

Plantar Fibromatosis: Use of Magnetic Resonance Imaging in Diagnosis

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For patients presenting with classic features of plantar fibromatosis, a presumptive diagnosis may be made on clinical grounds alone. In less clear cases, a biopsy may allow confirmation of the diagnosis; however, a biopsy exposes the patient to operative complications. Magnetic resonance imaging (MRI) offers a noninvasive method for confirmation of the clinical diagnosis that may obviate the need for a biopsy. We describe a case that demonstrates the potential of this technique.

Fibromatosis is characterized by infiltrative fibrous tissue proliferation that may be locally invasive but does not metastasize. Fibromatosis is classified as either superficial or deep; superficial fibromatosis affects the fascia but does not extend into the muscle, and deep fibromatosis affects the aponeurosis and muscles and rarely extends up to the subcutis. Superficial fibromatoses are subclassified according to site of involvement: Dupuytren's contracture (palm), Peyronie's disease (penis), Ledderhose's disease (soles), or knuckle pads (interphalangeal and metacarpophalangeal joints). These fibromatoses may occur individually or in association with other fibromatoses.¹ Although the etiology of plantar fibromatosis is unknown, an increased incidence has been reported with hyperlipidemia, diabetes, chronic liver disease, and seizure disorders.² A family history has been reported in 13% of patients, suggesting an inherited risk.³ Trauma may be an inciting cause in genetically predisposed patients.²

Asymptomatic nodules require no treatment. The mainstay of treatment for symptomatic lesions is

nonoperative; orthoses may limit discomfort, and intralesional steroid injection has been successful in decreasing the size and discomfort of the nodules.⁴ Because several studies have documented recurrence rates of 8% to 66% after initial local or wide excision of the nodules,⁵⁻⁷ surgical treatment is reserved for lesions causing pain or disability despite nonoperative management. Clinical risk factors for recurrence after initial surgical treatment include the presence of multiple or bilateral nodules and a positive family history.³ Surgical techniques leaving residual fascia have been thought to increase the risk of recurrence, although a recent study found no significant difference in recurrence rates among the varying surgical techniques used for primary resection.³ In treatment of recurrent disease, however, this same study noted a decreased rate of recurrence after subtotal fasciectomy compared with local or wide excision (24% and 75%, respectively). Postoperative complications including wound and skin graft breakdown, nerve laceration or entrapment, deep venous thrombosis, and persistent pain are frequent, ranging from 18% after treatment of primary lesions to 44% after treatment of recurrent lesions.³ Given the poor clinical outcomes documented after surgical treatment, a nonsurgical means of confirmation of an uncertain clinical diagnosis is needed.

Case Report

A 68-year-old white man was referred for evaluation of multiple, bilateral, nontender nodules on the soles of both feet. The nodules had been present for more than 3 years and were gradually enlarging. His medical history was notable only for unilateral Dupuytren's contracture, hyperlipidemia, adenomatous colonic polyps, osteoarthritis, mild chronic obstructive pulmonary disease, and erectile dysfunction without Peyronie's disease. His medications included aspirin and simvastatin. He had no family history of similar lesions. Physical examination

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Figure 1. Bilateral nodules overlying the flexor tendons of the great toes.

revealed a 2-cm firm nodule overlying the flexor tendon of the right great toe and 3 firm nodules 0.5 to 1.5 cm in diameter overlying the flexor tendon of the left great toe (Figure 1). The nodules were not adherent to the overlying skin. Dupuytren's contracture was noted in the left palm. Knuckle pads were not present. Plantar fibromatosis was considered in the differential diagnosis. For confirmation, a small incisional biopsy was performed without complications.

Examination of a biopsy specimen using a hematoxylin and eosin (H&E) stain (Figure 2) revealed compact orthohyperkeratosis consistent with acral skin. Horizontal fibrosis was noted in the upper-to-mid dermis. A nodule composed of bland, plump, spindle-shaped myofibroblasts arranged in fasciculi was present in the deep dermis. There were no mitotic figures or cytologic atypia. The biopsy result was consistent with but not diagnostic of plantar fibromatosis.

