

Long Wave Infrared Thermography as an Assessment Adjunct for Patient Advocacy

Erin McClure, BSN, RN, WCC, DAPWCA and Colleen Spiller, MA, BSN, RN, CWOCN

Background

The current method of skin inspection utilizing the components of color, temperature, texture, moisture, and integrity provide subjective data. There is a gap in the nursing skin assessment for providing objective and quantifiable physiological data. Objective and quantifiable data is important for nurse advocacy in patient care and physiological data in the form of temperature change allows for documentation of the successful treatment outcomes. Signs and symptoms such as pain, and erythema often lead to a 'wait and see' approach. This approach is multi-faceted and includes stress for the patient, unnecessary diagnostic testing, and higher costs. Nursing advocacy has been limited to conversations with patients/caregivers, provider-based testing, and subjective patient presentation.

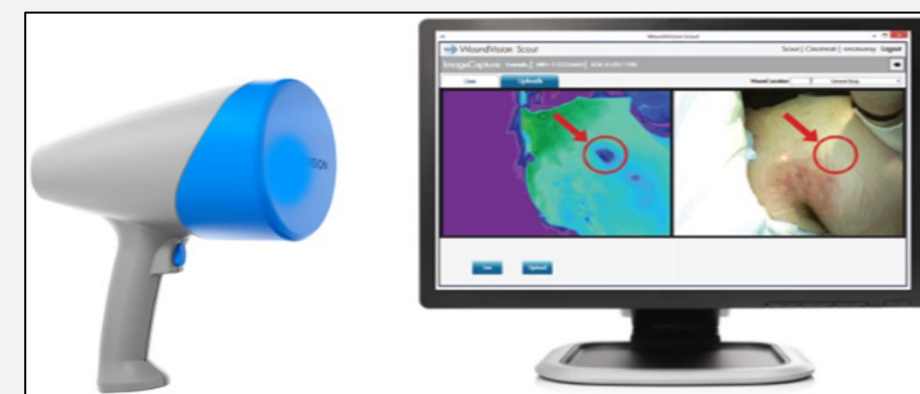
METHOD

Long Wave Infrared Thermography, (LWIT) provides temperature differentials of intact skin and/or open wounds. Temperature can indicate increased or decreased physiological activity which can provide signs and symptoms of potential inflammatory or ischemic processes in the form of objective and quantifiable measurements. Placing LWIT at the bedside is a nurse-driven assessment adjunct that provides quantifiable data which expands the current nurse advocacy role by adding thermographic findings to help guide further diagnostic tests/interventions.

MATERIALS

Hand-held, photographic and LWIT device and software solution:

- Non-radiating, non-invasive, and non-contacting
- Provides photographic documentation as well accurate & repeatable wound size measurement
- LWIT reveals [patho] physiologic markers invisible to naked eye and objectively visualizes & quantitatively measures circulation, perfusion, and metabolic activity.



