Thermography in the study of axillary adenopathies - what is the role?

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Learning objectives

To describe the thermography technique.

To understand the role of thermography to identify atypical axillary lymph nodes in patients with breast cancer.

Background

A suspected feature of adenopathy is currently evaluated by percutaneous procedures. However, these diagnostic techniques are invasive, painful and costly.

Thermography is a sensitive technique to detect thermal changes, that are functional characteristics of the tissue, which occur before structural changes, so an earlier diagnosis of adenopathies can be achieved. Technological improvements have led to increases in the thermography device sensitivity.

It is well known that an adenopathy modifies vascularization through pathological angiogenesis which results in hyperthermia detectable with high accuracy by thermography. It is illustrated by an axillary asymmetry image. (Figures 1-3) In addition, studies show the remarkable stability pattern of infrared images in healthy individuals, so a change in this pattern is easily detectable as a suspect zone.

This low-cost, painless and highly sensitive technique proves to have a huge potential in the screening of adenopathies. Thus, thermography plays a promising role in the study of adenopathies, and an innovative method of screening.

Images for this section:

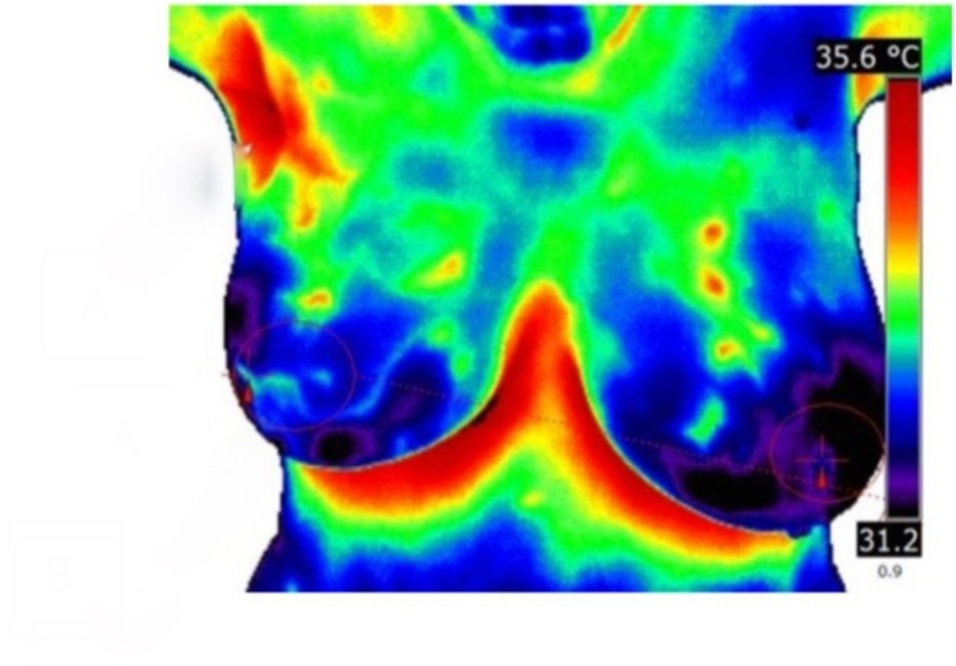

Fig. 1: Thermovascular asymmetry of the axilla. Right axillary hyper-radiation.

