

INFRA-RED IMAGING IN BREAST CANCER

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ABSTRACT:

In 1982, inspired by the notion of angiogenesis in experimentally transplanted cancer in animals showing that a small transplanted cancer could not "take" in the recipient organ unless tumor angiogenesis was established. We undertook a clinical research in 530 breast cancer patients who had previous mammography to see whether angiogenesis could be seen on mammography in early breast cancer and if so, could it have any impact on the detection of early breast cancer. Furthermore, we studied angiogenesis by infra-red imaging camera in a large number of symptomatic and asymptomatic patients, in 148 non-palpable cancers and in 20 inflammatory breast carcinomas. We found the following:

1. Angiogenesis was the first sign appearing on mammography before the appearance of image of breast cancer, predicting in 91% of the cases which breast might develop breast carcinoma. This is an important finding in the detection of the early stages of breast cancer development.
2. Infra-red imaging goes hand in hand with mammography. Hypervascularity and hyperthermia could be shown in

86% of non-palpable breast cancer. In 15% it helped to detect the cancer upon an unsuspecting image on mammography.

3. Infra-red imaging was found to be the only test showing the efficiency of chemotherapy in inflammatory breast carcinoma.

Keyword: Infra-red imaging in breast cancer, angiogenesis in breast cancer.

INTRODUCTION:

Infra-red heat detection, a vintage of the second world war, was used in medicine particularly in breast cancer. ⁽¹⁻²⁾ The result was so impressive in the beginning that it was thought that any breast hyperthermia was harboring cancer. After a short-lived glorious period, it was discarded in the early 80's because it was found to be unreliable ⁽³⁾ with too many false positives. Unfortunately, in the USA essentially because of the lack of long-standing follow up, it was not possible to evaluate the real value of this test despite the fact that Europeans had shown in large scale that 38% of unilateral breast hyperthermia in asymptomatic patients turned to cancer in five years ⁽⁴⁾.

In 1982, on one hand, we were struck by the statistics of the American Cancer Society, which showed cancer mortality was not changed in the last thirty years despite modern technology. On the other hand, we were impressed by experimentally transplanted cancer in animals which showed that a small transplanted cancer could not "take" in the recipient organ unless tumor angiogenesis was established. We undertook the following research plan: Why breast cancer mortality has not been changed over the last thirty years? Can we do anything in order to lower the mortality? We knew, however, the only way to curb mortality was detection of early breast cancer. Could the notion of angiogenesis, its demonstration on mammography, combined with infra-red imaging, improve the detection of breast cancer earlier?

METHODS AND MATERIALS:

Thus, any patient who came to see us, whether for screening or for second opinion of her breast cancer, was requested to provide us with all her previous mammography films. From 1982 to 1995 we collected 530 patients with breast cancer who had previous mammography prior to the diagnosis of their breast cancer; 204 of which were xeromammography. At the same time, we used an infra-red imaging camera in a large number of asymptomatic and symptomatic patients, in 148 non-palpable breast cancer, and in 20 cases of inflammatory carcinoma, before and during chemotherapy. It was performed in a room with a temperature of 70°f with the patient in a sitting position. After cooling the torso for five minutes, Polaroid pictures of the chest, in black and white and color, were obtained in the frontal and oblique planes.

RESULTS:

On mammography of 530 patients with previous mammography, we found the following:

- A. In 91% of the cases signs of angiogenesis, vascular alteration, hypervascularity, engorgement of vessels, and in many cases, formation of proper vessels of carcinoma, calcified nutrient artery and drainage veins, appeared long before the appearance of breast cancer on mammography. It proves that angiogenesis can be seen on mammography and be useful in early breast cancer detection.
- B. During the study of previous mammography, prior to breast cancer detection, many new signs were discovered before the formation of the mass density on mammography ⁽⁵⁾. Without the knowledge of these subtle signs, many early stages of breast cancer can easily be missed.
- C. When the mammography showed even a small mass density which proved to be carcinoma, in 95% of the cases, a subtle mass deformity was already present in either one year or many years earlier on previous mammography. If mortality has not been changed with modern technology, part of that is because the diagnosis of breast cancer is done too late with the screening mammography.