DISCLOSURE

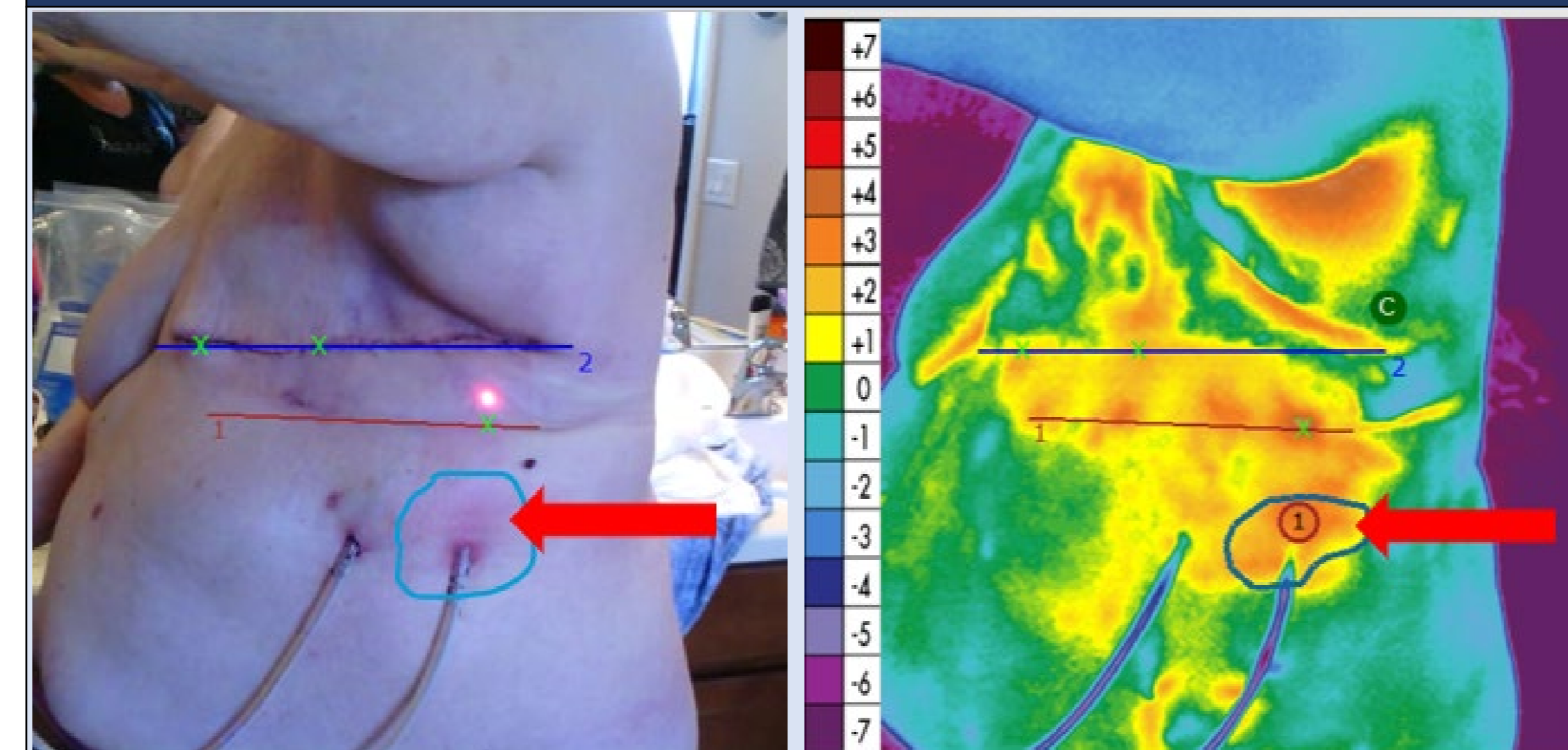
Photographic and LWIT imaging device utilized: Scout, by WoundVision, Indianapolis, IN.

Authors are employed by WoundVision.

REFERENCES

- [1] Langemo D, Spahn JG. A multimodality imaging and software system for combining an anatomical and physiological assessment of skin and underlying tissue conditions. *Adv Skin Wound Care* 2016;29:155-163.
- [2]. Chanmugam, A., Langemo, D., Thomason, K., Haan, J., Altenburger, E. A., Tippet, A., Henderson, L., & Zortman, T. A. (2017). Relative Temperature Maximum in Wound Infection and Inflammation as Compared with a Control Subject Using Long-Wave Infrared Thermography. *Advances in Skin & Wound Care*, 30(9), 406-414.

