

Treatment of Morton's neuroma with focused shock waves

Comparison between shock waves and surgery

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Abstract

Various treatments have been described for Morton's neuroma. We compare the results of shock wave treatment with surgical neurectomy in a prospective series of 32 cases randomly assigned. In the group of patients treated with focused waves (17 cases), the percentage of good results was 70.6%, while in the operated patients (15 cases) it amounted to 93.2%. Poor results were found in 29.4% in shockwave group and 6.8% in surgical group.

Focused shock waves have a high, but lower success rate than surgery in the treatment of Morton's neuromas. Nevertheless, due to their non-invasiveness and low chance of complications, they can be considered an option prior to minimally invasive and surgical techniques.

Keywords: Morton neuroma, shockwaves, neurectomy.

Introduction

Morton's neuroma can be clinically considered as a painful syndrome in the forefoot, more commonly in the distal 3rd intermetatarsal space (IMTS), with or without numbness in the toes, which worsens with lateral compression of the metatarsals and/or while wearing closed shoes.

Objectively, it is caused by a tumor lesion in the interdigital nerve between the metatarsal heads usually identified in ultrasound and/or magnetic resonance imaging. In fact it is not a true neuroma but it is fibrosis of the nerve, probably caused by repetitive pressure or irritation [1].

Various treatments have been described for Morton's neuroma. Classically, conservative treatment is exhausted before advancing with invasive methods [1-5]. Educating the patient on the use of proper footwear, the incorporation of metatarsal bars and anti-inflammatory medication are usually the first choice. When conservative treatment failed, a series of minimally invasive procedures including corticosteroid injection [1-9], chemical neurolysis with alcohol [10-12] or radiofrequency thermal neurolysis

[13,14] can be employed as second-line treatments prior to surgery. Even hyaluronic acid injection has been proposed as a therapeutic option [15].

The third step of indications is surgical treatment. Two different approaches are proposed to excise the neuroma: dorsal and plantar [1]. Good results have been reported even in long-term follow-up for both approaches [16-20].

Distal metatarsal metaphyseal osteotomy and percutaneous release of the deep transverse metatarsal ligament have also been proposed as a mini-invasive option [21,22].

Extracorporeal Shockwave Treatment (ESWT) is a procedure based in focused sound waves application that, in ischemic tissues due to degenerative processes, has shown stimulatory effects for neovascularization, in addition to transient anesthetic effects. ESWT showed favorable effect on numerous musculoskeletal pathologies [23]. Two randomized control trials have compared shockwaves to placebo [24,25] reporting a significant clinical response compared to the placebo group.

As far as we know, there are no studies that compare the effect of focused waves with surgery. The aim of this study is to make that comparison and assess the effectiveness of shock waves.

Materials and methods

Inclusion criteria were 1) presence of sharp pain in the forefoot, 2) burning, with or without paresthesia in the toes, 3) worsening with digital compression in the intermetatarsal spaces, 4) ultrasound or MRI with evidence of a solid nodule, 5) failure of at least 6 months of physical therapy treatment and a minimum follow-up time of 12 months after ESWT. Exclusion criteria were 1) local infection, 2) local tumor, 3) associated pathologies in the foot, 4) rheumatic diseases, 5) pregnancy, 6) severe coagulopathies and 7) Local with corticosteroids injection in the previous month.

Treatment assignment to surgery or shock wave therapy was random. Informed consent was obtained in all patients prior to the procedures.

During the study period a total of 29 patients

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Table 1: Pain scale.	
Pain scale	
A	No pain
B	Rarely pain (with shoes or physical exertion)
C	Little relief
D	Severe pain

and 32 feet were included. Of these, 15 patients and 17 feet underwent ESWT (group 1), and were followed for an average of 16 months (12 to 36 months) after application. In 13 feet the neuroma was identified in the 3rd IMTS; 3 feet on the 2nd IMTS and 1 foot on the 4th IMTS.

In the same period, 14 patients and 15 feet (group 2) were treated by dorsal approach neurectomy surgery, and followed up for an average of 15 months postoperatively.