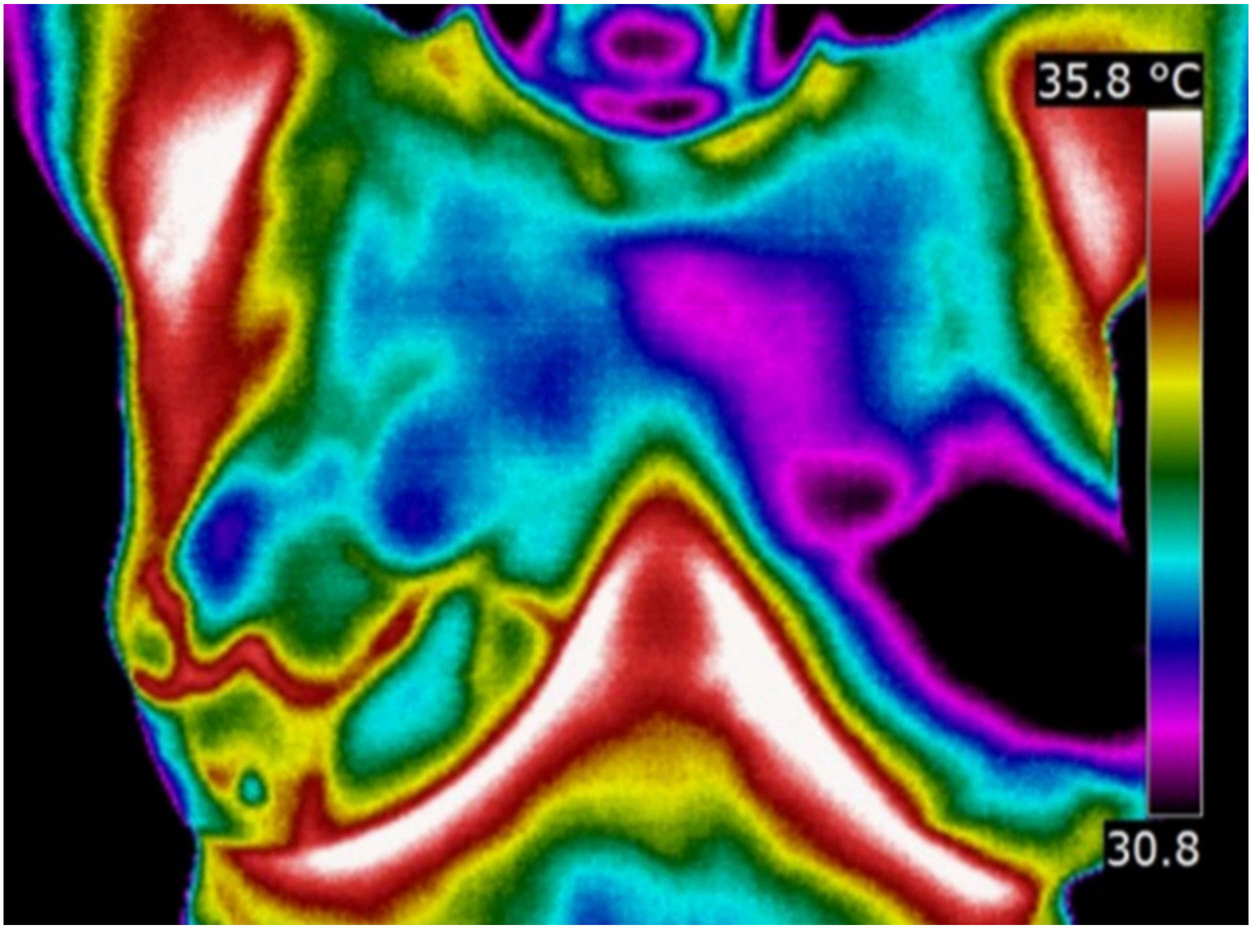

Fig. 2: Axillary symmetry of temperature on the evaluation by thermography.