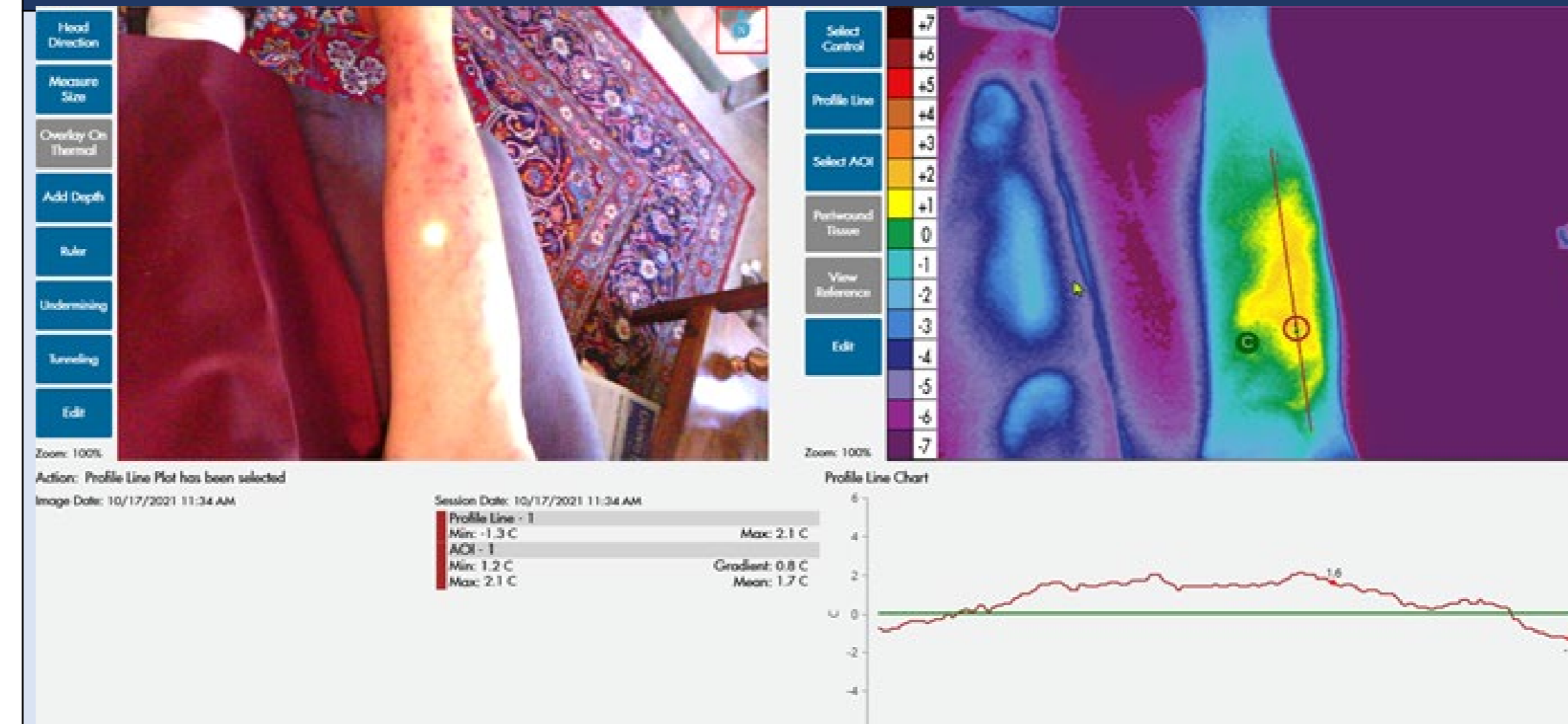
Case #1: Drain Tube Site S/S of Infection



Left Breast Mastectomy

- 73-year-old female History of: Left Lobular Breast Cancer, COPD, DM Type II, Graves Disease, HTN
- Left lateral image taken 13 days post left breast mastectomy..
- **Visual:** Circumferential erythema around lateral drain tube extending proximally. Warm, firm, indurated, and localized pain with palpation. Afebrile.
- **Thermal:** Significant increased metabolic activity/ Hyperperfusion, **+3.7°Celsius**, indicative of an inflammatory process.

