



Background

Sympathetically mediated pain remains a diagnostic and therapeutic challenge for the pain medicine clinician. Sympathetic outflow regulates vasomotor tone, and technologies that provide insight into sympathetic vasomotor control, including thermal surface imaging, digital blood flow laser speckle imaging, and non-invasive measurements of sympathetic vasomotion, may provide valuable information in the identification and treatment of sympathetically mediated pain.

Case

Patient: 50-year-old male with type 2 diabetes mellitus

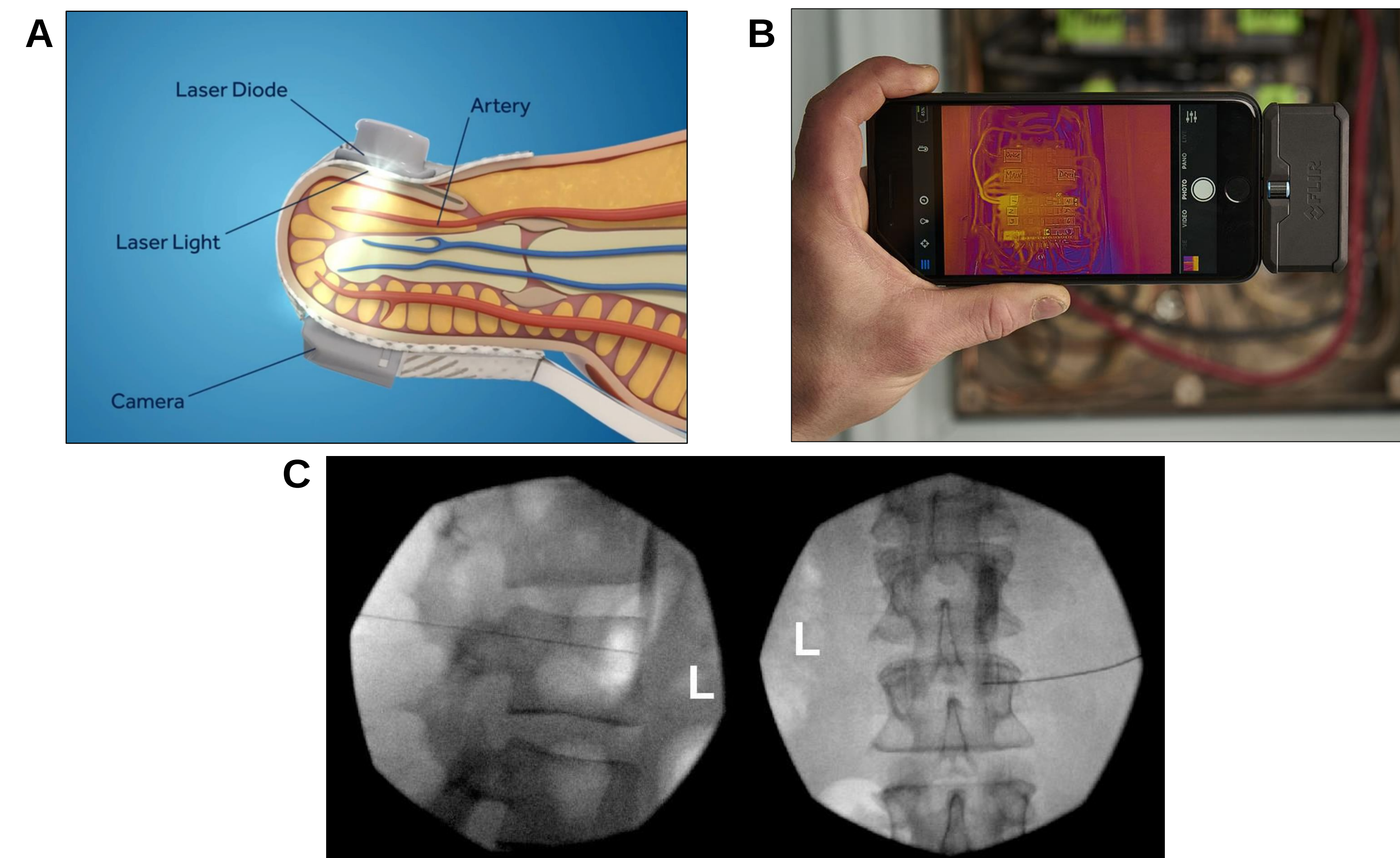
HPI: 8 years of post-traumatic severe right foot pain with allodynia and asymmetric changes in temperature, skin color, sweating, edema, and hair growth in his right foot in a non-dermatomal distribution

Exam: Multiple well-healed linear surgical scars, allodynia, and decreased ankle range of motion

