I[ST] CANADIAN SYMPOSIUM ON THERMOGRAPHY

In the splendid hills of Quebec, on the 15th and 17th of October 1976, the 1st Canadian Symposium on thermography was held at Auberge Mont-Gabriel. The organizer and president was Dr. R. Ghys (Canada). Many thermographers participated in -the Symposium and some even came from U.S.A., England, Belgium, France and Italy. The papers presented were so interesting that Acta Thermographica feels justified in presenting their summaries even if it is planned to publish the proceedings by the European Press, Ghent, Belgium; other information address to Dr. R. Ghys - 10690 Avenue d'Anteui1. Montreal - 43L2K6 CANADA. Two sessions were dedicated to breast thermography (moderator Drs. M. Abernathy (U.S.A.) and H. Isard (U.S.A.) and two sessions were dedicated to nonmammary thermography (moderators Drs. W. B. Hobbins (U.S.A.) and E. Cooke (England).

A technical workshop was conducted by M. Bacon (Canada).

A guest speaker at the Social Banquet was G. F. Pistolesi (Italy) who spoke on the << History of fire ».

R. **BYRNE** (Milwaukee, U.S.A.)

The value of breast thermography as a risk indicator

Our experiences with high resolution breast thermography will be reviewed. We now have 703 biopsied cases including 205 carcinomas. Our data indicates that a woman with an abnormal thermogram is significantly at greater risk for having a carcinoma than a woman with a normal thermogram. We believe that thermography in conjunction with a clinical examination as a risk indicator to select women on whom to perform mammography is a valid application. Thermography may also be of value in follow up of asymptomatic women, as well as in thermography assisted mammography.

W. B. **HOBBINS** (Madison, U.S.A.)

Thermography - Highest risk marker in breast cancer

The family history and thermographic study were compared in 7,600 asymptomatic patients screened for breast cancer.

When the nineteen cancers found and screening results were evaluated it was found that thermography was the highest risk marker.

23% of the women screened had a family history - 3 cancers were found in this group.

25% of the women screened had an abnormal thermogram and 17 cancers were found in this group.

Risk with family history was l/664 and risk with abnormal thermogram was l/63. Entrance risk was l/400.

Abnormal thermogram is 10 times more a risk marker than family history.

H. **ISARD** (Philadelphia, U.S.A.)

Criteria for evaluation of breast thermograms

The full potential of breast thermography in the detection of breast cancer is yet to be established. Criteria of abnormality are still being formulated and additional investigation into the nature of heat transference is required. Abnormal thermograms are found in both benign and malig-

nant disease and so far thermography has not differentiated the two. Surgical intervention may be influenced by thermography although it should not be predicated upon it. Breast thermography may paly a different role in the study of symptomatic women compared with its use in screening situations for asymptomatic women. In the latter instance it may ultimately serve as a pre-screening tool to select those women who are in urgent need of mammography and physical examination. Breast thermograms fall into three categories depending upon the degree of vascularity and the configuration of the discernible vessels. They are listed as: 1) Avascular or cool. 2) Vascular with linear vessel markings sharply defined. 3) Mottled or patchy, lacking linear configuration. Relative symmetry is the key finding of the normal thermogram irrespective of the degree of vascularity. Symmetry is related to 1) vascular configuration; 2) thermal content; 3) anatomic configuration with preservation of normal breast contour. The avascular mammatherm discloses a uniform dearth of recognizable superficial vessels. The temperature overying the breasts is cooler than that of the chest, shoulder and root of the neck. Frequently there is faint visualization of the areola of the nipple.

The linear or vascular mammatherm may be of a minimal, moderate or marked degree. The linearity is apparent and the margins of the vessels are well defined. There is similarity of the venous configuration.

The mottled, patchy or polka-dot mammatherm lacks the sharp linearity. The findings are not uncommonly present overlying the upper abdomen. The etiology of this presentation is unknown.

Whereas symmetry is the key finding of the normal mammatherm, asymmetry becomes the important criterion of abnormality. The asymmetry may be 1) graphic; 2) thermal.