For the application of ESWT an electrohydraulic device was used (Direx/Orthima). The number of sessions was between 1 to 2. Applications were only repeated in those patients complaining persistent pain after 60 days. Each sessions included 1500 pulses, with an energy level of 0.35 mJ/mm² and a frequency of 2 Hertz.

The chosen area of treatment was approached from the plantar side considering the point of greatest pain under digital pressure. Anesthesia was not administered. Applications were performed at a doctor's office, 14 feet received a single application; and 3 feet, two applications.

For neurectomy surgeries local anesthesia under intravenous sedation was used, at a hospital operating room. A longitudinal approach on the dorsum of the foot over the IMTS corresponding to the neuroma was performed.

Pain was assessed with the table described in table 1. This evaluation was made before the treatments and compared at least 12 months after therapy.

Johnson Grading Scale (JGS) [6,26] was used to evaluate overall satisfaction at final

follow-up (at least 12 months). The scale has 4 possible answers. 1-dissatisfied, 2-satisfied with major reservation, 3-satisfied with minor reservation and 4-completely satisfied. We consider a 3/4 response as good results and a 1/2 degree of satisfaction as poor.

Results

Pain scale in patients in group 1 (undergoing ESWT) was initially: A= 0 (0%), B= 1 (5.7%), C=3 (17.6%), D=13 (76.5%). At 12 months follow-up was: A= 7 cases (41.2%); B= 5 cases (29.4%); C= 1 case (5.8%) and D= 4 cases (23.5%).

In patients in group 2 initial evaluation showed A= 0 (0%), B= 0 (0%), C=1 (6.7%), D=14 (93.3%). The pain scale at 12 months follow-up in patients that underwent neurectomy was: A= 10 feet (66.6%); B= 4 feet (26.6%); C= 1 foot 6.6%) and D= 0 feet (0%).

We found a direct correlation between the degree of pain and the level of satisfaction.

According to JGS: in the ESWT group, 70.6% cases had a good results and 29.4%, poor results. In the surgical group 93.2% cases had a good result and 6.8% had a bad result.

In ESWT group 4 feet remained in severe pain; and there were no side effects.

In the group that underwent surgery 1 foot had paresthesias in the 3rd toe for 6 months, with normalization of sensitivity after this period.

Discussion

In the group of patients treated with focused waves (group 1), the percentage of good results was 70.6%, while in the operated patients (group 2) it amounted to 93.2%. Poor results were found in 29.4% in shockwave group and 6.8% in surgical group. Clearly the results of surgery were superior, however the results were very favorable in group 1 as well.

Shockwaves have the advantage of being a conservative treatment with a low complication rate [23]. There were not side

effects in our cases. Complications secondary to alcohol injection, such as burning pain, which in some cases lasts for weeks [12,] and even digital ischemia [27] have been reported. The British National institute for health and care excellence (NICE), has alerted about a list of possible complications of radiofrequency ablation including pain, superficial cellulitis, burns, and temporary nerve irritation [28].

There is still not enough high quality evidence to support the massive indication of radio-frequency ablation and cryoablation [5,28]. Radiofrequency ablation is not recommended as routine treatment by NICE [28].

Neurectomy is the most common surgery for Morton's neuroma. Although in our series the surgical complications were low (1 case), other authors have reported more severe and numerous complications [1, 16,17,29]. The failure rate following surgical excision has been reported as up to 40% [29]. Complications after surgery include pain [1,16], restriction of activities [1], restrictions with footwear [16], complex regional pain syndrome [1], sensory deficits [17] and recurrence of the Morton's neuroma [1].

For all these reasons, we consider that it is better to start with non-invasive techniques that are less exposed to complications. It has been proven in the field of shoulder surgery that the prior application of shock waves, for example in the case of rotator cuff calcifications, does not alter the outcome of future surgery [30]. However, for example, surgery following alcohol injections can be difficult due to increased fibrosis in Morton's neuroma [1].

In conclusion, focused shock waves have a high, but lower success rate than surgery in the treatment of Morton's neuromas. Nevertheless, due to their non-invasiveness and low chance of complications, they can be considered an option prior to minimally invasive and surgical techniques.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has/er given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflicts of Interest: Nil. **Source of Support:** None.

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