

## ULTRASOUND EVALUATION OF THE PLANTAR FASCIA

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Plantar heel and arch pain are common presenting complaints of podiatric patients. The etiology of this pain can be difficult to diagnose. Plantar fasciitis and heel spur syndrome are often diagnosed clinically. Infracalcaneal bursitis, fat pad trauma, neurogenic heel pain, and calcaneal stress fractures can also present with similar signs and symptoms. Ultrasound can be used to directly visualize the plantar fascia and the infracalcaneal soft tissue structures, thus providing a more accurate diagnosis when combined with radiographs. Ultrasound can also be used to guide injections to avoid injecting directly into the fascia.

The plantar fascia and associated tissues are best visualized with a 7.5 millihertz (or higher) linear probe. The examination can be performed with the patient in the supine or prone position with the foot dorsiflexed. The plantar fascia should be imaged from the calcaneus into the midfoot especially the medial band. The fascia should be imaged in the longitudinal scan, parallel to the long axis, and transverse scan, perpendicular to the long axis (Figures 1, 2). In heavier patients with thicker fat pads, the probe can be rocked posteriorly and anteriorly to differentiate the inferior margin of the fascia from the plantar fat pad.

Normal fascia will appear as a thin hyperechoic or brighter structure with multiple parallel lines on the longitudinal scan (Figure 3). The normal fascia typically

measures less than 4 mm in thickness. Abnormal fascia will have an increased thickness ( $>4$  mm) and decreased echogenicity sometimes with focal hypoechoic or darker areas representing cystic degeneration (Figure 4). Contralateral comparison scans should be performed to compare measurements of thickness. Plantar fascia tears are seen as a disruption of the normal fibrillar architecture with focal fluid filled hypoechoic areas (Figure 5). These tears can be intrasubstance or end-to-end, either partial or full-thickness. Calcaneal spurs are seen as hyperechoic flecks extending from the calcaneus in the insertional region (Figure 6). Remodeling to the calcaneal tuberosity can also be seen, and this may be suggestive of arthropathies. Infracalcaneal bursitis will appear as comma-shaped heterogeneously hypoechoic masses located directly inferior to the calcaneal tuberosity (Figure 7). Plantar fibromas appear as round to oval shaped well-defined to moderately infiltrative heterogeneously hypoechoic masses located adjacent to the inferior margin of the plantar fascia (Figure 8, 9).

Ultrasound guided injections of the plantar fascia and infracalcaneal bursa have been used with excellent results by the author. A medial to lateral approach with the injection, perpendicular to the long axis of the fascia, is the author's preferred method (Figure 10). The injection site is prepped using alcohol or betadine. The probe is placed in the transverse scan position parallel



Figure 1. Probe placement for longitudinal scan.



Figure 2. Probe placement for transverse scan.

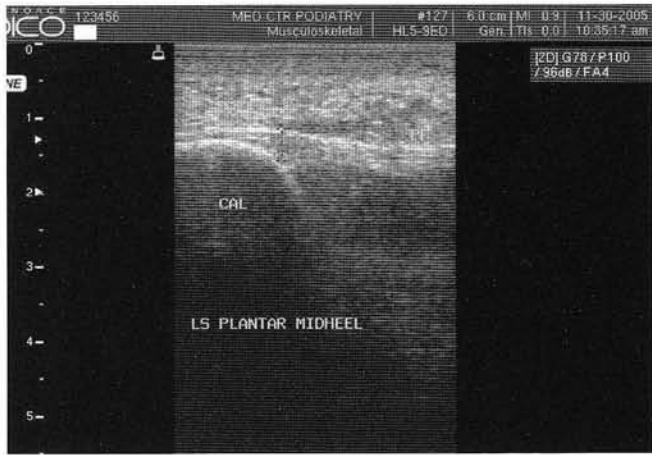


Figure 3. Longitudinal scan of normal plantar fascia. The plantar surface of the foot is located at the top of the screen. The posterior surface is to the left of the screen. The calcaneus is the hyperechoic convex area labeled CAL. The plantar fascia is the linear parallel hyperechoic structure running from left to right from the calcaneus.



Figure 4. Longitudinal scan of abnormal plantar fascia. Note the increase in hypoechoic appearance of the fascia. The fascia thickness is 0.73 centimeters.



Figure 5. Longitudinal scan of intrasubstance degeneration of the plantar fascia. Note the fusiform thickening with focal hypoechoic region located at the insertional portion at the anterior aspect of the calcaneal tuberosity.



Figure 6. Sonographic appearance of a calcaneal spur (HS), the hyperechoic extension of the calcaneal tubercle. Notice the hypoechoic changes of the plantar fascia (PF).



Figure 7. Sonographic appearance of infracalcaneal bursitis. Notice the heterogeneous mixed-echoic mass located inferior to the calcaneal tubercle.



Figure 8. Longitudinal scan of a plantar fibroma. The mass is hypoechoic and located along the inferior surface of the fascia.

to the needle. The needle will appear as a hyperechoic linear structure (Figure 11). The needle should be positioned inferior to the fascia band. Upon injection of the local /cortisone mixture, a hypoechoic bolus will appear (Figure 12). The use of ultrasound guided injections will prevent intrafascial injections, thereby reducing the risk of potential rupture.

Ultrasound has vastly improved the ability to diagnose the true etiology of plantar heel and arch pain.



Figure 9. Transverse scan of the same plantar fibroma.

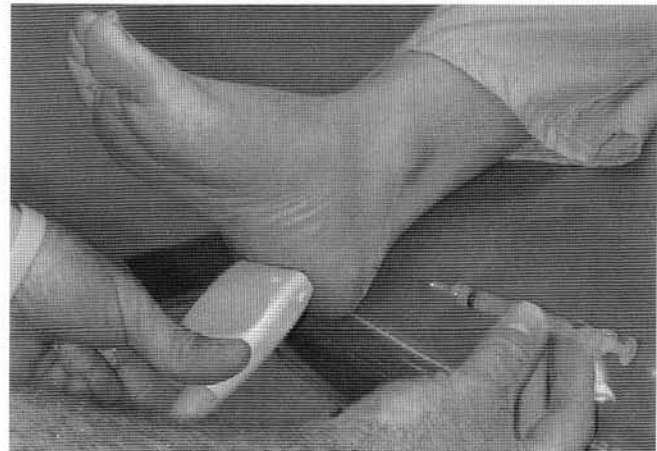


Figure 10. Ultrasound-guided injection of the plantar fascia – medial/transverse approach.



Figure 11. Transverse scan pre-injection. The needle appears as a hyperechoic linear structure in the plantar heel pad.



Figure 12. Transverse scan post-injection. Notice the hypoechoic bolus to the right of the hyperechoic needle.

This leads to earlier appropriate treatment choices. Ultrasound guided injections can improve results and reduce the risk of complications.

## BIBLIOGRAPHY

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