Diagnosis: Complex regional pain syndrome

Treatment: Right lumbar sympathetic block

Methods



Digital Blood Flow

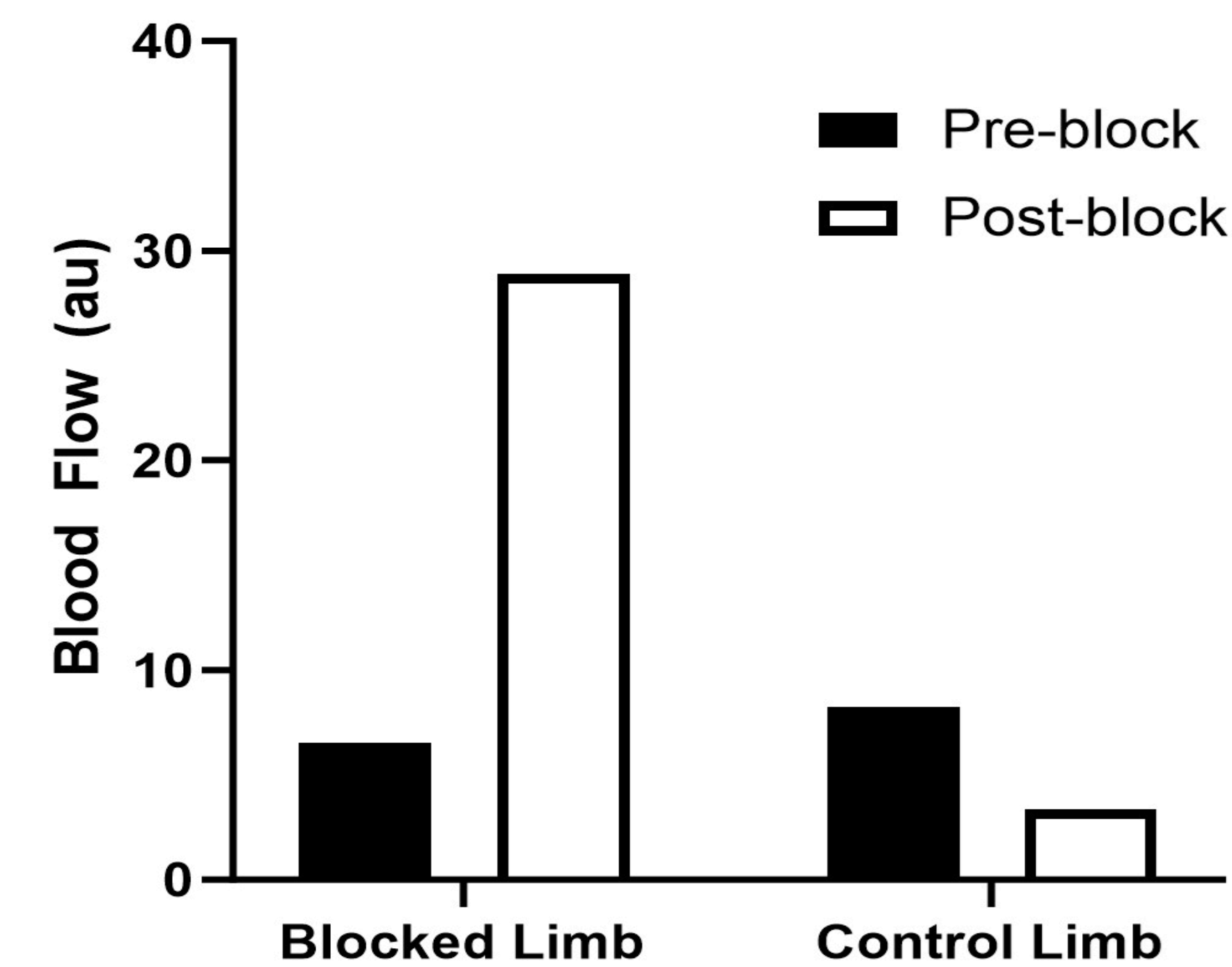


Figure 2. Lumbar sympathetic block increased blood flow in the ipsilateral blocked limb but not the contralateral control limb.