The graphic findings refer to 1) vascular - depicting the numbers of vessels, their caliber, location, configuration and dfinition; 2) non-vascular - referring to the anatomic configuration of the breast contour and includes the edge sign with loss of the normal contour of the breast, and a bulging contour which occurs with an enlarged breast.

The thermal content can be characterized under: 1) diffuse heat - global or regional; 2) focal heat - localized or periareolar; 3) vascular - confined to one or more vessels.

Considering all of these criteria, abnormal thermographic patterns are listed as: 1) focal heat - periareolar, « Hot Spot »; 2) diffuse heat; 3) vascular discrepancy - hypervascular, cluster formation, avascular; 4) distorted marginal configuration - edge sign, bulging contour.

P. **Besson** (Lille, France)

Thermographic discordances in breast exploration

During this year, breast explorations including a thermography, a mammography, a clinical examination and, if necessary, a cytological puncture have been undertaken in 507 patients.

We have studied the discordances between these methods of exploration and, particularly, the false positives and false negatives of thermography. The rates given by the world statistics as regards false negatives range between 3 and 28.8%; in France, they range from 7% for the Marseille Cancer Centre to 27% for the Strasbourg School.

In this series, 99 cancers were discovered but the thermographic explorations gave a false negatives rate of 15.5%. They were encountered in slow growing cancers, in small cancers sunken into a fatty breast, or even in scirrhous carcinoma.

There were 4.5% false positives, as a consequence of abcesses or cysts with secundary infection.

Mammography showed a rate of 11% false negatives and 10% false positives, whereas cytology showed a false negatives rate of 9%.

The association of these four methods of mammary exploration allows us to give the exact diagnosis in 99% of the cases.

R. E. NERLINGER, R. F. CURLEI, S. A. FEIG, J. H. FRANCO, A. S. PATCHEFSKY, G. F. SHCUWARTZ, G. S. **SHABER** (Philadelphia, U.S.A.)

Thermography in a breast screening project

Breast cancer screening using thermography has been the subject of much controversy. Results have varied from very acceptable to extremely poor. We, at the Breast Diagnostic Center of Thomas Jefferson University, have seen a vastly improved performance in the last year. Close quality control of technique and film processing combined with increased reader expertise have contributed to this improvement. Thermography alone has been positive in 75% of the 51 cases of cancer discovered in 5,336 women in this period. 26% of all patients had positive thermograms. When combined with clinical examination, 88% of these proven carcinomas were detected. These results would lead us to believe that thermography may be a viable technique for breast cancer screening and further evaluation should continue.

W. GORDENNE (Liege, Belgium)

Liquid crystals thermography and breast cancer

Our thermographic tool, prepared according to TRICOIRE's system (Paris), is composed of a serie of mylar sheets covered with encapsulated liquid crystals belonging to cholesterics. A change in local temperature will modify the molecular organization of cholesteric liquid crystals, inducing modification of white light reflection. According to temperature shift,, the sheets will exhibit a color spectrum from red to violet. This type of contact thermography is not quantitatively so precise than I. R. thermography; but, it allows a very good analysis of breast superficial vascular network. When applied to systematic evaluation of typical breast malignancies, it is possible to observe different signs highly discriminative in their diagnosis. Types of images are quite different according to tumoral depth, cutaneous state and local metabolism. In most cases, convection appears as the most important phenomenon to create a specific image. It is actually proved that a breast cancer, with high metabolism, is able to reheat local circulation. These thermal modifications can essentially be observed on superficial venous network. Which place belongs to thermography in breast cancer mass screening? It is certainly less important than the one of physical examination and moreover of mammography. Diagnosis of small lesions is especially difficult. In a recent serie of 107 breast cancers, we have noticed about 20% thermographical false negatives. Nevertheless, if contribution of thermography in diagnosis is less important than the one of other investigation techniques, this method is actually the most accurate in establishing a disease's prognosis.

