

Quality improvement in action

Morton's neuroma: diagnostic accuracy, effect on treatment time and costs of direct referral to ultrasound by primary care physicians

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ABSTRACT

Background The first-line treatment for symptomatic Morton's neuroma in our hospital is a perineural ultrasound-guided injection of corticosteroid and local anaesthetic (USI). The NHS has recently implemented 18-week referral-to-treatment targets. When GPs specifically suggest a diagnosis of Morton's neuroma there are two referral pathways in our hospital: direct referral to radiology for USI (limited slots) or referral to the specialist foot and ankle clinic. Patients with less specific referral letters are also evaluated in clinic and referred for USI as appropriate.

Methods A retrospective audit was performed reviewing referral letters from general practitioners (GPs) in 2005–2006. A comparison was made between the referral pathways for time-to-treatment (TTT), accuracy of GP diagnosis, and cost implications.

Results In the directly referred group, the median TTT was 99 days, compared to 206 days for patients

who went via a foot and ankle clinic ($P < 0.001$). Of 57 patients with a GP diagnosis of Morton's neuroma, 40 (70%) had the diagnosis confirmed on USI compared to 44 of 64 (69%) patients referred by a foot and ankle surgeon, showing no significant difference between the groups ($P = 0.87$).

Conclusion For patients with features highly suggestive of a Morton's neuroma, direct referral from primary care for USI had a similar accuracy to referral from a specialist hospital clinic and the time-to-treatment was significantly shorter. The mean waiting time of this group was within the 18-week government target without any changes to our current radiology protocols.

Keywords: injection, Morton's neuroma, primary care, time to treatment, ultrasound

How this fits in with quality in primary care

What do we know?

Morton's neuroma is a common condition presenting to primary care. Current practice usually involves referral to a specialist orthopaedic surgeon for those patients who fail to respond to conservative treatment. This can significantly delay time to treatment and prevent achievement of the government 18-week referral-to-treatment target.

What does this paper add?

This paper provides evidence that general practitioners can appropriately diagnose Morton's neuroma and, importantly, that direct referral of these patients to ultrasound for injection greatly expedites treatment, with accompanying cost savings.

Introduction

Morton's neuroma is a painful condition of the foot, characterised by neural degeneration and perineural fibrosis, most commonly seen between the third and fourth or the second and third metatarsals.¹ It was first described by Durlacher in 1845.² Thomas Morton, in 1876, described the syndrome as 'a peculiar painful affection of the fourth metatarsophalangeal articulation'.³

The exact pathogenesis of Morton's neuroma is uncertain, but the currently accepted theory is that it is caused by repetitive trauma of the plantar nerve at the edge of the metatarsal ligament which leads to perineural fibrosis.¹ Nissen suggested that the pathology was a vascular phenomenon leading to neurofibrosis,⁴ whereas Bossley and Cairney suggested that swelling of the intermetatarsal bursa compressed the nerve, resulting in a neuroma.⁵ Debate rages as to the significance of the swelling of an interdigital nerve and its relationship, or not, to symptoms characteristic of a Morton's neuroma.

Previous small studies have estimated the prevalence of Morton's neuroma to be around 30%.^{6,7} It most commonly presents with pain in the forefoot, radiating to the two involved toes, with pain aggravated by wearing pointed and high-heeled shoes and relieved by taking the shoes off and massaging the foot. Patients often complain of feeling as if they are walking on a stone in their shoe. Not all patients have such specific symptoms. A positive web space compression test, performed by squeezing together the metatarsal heads with one hand and with the other hand compressing the involved web space between thumb and finger and producing severe pain, is highly suggestive of a Morton's neuroma.⁸

Diagnosis in most centres can be made using either ultrasound,⁹⁻¹² or magnetic resonance imaging (MRI),^{13,14} although some studies show that clinical evaluation is as accurate as radiological diagnosis.¹⁴ Morton's neuroma can be treated conservatively using shoe modifications, or if this fails to improve symptoms then ultrasound-

guided injection using a combination of steroids and local anaesthetic can be used to relieve symptoms. Other surgical options include neurolysis, percutaneous electrocoagulation, cryogenic denervation of the intermetatarsal neuroma or surgical decompression.¹⁵

In our primary care trust (PCT), general practitioners (GPs) have direct access to orthotic services and so patients with mild symptoms will usually be referred there first. At the Nuffield Orthopaedic Centre, a secondary and tertiary elective orthopaedic hospital, the first-line treatment for patients referred with symptomatic Morton's neuroma is an ultrasound (US)-guided evaluation, and injection of depo-medrone and bupivacaine. Failure of successive injections to resolve symptoms leads to the offer of surgical treatment.

