSAID's, and steroid injections. Neurolytic agents such as phenol, and more commonly, dilute 4% alcohol have been advocated (1). When conservative treatment fails surgical intervention may be indicated. Excision of the Neuroma is the most common surgical procedure performed but significant failure rates have been reported (2,3). Poor results can occur from incomplete excision or the formation of a stump Neuroma which can be more troublesome than the original pain.

Cryogenic neuroablation is a term that is used to describe the destruction of axons to prevent them from carrying painful impulses. This is accomplished by applying extremely cold temperatures of between - 50C and - 70C to the nerve. This results in degeneration of the intracellular elements, axons, and myelin sheath with wallerian degeneration (4). These changes are consistent with a 2nd degree nerve lesion. The epineurium and perineurium remain intact and this prevents the formation of stump Neuromas as the nerve regenerates. The preservation of these structures differentiates cryolesions from surgical excision and neurolytic agents.

## Technique

Prior to injecting the local anesthetic, the area of greatest neuroma pain is palpated on the plantar surface of the foot and marked with a surgical pen. Approximately 4cc's of the local anesthetic are infiltrated from the dorsal surface of the foot to the area of pain. Generally I'll inject 3cc's of 1 % plain lidocaine into the intermetatarsal space with an additional 1cc of lidocaine with epinephrine deposited just below the skin dorsally for homeostasis. The surgical site is prepped with betadine and a 3mm incision is made dorsally with a number 65 beaver blade. A trocar or angiocatheter is used to separate the tissue as it is advanced to the area of pain that was previously marked. The deep transverse metatarsal ligament is encountered and if preferred, can be sectioned. The 2mm cryoneedle is inserted to the area of the Neuroma and a 3 minute freeze cycle is administered followed by a 30 second defrost and another 3 minute freeze cycle. The wound is irrigated with 2cc's of 0.5% plain marcaine and 0.25 cc's of steroid.

No sutures are required but a mildly compressive dressing is applied. The patient is also given a NSAID to reduce postoperative discomfort.

## Postoperative Care

If the patient has had only the percutaneous cryosurgery procedure performed they are instructed to reduce activity for the next two to three days and when resting to apply ice to the surgical site. The morning after the procedure they can remove the dressing take their shower and use a band aide with a topical antibiotic. The incision is usually healed in about three days.

The destruction of the axons is immediate with cryosurgery so the patients only feel discomfort related to the minor procedure. This discomfort is mild and usually resolves in about one week. The patients are usually wearing normal shoes and are reasonably active during this period. If the deep transverse ligament has been released the surgical site is more uncomfortable and may take 2-3 weeks to heal.

## Results

The majority of patients obtain complete relief or significant improvement following cryosurgery. When no relief occurs, it is usually because of dense scar tissue related to previous excision of the neuroma (5). Performing a percutaneous Adhesiotomy or inserting the cryoneedle through the plantar aspect of the foot can overcome this. When the axons are destroyed with this procedure they usually regenerate at the rate of 1-3 mm per day. This procedure isn't considered permanent but in my experience some of my patients have reached the three year mark with no recurrence of Neuroma pain.

## Complications

There is a very low incidence of complications associated with cryosurgery. Infections are rare as is abscess formation at the incision site. Because cryosurgery involves very cold temperatures, this procedure should be avoided in patients with Peripheral Vascular Disease and conditions such as Raynauds Phenomona.

## Discussion

I have used 4 % alcohol injections for many years but with mixed results. Some patients do respond favorably to this treatment but many continue to have neuroma pain. We have just completed a blinded study comparing the effectiveness of, steroid to alcohol injections.

Approximately 50% of the alcohol group dropped out of the study because of severe pain associated with the alcohol injections. Two of the patients were treated in the emergency room later in the day because of burning pain at the injection site.

I am also concerned about the effect of the alcohol on the peripheral nerves. Presumably the alcohol destroys the axon and its myelin sheath but it cannot be tissue specific and must also destroy the endoneural, perineurium and epineurium.

If the destruction of the nerve is complete a neurotomesis is created that will invariably form a stump neuroma as the axons regenerate. In this sense the nerve destruction may have the same risks as neuroma excision. Also the long-term results of alcohol injections have not been reported.

With Cryosurgery the destruction of the axons is almost completely painless. I used to perform the procedure using only 1/2 cc of local anesthetic for the skin where the incision was placed. No anesthetic was used to block the nerve. When the ice ball was applied to the neuroma the patients experienced only a mild burning sensation that resolved after 1 to 2 minutes. There was only minimal postoperative discomfort for the procedure that was controlled with NSAID's. More significantly, Cryogenic Neuroablation does not destroy the epineurium or perineurium, the basic architecture of the nerve and as a result stump neuromas

do not form as the nerve regenerates. In my 3 years experience performing this procedure on approximately 200 patients very few of the patients have had a recurrence of their Neuroma pain.

If pain returns a year or two later the procedure is simply repeated. Axons regenerate at the rate of 1-3 mm per day. The ice ball is thought to destroy a 1cm portion of the nerve therefore the axon regeneration should be complete within several weeks. It appears the long lasting relief is due to the reduction of neural edema and fibrosis of the neuroma.

Similar long-term relief has also been reported with the use of Cryosurgery in the treatment of painful trigeminal nerve pathology (6,7).

All of my patients who have had Cryogenic Neuroablation have maintained full motor function with no greater loss of sensation than they had prior to the procedure. Alcohol injections are not effective for everybody and the same is true for Cryosurgery. Limitations of this procedure appear to be the size of the Neuroma and excessive fibrosis from previous neurectomy. If the neuroma is in the of 3cm diameter or greater the 1cm ice ball may not be able to penetrate the entire mass. Excessive dense scar tissue may also reduce effectiveness of the Cryosurgery although using both a dorsal and plantar approach may yield a much better response from patients that I've encountered with very large Neuromas and excessive scar tissue have also failed all previous treatment including alcohol injections.

#### Summary

Cryogenic Neuroablation is a very safe minimally invasive procedure that is performed in the office setting and gives very good relief of Norton's' Neuroma pain. The disability period is very short with the patient's only reducing activity for 2 to 3 days. Unlike alcohol injections the procedure is not painful therefore patient acceptance is excellent.

#### Reference:

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