

Thermographic Screening of Breasts and Internal Genitalia

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The Journal of the Professional Academy of Clinical Thermology Spring Edition 2013



PROFESSIONAL
ACADEMY OF
CLINICAL
THERMOLOGY

Abstract

BACKGROUND: Thermovisual screening in order to select groups of women at high risk for the existence of breast tumors and onco-gynecological pathology.

METHODS: In this clinical trial, 18,000 women plant employees were studied. Three thermal imaging cameras were used, three technicians to obtain thermograms, and two specialist-thermologists to interpret the images.

RESULTS: For Breast Thermographic Screening, 563 (3.2%) were true positive for breast cancer, 571 (3.1%) were false positive for breast cancer, and 85 (0.5%) were false positive for breast cancer. 2,952 (16.4%) were true positive for breast benign condition, 1,818 (10.1%) were false positive for breast benign condition, and 0 (0%) were false negative for breast benign condition. For Internal Genitalia Thermographic Screening, 161 (0.9%) were true positive for cancer, 571 (3.1%) were false positive for cancer, and 74 (0.4%) were false negative for cancer. 753 (4.2%) were true positive for benign condition, 1,818 (10.1%) were false positive for benign condition, and 0 (0%) were false negative for benign condition.

CONCLUSION: Thermography is a valuable screening method to identify mammological and gynecological pathology including such serious conditions as cancer and benign tumors.

The thermovisual screening in order to select groups of women at high risk for the existence of breast tumors and onco-gynecological pathology was performed on Rustavi (Georgia) Chemical Plant in 1992. For this work 3 thermal imaging cameras have been used. Three technicians to obtain thermograms and two specialist-thermologists to interpret images were involved in the project.

18,000 women plant employees was studied. The age of the studied women ranged within 30-60 years (reproductive age - 10,600 women, menopausal/postmenopausal age - 7,400 women). Distribution of tested women by age is presented in Table 1.

Table 1. Distribution of tested women by age

| Age (years old) | Amount of Women |
|-----------------|-----------------|
| 30 - 39 | 5,200 |
| 40 - 49 | 5,400 |
| 50 - 59 | 4,347 |
| 60 and more | 3,053 |
| TOTAL | 18000 |

Breast thermograms were made out in three positions: frontal, right lateral and left lateral and were interpreted according to the following criteria:

“Normal Thermogram”:

- 1) Symmetrical Thermo-Architectonic

- 2) Moderately developed vascular pattern
- 3) Absence of local hyperthermic areas
- 4) Absence of areolar hyperthermia
- 5) Average Delta T°C between symmetrical spots in range of (plus-minus) 0.5–1.0°C

“Suspected Malignant Process”:

- 1) Asymmetrical Thermo–Architectonic
- 2) Extended vascular pattern
- 3) Presence of local monolateral hyperthermic areas
- 4) Monolateral areolar hyperthermia
- 5) Delta T°C between symmetrical spots in range of +1.5–2.5°C
- 6) Flattening of thermal image on the affected breast

“Suspected Benign Process”:

- 1) Asymmetrical Thermo–Architectonic
- 2) Absence of extended vascular pattern
- 3) Presence of local monolateral hyperthermic or hypothermic areas
- 4) Absence of monolateral areolar hyperthermia
- 5) Delta T°C between symmetrical spots in range of +1.0–1.5°C or –1.0–1.5°C
- 6) No flattening of thermal image on the affected breast

In total 54000 breast thermograms were analyzed.

Internal genitalia thermograms were made out in frontal position and were interpreted according to the following criteria:

“Normal Thermogram”:

- 1) Symmetrical Thermo–Architectonic in hypogastrum area
- 2) Absence of local hyperthermic areas
- 3) Average Delta T°C between symmetrical spots in range of (plus-minus) 1.0°C
- 4) Average Delta T°C between umbilical region and projection of internal genitalia in range of 2.0 – 3.0°C

“Suspected Malignant Process”:

- 1) Asymmetrical Thermo–Architectonic in hypogastrum area
- 2) Presence of local hyperthermic areas

- 3) Average Delta T°C between symmetrical spots in range of + 1.5–2.0°C
- 4) Average Delta T°C between umbilical region and projection of internal genitalia in range of (+0.3) – (–1.8)°C

“Suspected Benign Process”:

- 1) Asymmetrical Thermo–Architectonic in hypogastrum area
- 2) Presence of local hyperthermic or hypothermic areas
- 3) Average Delta T°C between symmetrical spots in range of + 1.0–1.5°C or –1.0–1.5°C
- 4) Average Delta T°C between umbilical region and projection of internal genitalia in range of (+1.5) – (–3.5)°C

In total 18000 thermograms of internal genitalia were analyzed.