This retrospective audit was undertaken to improve waiting time for patients from referral to ultrasound-guided injection (USI). There are two referral pathways in our hospital:

- A direct referral to US \pm injection upon receipt of a GP referral letter suggesting a specific diagnosis of Morton's neuroma, for which we have a limited number of slots
- B assessment in a foot and ankle clinic \pm referral to USI as appropriate, for all remaining referrals.

The aims of this audit were firstly to investigate the difference in time to treatment (TTT) between the two referral patterns, and secondly to ascertain the accuracy with which GPs were able to diagnose Morton's neuroma. A further aim was to consider the financial implications of treating patients using these two referral patterns.

Methods

Patients were included in the audit if they were referred by GPs between January 2005 and December 2006 to the Nuffield Orthopaedic Centre Foot and Ankle team, with a specific diagnosis of Morton's

neuroma in their referral letter. Data were collected from patients' clinical notes, referral letters, and radiology reports, and, using these, we excluded patients with recurrent Morton's neuroma.

Time to treatment

The assignment into one of two groups was recorded: direct referral to US for injection (group A), or attendance at the foot and ankle clinic for assessment, with referral to ultrasound if appropriate (group B: see Figure 1).

For group A, a forwarding letter had been sent to the radiology department with a copy of the GP referral letter, and a US appointment was made. For group B, a routine outpatient appointment was made to see a member of the foot and ankle team. Patients were assessed in clinic and referred on to USI, as appropriate, by means of a dictated clinic letter. We compared their TTT.

The USIs were performed by three experienced consultant musculoskeletal radiologists using a 12 MHz linear transducer in the sagittal and axial planes. US was performed on the dorsum and sole of the foot, and feet were injected from the dorsal side using a combination of 40 mg depomedrone and 5–10 mg bupivacaine.

Accuracy of diagnosis

In order to determine accuracy of GP diagnosis of Morton's neuroma, we compared the success rate of diagnosis within groups A and B to a further group (C:

see Figure 1). Group C were patients referred by a foot and ankle consultant to USI, querying a Morton's neuroma during the same period. These patients did not have a GP diagnosis of Morton's neuroma in their referral letter but symptoms were described as 'metatarsalgia' or 'forefoot pain' or some other condition.

Cost evaluation

Costs of an outpatient appointment were obtained from the trust.

Statistical methods

Data for TTT were seen to be non-parametric by visual assessment of frequency histograms, and therefore a Mann–Whitney *U* test was used to compare groups. For the comparison of accuracy in diagnosis, a χ^2 test was used and a two-tailed *P* value calculated. Statistical analyses were performed using SPSS version 17.0 (Illinois, USA).

Results

There were 29 patients in group A, 27 female and two male, with a median age of 57 years (range 27–87 years). There were 28 patients in group B, 19 female and nine male, with a median age of 59 years (range 31–89 years). In group C there were 64 patients, 53

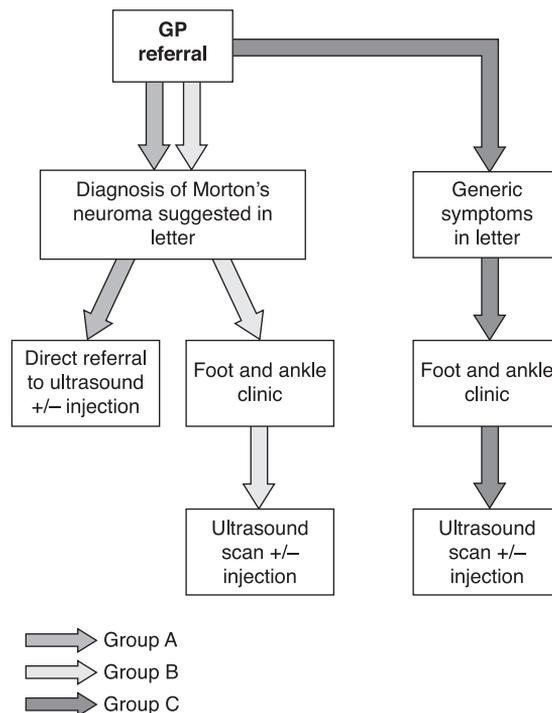


Figure 1 Referral pathways for treatment of Morton's neuroma

female, 11 male, with a median age of 53 years (range 27–87 years).

For all 28 patients in group B, the foot and ankle surgeon agreed with the GP's diagnosis of Morton's neuroma; hence they all proceeded on to radiology for a US.

Time to treatment

The TTT for the 29 patients in group A was compared to the 28 patients in group B. The median TTT in group A was 99 days (interquartile range (IQR) 23 days), and was significantly shorter than that for group B, 206 days (IQR 51 days; $P < 0.001$).

Accuracy of diagnosis

For those 57 patients in whom the GP had suggested a diagnosis of a Morton's neuroma, 40 (70%) had confirmed Morton's neuroma on US and proceeded to injection. The other US findings are summarised in Table 1.

