INFRA-RED THERMAL IMAGING AND EARLY BREAST CANCER DETECTION

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All objects with an absolute temperature above zero emit infrared radiation from their surface. Human skin emits infrared radiation mainly in the 2 - 20 micron wavelength range, with an average peak at 9-10 microns.

The first use of diagnostic thermography came in 1957 when R. Lawson discovered that the skin temperature over a cancer in the breast was higher than that of normal tissue[1]. Hypervascularity and hyperthermia could be shown in 86% of non-palpable breast cancers [2].The increased vascularity and neoangiogenesis seems to be necessary to maintain the increased metabolism of cellular growth and multiplication. In 1982, the Food and Drug Administration published its approval and classification of thermography as an adjunctive diagnostic screening procedure for the detection of breast cancer. Thermography has tremendous potential as an early risk indicator or as a monitor for treatment. Breast thermography has several key advantages. It is radiation-free, non- contact and non-invasive and the scan is completed in approximately 10 minutes. Thermography detects abnormalities up to10 years earlier than normal breast screening and is suitable for women of all ages. There is a distinct advantage of Thermography in younger pre- menopausal women who are often difficult to diagnose accurately because of the density of the breast tissue. It can also be used to monitor existing breast problems.

It is very important that proper protocols are used when performing breast thermograms. These include adequate cooling down procedures prior to imaging, and climate-controlled controlled ambience (18C-22C) range with no light and draft. The patient is given adequate instructions and protocols prior to their examination as there are many factors, which can create false findings on the thermogram.

The Dynamic thermal challenge test

The procedure involves performing a baseline thermogram of the breast (fig 1) and then to expose the patient's hands to ice cold for 1 minute. This creates a "fight- flight" sympathetic nervous system-induced vasoconstriction in healthy tissue whereas malignant regions do not cool. This form of dynamic thermography has been reported to decrease the false-positive rate to 3.5% (96.5% sensitivity) after a study on 10,834 patients[3-6]. Newer artificial intelligent thermal system technologies incorporate a cooling procedure and thereby shorten the whole scan procedure. A resistance to cooling does not equate with a diagnosis of cancer but taken together with other thermal changes may indicate a higher risk of abnormality and warrant further investigation.

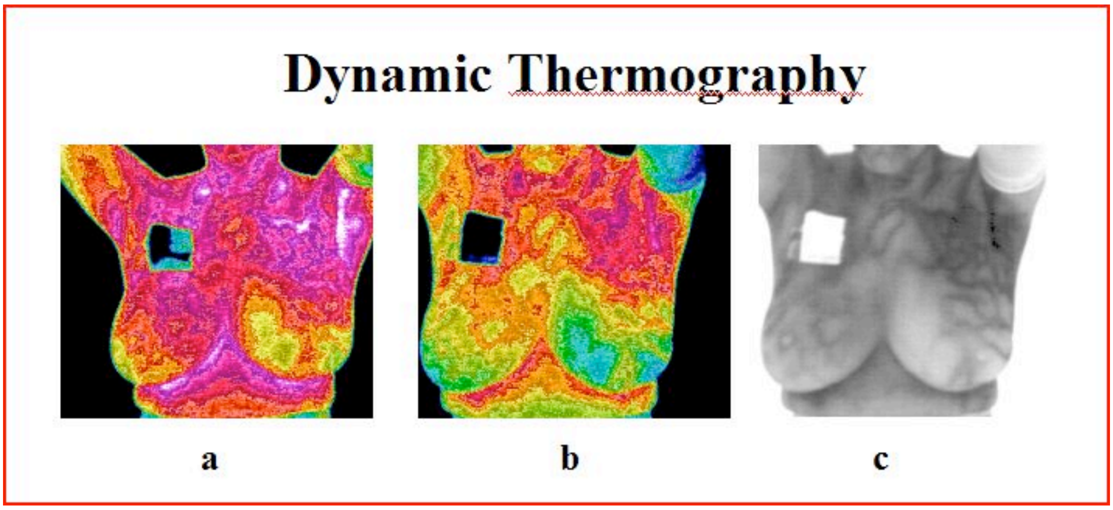

Fig 1 (a)Breast thermogram unchallenged. (b) Same patient after cold challenge (hands emmersed in cold water for 1 minute). Abnormal response in the upper outer quadrant of the left breast. Note the highly vascular area on the grey scale (c) After cold challenge (Grey scale). The square over the right chest wall is a hormone patch in situ

In worldwide retrospective studies, thermograms were positive in a minimum of 71% to a maximum of 93% in patients with breast cancer as reported by Nyirjesy[7].There are literally thousands of pages of discussion in print regarding the benefits of thermography as it relates to breast cancer. Despite the wide variety of protocols and equipment utilized, a tremendously high statistical correlation of accuracy prevails. Numerous studies have been published demonstrating that patients reported to have false positive thermograms i.e. positive thermograms and negative mammograms who were told the thermography was wrong, were determined by long term follow-up to have developed breast cancer in exactly the location thermography had demonstrated its positive finding 5-10 years earlier. Some of the key findings from the Medical and Scientific literature are as follows: 91% of the nonpalpable cancers were detected by thermography in 61,000 women screeened using thermography over a 10-year period. Of those with cancer, thermography alone was the first alarm in 60% of the cases [8]. It has been well documented that long-term observation (8-10 years or more) is necessary to determine a true false-positive rate. One study noted that 30% of the cancers found would not have been detected if it were not for thermography [9]. From a patient base of 58,000 women screened with thermography, 1,527 patients with initially healthy breasts and abnormal thermograms were followed for 12 years. Of this group, 40% developed malignancies within 5 years. The study concluded "an abnormal thermogram is the single most important marker of high risk for the future development of breast cancer" [10]. It has been estimated that the incidence of breast cancer detection per 1,000-screened patients would increase from 2.72% using mammography to 19% utilizing thermography[11].

Thermography's only error is that it is too right too early. It is our job as scientists, physicians and patients, to identify the appropriate protocols once a thermogram is positive. It is in this capacity that the paradigm must shift and where preventative medicine must play a key role. Lifestyle and dietary risks that include key nutrient supplementation are proving to be very useful in this regard. Particularly pertinent here is the assessment of how a woman metabolizes estrogen by a simple urine test to estimate the proportion of toxic and non-toxic estrogen metabolites. A simple nutritional manipulation can impose a genetic change that forces the production of 2 –hydroxy non-toxic estrogens instead of the more toxic 16-hydroxy estrogens. Here is another simple tool for assessing risk. Moreover the nutritional manipulation I refer to is an example of Nutrigenomics…the ability of key nutrients to change genetic behavior. The good news here is that even if a woman has a genetic risk we now know that this can be manipulated by simple nutrients to reduce risk of breast cancer.

The case for the widespread introduction of breast thermal imaging, especially for young women, is gaining momentum. Its adoption as a routine procedure as part of all ongoing breast screening programs would allow a more optimal and targeted use of mammography but more importantly would allow for prevention and much earlier treatment with the consequence of reducing mortality from breast cancer with corresponding significant cost savings for the Healthcare System.

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