Thermography in breast cancer screening: Progress and prospects

STEPHEN A. FEIG, M.D., and JOHN D. WALLACE, A.B.

Feig, S. A., and J. D. Wallace. Thermography in breast cancer screening: Progress and prospects. *Med. Instrum.* 11: 21-25, 1977.—The use of thermography in breast cancer detection is reviewed. Although advantageous in its total lack of radiation exposure to the patient, thermography has limitations in that significant false-positive and false-negative cancer detection rates have been demonstrated. The potential use of thermography in evaluation of the pathogenesis of breast cancer and in identifying women at high risk is discussed.

breast; carcinoma; infrared energy; thermography

Breast Cancer Detection Modalities

ONE OUT OF EVERY FIFTEEN WOMEN will develop carcinoma of the breast. It is the most frequently occurring of all malignant tumors in the female population. Survival depends on two related factors: size of the primary tumor, and involvement of regional lymph nodes. Patients with smaller lesions and fewer involved nodes have the highest cure rate. Improved survival results from the early detection of smaller, less advanced lesions. The three modalities used for this purpose are thermography, mammography, and clinical examination.

Thermography

Thermography provides a pictorial representation of breast surface temperature. Since the human skin is a nearly perfect absorber and emitter of infrared energy, skin temperature can be determined by the infrared energy, which it emits. Infrared energy is part of the electromagnetic spectrum (Fig. 1).

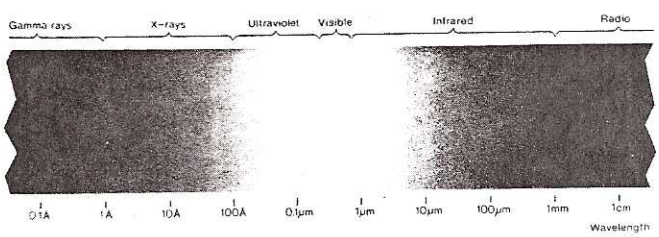

Fig. 1. **The electromagnetic spectrum.**

From the Department of Radiology, Thomas Jefferson University Hospital, Philadelphia, PA 19107.

Received for publication June 30, 1975.

Infrared energy can temporarily alter the electrical resistance of photoconductive materials such an indium antimonide contained in the thermographic apparatus. This principle forms a basis of thermographic instrumentation. A translated image is then displayed on a cathode-ray tube and photographically recorded (Fig. 2).

On the thermographic image (inverted mode), the warmest areas are black, the coolest white (Fig. 3). Intermediate temperature zones are seen as shades of gray. The warmer superficial veins are well seen against the relatively cooler background of the skin. The nipples are generally coolest. Since the breast fat is a relatively good insultor, most heat is

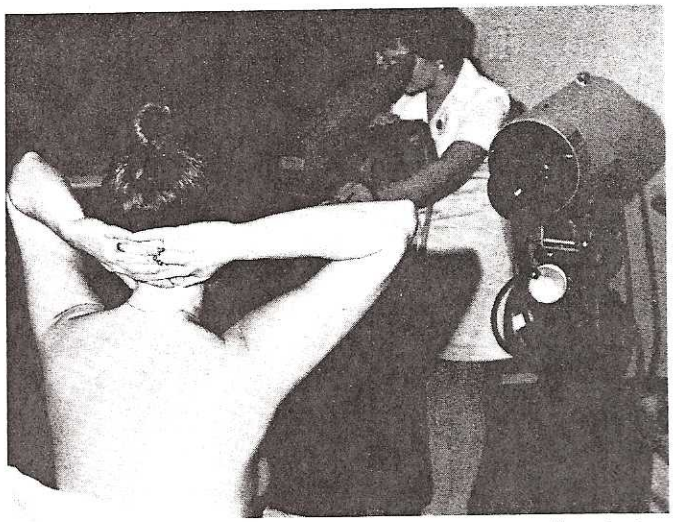

Fig. 2. **Thermographic apparatus is entirely a recording device and unlike mammography does not expose the patient to radiation.**

