

Original Article

Diagnostic Accuracy of Magnetic Resonance imaging in Morton Neuroma

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Objective: To determine the diagnostic accuracy of magnetic resonance imaging (MRI) in morton neuroma using histopathology as a gold standard.

Place & Duration of Study: This study was carried out in Pakistan Institute of Medical Sciences, Islamabad from November 2009 to October 2011.

Study Design: Case Series

Materials and Methods: It included 9 patients who presented with complaints of localized pain in the forefoot which was worsened by wearing shoes and by walking. MRI was done in all these patients and the findings noted. After the MRI, biopsy was done and the histopathological diagnosis was used as the gold standard.

Results: The age of patients diagnosed with morton neuroma ranged from 32-46 years and the male to female ratio was 1:7. Out of the 9 patients, 8 patients were diagnosed according to MRI findings to have Morton neuroma and 1 patient was diagnosed as having bursitis. Later on, the patients were followed and biopsy was done and the MRI findings were correlated with the histopathological findings. There were 8 true positive cases and 1 true negative case. The sensitivity and specificity of MRI was 100% for the diagnosis of morton neuroma. The diagnostic accuracy of MRI in morton neuroma was determined to be 100%.

Conclusion: MRI is a safe and accurate test in the diagnosis of morton's neuroma.

Key Words: Magnetic resonance imaging, morton neuroma, histopathology.

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Introduction

Morton neuroma is a perineural fibrosis and nerve degeneration of the common digital nerve that usually occurs in the second and/or third intermetatarsal spaces. Morton neuroma is not a true neuroma but, rather, fibrosis due to repetitive irritation of the nerve. The American surgeon Thomas George Morton described this condition in 1876¹ The most common clinical symptom of Morton neuroma is localized pain in the forefoot. It can be sharp or dull, and is worsened by wearing shoes and by walking. Pain usually is less severe when the foot is not bearing weight. Clinical findings, however, may be equivocal. Therefore, MR imaging is used for preoperative assessment of patients with chronic forefoot pain.² Recently, MRI using T1-weighted sequences with fat saturation after i.v. Gadolinium DTPA has been suggested as the most effective MR sequence for depiction of Morton's neuroma of the forefoot.³ Peripheral neuropathy also can cause symptoms such as a burning or neuritic sensation, but these tend to occur throughout the toes and on both feet.⁴ Differential diagnoses with similar symptoms include bursitis, stress fractures, neoplasms

and fibromas. Imaging studies, particularly MRI is a valuable tool in differentiating these conditions. Neuromas are a common ailment seen by foot and ankle specialists. The diagnosis is often straightforward because of the description of a sharp, shooting pain or numbness in the affected digits.⁵ However, because the patients' descriptions of the pain can vary or because the pain can be related to another ailment in the differential diagnosis, MRI has become a useful imaging tool in obtaining a precise diagnosis.⁶ This study was conducted to determine the efficacy of MRI in the diagnosis of morton neuroma.

Materials and Methods

This study included 9 patients and was conducted during a period of 2 years from November 2009 to October 2011 at Pakistan Institute of Medical Sciences, Islamabad. All patients with clinical signs and symptoms of morton neuroma, including localized pain in the forefoot or any pain in the foot which worsened by wearing shoes and by walking were included in the study. Data, including demographic details and a detailed clinical history was recorded. The MRI of the affected foot was performed in each patient. The MR

images of the forefoot were obtained in a send receive extremity coil. The foot was placed and the patient was in the prone position. The standard protocol consisted of a sagittal T1-weighted spin-echo sequence, a transverse (perpendicular to the metatarsals) T1-weighted spin-echo MR sequence, and a T2-weighted turbo spin-echo sequence. Contrast-enhanced T1-weighted fat-suppressed spin-echo MR images were also obtained in all the patients.

The MR diagnosis of a Morton neuroma was made by the following MR criteria;

1. A well-demarcated spindle-shaped mass in the region of the neurovascular bundle on the plantar side of the deep transverse metatarsal ligament.
2. On transverse MR images a change in caliber of the nerve.
3. Isointense signal intensity to muscle on T1-weighted images.
4. Hypointense signal intensity to fat tissue on non-fat-suppressed T2-weighted images.
5. Marked enhancement on T1 weighted contrast-enhanced fat suppressed images.

All the patients were then referred for biopsy and the MRI findings were correlated with the histopathological diagnosis which was used as the gold standard. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of MRI in the diagnosis of morton neuroma was determined.

Results

The age of the patients was 32-45 years and the male to female ratio was 1:7. Out of a total of 9 patients, there were 8 true positive cases and 1 true negative case which was diagnosed to be a case of bursitis. There were no false negative or false positive cases in this study. The sensitivity and specificity were calculated to be 100%. The diagnostic accuracy of MRI in morton neuroma was calculated to be 100%.

