# ULTRASOUND IDENTIFICATION OF THE DEEP BAND OF THE LATERAL PLANTAR APONEUROSIS

Karena Fassett[1], Cara Fisher, PhD[2]

1. Texas Christian University School of Medicine; 2. University of North Texas Health Science Center, Fort Worth, TX

## RESEARCH QUESTION

In a convenience sample of cadaveric feet, can ultrasonography (US) provide accurate identification of the deep band of the lateral plantar aponeurosis as confirmed by direct anatomic evidence of the structure?

## BACKGROUND

While anatomy textbooks generally portray the human body fairly consistently, there are numerous anatomical variations of those portrayals. These variations may or may not be clinically relevant. In 2018, Drs. Cara Fisher and Cameron Beck described in detail, for the first time, an anatomical variation of the plantar aponeurosis (PA). This variation, a fascial band that dives deep into the foot instead of staying superficial, crosses over a branch of the lateral plantar nerve which could lead to compression of the nerve. In future studies, we hope to investigate the potential clinical significance of this variation. In this research project, our goal is to determine if the fascial band can be identified noninvasively using US.

## METHODS

Under the direction of my SPT mentor, Dr. Fisher, I assisted in testing 15 pairs of fresh-frozen cadaveric feet (n = 30) for the presence of the deep band of the lateral PA. We assessed the feet using US. If the fascial band variation appeared to be present, we used US to guide an injection o fa small bead of latex at that site. WE then dissected the foot to the latex to verify its presence. Our findings were recorded at the end of each dissection.

## Our results suggest the deep band of the lateral plantar aponeurosis cannot be reliably identified via ultrasonography

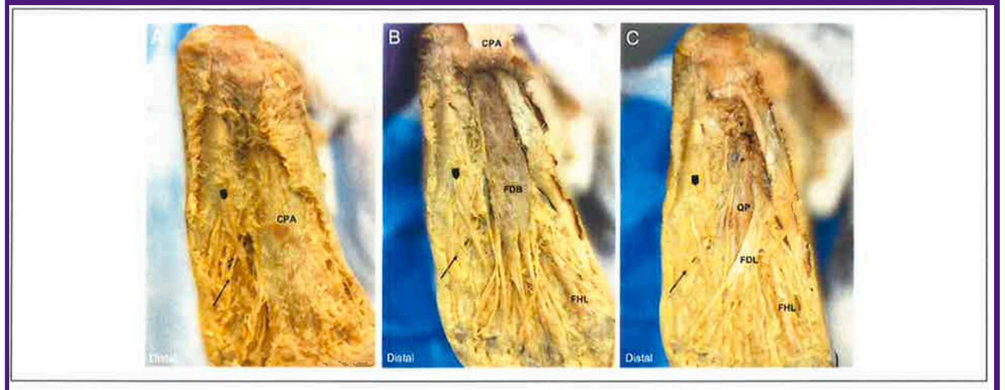


**Figure 1.** Images depict the progression of a dissection, from superficial to deep, of the plantar foot containing the deep band of the lateral plantar aponeurosis (black arrowhead) crossing over the lateral plantar nerve (black arrow). (A) The deep band of the lateral plantar aponeurosis passing deep to and not receiving any contributions from the central plantar aponeurosis (CPA). (B) The deep band of the lateral plantar aponeurosis passing deep to the tendons of the flexor digitorum brevis (FDB) muscle with the CPA reflected and the flexor hallucis longus (FHL) tendon exposed. (C) The deep band of the lateral plantar aponeurosis passing deep to the tendons of the flexor digitorum longus (FDL) muscle with the FHL tendon and quadratus plantae (QP) muscle exposed.

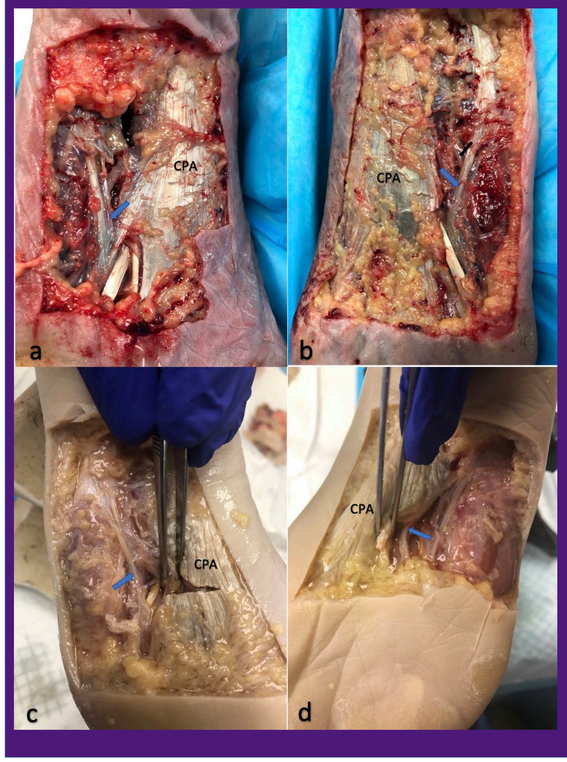


Figure 2. Image “a” was noted to have a substantial deep band of the lateral PA (blue arrow). Image “b” has both the deep band of the lateral PA (blue arrow) and lateral plantar nerve (black arrow) labeled. In images “c” and “d” the deep band of the lateral PA is visualized (blue arrow). The central plantar aponeurosis (CPA) is labeled in all images.

## RESULTS

In a sample of 30 feet, the prevalence of the deep band of the lateral PA was 36.7%. Our results suggest that US is not a reliable screening tool to detect the deep band of the lateral PA with a sensitivity of only 36.4% and a specificity of 73.7%. The positive predictive value (PPV) was 44.4%, which is only 7.7% higher than the prevalence of the band in our sample of feet. Despite these negative results, we believe a repeat study that addresses certain limitations would be needed to confidently conclude that US cannot detect the deep band of the lateral PA in cadaveric feet.

| US Screen | Dissection Results | | |
|---|---|---|---|
| | Band Present | Band Absent | |
| **Positive** | 4 | 5 | PPV = TP/(TP+FP) = 0.444 |
| **Negative** | 7 | 14 | NPV = TN/(TN+FN) = 0.667 |
| | Sensitivity = TP/(TP+FN) = 0.364 | Specificity = TN/(TN+FP) = 0.737 | Prevalence = (TP+FN)/(TP+FN+FP+TN) = 0.367 |

*Table 2. The 2x2 table above displays the numbers of true positives (TP), false positives (FP), false negatives (FN), and true negatives (TN) regarding ultrasound screening vs anatomical dissection. From these data, the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and prevalence were calculated.*

## FUTURE DIRECTIONS

There are a few improvements we could make to our original study design if the study was to be repeated. First, our sample size should be increased to 50 pairs of cadaveric feet (n = 100) to boost the power of our study results. To reduce US operator bias, we could bring in a small panel of US technicians instead of relying on one person to analyze the feet. Finally, it would be interesting to repeat US analysis using different brands and models of ultrasound devices, as the handheld butterfly device we used may not have been adequate to identify the small fascia band variation.

If the deep band of the lateral PA does have clinical significance, it is likely related to compression of the lateral plantar nerve. Future investigations should focus on this association.