POSITION PAPER ON DIGITAL INFRARED IMAGING OF THE BREAST

Peter Leando Ph.D.

Abstract :

There is great optimism for the future of the diagnosis and management of breast cancer.

Genetic and clinical researchers continue to work hard in an attempt to answer the scientific questions that continue to delay a cure for this terrible disease.

A vital component in the research process has been neglected because of media controversy, flawed research and in the past, limitations with interpretation of non digitized thermal images. Until such time as a cure has been found, the future progress in breast disease must be made in the fields of early detection and risk evaluation coupled with sound clinical decision making.

Digital Infrared Thermal Imaging (DITI) has been clearly demonstrated to be the earliest and safest risk marker of breast pathology, and the best case management tool available today in the ongoing monitoring and treatment of breast disease.

Thermal imaging, as a test of physiology, can detect subtle changes in breast temperature that indicate a variety of breast diseases and abnormalities. Unlike mammography, (currently the main method for breast cancer detection), DITI looks at the physiological component of breast abnormality, not the anatomical.

In simple terms, thermography is capable of detecting and measuring the body's physiologic response to abnormality while mammography is capable of detecting and measuring the structural or anatomical lesions present.
It has been estimated that thermal imaging is 2-5 years ahead of mammography as a risk indicator.

By utilizing digital infrared thermal imaging under carefully controlled clinical protocols developed in the US and Europe, the most complete diagnosis can be made by combining the physiologic status of the patient with other assessment tools.
Effective treatment can then be managed by the patients physician.

Introduction

Breast cancer and other breast diseases are a major issue in women's health today, particularly in advanced industrialized nations. Approximately 1% of breast cancer cases occur in men .

Scientists and health care researchers have been looking for decades at tools that can identify breast cancer reliably and quickly. It takes years for a tumor to grow, and the earliest possible indication of abnormality is needed to allow for the earliest possible treatment and intervention.

AGE	AVERAGE TUMOUR DOUBLING TIME
Under 50	80 days
Age 50 - 70	157 days
Over Age 70	188 days

Source: Cancer 71:3547-3551, 1993

A procedure which has gone largely unnoticed and under-utilised is Thermal Imaging of the breast. Digital infrared thermal imaging (DITI) offers the opportunity of earlier detection of breast disease than has been possible with breast self examination, physician palpation or mammography alone.

DITI is a non invasive test. There is no contact with the body of any kind, no radiation and the procedure is painless. The scanning system merely detects and records the infrared radiation that is emitting from the patients body.

Utilizing sophisticated infra-red technology and innovative computer software, thermal imaging technicians simply capture a digitised image of the breasts in the form of an infra-red thermogram, or heat picture. The resultant data is stored in a computer and then can either be printed on high resolution color printers, or sent electronically to a doctor for analysis.

The doctor, radiologist or thermologist (thermal imaging specialist), then compares the thermal patterns in each breast. Any significant asymmetries, or any specific blood vessel patterns in one breast that do not appear in the other indicate a physiologic abnormality. This may be pathological (including cancer, fibrocystic disease, an infection or a vascular disease) or it might indicate an anatomical variant. When a thermogram is positive the job of differential diagnosis and further monitoring begins, allowing for the earliest possible treatment.

This is all that thermal imaging provides - a physiologic marker that some abnormality is present in the breast. Nothing more and nothing less. This is, however, an extremely valuable and important finding, but it has historically been the subjective interpretation of these findings that has been a problem. Now with the advent of digital infrared thermal imaging systems and the computerised thermal evaluation software for
interpreting digital thermograms, the results become more objective.

History

The medical community investigated breast thermography quite extensively during the late 1970's and early 1980's. The American FDA approved the procedure as an adjunctive tool in breast cancer screening and many physicians, concerned about the radiation exposure of mammography, began to promote thermography as a replacement for mammography. To promote Thermography as an alternative to Mammography was complete error but the rational for performing this test and the physiological basis of Thermography must have been poorly understood or totally overlooked by the clinicians and researchers of the day.

