



Ultrasound guided steroid injection in the treatment of interdigital neuralgia

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The aim of this study was to assess the clinical effectiveness of ultrasound guided injection in the management of Morton's Metatarsalgia.

Patients clinically diagnosed with interdigital Morton's neuroma were treated with ultrasound guided injection of local anaesthetic and steroid. Fifty four patients were available for follow-up, and all had detailed telephone questionnaires completed. These questionnaires included a pre and post injection symptom score, and Johnson Satisfaction score.

The results indicate that 69% of patients had ultrasound diagnosis of Morton's neuroma and 31% had an ultrasound diagnosis of intermetatarsal bursa. Mean follow-up was 11.4 months. Sixty seven percent of the patients were satisfied with the results of treatment. At follow-up 63% of patients had no limitation in activity levels, and had no need to modify shoe wear. Of all patients included in the study, only three have gone on to require surgery for ongoing symptoms. Although some studies have suggested that neither injection nor imaging have a role in the treatment of Morton's neuroma, this study, however, demonstrates that ultrasound guided placement of local anaesthetic and steroid in either an intermetatarsal bursa or Morton's neuroma gives a good short and medium term symptom relief and in the majority of cases avoids or at least delays the need for surgery.

Keywords : Morton's neuralgia ; neuroma ; foot ; ultrasound.

INTRODUCTION

The Italian Durlacher, a chiropodist to Queen Victoria, had described the classical features of this condition in his book, before Thomas Morton who wrongly attributed the symptoms to the subluxation of the metatarso-phalangeal joint (MTPJ) and advocated excision of the MTPJ. The term Morton's neuroma came into use in the 19th century and should be abandoned in the 21st century, as the condition was neither first described by Morton nor is a true neuroma. The term interdigital neuritis has been proposed, but the condition appears to be more a mechanical than an inflammatory process.

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Fig. 1. — Mulder's sign

Therefore, we propose that the term interdigital neuralgia more accurately reflects the symptoms and signs of this condition. It is a degenerative process of the nerve characterised by epineural, perineural and endoneural fibrosis ; hyalinisation of the wall of the endoneural vessels ; demyelination ; endarteritis of surrounding vessels (10, 15, 16) and degeneration of the surrounding fatty tissue. Various theories regarding its aetiology have been suggested. These include entrapment neuropathy (4), ischaemia (12), enlarged bursa (2) and repetitive micro trauma (6) to the nerve.

Conservative measures such as footwear modification and metatarsal pads have some success. Other treatment modalities include blind injection of steroid and local anaesthetics. Surgical excision has been popular despite a success rate that rarely exceeds 80% (9). Resection of the intermetatarsal ligament with or without neurolysis has also been suggested (13).

The role of ultrasound in the diagnosis of an interdigital mass has been reported and is still controversial. More recently, it has been proposed that ultrasound-guided injection of steroid or alcohol may be more beneficial than blind injection. This study has investigated the role of ultrasound in the treatment and diagnosis of interdigital neuralgia.

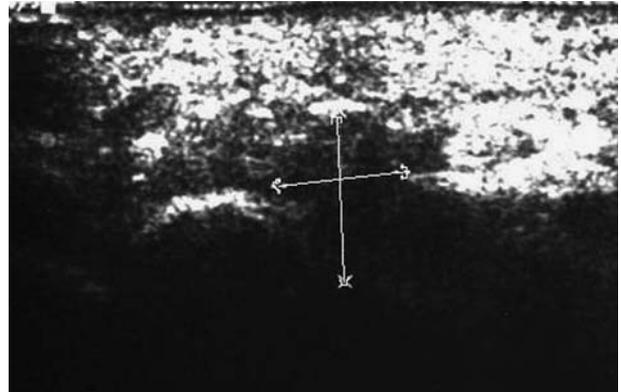


Fig. 2. — Intermetatarsal mass shown by ultrasonography

PATIENTS AND METHODS

This is retrospective study in which 54 patients, with a clinical diagnosis of interdigital neuralgia made by two foot and ankle surgeons, were referred for ultrasound diagnosis and steroid injection. The clinical diagnosis was made based on a history of interdigital pain, interdigital tenderness/mass, Mulder's click and the absence of signs to suggest other factors such as capsulitis or stress fractures etc. Plain radiograph of the affected feet was done.

Ultrasound Technique

All 54 patients had their feet scanned by one musculoskeletal radiologist, who initially applied digital pressure on the painful area whilst squeezing the metatarsal shafts with the other hand in order to elicit Mulder's sign (11). The ultrasound scan was then performed with the patients seated on the examination table with their legs extended and the ankle dorsiflexed. Each web space of the foot was scanned in the coronal and sagittal plane. Scanning was performed using a 10-MHz linear transducer on the plantar aspect of the foot. Compression of the metatarsal heads as used in eliciting Mulder's click was demonstrated to show a hypoechoic mass prolapsing in and out of the intermetatarsal space, reproducing the patient's pain (fig 1 & 2). Of the 54 patients, 45 (83%) were diagnosed as having a mass present while nine patients were diagnosed as having dropped metatarsal heads.