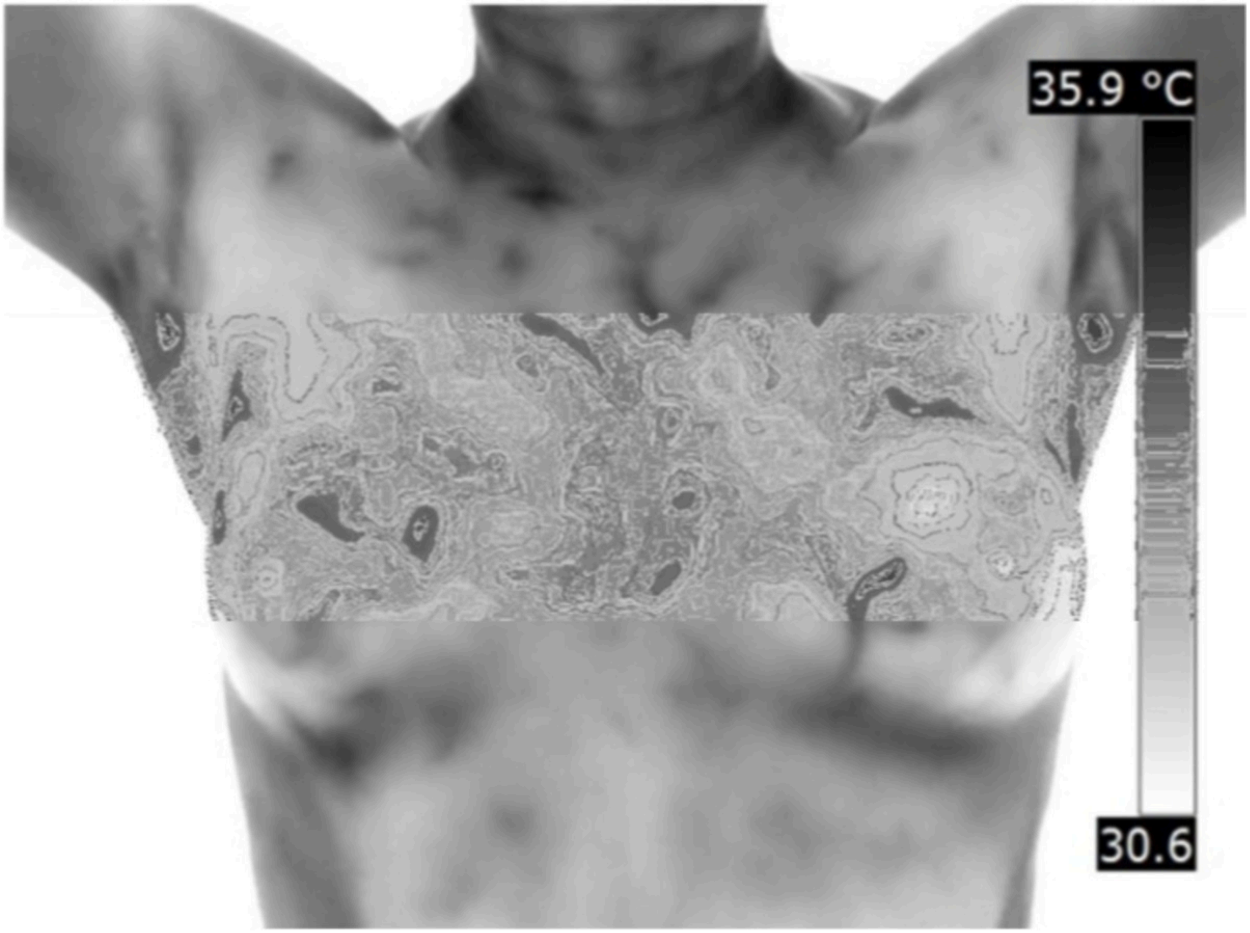

Fig. 3: Thermogram, in gray color scale, demonstrating breast and axillary vessels.

Findings and procedure details

What is thermography?

Image technique that uses infrared radiation from the electromagnetic energy spectrum. Low frequency and high wavelength. No ionizing effect.

How does it work?

All objects with an absolute temperature above zero (0 Kelvin = -273 ° C) emit infrared radiation. The hotter the object is, the more radiation it emits. Infrared radiation has a wavelength greater than the sensitivity of our eyes, so it is invisible. The thermography devices are sensitive to this radiation and have algorithms that produce an image on the visible spectrum, allowing us to see a map of the thermal energy of the object.

The skin of the human body has a standard emissivity of 0.98, that is a high and adequate value to the sensibility of the thermography studies. Currently, the devices have a capacity to detect differences in temperature about of 0.025ºC.

Which parameters should be verified in the device?

To verify the value of the emissivity about 0.98.

To select the focus (automatic or manual).

To define the spectral range representative of the thermal changes (color scale or gray scale).

We never should forget that these adjustable parameters must be described on the report in order that the study can be reproducible.

How to do this exam?

The temperature and humidity of the room should be controlled and stable, within the values around 18-25ºC.

The room should have windows and doors closed.

The study must be done away from sources of heat or cold (AC, computers, radiators, etc.).

Patients should wait in the garments without clothing that covers the thoracic region for about 15 minutes (optimal time to acclimatize to room temperature).

What kinds of devices of thermography there are?

There are two options for thermography camera:

Thermography camera that contact directly with the armpit. Figure 4

Thermography camera that not contact with armpit and the study is done with the patient about 3 meters of distance from the device. Figure 5

In both studies, the upper limbs raised above the head and three images are taken to find an average pattern.

The cold test can also be performed, in which the patient places his hands in cold water (10ºC) for 1 minute, and then three more images are taken.

According to Hoekstra ("For physicians", 2007), the thermographic signals to be analyzed are:

-Vascular pattern of hyperthermia and asymmetry

-Focal patterns with + 2.5 ° C of thermal difference

-Anarchic or complex vascular pattern

-Any combination of these signs.

Images for this section:

Fig. 4: FLIR T400 Termography Device.