Thermal Surface Imaging

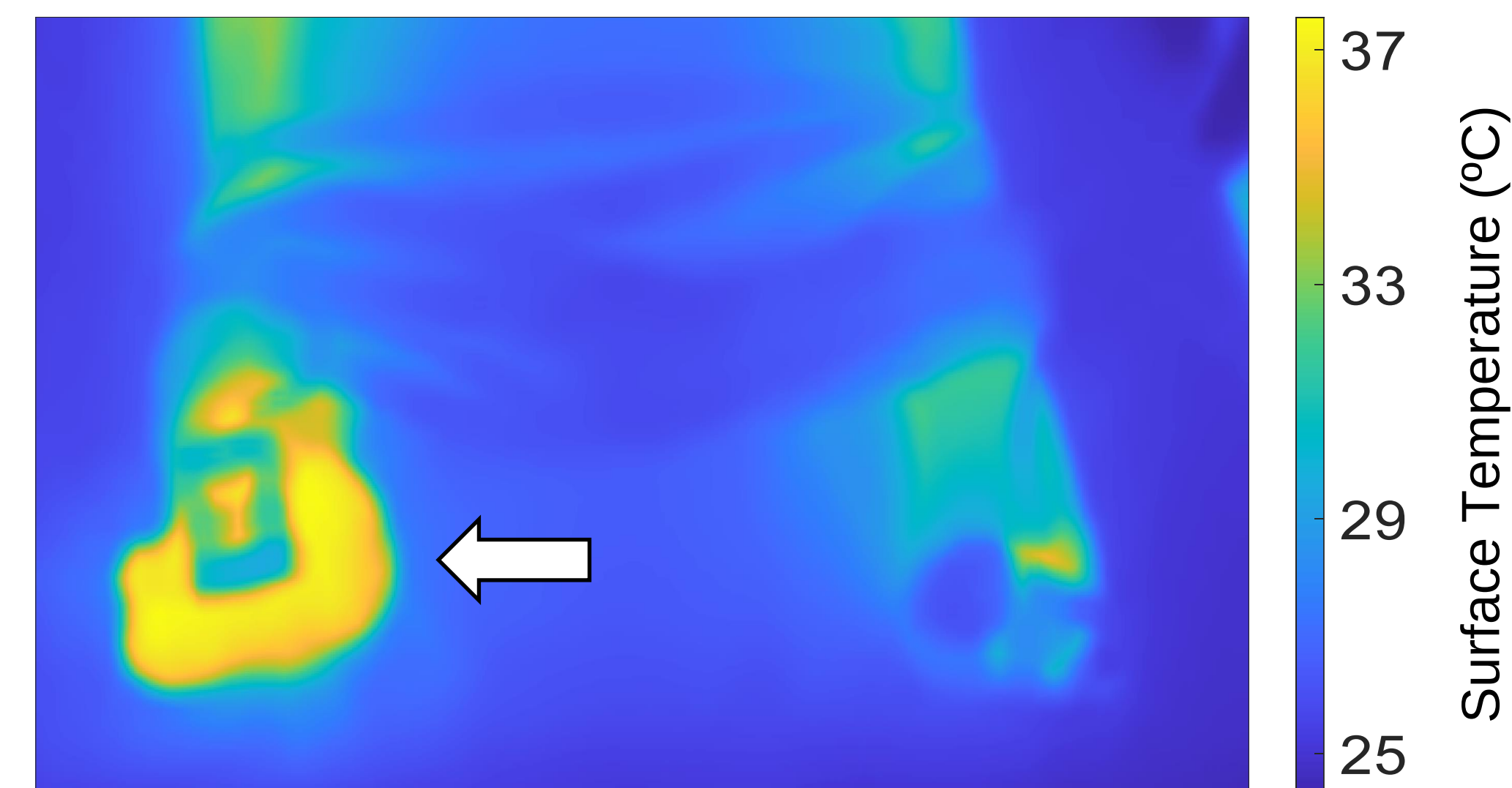


Figure 3. Infrared thermal surface images showing hyperperfusion-induced hyperthermia of the blocked foot (white arrow) relative to the contralateral foot.