Table I. — The questionnaire

Pre injection history :	Level of pre injection pain Subjective paraesthesia in toes Web space swelling Limitation/ modification in shoe wear Restriction of activity
Pre injection Examination	Web space tenderness Mulder's click
Post injection results :	Level of post injection pain Activity restriction Footwear requirements
Post injection results :	Level of post injection pain Activity restriction Footwear requirements
Johnson Satisfaction Score (8)	Completely satisfied Satisfied with minor reservations Satisfied with major reservation Dissatisfied
Eventual outcome	The need for surgery

Injection technique

Under ultrasound control and with aseptic technique, a mixture of 2 ml 0.5% bupivacaine and 20 mg of Triamcinolone Acetonide was injected into the interdigital mass area of 45 feet of the 45 patients diagnosed with an interdigital mass. All patients who had injection were reviewed by the radiologist at 2 weeks post injection.

Follow-up

A questionnaire was completed using two sources of information : the patients' medical records and a subsequent telephone call (table I).

RESULTS

Of the 54 patients, 9 patients who had not been found to have an interdigital mass and had not had an injection were excluded. Six patients were not contactable and the remaining 39 patients were contacted by telephone : Seven (18%) were male and 32 (82%) female with an average age of 55.8 years (range 26-83, SD 13.4). The mean follow-up was 11.4 months. There was no report of any post injection complications such as infection or fat pad atrophy.

Subjective pain intensity

The detailed results are presented in table I. Thirty eight (97%) patients had reported moderate or severe pain at presentation, in comparison to 18 (46%) patients who remained in severe pain post injection. Eleven (28%) patients experienced complete pain relief after treatment (table II). Chi square test showed a *p* value of less than or equal to 0.001, reflecting a significant difference between pain distribution before and after treatment.

Activity Limitation

Twenty two (56%) patients had no activity limitation after treatment in comparison to 3 (7%) at presentation (table III).

Statistical analysis, using Chi square test showed a *p* value of less than or equal to 0.001, reflecting a significant difference.

Footwear modifications

Footwear modification was required by 26 (67%) patients at presentation compared to 21 (53%) patients at follow-up. Chi square test showed that the difference was not significant,

Table II. — The results of pain sensation both pre and post injection

Pain Intensity	Pre Injection Pain No. of patients (%)	Post Injection Pain No. of patients (%)
none	0 (0%)	11 (28%)
mild	1 (3%)	10 (26%)
moderate	12 (30%)	11 (28%)
severe	26 (67%)	7 (18%)

Table III. — The results of the ultrasound injection in relation to severity of activity limitation

Activity Limitation	Pre Injection No. of patients(%)	Post Injection No. of patients(%)
None	3 (7%)	22 (56%)
Recreational	6 (14%)	8 (21%)
Mild Daily	15 (38%)	6 (14%)
Severe Daily	15 (38%)	3 (7%)

probably because many patients were still using an insole.

Johnson Satisfaction Scale

A Satisfaction Score was proposed by Johnson *et al* (8) in 1988 in order to quantify the degree of patient satisfaction with a surgical procedure and has been accepted as a good method to assess the outcome of surgery.

Twenty three (59%) patients reported a variable degree of satisfaction. Of those patients, 12 (31%) were completely satisfied, 6 (15%) patients were satisfied with minor reservations and 5 (13%) patients were satisfied with major reservations. Sixteen (41%) patients were dissatisfied.

The eventual outcome

The eventual outcome was measured, in terms of the need for surgical intervention. Only 3 (8%) patients proceeded to a neurectomy ; the remaining 36 patients did not wish to have a surgical intervention – this included the remaining 13 of the 16 patients who had stated they were dissatisfied with their injection. At operation, a perineural

swelling was found in all cases and the histology was said to be compatible with a Morton's neuroma.

DISCUSSION

Considerable variation exists in the management of interdigital neuralgia (7).

The long term results of surgical excision of the interdigital nerve have a satisfaction rate which rarely exceeds 80-85% : the main complication of neurectomy is recurrent painful neuroma which is less responsive to a further surgical intervention. Therefore many authors recommend a trial of conservative treatment, including footwear modification and local injection.

The use of ultrasound in confirming an intermetatarsal mass is operator dependent and controversial. Sharp *et al* (17) suggested that clinical assessment is the most sensitive and specific diagnostic modality and found that the accuracy of ultrasound is dependent on the size of the lesion. However, the ultrasound in their study was performed from the dorsum of the foot and did not include a dynamic assessment that included reproduction of Mulder's click. We have not found any report of the dynamic reproduction of the Mulder's click on ultrasound and have found it to be diagnostic. This study has not sought to establish a correlation between clinical diagnosis and ultrasound since only 3 patients have had surgery. Furthermore, there are no specific features that establish a diagnosis in histological specimens.