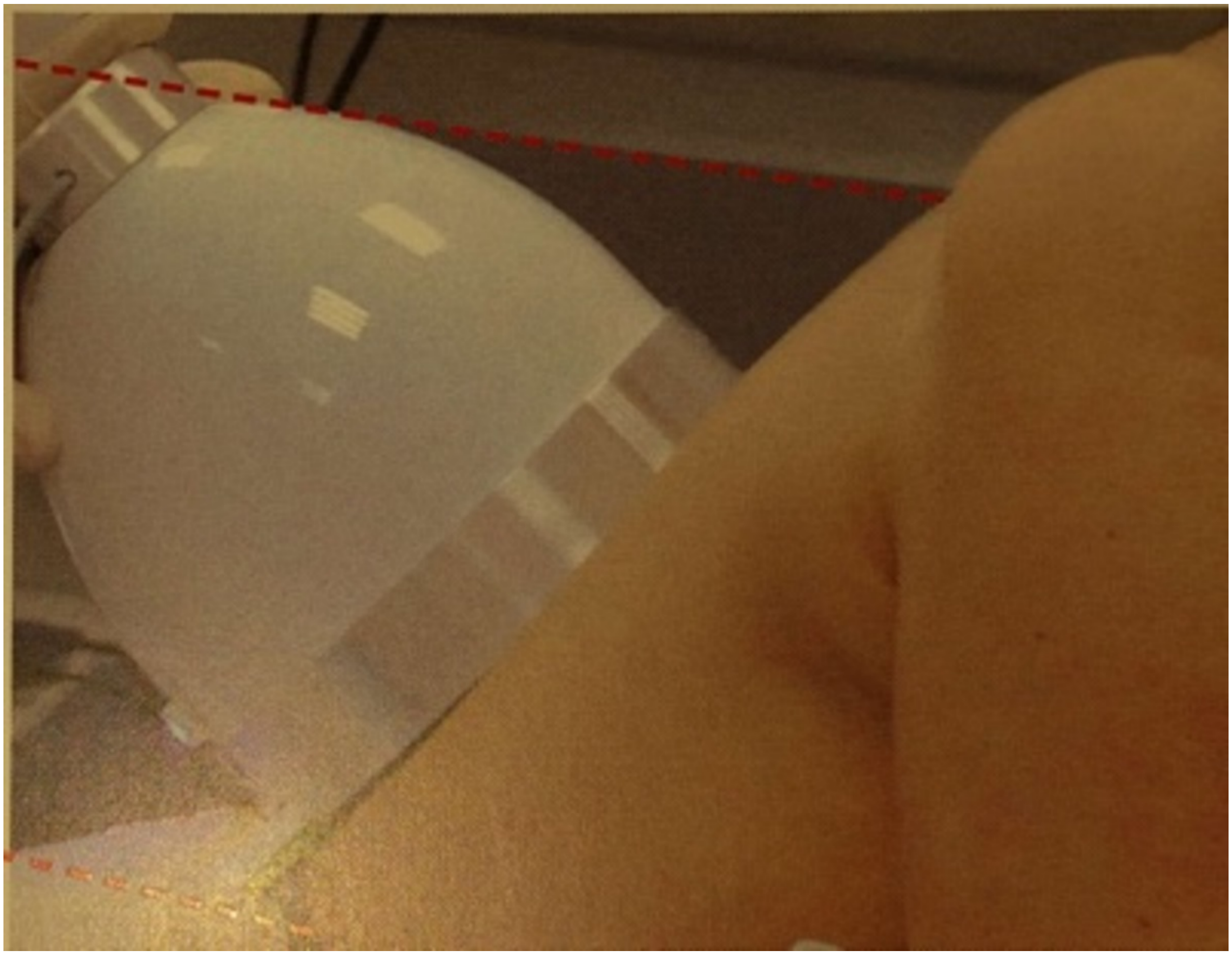

Fig. 5: BRASTER Termography Device

Conclusion

This study aimed to highlight the potential of thermography as a future method of screening adenopathies, considering its great sensitivity and low cost, as well as the fact that it is a non-invasive, innocuous and painless method.

Personal information

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References

Deborah A. kennedy, et al., "A Comparative Review of thermography as a Breast Cancer Screening Technique", Integrative Cancer Therapies, Vol 8, Nº1, Março 2009

Gladis Souza, "Análise e triagem de tumor benigno de mamas a partir de imagem infravermelha", Dissertação apresentada ao Programa de Pós-Graduação em Engenharia Mecânica da Universidade Federal do Paraná, 2014

Tadeusz J. Popiela, "Thermographic Atlas-Breast Cancer", Warsaw 2016

#Maria da Conceição Formoso Nobre Santos, "Uso da termografia para caracterizar qualitativamente fachadas de edifícios", Dissertação apresentada para a obtenção do grau de Mestre em Engenharia Civil na Especialidade de Construções, Coimbra, Julho, 2014

#Chaefer, G, et al, "Thermography based breast cancer analysis using statistical features and fuzzy classifications ", Loughborough University 2009