Magnetic resonance imaging (MRI) was performed and demonstrated a heterogeneous mass 2.0×1.2×1.5 cm located in the distal medial band of the plantar fascia of the right foot, abutting the flexor hallucis longus ligament. It also revealed a heterogeneous mass 2.5×1.8×1.5 cm in the medial band of the plantar fascia of the left foot, also abutting the flexor hallucis longus ligament. The smaller nodules of the left foot were not demonstrated on the MRI scan. Masses were isointense to hypointense on T1-weighted images (Figure 3), and isointense to minimally hyperintense on T2-weighted images (Figure 4). Administration of gadopentetate dimeglumine revealed heterogeneous enhancement of the nodule (Figure 5).

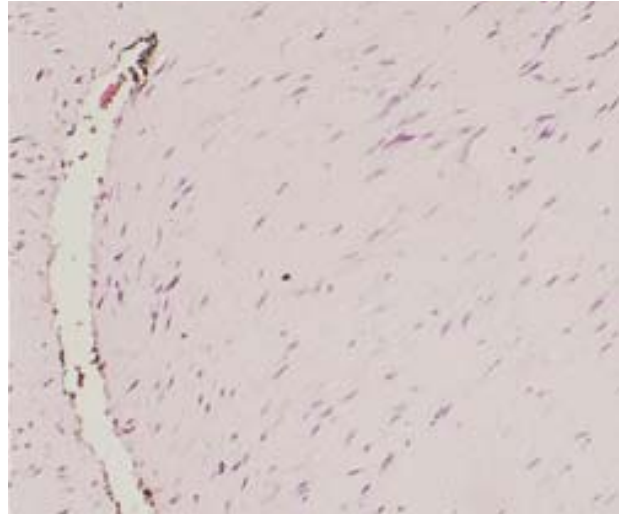


Figure 2. Biopsy specimen demonstrates horizontal fibrosis in the upper-to-mid dermis and a nodule composed of bland, plump, spindle-shaped myofibroblasts arranged in fascicles in the deep dermis. No cytologic atypia or mitotic figures are noted (H&E, original magnification ×100).

The clinical presentation, histopathologic features, and appearance on MRI confirmed the diagnosis of plantar fibromatosis. The patient was treated with orthotic inserts, which he elected not to wear because of lack of significant symptoms from the nodules. His examination remained unchanged over the following year except for minimal subjective enlargement of the right-sided nodule.

Comment

Plantar fibromatosis typically presents as a well-demarcated nodular thickening over the medial band of the plantar fascia. The nodule may be adherent to the overlying skin and single (70%) or multiple (30%). Nodules may be bilateral in 13% of patients.³ The nodules tend to enlarge slowly over years and may cause symptoms either from mass effect, location in a weight-bearing area, or local invasion of muscle or neurovascular structures.

Logan et al⁸ reviewed the common radiographic appearances of benign soft tissue tumors of the foot. Plantar fibromatosis appeared as a nodular thickening of the soft tissues superficial to the plantar fascia with low signal intensity on T1-weighted images, low-to-intermediate signal intensity on T2-weighted images, and high signal intensity on fat-suppressed sequences.

Morrison et al⁹ reviewed the characteristic appearance on the preoperative MRI scans of 27 plantar fibromatosis lesions that subsequently were proved pathologically. All 27 lesions were located in the



Figure 3. Sagittal T1-weighted spin echo image (500/16) demonstrating a heterogeneous isointense-to-hypointense nodule in the plantar fascia of the right foot.