D. Infra-red imaging done in 148 patients with non-palpable cancer showed in 86% hypervascularity and hyperthermia in homolateral breasts. In 15% of the cases, it prompted a biopsy of the unsuspecting area on mammography which turned out to be a carcinoma. (Fig 1)

E. Infra-red imaging was performed before and during treatment of 20 cases of inflammatory breast carcinoma. In all cases, initial intense hypervascularity and hyperthermia regressed at 3 months after neo adjuvant chemotherapy (depression of

breast cancer angiogenic factors). As soon as resistance to chemotherapy developed, the angiogenicity returned and the hypervascularity and hyperthermia reappeared as well. (Fig 2,3) This shows the correlation of hypervascularity and hyperthermia with breast cancer angiogenesis.

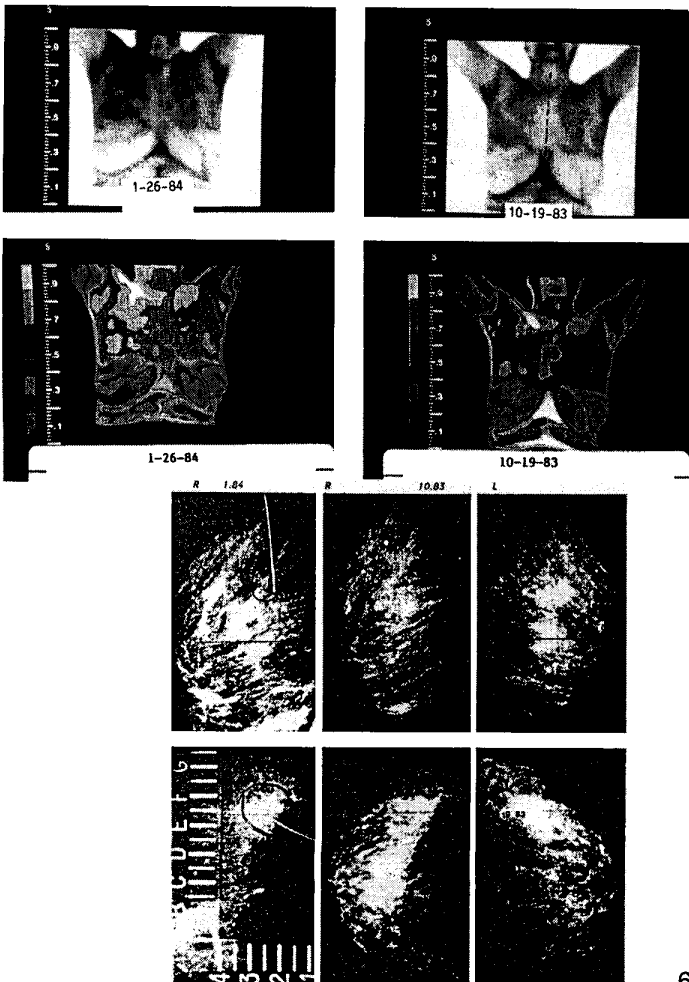
DISCUSSION:

Vascular or asymmetric breast heat is not specific for any breast condition. It is seen in various circumstances, physiologic states (menstrual cycle, pregnancy), unilateral breast hypertrophy, congenital vascular varicose malformations, infection, mastitis, trauma, fibrocystic benign and malignant lesions.

It is customary to evaluate the validity of a test by its sensitivity and specificity. Such an evaluation in infra-red imaging is meaningless. There are many tests in medicine that give us only a direction for further investigation, such as blood hyperleukocytosis, rectal fever, lumpy breasts on physical examination.

Infra-red imaging becomes meaningful if it is used in radioclinical context with the understanding of the natural history of breast cancer. Knowing that the breast cancer is not an overnight event, it takes a year or years to develop. Breast cancer cells secrete substances such as angiogenic factors that cause functional and anatomical breast vascular changes and the formation of new vessels which cause breast hypervascularity and hyperthermia long before the appearance of image of cancer on mammography. Non-specific subtle mammographic changes can be core needle biopsied and

Figure 1:



cytomorphologic and genetic markers studied.