“Thermography was, and DITI is, a test of PHYSIOLOGY. It does not look at anatomy or structure, it only detects and records the infra-red heat radiating from the surface of the body“.

Mammography, on the other hand, is a test of ANATOMY. It looks at structure. When a tumor has grown to a size that is large enough and dense enough to block an x-ray beam, it produces an image on the x-ray or mammographic plate that can be detected by a trained radiologist. A fine needle biopsy is then generally performed to identify the type of tissue in the mass, to determine if atypical or cancerous cells are present.

The initial research conducted on thermal imaging was to determine if it was safer and more diagnostically accurate than mammography. These comparisons should not have been made, as you cannot compare a test of anatomy with a test of physiology.
It is also important to remember that neither thermography, nor mammography, can diagnose breast cancer; they are both adjunctive diagnostic tests which reveal different aspects of the disease process and allow for further exploration. Pathology is the only conclusive diagnostic test.

Studies that were done with thermal imaging on patients who had an established diagnosis of breast cancer indicated that in nearly every case the cancerous breasts were hotter. There were specific patterns of heat that suggested that cancerous tumors were surrounded by blood vessels that were engorged, and this produced hotter areas on thermal images of the affected breast than the normal vessels in the opposite breast.

This made complete sense, until the research proceeded to look at younger and younger women. It was at

this time thermography was viewed with suspicion. The problem was, early stage tumors had not grown large enough, or dense (thick) enough, to be seen by current mammography. When the thermogram picked up the heat from a developing tumor, a mammogram was performed and often a mass was not detected. The result of the thermogram is then considered a "False Positive". The more patients of younger age screened with the so-called false positive, the more suspicion was placed on thermography.

Years later, in re-call studies, a large percentage of these women had developed cancer, or other breast disease, in exactly the location of the abnormal "false positive" thermogram, thus validating its early warning role. "Thermography's only error was that it was too accurate - too early".

At this time Thermography was viewed as a competitive tool to mammography, a role for which it was not suited or intended. Thermography today in the form of DITI is complementary to mammography and must only be used as an adjunctive tool in the fight against breast cancer. By using the objective results of DITI correctly it is possible to achieve the best management of the patient.

Historic Objections to Thermography

In the years following the early breast cancer trials, thermography was used by a variety of clinicians and researchers from around the globe. Some of these individuals were not adequately trained or certified in thermography and as a result, sometimes used inappropriate protocols and techniques. Also, some thermographic equipment used at that time was not suitable for detecting the correct wavelength of infrared radiation that emits from human skin.

As a diagnostic tool of physiology, thermal imaging was also being used in sports medicine, dentistry, podiatry, chiropractic, orthopedics rheumatology and neurology in a variety of support or adjunctive diagnostic roles. It was soon realised that thermography could clearly, objectively and easily demonstrate the physiological component of pain and injury, especially to the spinal column, due to car accidents, job injuries and a host of other "tort" related law suits.
Everyone involved had benefit from these positive test findings that could be clearly shown to a jury.

Everyone that is except the defendant insurance industry.

In the United States particularly, millions of dollars were awarded to people in pain, as a direct and indirect result of thermographic testing - a test that could "prove" a long term injury consequence, and support medical testimony from the plaintiff whilst fully contradicting paid medical testimony from the defendant.

Needless to say, the insurance industry in the U.S. placed an all out effort in diminishing the value of thermography in courts of law. The tactics used were disappointing and included:

1) Deposition and testimony of uncertified clinicians incapable of answering questions correctly
2) Deposition of doctors improperly using the procedure.
3) Outdated material utilized at trial and not contradicted appropriately
4) Material used "out of context"
5) Using the wrong type of thermal imaging equipment

Eventually lobbying efforts at the AMA's House of Delegates and at Medicare, brought about the removal of thermographic coverage by insurance companies and the greatly reduced utilisation of thermography in the United States. This was most unfortunate for the patients that could benefit from thermal imaging.

