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Metatarsalgia and Morton's Disease: Comparison of Outcomes Between Open Procedure and Neurectomy Versus Percutaneous Metatarsal Osteotomies and Ligament Release With a Minimum of 2 Years of Follow-Up

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ABSTRACT

The present study compared the clinical results of open neurectomy versus a percutaneous procedure for Morton's disease. This was a retrospective study comparing the functional results after 2 surgical procedures: open neurectomy and a percutaneous procedure (with deep transverse metatarsal ligament release and distal metatarsal osteotomies). The present study included 52 patients (26 in each group), and the mean follow-up period was 4 (range 2 to 7) years. The patient evaluation criteria included the presence of painful symptoms of Morton's disease, American Orthopaedic Foot and Ankle Society (AOFAS) functional scale score, patient satisfaction, and delay for recovery. Percutaneous treatment of Morton's disease and open neurectomy produced complete relief of pain in 25 of 26 patients in each group. At the latest follow-up visit, the mean AOFAS score had significantly improved from 36 ± 11 preoperatively to a mean of 89 ± 18 ($p < .001$). After 2 years, the functional improvement obtained with the percutaneous procedure persisted, with a stable AOFAS score (96 ± 10). Persistent metatarsalgia was reported by patients who had undergone open neurectomy, with a significantly decreased AOFAS score (81 ± 21, $p = .009$). The percutaneous procedure for Morton's disease provided excellent functional outcomes (AOFAS score >90) significantly more often with a shorter delay than after open neurectomy ($p = .03$). At the latest follow-up visit, metatarsalgia due to plantar hyperpressure or bursitis and requiring plantar orthotics was present in 11 of 26 patients (44%) after open neurectomy and in 1 of 26 patients (4%) after the percutaneous procedure ($p = .002$). Percutaneous treatment of Morton's disease is a reliable procedure providing results as good as those after open neurectomy, with significantly better outcomes in the longer term and a lower rate of late metatarsalgia.

Described by Morton in 1876 (1) as local pain under the fourth metatarsal head from a neuroma, surgical removal of the neuroma was proposed in the case of failure of conservative management, providing reliable relief of the symptoms (2,3). The term *neuropathy* is now preferred because of the mechanical pathophysiology, with chronic compression of the interdigital plantar nerve in the more rigid intermetatarsal space, usually between the third and fourth metatarsal heads. Also, histologic examination will reveal chronic inflammation around the nerve without the histologic features of a neuroma (4–7).

Diagnosis is determined from the clinical symptoms with severe intermittent pain and paresthesia, most frequently in the third web space (8). Magnetic resonance imaging (MRI) or ultrasonography can be useful for confirming the diagnosis or for atypical cases (9,10). However, the presence of Morton's disease has often been overestimated, and confusion arises owing to symptoms from hyperpressure under the lateral metatarsal heads (hyperplantar keratosis, metatarsalgia, metatarsophalangeal joint bursitis, synovitis, or instability) that can be associated with true Morton's disease (4,10–12).

Open neurectomy results in reliable relief of the nerve compression symptoms. However, nearly 30% of the patients will need to wear insoles after surgery (3) because of persistent lateral metatarsalgia from the plantar hyperpressure often associated with Morton's

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disease but not addressed at neurectomy. New procedures have been developed to release the interdigital nerve without neurectomy and treat potentially associated forefoot disorders at the same setting (13). Minimally invasive procedures have associated section of the deep transverse metatarsal ligament and distal metatarsal osteotomies to correct potential plantar hyperpressure detected at the preoperative assessment (14,15).

We were interested in determining whether the open neurectomy versus percutaneous section of the deep transverse metatarsal ligament and percutaneous distal metatarsal osteotomies after failure of conservative treatment of Morton's disease would provide comparable clinical outcomes. We hypothesized that these procedures would provide comparable results after at least 2 years of postoperative follow-up. Our primary aim was to assess the complete relief of the intermittent severe pain typical of Morton's disease. Our secondary aim was to determine the functional results. We undertook a retrospective cohort study to compare the outcomes of patients who had undergone open neurectomy versus the percutaneous procedure.

Patients and Methods

The present study was a retrospective analysis of prospectively collected data at 1 hospital from February 2000 to December 2009. According to French law on biomedical research and current regulations, such studies do not require previous submission to, or approval from, an institutional review board and do not require written consent from the patients.