Sympathetic Vasomotion

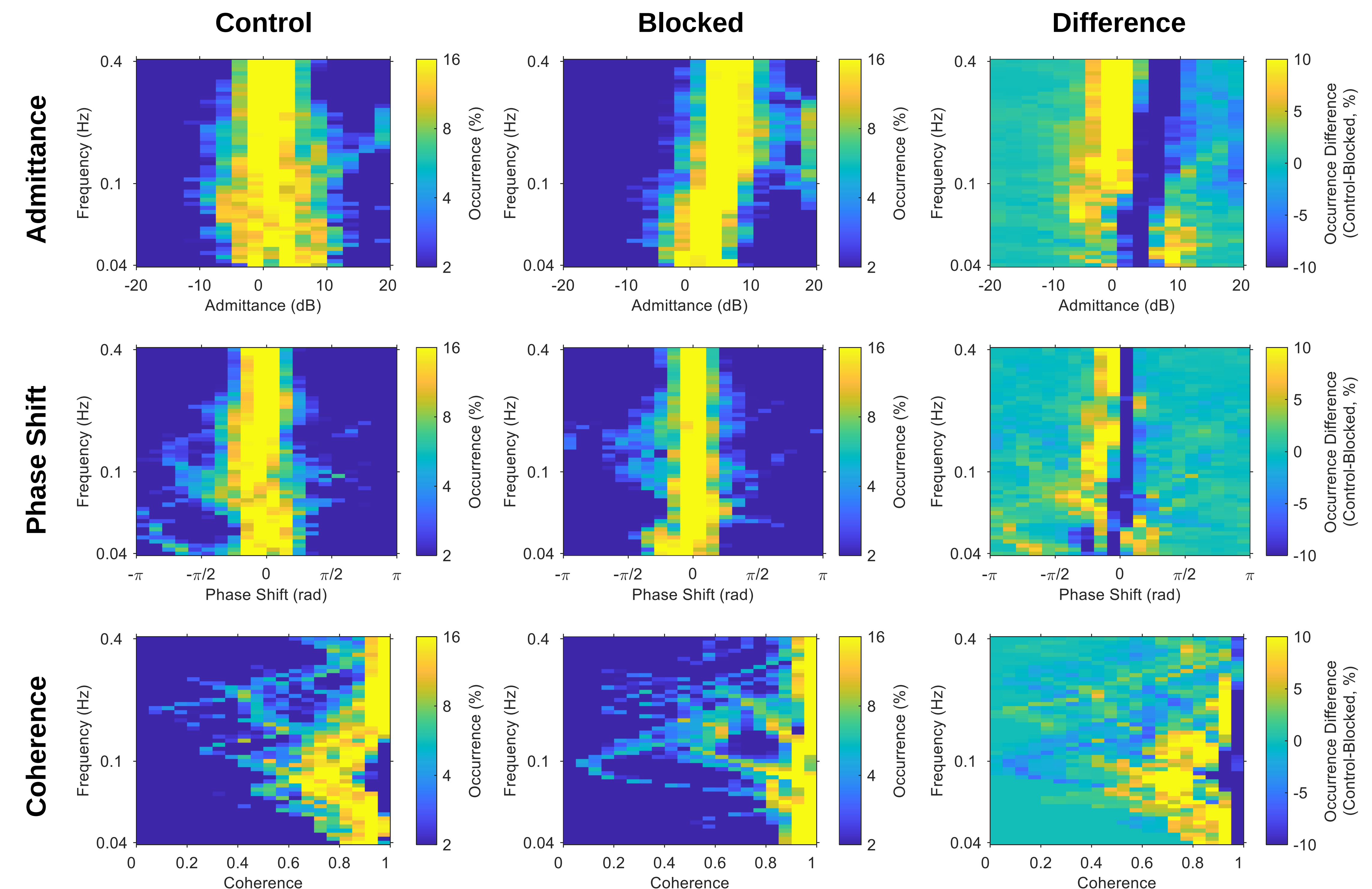


Figure 4. Occurrence histograms² for admittance gain (top), phase shift (middle), and coherence (bottom) components of digital vasomotion for the control (left), blocked (center), and control-blocked difference (right). Lumbar sympathetic block reduces low admittance gain, low phase shift, low coherence behavior consistent with vasoconstrictive, baroreflex-mediated, active vascular control characteristic of sympathetic vasomotion.

Conclusions

- Lumbar sympathetic blockade increased ipsilateral digital blood flow and surface temperature while decreasing sympathetic vasomotion
- Despite multimodal confirmation of technical success, patient did not experience relief of chronic pain
 - This essentially ruled out a sympathetic component of his pain and helped jumpstart discussion of other therapies
- More study of the role of the sympathetic nervous system in human chronic pain states is needed

References

- (1) Choi B, Ramirez-San-Juan JC, Lotfi J, Stuart Nelson J. Linear response range characterization and in vivo application of laser speckle imaging of blood flow dynamics. J Biomed Opt. July-August 2006;11(4):041129.
- (2) Pellegrino PR, Zucker IH, Chatzizisis YS, HJ Wang, Schiller AM. Quantification of Renal Sympathetic Vasomotion as a Novel Endpoint for Renal Denervation. Hypertension. 2020 Oct;76(4):1247-1255.

Figure 1. (A) A probe consisting of a laser diode and camera allows for non-invasive laser speckle imaging of digital capillary blood flow¹. (B) Infrared thermal images were obtained using a commercially available device. (C) Lumbar sympathetic block was performed at the L3 anterolateral aspect of the L3 vertebral body with fluoroscopic guidance.