The Correct Role for Thermal Imaging

Used in the correct model, DITI of the breast can make a profound and positive impact on breast cancer and other breast disease.

DITI is a risk marker for breast pathology. There is a large base of studies that have been published world wide demonstrating the clinical utility and reliability of the procedure when used in the correct model.

In performing this procedure, which is non-invasive and non-contact, it is possible to establish a baseline study for women in various risk categories as young as 18 years of age. Yearly thermographic evaluations as part of a routine annual physical can be performed inexpensively and quickly.

As each individual has their own thermal pattern (which is normally symmetrical) and includes vascular anatomy we can establish a baseline study for the subject which can be archived for annual comparison. Because the subjects thermal patterns are accurate and repeatable throughout their lifetime, any changes to their normal 'thermal fingerprint' caused by early cell changes (pathology) will become increasingly apparent. Monitoring changes (thermal asymmetry and neovascularity) over periods of time with DITI is the most efficient means of identifying subjects who require further investigations.

As soon as a suspicious (positive) breast thermogram is performed, the appropriate follow-up diagnostic and clinical testing can be instigated. This could include mammography and other imaging tests, clinical laboratory procedures, nutritional and lifestyle evaluation and extended awareness for changes in the breast during self examination.

With this protocol, we improve our chances of detecting cancer at its earliest possible occurrence. It has been estimated that DITI is capable of detecting the presence of pathology 2-5 years before mammography can detect a mass.

This is both exciting and frustrating for the clinician and the patient. It is exciting as it gives us a better opportunity to intervene while breast conserving treatment or surgery is still possible but can be frustrating to have a positive finding with a procedure that suggests the possibility of a terrible disease in an early stage and then have no other tools available to confirm or deny the tests correctness. *However this is not DITI's failure.*

In addition to its on-going use as part of an early detection program for all women, DITI as a non-invasive, low cost procedure, can be made available to two distinct subpopulations :

1) Patients (currently aged under 50 and over 69) who fall outside current subsidised screening programs.

2) Patients who are afraid of mammography due to fear of x-ray or breast compression and thus do not get their recommended mammogram.

Conclusion

The role of thermography is vastly different than it originally was determined to be. We must now regard this tool for what it really is: a highly accurate, high yield thermometer, much like the one every doctor uses daily to determine the presence of a fever. Thermography as a physiologic test demonstrates heat patterns that are strongly indicative of breast abnormality, nothing more, nothing less. Once abnormal heat is
detected in the breast (a thermal asymmetry), follow-up procedures, including clinical blood investigation and mammography, are necessary to rule out or properly diagnose cancer and a host of other breast diseases such as fibrocystic syndrome, Pagets disease, etc.

Digital Infrared Thermal Imaging is a complimentary, not competitive, tool with mammography.
With the new ultra-sensitive, high resolution digital infrared cameras available today the technology that has been developing over the past 20 years is now creating renewed interest.
Canadian researchers recently confirmed that infrared imaging of breast cancers could detect minute temperature variations related to blood flow and demonstrate abnormal patterns associated with the progression of tumors. These images or thermograms of the breast were positive for 83% of breast cancers compared to 61% for clinical breast examination alone and 84% for mammography.
The 84% sensitivity rate of mammography alone was increased to 95% when Infrared Imaging was added.

It is in this role that thermography provides its most practical benefit to the general public and to the medical profession. It is certainly an adjunct to the appropriate usage of mammography and not a competitor. In fact, thermography has the ability to identify patients at the highest risk and actually increase the effective usage of mammographic imaging procedures
Until such time as a cure has been found for this terrible disease, progress must be made in the fields of early detection and risk evaluation coupled with sound clinical decision making.
Thermography has been clearly demonstrated to be a valuable and safe early risk marker of breast pathology, and an excellent case management tool for the ongoing monitoring and treatment of breast disease.

