

Plantar vein thrombosis: a rare cause of plantar foot pain

Daniel S. Siegal · Jim S. Wu · Darren D. Brennan ·
Tracy Challies · Mary G. Hochman

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Abstract Plantar vein thrombosis is a rare condition, with only a handful of cases reported in the literature. The cause is unknown; however, the disease has been attributed to prior surgery, trauma, and paraneoplastic conditions. We present a case of a 32-year-old female runner with plantar vein thrombosis diagnosed on contrast-enhanced MRI and confirmed on ultrasound. The symptoms resolved with conservative treatment and evaluation revealed the presence of a prothrombin gene mutation and use of oral contraceptive pills. To our knowledge, this is the first case of plantar vein thrombosis diagnosed initially by MRI. Moreover, this case suggests that plantar vein thrombosis should be considered in patients with hypercoagulable states and plantar foot pain.

Keywords MRI · Plantar foot pain · Venous thrombosis

Introduction

Plantar vein thrombosis is a rare cause of foot pain, with only a few reported cases in the literature [1–4]. Predisposing conditions include recent surgery, trauma, paraneoplastic conditions, and anticardiolipin antibody syndrome [1–4]. Previously reported cases of plantar vein thrombosis

have been diagnosed with ultrasound [1–4]. We describe a case of isolated plantar vein thrombosis in a 32-year-old woman with a hypercoagulable state diagnosed by MRI, and describe the associated imaging findings.

Case report

A 32-year-old woman presented with a 1-week history of pain along the dorsum, lateral, and plantar aspects of her right foot. She was an active athlete, running 30 miles per week, in addition to participating in other cross-training activities. She had no history of foot trauma, and no prior history of similar symptoms. The patient used oral contraceptive pills, primarily for treatment of endometriosis. She was known to have the prothrombin gene mutation, which was incidentally discovered while volunteering as a control in a laboratory, but had no prior history of thromboembolic events. After 1 week of limited activity, the pain did not resolve, and she became unable to bear weight on her right foot. Physical exam was notable for tenderness and prominent swelling along both the plantar and dorsal aspects of the foot. Initial radiographs were unremarkable. Because of persistent pain, she underwent MRI examination of the foot for investigation of occult stress fracture or infectious process causing swelling.

Magnetic resonance imaging performed with and without intravenous gadolinium revealed enhancement and bright T2 signal surrounding the lateral plantar artery and vein, with filling defects in the lateral plantar vein (Fig. 1a, b). No fracture or other marrow abnormality was detected. Findings on MRI were confirmed on color Doppler ultrasound performed 1 day after the MRI examination. The ultrasound showed noncompressible thrombi in the dorsal superficial and lateral plantar veins of the foot (Fig. 2).

D. S. Siegal · J. S. Wu (✉) · D. D. Brennan · M. G. Hochman
Department of Radiology, Beth Israel Deaconess Medical Center,
330 Brookline Avenue - E/CC 426,
Boston, MA 02215, USA
e-mail: jswu@bidmc.harvard.edu