Of the 64 patients in group C, 44 (69%) had a confirmed diagnosis of Morton's neuroma. There was no statistically significant difference between the two groups ($\chi^2 = 0.029$, $P = 0.87$). No patient had their diagnosis subsequently refuted, and the diagnosis following US imaging was found to be appropriate in each case.

Cost evaluation

The cost of an outpatient appointment was £175. By preventing 29 outpatients appointments the saving to the trust was estimated to be £5075.

Discussion

Time to treatment was significantly shortened by more than a half with direct referral to USI from primary care compared to referral via a specialist clinic. There was no significant difference in accuracy of diagnosis of Morton's neuroma between GPs and foot and ankle surgeons. In addition, there was a saving of 29 outpatient appointments, amounting to approximately £5075.

There are a number of limitations in this study. The first is that our comparison of GP diagnostic accuracy compared to that of a foot and ankle surgeon was conducted with different patient cohorts. Patients presenting to a GP may not have a clear-cut diagnosis of a Morton's neuroma and it is appropriate that this group of patients should be seen by a foot and ankle team member. However, it is important to note that the alternative diagnoses in group A (see Table 1) would have warranted a US, even if these patients had been seen first in a specialist clinic. Secondly, the success rate for GPs correctly diagnosing Morton's neuroma was achieved with them being blinded to the fact that this audit was being conducted.

The NHS Improvement Plan (June 2004) set out the following aim: 'By 2008 no one will wait longer than 18 weeks from GP referral to hospital treatment'. The subsequent guidance document was released in May 2006,¹⁶ leading to added pressures on an already busy foot and ankle service.

Waiting times have dramatically dropped in our hospital for all conditions since this audit, but the principle of saving costs and reducing delay is important in our practice. Experienced musculoskeletal radiologists screen patients for alternative diagnoses because, although asymptomatic patients may be shown to have a 'neuroma' on ultrasound, this is not enough to make the diagnosis. Radiologists can also visualise the forefoot for other diagnoses such as mechanical overload, synovitis or instability of the metatarsophalangeal joints or tendon sheaths, seronegative arthritides, tumours, bursae and stress fractures or reactions of metatarsals.

The literature describes that ultrasound, computerised tomography (CT) and MR imaging have all previously been used in the investigation of patients whose clinical findings are suggestive of Morton's neuroma.^{9,13,14,17} Ultrasound has been found to be specific and sensitive but operator dependent,^{9,10,12,14} with some studies quoting prospective sensitivity of up to 98%, and retrospective sensitivity of up to 100%.^{11,12} We are fortunate to have highly experienced specialist interventional musculoskeletal radiologists in our hospital.

Morton's neuroma and its treatment remains a controversial topic of foot and ankle surgery today. At our hospital, we have an established primary treatment

Table 1 Ultrasound scan diagnoses of GP referrals with suspected Morton's neuroma

Findings on ultrasound	Number (%) of patients
Morton's neuroma	40 (70.2)
Nothing abnormal detected	7 (12.3)
Bursitis/bursa	2 (3.5)
Ganglion	3 (5.3)
Osteoarthritis/degenerative changes	2 (3.5)
Glomus tumour	1 (1.9)
Angioleiomyoma	1 (1.9)
Space-occupying lesion	1 (1.9)

using ultrasound with steroid and local anaesthetic injection. A recent Cochrane review in 2004 concluded that there were no well-designed randomised controlled trials to evaluate the outcome of various treatments for Morton's neuroma.¹⁸ The published literature shows varying rates of success from injection; two recent papers have success rates of 69% and 82%, respectively.^{19,20} Research has also shown alcohol injection to be a treatment of similar efficacy,^{21,22} but this requires multiple injections, with over four injections per patient in one study.²¹ This supports selection of our primary treatment, with surgical excision reserved for those patients in whom primary treatment is unsuccessful.

As a result of this audit, a direct referral to USI for suspected cases of Morton's neuroma is being negotiated between the PCT and our hospital. The financial implications of this audit were a saving of 29 outpatient appointments in two years; with the implementation of this protocol to all patients for whom the GP suggested in their referral letter a diagnosis of Morton's neuroma, we would have saved 57 outpatient appointments at cost saving of just under £10 000.

In the UK, there are an increasing number of specialist interventional musculoskeletal radiologists. For areas where the local policy of Morton's neuroma treatment is USI, we would advocate consideration or a trial of direct referral. Locally, we anticipate studying if there is an increase in numbers referred directly to USI, and if the implementation of direct access has any effect on the accuracy of GP diagnosis of Morton's neuroma or leads to over-referral due to ease of access.

