

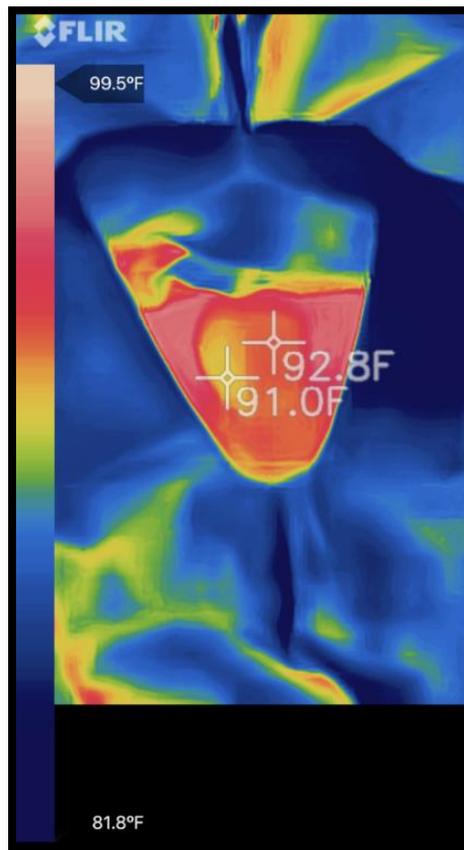
Smartphone Thermal Imaging in the Detection of Testicular Ischemia

Background: In the setting of testicular torsion, the duration of symptoms prior to operative detorsion is the most important variable which determines risk of necrosis and testicular loss. A quick point-of-care test for testicular ischemia would be useful to confirm the diagnosis and proceed more quickly with operative treatment. Thermal Imaging detects the infrared (heat) pattern of an object and the technology is now available as an inexpensive (\$400) attachment to smartphones.

Methods: Smartphone Thermal Imaging was studied as a point-of-care diagnostic test for testicular ischemia in an IACUC approved study that prioritized survival of all animal subjects. Thirty canines weighing over 12 kg (range 13.6 – 37.2 kg, avg 23.9 kg) were observed during elective neuter procedures with consent from owners. Randomization determined ligation of the right vs left spermatic cord. With both testicles remaining in the scrotum, blinded inspection was performed with a FLIR ONE Pro Thermal Imaging camera for smartphone use. Inspection halted when ischemia was diagnosed by comparison of the two testicular thermal images. Temperature measurements of the testicles were taken with the same device. The bilateral orchiectomy procedures were then completed as planned and subjects were discharged home after postoperative recovery.

Results: Within 11 minutes of ligation of the randomized spermatic cord, an obvious change in the thermal imaging pattern allowed for the correct diagnosis of the ischemic testicle in 30 of the 30 subjects in a blinded fashion. The average observation time was 7.3 minutes. The ischemic testicle always had the lower measured temperature. Temperature differences between testicles at the time of ischemia diagnosis ranged from 0.7° to 3.7° C with an average difference of 1.79° C [95% CI: (1.50, 2.08)]. A Thermal Imaging evaluation of the testicles takes 30 seconds to perform.

Conclusion: Within 11 minutes after ligation of the blood supply, blinded inspection of Smartphone Thermal Images allowed the correct diagnosis of testicular ischemia in 100% of subjects. Prospective evaluation of this emerging point-of-care technology in the clinical diagnosis of testicular ischemia is suggested.



Smartphone thermal image obtained by FLIR ONE Pro Thermal Camera.
Right testicular ischemia is confirmed (in yellow).