T. Challies
Department of Pathology, Beth Israel Deaconess Medical Center,
330 Brookline Avenue,
Boston, MA 02215, USA

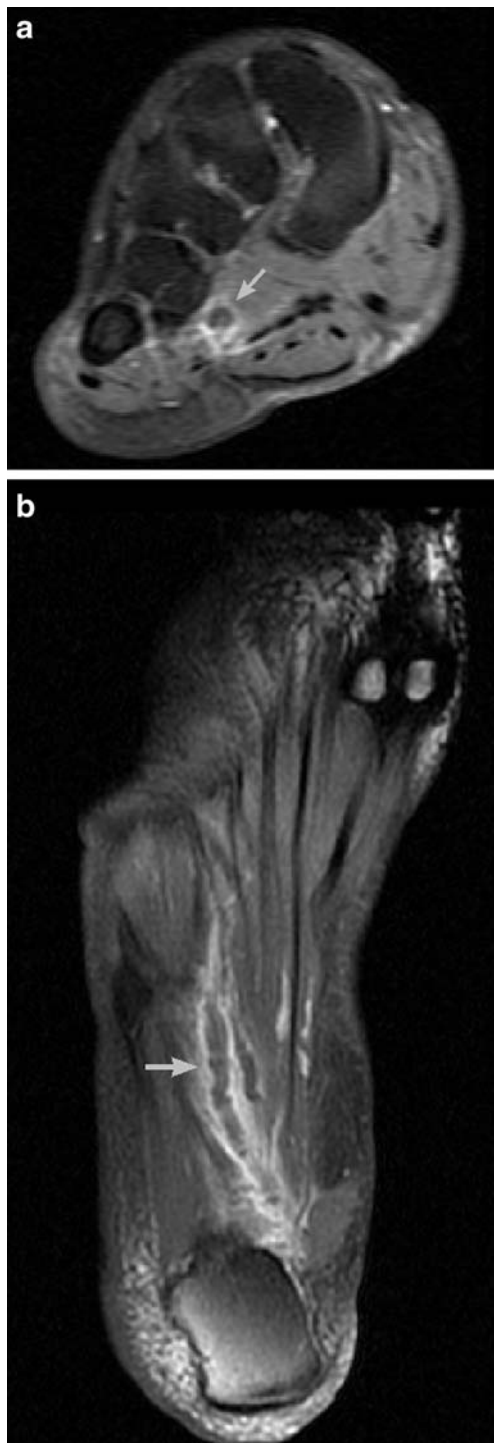


Fig. 1 **a** Coronal and **b** axial contrast-enhanced fat-suppressed T1-weighted spoiled gradient-echo (SPGR) images demonstrate enhancement of the perivenous soft tissues and non-enhancing filling defects in the lateral plantar vein (*white arrow*)

Evaluation of the contralateral foot showed normal flow and easily compressible plantar veins. The patient underwent color Doppler ultrasound of the deep veins of the right thigh and lower extremity, which demonstrated no signs of thrombus.

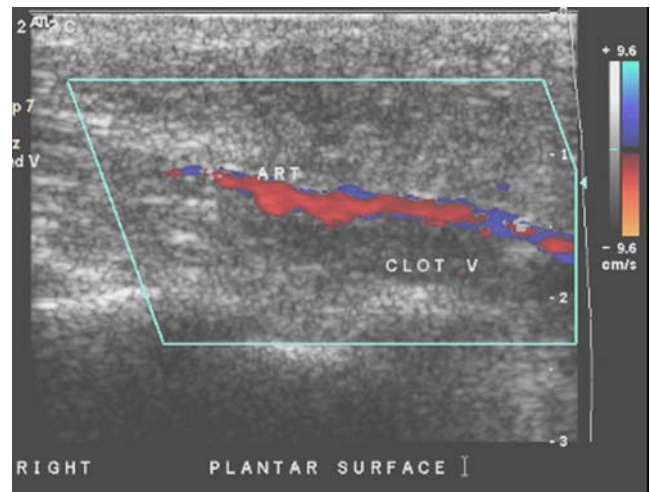


Fig. 2 Longitudinal color Doppler Sonogram (7 MHz) image of the plantar foot shows normal color flow in the lateral plantar artery and absent flow in the corresponding lateral plantar vein. The lateral plantar vein was noncompressible

The patient's symptoms resolved after 6 weeks on a treatment regimen of rest, nonsteroidal anti-inflammatory medications, and acetaminophen. She had complete resolution of clinical symptoms; thus, no follow-up imaging was performed. A complete hypercoagulable evaluation con-