Inclusion and Exclusion Criteria

The patients were enrolled consecutively. Precise questions were asked to better assess the patients' forefoot chronic pain. The inclusion criteria were as follows:

1. The presence of Morton's symptoms, defined as sudden pain in the intermetatarsal space and adjacent toes when walking that force the patient to stop walking and remove the shoes to relieve the pain and a positive Mulder sign and click test at physical examination
2. With or without static metatarsalgia defined by plantar pain under the lesser metatarsal heads when walking linked to plantar hyperpressure or lesser metatarsophalangeal (MTP) joint bursitis
3. MRI assessment of Morton's disease (i.e., a hypointense mass in the intermetatarsal interdigital space) (12)
4. An operative procedure for Morton's disease
5. Failure of at least 6 months of conservative treatment, including steroid injections, orthotics, and shoe adaptations

The exclusion criteria were no sudden pain due to Morton's disease, isolated metatarsalgia, improvement of Morton's symptoms with conservative treatment, and/or discordance between the clinical and MRI findings.

Surgical Techniques

From 2000 to 2004, the surgical procedure for Morton's disease was open neurectomy through a dorsal approach. Since 2005, all patients have undergone percutaneous release of the deep transverse metatarsal ligament and percutaneous distal metatarsal osteotomy of the second, third, and fourth metatarsals. All procedures were performed by the same surgeon. The percutaneous forefoot surgery was performed using specific tools according to previously described techniques (15). Dorsal portals at the level of the metatarsal heads were performed with a Beaver blade. The intermetatarsal ligament was cut from proximally to distally, with the blade introduced in the intermetatarsal web space closest to the metatarsal neck in a plantar direction and 45° to the metatarsal shaft. The blade was then pushed distally, parallel to the metatarsal, to cut the intermetatarsal ligament. Distal metatarsal osteotomies were then performed using a full cutting straight 2.0-mm burr on the distal metaphyseal part of the metatarsal (Fig. 1). The osteotomies were extra-articular, oblique from plantarly and proximally to dorsally and distally, with a 45° angulation of the shaft (Fig. 2). The capital fragments were shifted to ensure mobilization of the metatarsal head and that the osteotomy was complete. No fixation was used in these metaphyseal extra-articular osteotomies to enable shortening and elevation of the metatarsal head to increase the intermetatarsal space (for nerve release) and decrease the plantar pressure. All the open neurectomies were performed with the patient under regional anesthesia (popliteal block with 20 mL of ropivacaine 20%), and all the percutaneous procedures were performed with the patient under local anesthesia (perimetatarsal infiltration with 20 mL of ropivacaine 20%). If a symptomatic hallux valgus deformity was associated with Morton's disease, surgical correction was performed at the same surgical setting. From 2000 to 2004, scarf osteotomy was performed, and from 2005 to 2009, percutaneous chevron osteotomy was performed.

Fig. 1. Percutaneous distal metatarsal osteotomy with fluoroscopic control of the location of the straight burr before osteotomy.

Patients

A total of 52 consecutive patients were included, 26 in each group. The number of patients in each group was exactly the same by chance. The relevant clinical data are presented in Table 1 and include patient sex, age, and level of activity at surgery (retired, sedentary, recreational sport, competitive sport); localization of severe and intermittent sudden pain from Morton's disease; the presence of metatarsalgia (chronic pain) due to plantar hyperpressure of the lateral metatarsals; coexistent associated symptomatic hallux valgus; forefoot shape (Greek when first ray was shorter than the second ray, Egyptian when the first ray was longer than the second ray, and square when the same length); and varus or valgus hindfoot alignment. The hindfoot alignment was measured only by physical examination with patient standing. In the case of valgus angulation, a difference between the hindfoot axis and leg axis of more than 10° was considered roughly to be valgus alignment. The American Orthopaedic Foot and Ankle Society (AOFAS) forefoot functional scale score (16) was assessed preoperatively for all the patients when surgery had been scheduled. MRI was performed preoperatively for all patients by a senior radiologist specializing in musculoskeletal imaging. For all the patients, the presence of an effusion in the lesser MTP joints was also assessed. A dorsoplantar full weightbearing radiograph was taken preoperatively to assess the metatarsal index and congruency of the lesser MTP joints. The metatarsal index was defined as the relative length of the first metatarsal versus the second, as assessed on the anteroposterior views, and classified as index minus if the first metatarsal was less

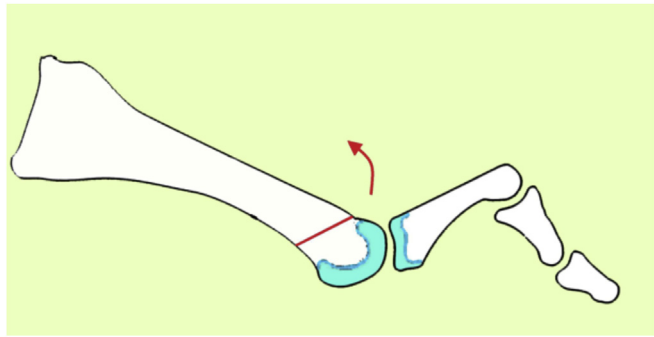

Fig. 2. Percutaneous distal metatarsal osteotomy showing location of osteotomy. Immediate full weightbearing will lead to elevation and pullback of the metatarsal head.