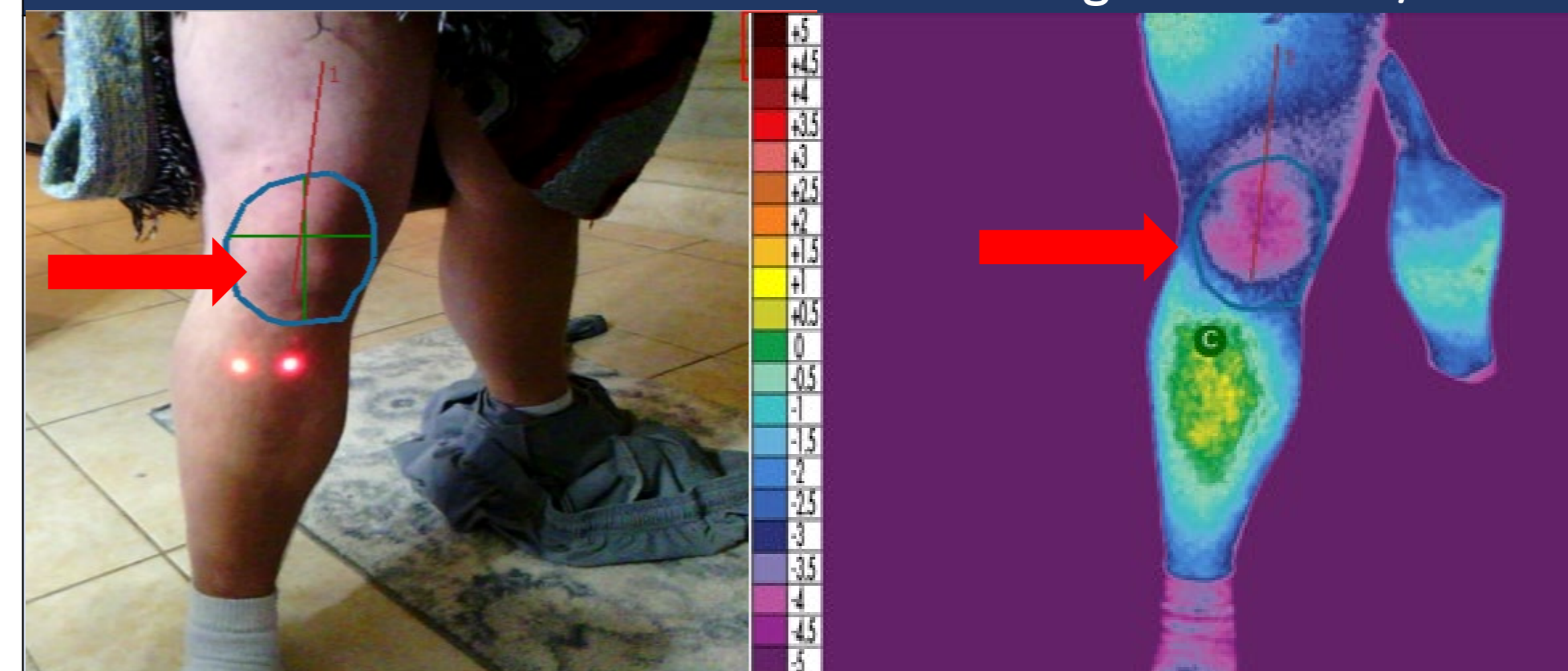
Case #2: S/S of Vasculitis



Right Anterior Lower Extremity

- 83-year-old female with history of CHF, CREST, PM. Monoclonal gammopathy detected 3 months prior
- **Visual:** Unilateral presentation of flat, red macules to right leg. Afebrile, edema, painful to the touch and an area of warmth and distinct boggy over the right pretibial area. Onset was sudden with no known precipitating factors.
- **Thermal:** Significant thermal anomalies to the right pretibial and right upper thigh.

Case #3: Right Knee Pain/Edema



Right Knee Pain and Edema

- 30-year-old male patient post rigorous ground exercise/training. Stood up and felt sudden onset of sharp pain.
- No significant medical history.
- LWIT images obtained two days after onset of pain.
- **Visual:** Edema, boggy over patellar region, cool and painful upon palpation, limited range of motion.
- **Thermal:** Prominent defined, localized, temperature abnormality, hypoperfusion, **-2.8°C**.

DISCUSSION OF CASES

CASE #1 Drain Tube Site S/S of Infection

First post-op visit, surgeon performed visual examination and removed both drain tubes, and stated, "All looks good". Advocating for patient, LWIT images presented as an adjunct to the visual assessment and discussed with surgeon which resulted in additional lab testing (CBC with Differential). WBC 16.3 thou/cumm. Patient placed on oral antibiotic therapy x 10 days.

RESULT: Reimaged site on days 3 and 10 of antibiotic therapy and temperature decreased from **+3.7°C to +0.9°C (a 2.8 ° C decrease)**, placing it in normal range, **+1.1°C to -1.1°C**. Advocating for patient resulted in further evaluation resulting in treatment of a drain tube site infection leading to decreased pain and increased quality of life.

CASE #2: S/S Vasculitis

LWIT imaging warranted further assessment by both cardiology and nephrology. Bilateral PVL Duplex completed with normal findings. Extensive lab work completed. Final diagnosis of vasculitis with continued follow up to monitor renal function.

RESULT: Patient progressed to further diagnostic testing resulting from increased metabolic activity, **+2.1°C**, quantified by LWIT, which was used to advocate for the patient.

CASE #3: Right Knee Pain/Edema

LWIT serial images captured over 4-days. Upon rising in a.m., mild hypoperfusion present, **-1.2°C to -1.6°C**, and afternoons when active and ambulatory would increase to **-2°C** and greater ranges with complaint of pain. Patient followed up with PCP, showing images as adjunct to visual assessment, advocating for additional testing.

RESULT: LWIT images led to further diagnostic testing, X-Ray, and MRI, which led to diagnosis of a meniscus tear and 1.1 cm cyst.

CONCLUSION

LWIT is a valuable bedside assessment tool that is quick, non-invasive and non-radiating. Nurses may utilize this objective and quantifiable data when advocating for further patient diagnostic tests/interventions.