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Continuing Education Article #7

Thermography: A Review in Equine Medicine

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Thermography is a noninvasive technique that measures infrared emissions, producing a graphic representation of the surface temperature of an object.[1] A medical thermogram represents the surface thermal patterns of an organ.

The temperature of the body core is about 37°C (98.6°F). The skin is about 5°C (9°F) cooler because heat is lost into the environment by evaporation, conductive heat transfer, convection, and radiation exchange.[2,3] Skin derives its heat from local circulation and metabolism.[3-7] Variations in skin temperature result from changes in tissue perfusion and blood flow in superficial veins.[8] Venous blood, which drains metabolically active areas, normally is slightly warmer than arterial blood.[9,10] Superficial veins heat the skin more than superficial arteries do, and venous drainage from tissues or organs with a high metabolic rate is warmer than venous drainage from normal tissue.[10]

Infrared radiation is emitted from any object that has a temperature above absolute zero.[11] The peak radiant energy from the body is in the infrared region between 4 μm and 20 μm. The emissivity of skin is in the region of maximum radiant energy; therefore, the skin temperature can be determined by measuring this energy.

To date, interpretation of veterinary thermograms has been based on thermal patterns and temperature differences between isothermic bands. It has been shown in humans that interpretation should be based not only on these criteria, but also on specific temperature and anatomic patterns. The purpose of this article is to review the instrumentation and techniques of thermography, to report the minimum requirements for the production of reliable thermograms, to provide guidelines for their interpretation, and to compare thermography with other techniques.

Instrumentation and Techniques

Medical infrared detectors (Table I) are composed of several intricate parts,[12] the most important of which is the detector. There are three types of detectors: rare earths, pyroelectrics, and liquid crystals.

The *rare earth detectors* are made of prepared compounds that include indium, arsenic, lead, antimony, selenium, germanium, silver, mercury, zinc, or copper. Mercury–cadmium–telluride detectors are the most common. The detectors are photoconductors in which resistance decreases with an increase in incident radiant energy. The peak spectral sensitivity of each detector depends on the combination of materials used. The peak sensitivity