Evaluation of the Wound Healing Process in Dairy Calves Using Thermographic Examination: Primary Closure vs Second Intention Healing Model

Claudia Ferreira Class of 2020, Dr. Chigerwe BVSc MPH PhD DACVIM, School of Veterinary Medicine, Department of Medicine and Epidemiology

Background

Medical thermography utilizes **infrared imaging** sciences to detect radiation in the long-infrared range of the electromagnetic spectrum. Because infrared radiation is emitted as black-body radiation, thermographic cameras can detect minute fluctuations within temperatures of objects and body systems. Thus, thermal imaging is used to monitor physiological activities, such as **inflammation**, by providing quantifiable data as a means of diagnostic interpretation. This technology provides an efficient application of infrared imaging to the medical examinations of animals. Comparable to naturally occurring ones, iatrogenically induced wounds involve a physical disruption of the surface epithelium and subepithelial tissues.

The events of normal wound healing include the hemostasis phase, the inflammatory phase, the proliferative stage, and finally, the maturation stage. It is expected that thermographic activity is at its peak during inflammatory phase of wound healing.

Figure 1: Thermal imaging camera model Flir Vet T-420a

Purpose

We hypothesized that there will be a difference in surface temperature as determined by thermography between iatrogenically created wounds allowed to heal by first intention or second intention. The aims of our study was create a relationship between the expected **wound healing process** and the associated inflammation using thermography in a non-previously reported calf model. The information is anticipated to help clinicians in identifying complications in post-operative or post-management wound healing in calves.

Methods

Experimental animals consisted of 6 Jersey bull calves. A day prior to the experiment, two skin patches were clipped on each lateral thigh of the calves. The patch positioned most dorsally was allocated for the treatment site (**primary or secondary wound healing**), and the ventral patch was designated as the control or wound-free site. Immediately following clipping, a thermal image of the 10 cm^2 clipped sections on each of the hind limbs was taken. Two circular defects were created using an 8mm skin biopsy punch. Thermographic measurements were taken immediately prior to wound creation, immediately following suture placement for wound healing by primary intention as well as incisions made for wounds healing by second intention, using a Flir Vet T-420a camera at a constant distance of 1 meter. Further thermographic readings were acquired at 2h, 4h, 8h, 12h, 24h, 48h, 96 h, 7 days, 10 days, 14 days and 21 days.

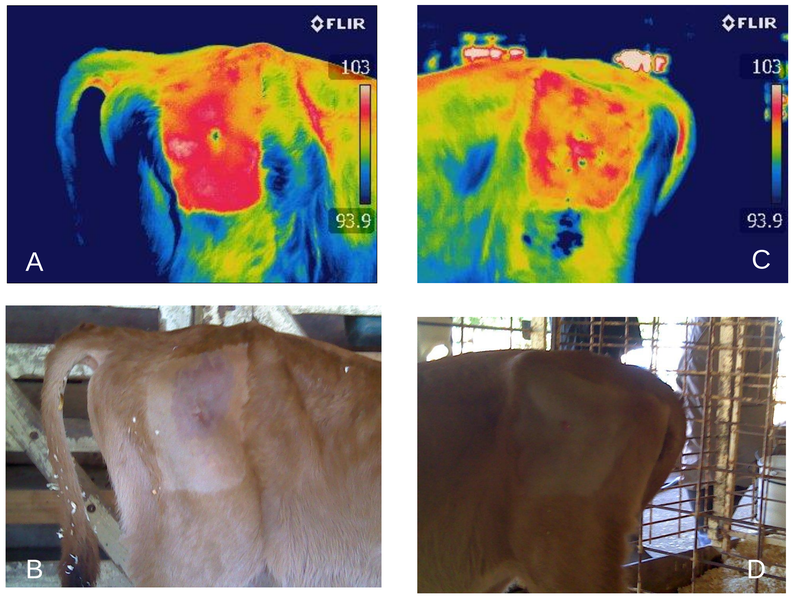

Figure 2: Thermal images in comparison to their digital image counterparts: (A) Depicts the thermal characteristics of an 8 mm wound healing by primary closure method 4 hours after the initial defect was created; (B) Wound healing by primary closure; (C) Depicts thermal characteristics of an 8 mm wound healing by second intention 4 hours after the initial defect was created; (D) Wound healing by second intention

Results

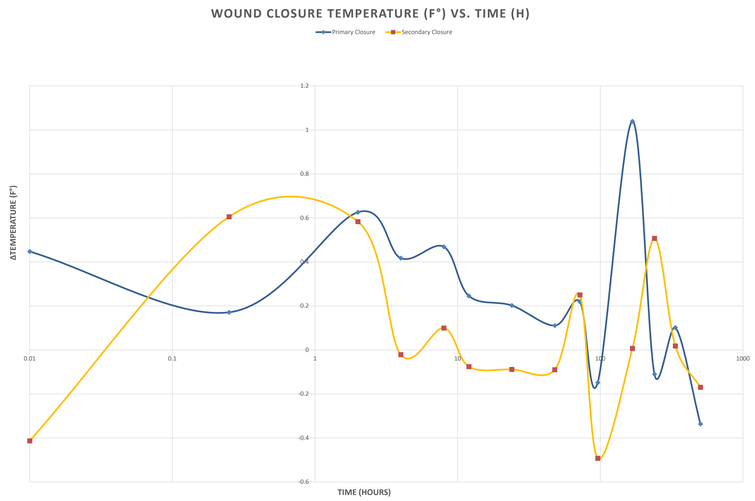

Figure 3: Comparison in change in skin temperature between wounds healing by primary closure and second intention.

Conclusions

- No statistical difference was found in the temperature between sutured wounds and the untreated group.
- Time after creation of the defects had a significant effect on the surface temperature.
- The data reported within this experiment suggests there is no difference in subcutaneous inflammation when a wound is sutured compared being allowed to heal by second intention.
- Other factors that could be further analyzed in future studies include the significance of wound size, the sensitivity of thermal imaging camera, and implementation of aseptic methods while suturing. wounds.

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