R. **GHYS** (Montrkal, Canada)

Evaluation of breast malignancy by the A.C.T.M. scoring system

The A.C.T.M. scoring system (anamnesis, clinical examination, thermography, mammography) offers a simple and accurate method to evaluate the malignancy or benignancy of breast lesions.

Applied retrospectively to 784 cases, with breast pathologies diagnosed on the occasion of screening clinics, the evaluation was in error in only four patients. Therefore, the A.C.T.M. system should make it possible, in more than 99% of the cases, to establish before any surgery whether a breast tumour is malignant or not.

Many unnecessary biopsies could be avoided. In cancer cases, treatment could be done according to comparable quantized criteria of malignancy.

The A.C.T.M. system would also lead to a quantitative measurement of the evolution potential (PEV) of a breast tumour, and to appreciate the chance of recurrence in follow-up cases.

E. **Cooke** (London, England)

Thermography and deep venous thrombosis

Fatal pulmonary embolism is a common but preventable cause of death. The clinical diagnosis of deep venous thrombosis is frequently inaccurate, so that special investigations are necessary to avoid embolism on the one hand and haphazard anticoagulation on the other. Thermography provides an accurate and rapid non-invasive method of diagnosis in prospective studies and when patients are symptomatic. Typical appearances, results and comparison with other techniques are described.

G. F. **Pistolesi** (Verona, Italy)

Thermography in angiopathy from vibrating tool

25 workers with Raynaud's phenomenon from vibrating tool angiopathy were examined with both thermography and photoplethismography. The thermal pattern of the normal hand was established. Thermography, even if done only under standard conditions, is capable of objectively demonstrating significant lesions in 84% of the cases.

Photoplethismography of the same patients and under the same conditions is positive in only 24% of the cases.

Thermography after a cold immersion test does not give substantially better results from those obtained under standard conditions. The usefulness of the method is advocated especially for disability insurance medicine and occupational medicine.

P. **Besson** and J. **Buvat** (Lille, France)

Varicoceles diagnosis by thermography

The development of sexology in France has allowed us to undertake a thermographic study of the masculine fertility troubles in relation with the existence of varicocele.

About 50 patients showing oligo-astheno- or terato-oligo-astheno- or terato-spermiae have been studied.

We have eliminated the use of liquid crystals thermography in researching varicocele, because, on the one hand, of the lack of commodity in the utilization of this equipment, and, on the other hand, of the lack of precision of this technique. Only dynamic telethermography with the AGA camera has allowed us to establish a reproducible examination protocole for each case.

If there is a suspicion of varicocele, thermography is repeated after a 5 minutes cooling period.

Varicoceles clinically perceptible or suspected are now systematically detected by thermography.

Our efforts now bear on the research of infraclinical varicoceles.

G. **Hann** and R. **Black** (Toronto, Canada)

Colour thermography in paediatric rehabilitation (tissue trauma program)

A paediatric population with insensitive skin over bony promiences is not at risk for « bed sores » but at appreciable risk for decubiti secundary to wheelchair seats, orthoses, shoes.

We have assumed that the thermal response of insensitive skin is proportional to the magnitude and duration of load upon the skin. We have found that colour thermograms give immediate information as to the tissues under excessive pressure. A study involving 100 patients has been done to demonstrate the application of colour thermography in evaluating wheelchair cushions. The relationship between isotherm patterns and seat biomechanics will be discussed for selected cases. This information helps in the redesigning of wheelchair seats, remoulding of polypropylene orthoses, rebuilding of shoes.

The monitor is an educational « feedback » device for our young patients who readily appreciate « hot spots » they must no longer sit on.

F. **Torossian** and J. **Calvet** (Toulouse, France)

Some aspects of dynamic telethermography in ear nose and throat pathology

After precising the limitations of thermography in ear, nose and throat pathology, we arrived at the following conclusions: - Thermographic pictures of the face and neck vary with physiological and morphological conditions; - Compared to other methods of investigation, which are essentially morphological, thermography is a true functional exploration.