To-day countless thousands of women, particularly those between the ages of 25 and 50 are disadvantaged by the lack of thermal imaging laboratories.
For Thermology to become more widely available and develop increased acceptance it is essential that the scientists and doctors who are Thermographers or proponents of Thermology ensure that only appropriate protocols are used for digital infrared thermal imaging, and once a thermogram is positive, the appropriate follow-up and treatment is offered.

We now have an exciting opportunity to at last improve the rate of diagnosis of this terrible disease. Screening younger women utilizing high resolution digital thermal imaging technology will enhance early detection of breast disease. By offering those women with positive findings, the appropriate lifestyle modification and treatment model, it may be possible in many cases, to prevent or minimize mortality from cancer and other breast diseases.

Original article first published March issue 1998 Australian Thermology Association Journal.

Address all correspondence to :

Peter Leando Ph.D.
Australian Thermology Association Inc
Noosa 4565 Q
Australia

REFERENCES

1. Hardy, JD: The Radiation of Heat from the Human Body, J. Clinical Investigation, 13:539-615

2. Hobbins, Wm, Abplanalp. K., Barnes, C., Moner, B.: Analysis of Thermal Class TH-V Examinations in 37,050 Breast Thermograms, Thermal Assessment of Breast Health MTP Press Limited, 25: 249-255, 1984

3. Gross, C., Gauthries, M, Archer, F. et al: Classification Thermogaphique des Cancers Mammaires, Bull Cancer (Paris), 58:351-362, 1971

4. Nyirijesy, J., Abernathy, MB., Billingsley, FS., Bruns, P.,: Thermography and Detection of Breast Cancer, a review and comments, J. Reproductive Medicine, 18/4 165-175

5. Cockburn, Wm., Breast Thermography, to screen or not to screen: J International Academy of Clinical Thermology, Vol1 No2, 17-44 1989

6. Cockburn, Wm., Breast Thermal Imaging, the paradigm shift: Thermologie Oesterreich ISSN-1021-4356. April 95.

7 Head JF, et al; Breast thermography is a noninvasive prognostic procedure that predicts tumor growth rate in breast cancer patients. (Ann N Y Acad Sci, Nov 30 1993)

8 Simpson HW; Sir James Young Simpson Memorial Lecture 1995. Breast cancer prevention: a pathologist's approach. (J R Coll Surg Edinb, Dec1996)

9 Feig SA; How good is thermography in breast cancer screening? (Am Fam Physician, Dec, 1975)

10 Williams KL, et al; Thermography in screening for breast cancer. (J Epidemiol Community Health, Jun,1990)

11 CIatto S, et al; Telethermography and breast cancer risk prediction. (Tumori, Apr 30,1989)

12 Isard HJ, et al; Breast thermography. A prognostic indicator for breast cancer survival. (Cancer, Aug 1, 1988)

13 Sterns EE, et al; Thermography as a predictor of prognosis in cancer of the breast. (Cancer, Mar 15,1991)

14 Sterns EE, et al; Thermography in breast diagnosis. (Cancer, Jul 15,1982)

15 Feig SA, et al; Thermography in breast cancer screening: progress and prospects. (Med Instrum, Jan-Feb,1977)

16 McKinna JA, et al; The early diagnosis of breast cancer--a twenty-year experience at the Royal Marsden Hospital. (Eur J Cancer, 1992,)

17 Letton AH, et al; Twenty-year follow-up breast screening project. (J Med Assoc Ga, Jan, 1996)

18 Ciatto S, et al; Diagnostic and prognostic role of infrared thermography. (Radiol Med (Torino), Oct, 1987)

19 Lapayowker MS, et al; Criteria for obtaining and interpreting breast thermagrams. (Cancer, Nov, 1976)

20 Letton AH, et al; Routine breast screening. Survival after 10.5 years follow-up. (Ann Surg, May, 1986)

21 Keyserlink JR, et al, Infrared Imaging as a useful Adjunct to Mammography. (Oncol News Sept 1997)