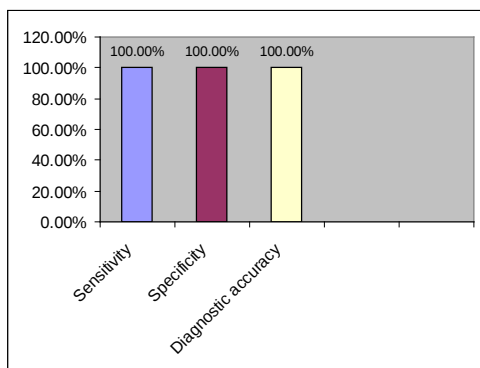


Figure I. Bar chart showing percentage of Sensitivity, Specificity and Diagnostic Accuracy of MRI in Morton neuroma.



Figure II. A well-demarcated spindle-shaped mass in the region of the neurovascular bundle on the plantar side of the deep transverse metatarsal ligament showing isointense signal intensity to muscle on T1-weighted images and hypointense signal intensity to fat tissue on non-fat-suppressed T2-weighted images.



Figure III. Post contrast study of the same patient showing marked enhancement on T1 weighted contrast-enhanced images.

Discussion

Threat Morton neuroma, or interdigital neuroma, is a common condition that involves enlargement of the interdigital nerve of the foot. Morton neuroma most commonly affects the third intermetatarsal space, but less commonly, it can also affect the second intermetatarsal space. Lesions in the fourth and first interspaces are unusual.⁴ The diagnostic accuracy of imaging for Morton neuroma is high.⁷ Among orthopedic surgeons, MR imaging has been claimed to be dubious and costly in the routine diagnosis of interdigital neuroma. However an efficacy study that evaluated the influence of MR imaging on the diagnostic thinking and the treatment plan of foot surgeons has demonstrated a

major impact of MR imaging on both items.⁸ In the study of Zanetti et al, the clinical diagnosis of Morton neuroma was withdrawn after MR imaging in one fourth of the feet. In more than one third of the remaining feet, MR imaging changed the localization or number of neuromas.³

The high diagnostic accuracy of MR imaging of Morton neuroma suffers from a high prevalence of Morton neuroma in asymptomatic persons. Two publications with various study designs revealed a prevalence of Morton neuroma of 30 to 33% in asymptomatic forefeet. Morton neuromas are found most commonly in the second and third intermetatarsal spaces in both symptomatic and asymptomatic feet. Morton neuromas in asymptomatic feet are significantly smaller in diameter than those found in symptomatic feet, with a notable large overlap between the two groups. Although this overlap exists, a cutoff value of 5 mm with regard to the transverse diameter as measured on transaxial MR images has been suggested based on MR and sonography studies for differentiating between symptomatic and asymptomatic Morton neuromas.

The distribution of asymptomatic Morton neuromas in the intermetatarsal spaces is similar to that present in symptomatic feet. Morton neuromas larger than 5 mm are likely to represent the cause of the patient's pain, whereas Morton neuromas smaller than 5 mm may be seen coincidentally and other pathologic conditions should be considered as causes.⁹

Symptoms in the intermetatarsal space adjacent to the one containing a Morton neuroma may be explained by communicating branches between the intermetatarsal nerves that have been found during surgery and in dissected cadaveric feet.¹⁰ MR imaging has prompted a change in the treatment plans in more than half (57%) of all cases³. MR imaging provides additional information concerning outcome after surgery for Morton neuroma. Biasca et al evaluated the reliability of preoperative case histories, clinical findings, and MR imaging in predicting clinical outcomes after surgical intermetatarsal neurectomy.¹¹ The differential diagnosis of Morton neuroma includes a stress fracture, a tendon sheath ganglion, a foreign-body reaction, a nerve-sheath tumor, strain of the plantar capsule, and capsulitis or bursitis at the level of the plantar metatarsal-phalangeal joint (MPJ).⁵ Occasionally, the diagnosis can be challenging because, in addition to inflammation of the capsule or bursa, inflammation of the adjacent nerve also may be present, causing the neuritic sensation of a Morton neuroma. Additional differential diagnoses with similar symptoms include neoplasms and fibromas. Imaging studies, particularly MRI is a valuable tool in differentiating these conditions. Neuromas are a common ailment seen by orthopedic surgeons. The diagnosis is often straightforward because of the description of a sharp pain or numbness in the affected

digits. However, because the patients' descriptions of the pain can vary or because the pain can be related to another condition in the differential diagnosis, MRI has become a useful imaging tool in obtaining a precise diagnosis.

Conclusion

The Diagnosis of Morton neuroma by MR imaging is highly accurate and has a large influence on the diagnostic thinking and treatment plan of orthopedic foot surgeons.

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