Cervical adenopathies are difficult to visualize, because of the « thermal parasitism » caused by the large blood vessels of the neck. Nevertheless, visualization of enlarged lymph nodes (diameter 1.5 cm) is often possible: « hot spots » and lymphatic tracks are observed. Enlarged lymph nodes are often cold, small ones are almost invariably warm. Dynamic telethermography is of great value in the following cases: - It shows with great precision the extension of skin epithelioma. - It facilitates the follow-up of tumours after surgery or radiotherapy. - It shows up primitive or metastatic bones cancers. - It gives a more precise definition of a << target zone >> for irradiation or surgery.

Subject to confrontation with all the other clinical or paraclinical methods of investigation, and provided that conclusions of the YES/NO type are not expected in all cases studied, D.T.T. contributes to the topographical diagnosis; it can also show the extension and the evolutivity (after irradiation) of several types of head and neck tumours.

R. **Ghys** (Montrtal, Canada)

Thermography and acupuncture

Thermography makes it possible to visualize acupuncture points during treatment. The importance and duration of the vasomotor reactions induced can also be evaluated objectively. The exact location of a « chinese point » can be found with an accuracy of ± 3 mm.

In normal subjects, reactions can be missing and the hyperthermia induced in rarely more than 1°C.

On the contrary, in pathological cases, hyperthermia is always present; in sometimes covers large areas with temperature differentials up to 4°C.

Hyperthermic trajectories can sometimes be seen especially in the periphery, following the meridians (<< Ching >>) described in the traditional chinese text-books (Nei-King So-Wenn).

L. **Reed** (Downsview, Canada)

Application of thermography to studies to man-in-the-cold

Physiological and biophysical aspects of body cooling, frosbites and the assessment of clothing and protective equipment have been conducted by thermographic means.

Special accessories devised for the project will be described.

W. B. **Hobbins** (Madison, U.S.A.)

Thermography and pain

Thermography can objectively demonstrate pain. Three basic thermographic responses to the origin of pain: 1) referred pain (sympathetic afferent pain), 2) radicular pain (peripheral nerve), 3) corda1 pain.

The pain must be present and active at the time of thermography or a false negative test will occur. In visceral pain of any cause, the thermal pattern will change in most cases. Examples will be shown to demonstrate the various pains.

Addendum thermal patterns of the skin are

under two influences: 1) Sympathetic nervous system; 2) Pathology of skin and its parts such as glands and breast; and adjacent tissues closely attached such as joint synovia.

Black body pig studies suggest that no deep body temperatures are transmitted through the subcutaneous insulation to be recorded on the skin.

G. **GORDON** and H. **GREENSPAN** (Sacramento, **U.S.A.)**

Thermographic applications to chelation therapy in vascular occlusive disease

This presentation will discuss the role of thermography in the 3 clinical stages of vascular ocelusive disease; 1) Detection diagnosis. 2) Regression. 3) Post-chelation therapy monitoring.

Throughout the discussion the thermographic interpretations will be substantiated-by other diagnostic modalities employed in the *Sacramento Medical Preventics Clinic.*

This clinic recently installed a Seachrist Hyperbaric Oxygen Chamber which is presently being used in addition to chelation therapy in the treatment of vascular occlusive disease.

The results of this treatment procedure will be thermographically reviewed.

J. W. **DAVIDSON,** J. G. **THOMSON,** R. C. **HESLER** (Hamilton, Canada)

Thermography in chronic rheumatic diseases

During the past year, thermographic joint surveys have been added to clinical and radiographic assessment of affected joints in patients attending a Rheumatic Diseases Unit. Thermograms have been reviewed and compared with clinical and radiographic studies. In 35 of 330 joints, increased heat emission has been demonstrated in the absence of radiographic changes. In large joints, thermography is of particular value in detecting arthropathy at an early stage. This retrospective pilot study is sufftciently encouraging to merit more comprehensive evaluation of the role of thermography in diagnosis and management of rheumatic diseases.