This study was started in the belief that ultrasound might make it easier to target the "hot spot" that causes patients' symptoms. The results showed the injection has reduced pain intensity in 82% of patients, which is statistically significant. However, 41% of patients were dissatisfied. The large percentage of dissatisfaction may be due to misdiagnosis or inaccurate placement of local anaesthetic and steroid mixture. These results, based on pain relief, are comparable to those results obtained by Greenfield (5) by using blind multiple injection of a similar mixture of local anaesthetics and steroid. At 2 years follow-up, 80% of his cases indicated complete relief of pain or had only slight pain. There

was no mention of particular complications associated with multiple steroid injections. In this study we limited treatment to a single injection in order to minimise the occurrence of such complications. In contrast to Greenfield's study, Mann and Reynolds (9) did not focus on the injection, but thought that injection did not result in lasting benefit and did not help in diagnosing neuroma. Our study disagrees with this statement as 46% of patients had complete satisfaction or satisfaction with minor reservation, and this appears to have reduced the number of patients that one would expect to have gone on to surgery. Bennett *et al* (1) attempted to evaluate the efficacy of a 3-stage protocol for the management of Morton's neuralgia. Stage 1 includes non operative measures, such as footwear modification. Stage 2 consists of local steroid injection into the affected web space, while stage 3 is surgical excision of the interdigital neuroma. Certainly conservative management is worth attempting first. The present study focused on local steroid injection under ultrasound guidance, and the results were similar to stage 2 of the Bennett protocol. One variable this study did not consider is the effect of symptom duration on the result of treatment. In the study by Bennett *et al*, patients with symptoms of less than one year duration

appeared to do better than those with symptoms of more than one year duration.

Rasmussen *et al* reported on 51 feet treated by a single corticosteroid injection for treatment of third webspace neuromas. They concluded that injections generally did not provide a cure for Morton's neuromas, but they did provide temporary relief and did not preclude a good surgical outcome. After 4 years, only 11% of the feet had lasting improvement. The authors felt, as did Bennett *et al*, that injection can be useful in confirming the diagnosis and as a predictor of operative success. Our study is not confined to a single web space, but agrees that a single injection reduces the need for surgery.

The study by Fanucci *et al* evaluated the efficacy of neuroma alcohol-sclerosing therapy under ultrasound guidance in the treatment of Morton's neuralgia after a 10-month follow-up. Total or partial symptomatic relief was obtained in 30 cases (75%) at 10 months follow-up (3). The use of such sclerosing therapy has not been documented before and the possible long-term complications are not known.

Table IV illustrates the result of various injection techniques in the treatment of Morton's neuroma. To our knowledge, there has never been a prospective randomised trial of the role of steroid in the

Table IV. — Comparison of results of previous studies of various injections of Morton Neuroma

Author	Type of local injection	Technique	Satisfaction rate	No. of injections
Bennett <i>et al</i> (1) Stage 2 (1995)	Xylocaine- Triamcinolone	Blind	46% satisfied	Single injection
Greenfield <i>et al</i> (5) (1984)	Xylocaine- Triamcinolone	Blind	80% complete or partial relief at 2 years	Multiple
Rasmussen <i>et al</i> (14) (1996)	Bupivacaine-Betamethsone	Blind	22% completely satisfied or with minor reservations	Single
Fanucci <i>et al</i> (3) (2004)	30% alcohol sclerosing solution	Ultrasound guided	75% completely satisfied or with minor reservations at 10 months	Multiple
Present Study (2006)	Xylocaine- Triamcinolone	Ultrasound guided	46% completely satisfied or with minor reservations	Single

treatment of Morton's neuralgia. A trial comparing local anaesthetic alone, steroid alone, local anaesthetic plus steroid and alcohol needs to be performed.

The eventual outcome has been the need for surgery. Only 3 (7%) patients have gone on to have surgery. The diagnosis of neuroma or bursa did not appear to affect the eventual outcome, since two bursa patients and one neuroma patient required surgical intervention. The histological specimens were not available to confirm the ultrasound diagnoses. It is surprising that so few patients requested surgery despite the low satisfaction among the two groups of patients. One explanation for this may be that although the patients were "dissatisfied", their painful symptoms had improved sufficiently to make the condition interfere less with their daily activities. We do not know the natural history of this condition; therefore it is difficult to comment on how many patient get better without having an active treatment at all.

In conclusion, the use of dynamic ultrasound to reproduce a Mulder's click is reported and may be useful in confirming the clinical diagnosis of interdigital neuralgia. A trial period of non operative measures is worth considering, before subjecting patients to surgery. Only a few patients in this study demanded surgery after the ultrasound guided injection, which supports the role of ultrasound in the injection of a mass associated with interdigital neuralgia.

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