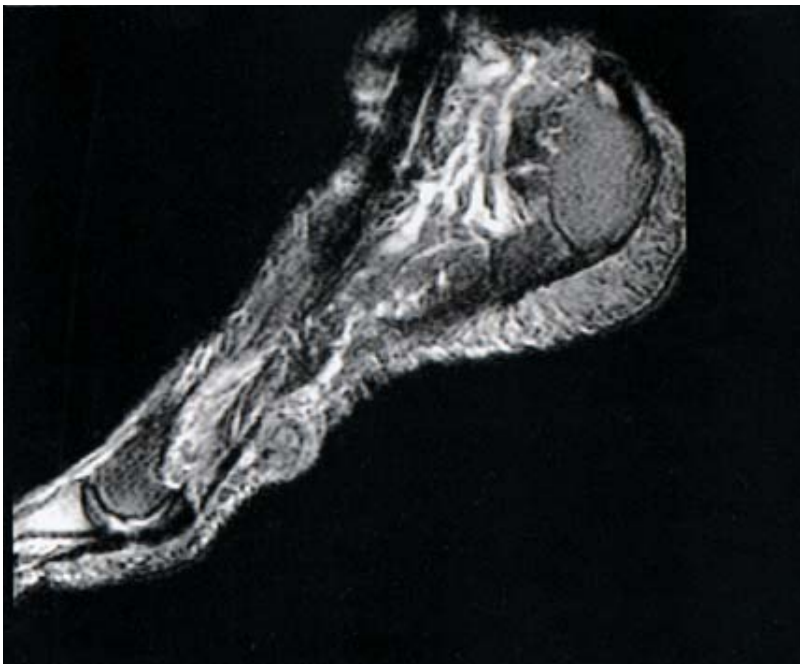


Figure 4. Sagittal T2-weighted fast spin echo image (3000/90) demonstrating a heterogeneous isointense-to-minimally hyperintense nodule in the plantar fascia of the right foot.

subcutaneous tissues of the foot intimately associated with the plantar aponeurosis. Twenty (74%) of the 27 lesions were located just superficial to the aponeurosis, displacing it upwards. Three (11%) lesions were centered on the aponeurosis, and 4 (15%) were deep to the aponeurosis. Twenty-one (78%) were associated with the medial aspect of the aponeurosis and 6 (22%) were located laterally. All lesions had infiltrative upper borders inseparable from the aponeurosis and

most (92%) had lower borders that were well defined against the subcutaneous fat. All of the 27 lesions on T1-weighted conventional spin echo images, 7 (78%) of the 9 on T2-weighted conventional spin echo images, and 17 (94%) of the 18 on T2-weighted fast spin echo images were isointense to minimally hyperintense compared with muscle. A total of 93% of the lesions showed mild-to-marked heterogeneous enhancement with gadopentetate dimeglumine.



Figure 5. Sagittal fat-suppressed T1-weighted spin echo image after administration of gadopentetate dimeglumine demonstrating heterogeneous enhancement of the nodule.

Morrison et al⁹ conclude that the consistency of location and the unique signal intensity characteristics allow diagnosis of plantar fibromatosis with reasonable confidence by MRI alone, with the rare exception of clear-cell sarcoma of the foot, which may have a similar radiographic appearance.

Wetzel and Levine¹⁰ assessed the value of MRI in specific diagnosis of soft tissue tumors of the foot. MRI and pathological findings were reviewed on 14 primary soft tissue tumors. By MRI findings alone, 12 tumors (86%) were correctly identified as benign, and 8 (89%) of the 9 benign lesions showed distinctive MRI findings that allowed a correct diagnosis.

Morrison et al⁹ and Pasternack and Davison¹¹ demonstrated that preoperative MRI accurately defined the precise anatomic location and the extent of plantar fibromatosis lesions of the foot. Pasternack and Davison¹¹ suggest that preoperative imaging might allow more complete removal of the lesion in patients requiring surgical treatment, potentially decreasing the chance of recurrence.

Given the characteristic location and signal intensity of plantar fibromatosis, MRI provides a nonoperative method for confirming an uncertain clinical diagnosis. Clinical suspicion of aggressive (infiltrative rather than nodular) fibromatosis and clear cell sarcoma may still require evaluation with a biopsy. For patients requiring surgical treatment, preoperative MRI can accurately define the extent of the lesion and may allow more complete surgical resection.

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