As a result of a general analysis of thermovisual images all breast thermograms were divided into the following groups (Table 2):

Table 2. Division of Breast Thermovisual Images.

| Group | Amount | % |
|------------------------------------|---------------|--------------|
| I - “Normal Thermogram” | 12,096 | 67.2 |
| II - “Suspected Malignant Process” | 1,134 | 6.3 |
| III - “Suspected Benign Process” | 4,770 | 26.5 |
| TOTAL | 18,000 | 100.0 |

Women from Group II – “Suspected Malignant Process” and Group III – “Suspected Benign Process” were referring for subsequent Mammography.

As a result of the mammography in Group II – “Suspected Malignant Process” 563 (49.7%) cases of breast cancer were revealed and proved by biopsy. In 500 women breast benign condition was diagnosed and in 71 cases breast pathology was rejected.

In Group III – “Suspected Benign Process” mammography revealed:

- Breast Fibrocystic Disease in 2,604 (54.6%) women;
- Breast Fibroadenoma in 348 (7.3%) women;
- Breast Cancer in 85 (1.8%) women (proved by biopsy);
- Normal Breast in 1733 (36.3%) women.

In general breast thermographic screening revealed (Table 3):

Table 3. Results of Breast Thermographic Screening

| Thermographic Diagnose | Breast Cancer | Breast Benign Condition | Total |
|------------------------|---------------|-------------------------|---------------|
| True Positive | 563 (3.2%) | 2,952 (16.4%) | 3,515 (19.6%) |
| False Positive | 571 (3.1%) | 1,818 (10.1) | 2389 (13.2%) |
| False Negative | 85 (0.5%) | 0 | 85 (0.5%) |

12,096 cases of women comprising Group I – “Normal Thermogram” were left not confirmed because no other than thermography studies were not conducted. On this basis we were unable to analyze possible True Negative cases.

18000 analyzed thermograms of internal genitalia were analyzed and divided into the following groups (Table 4):

Table 4. Division of Internal Genitalia Thermovisual Images.

| Group | Amount | % |
|------------------------------------|---------------|--------------|
| I - “Normal Thermogram” | 16,488 | 91.6 |
| II - “Suspected Malignant Process” | 378 | 2.1 |
| III - “Suspected Benign Process” | 1,134 | 6.3 |
| TOTAL | 18,000 | 100.0 |

Women from Group II – “Suspected Malignant Process” and Group III – “Suspected Benign Process” were referring for subsequent Ultrasound Test and Cytology of Douglass Space.

As a result of the mentioned above tests in Group II – “Suspected Malignant Process” 161(42.6%) cases of gynecological cancer were revealed and proved by biopsy. In 136 women internal genitalia benign condition was diagnosed and in 242 cases oncogynecological pathology was rejected.

In Group III – “Suspected Benign Process” Ultrasound Test and Cytology of Douglass Space revealed:

- Ovarian Cysts in 473 (41.7%) women;
- Uteral Fibromyoma in 275 (24.3%) women;
- Ovarian Cancer in 74 (6.6%) women;
- Absence of gynecological pathology in 312 (27.4%) women.

In generally internal genitalia thermographic screening revealed (Table 5):

Table 5. Results of Internal Genitalia Thermographic Screening

| Thermographic Diagnose | Cancer | Benign Condition | Total |
|------------------------|------------|------------------|--------------|
| True Positive | 161 (0.9%) | 753 (4.2%) | 914 (5.1%) |
| False Positive | 571 (3.1%) | 1,818 (10.1) | 2389 (13.2%) |
| False Negative | 74 (0.4%) | 0 | 74 (0.4%) |

16,488 cases of women comprising Group I – “Normal Thermogram” were left not confirmed because no other than thermography studies were not conducted. On this basis we were unable to analyze possible True Negative cases.

Thus taking into account such important properties of thermography as:

- accessibility;
- the relative non-expensiveness;
- providing sufficient diagnostic information;
- ease of thermovisual information analysis;

- opportunity to study a large number of people in relatively short time

We can conclude that thermography is a valuable screening method to identify mammological and gynecological pathology including such serious conditions as cancer and benign tumors.