REFERENCES

- 1 Wu KK. Morton's interdigital neuroma: a clinical review of its etiology, treatment, and results. *Journal of Foot and Ankle Surgery* 1996;35(2):112–19; discussion 87–8.
- 2 Durlacher L. *A Treatise on Corns, Bunions, the Diseases of Nails, and the General Management of the Feet*. London: Simpkin and Marshall, 1845.
- 3 Morton T. A peculiar painful affection of fourth metatarsophalangeal articulation. *American Journal of Medical Science* 1876;71:37.
- 4 Nissen KI. Plantar digital neuritis Morton's metatarsalgia. *The Journal of Bone and Joint Surgery* 1948;30-B(1):84–94.
- 5 Bossley CJ and Cairney PC. The intermetatarsophalangeal bursa – its significance in Morton's metatarsalgia. *The Journal of Bone and Joint Surgery* 1980;62-B(2):184–7.
- 6 Zanetti M, Strehle JK, Zollinger H and Hodler J. Morton neuroma and fluid in the intermetatarsal bursae on MR images of 70 asymptomatic volunteers. *Radiology* 1997; 203(2):516–20.
- 7 Bencardino J, Rosenberg ZS, Beltran J, Liu X and Marty-Delfaut E. Morton's neuroma: is it always symptomatic? *American Journal of Roentgenology* 2000;175(3):649–53.
- 8 Wu KK. Morton neuroma and metatarsalgia. *Current Opinion in Rheumatology* 2000;12(2):131–42.
- 9 Shapiro PP and Shapiro SL. Sonographic evaluation of interdigital neuromas. *Foot and Ankle International/American Orthopedic Foot and Ankle Society [and] Swiss Foot and Ankle Society* 1995;16(10):604–6.
- 10 Read JW, Noakes JB, Kerr D *et al*. Morton's metatarsalgia: sonographic findings and correlated histopathology. *Foot and Ankle International/American Orthopedic Foot and Ankle Society [and] Swiss Foot and Ankle Society* 1999;20(3):153–61.
- 11 Pollak RA, Bellacosa RA, Dornbluth NC, Strash WW and Devall JM. Sonographic analysis of Morton's neuroma. *The Journal of Foot Surgery* 1992;31(6):534–7.
- 12 Redd RA, Peters VJ, Emery SF, Branch HM and Rifkin MD. Morton neuroma: sonographic evaluation. *Radiology* 1989;171(2):415–17.
- 13 Lee MJ, Kim S, Huh YM *et al*. Morton neuroma: evaluated with ultrasonography and MR imaging. *Korean Journal of Radiology* 2007;8(2):148–55.
- 14 Sharp RJ, Wade CM, Hennessy MS and Saxby TS. The role of MRI and ultrasound imaging in Morton's neuroma and the effect of size of lesion on symptoms. *The Journal of Bone and Joint Surgery* 2003;85(7):999–1005.
- 15 Bondi L, Bondi R, Folliero A and Tarantino U. Treatment of Morton's neuroma: the evidence. *Journal of Orthopaedics and Traumatology* 2005;6(4):199–202.
- 16 Department of Health. *Tackling Hospital Waiting: the 18 week patient pathway. An implementation framework*. London: Department of Health, 2006. www.pfc.org.uk/files/18_weeks_implementation.pdf (accessed 22 July 2009).
- 17 Turan I, Lindgren U and Sahlstedt T. Computed tomography for diagnosis of Morton's neuroma. *The Journal of Foot Surgery* 1991;30(3):244–5.
- 18 Thomson CE, Gibson JN and Martin D. Interventions for the treatment of Morton's neuroma. *Cochrane Database of Systematic Reviews* 2004(3):CD003118.
- 19 Hassouna H, Singh D, Taylor H and Johnson S. Ultrasound guided steroid injection in the treatment of interdigital neuralgia. *Acta Orthopaedica Belgica* 2007;73(2):224–9.
- 20 Saygi B, Yildirim Y, Saygi EK, Kara H and Esemeli T. Morton neuroma: comparative results of two conservative methods. *Foot and Ankle International/American Orthopedic Foot and Ankle Society [and] Swiss Foot and Ankle Society* 2005;26(7):556–9.
- 21 Hughes RJ, Ali K, Jones H, Kendall S and Connell DA. Treatment of Morton's neuroma with alcohol injection under sonographic guidance: follow-up of 101 cases. *American Journal of Roentgenology* 2007;188(6):1535–9.
- 22 Masala S, Fanucci E, Ronconi P *et al*. [Treatment of intermetatarsal neuromas with alcohol injection under US guide.] *Trattamento dei neuromi intermetatarsali con somministrazione intralasionale di alcol sotto guida US*. *La Radiologica Medica* 2001;102(5–6):370–3.

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CONFLICTS OF INTEREST

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