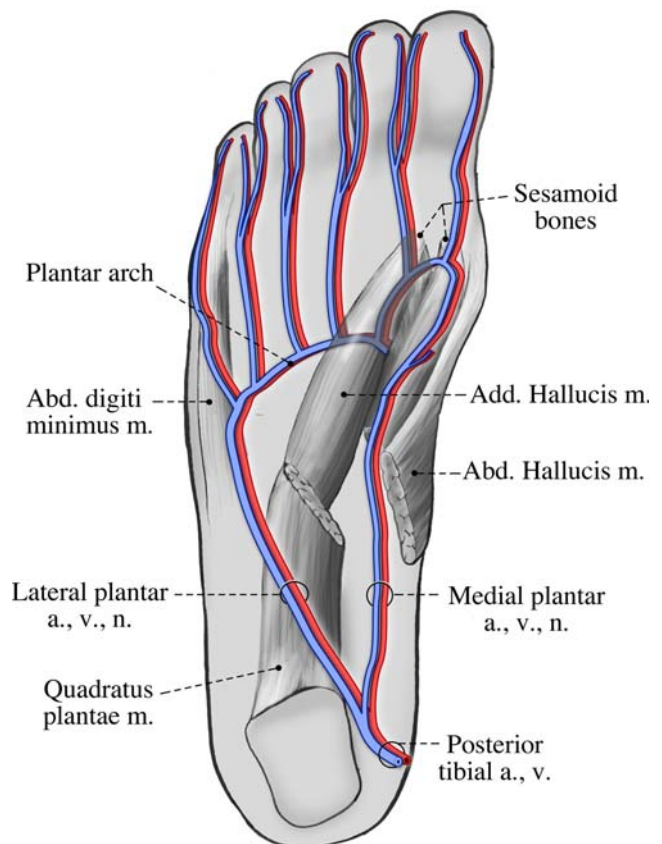


Fig. 3 Illustration of the right foot showing the location of the plantar arch, plantar neurovascular structures, and the adjacent muscles

firmed the patient to be heterozygous for the prothrombin G20210A mutation. In addition, the patient developed a superficial thrombophlebitis in an antecubital vein following a blood draw for evaluation of her hypercoagulable state. Symptoms resolved with the application of warm compresses to the area and acetaminophen for pain control. The patient was advised to stop oral contraceptive pills, which she eventually discontinued.

Discussion

The medial and lateral plantar veins course alongside their corresponding arteries in the sole of the foot, and join deep to the abductor hallucis muscle, forming a single plantar vein, which runs proximally. Portions of the great and small saphenous veins join with the plantar vein, adjacent to the medial malleolus, to become the posterior tibial vein (Fig. 3) [5].

Development of thrombi in the plantar veins is rare and the etiology is unknown. We found only six reported cases amongst four published reports. Bernathova et al. described three cases of plantar vein thrombosis diagnosed initially by ultrasound in two patients with symptoms following athletic activity and a third patient with a possible paraneoplastic syndrome [1]. Two prior case reports were in patients undergoing surgery, an immobilized patient following arthrocentesis, and a patient with complications following saphenectomy [2, 3]. Long et al. reported a case of plantar vein thrombosis in a patient with anticardiolipin antibody syndrome who developed spontaneous plantar foot pain [4]. In these prior case reports and in our example, plantar vein thrombosis was diagnosed by the absence of vascular flow on Doppler ultrasound and the inability to reduce the vessel lumen on compression sonography [1–4].

Our patient possesses the prothrombin G20210A mutation. This inherited thrombophilic disorder was first described in 1996 and confers an increased risk of venous thrombosis [6, 7]. The prothrombin gene mutation G20210A is inherited as an autosomal dominant trait. Individuals heterozygous for this mutation have an approximately 2- to 3-fold increase in the risk of deep venous thrombosis. Homozygosity is extremely rare, and it is not yet known how much this increases the relative risk of thromboembolic events [8]. The mutation leads to increased levels of thrombin, which are thought to accelerate the coagulation cascade, leading to an increase in thrombotic events. Recent studies have shown that the use of oral contraceptive pills in patients with the prothrombin gene mutation increases the relative risk of venous thrombosis

events [9, 10]. These hypercoagulable risk factors and athletic activity likely contributed to the development of plantar vein thrombosis in our patient.

Our case is unique in that this is the first reported case of plantar vein thrombosis diagnosed initially on MRI. Ultrasound has been the principal imaging tool reported for diagnosis of plantar vein thrombosis. Although ultrasound has utility in the diagnosis of some causes of plantar foot pain such as Morton's neuroma, plantar fibroma, and plantar fasciitis, it is operator dependent and may not be widely used in certain practices. MRI is frequently utilized for evaluating plantar foot pain, and radiologists should be aware of this entity and anatomy of the plantar veins. Findings on MRI include edema and enhancement of the adjacent perivenous soft tissue with filling defects in the plantar veins.

In conclusion, plantar foot pain can be caused by plantar vein thrombosis, and this diagnosis should be considered in patients with known hypercoagulable states. MRI can be useful in demonstrating this abnormality, and interpreters of MR images should be aware of this diagnosis.

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