Figure 2:

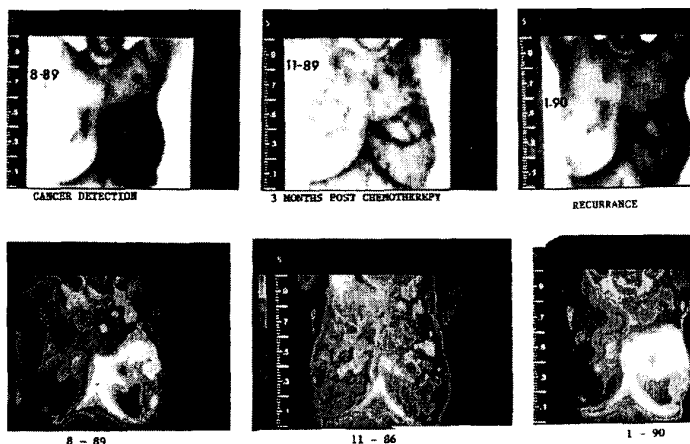
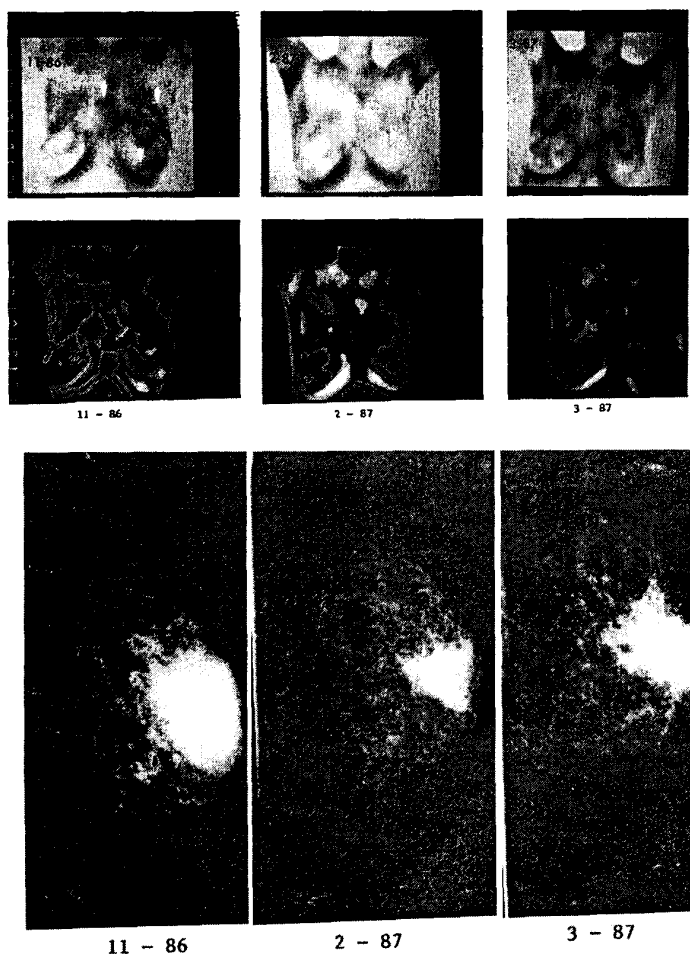


Figure 3:



CONCLUSION:

We found infra-red imaging is more useful as a predictor than a prognosticator of breast cancer. Breast cancer does not have a stereotypic manifestation. Each time it develops in different manners. That is why early detection of breast cancer on the first time mammography is so difficult in the screening mammography. Infra-red imaging, combined with the screening mammography, increases the detection of early breast cancer. It is an indispensable tool to be used in inflammatory breast cancer treatment. It is of great interest following high risk patients, and dense breasts, with infra-red imaging and mammography for detection of precancerous or cancerous lesions.

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