Breast cancer

What every woman needs to know
A literary review of articles on breast cancer and future expectations

“The courage of ideas” by Laura Venturi
Thanks to:

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Alfredo Falcone – Executive director of the Oncological branch at the University of Pisa.
Paolo Simi – Executive director U.O. of Molecular Cytogenetics University of Pisa.
Simonetta Rossi – Molecular Cytogenetics University of Pisa.
Lina Mameli – Supervisor section RX local of Pisa. Via G. Garibaldi.
Alberto Del Guerra – Institute of Physics University of Pisa.
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Introduction

Breast cancer is important under a biological profile and existential as well. In the Western world, it is the primary cause of tumoral death with no distinction in age groups and it affects about 1.7 million women every year worldwide, which will suffer from negative psychological effects for the rest of their lives when they are diagnosed. Modern medicine still hasn’t given any definitive answers regarding this devastating pathology: that explains the numerous international conventions and the worldwide literature on the subject.

In addition to the senology wards, there are many charity organizations that often even offer psychological support to women in order to help them recover and reintegrate in society. Aside from doctors, breast cancer has been of interest even to writers, historians, paleontologists and artists of various kind.

Most of all, we will try to explain the advantages and disadvantages of today’s most followed diagnostic-therapeutic itineraries, without neglecting new proposals and other topics of minor practical relevance.

The bibliographic information will be limited only to respected sources and the text will contain complementary annotations.

Most of the current diagnostic and therapeutic itineraries are based on statistical analysis that isn’t always agreed on, and this awareness could persuade to take on individual choices that aren’t usually proposed.

Prevarication of the scientific data isn’t actually rare in the medical field (see recent article – April 2015 – by Alessandro Mugelli, “Believe but verify” from the magazine titled “Toscana Medica”). But the most debatable aspect of statistics, probably is the fact that many of those whom undergo prevention cures and treatments are those people who actually do not need it (and this can accredit those who claim to have cured many tumors) and others who objectively need it; and we should wonder whether or not the advantages surpass the disadvantages. As a matter a fact, every cure and/or personal awareness of certain pathologies has negative side effects, even the psychological ones, and their consequences on the immune system shouldn’t be underestimated; and, as we’ll see, they can also interfere with the complex mechanisms that regulate heredity (epigenetics).

Therefore, this written work is especially dedicated to women, so that, on the basis of the current medical knowledge and the contingent situations, it can access a more personalized approach.

Particular attention and work was put into breast thermography, which in Italy has been almost abandoned after having surpassed the analogical thermography, because of the appearance of other diagnostic instrumental imaging methods (mammography, echography, MRI, PET, etc.). Because of the digital era, thermography has aroused new interests, reaching negative predictive values so high that is has been considered an essential subsidiary in every senology centre in many countries. As a matter a fact, a normal thermogram is, in about 95% of the times, an epitome for healthy breasts, and it’s rarely indicative of a tumor or other pathologies.

Generic abnormal thermographies usually precede the appearance of a tumor by 8-10 years. To read a thermogram means to interpret it, and this can be done by a radiologist, but after an adequate training, it can also be done by any type of doctor or specialist.

A popular work on thermography can be found in digital format in the library of Amazon.it:
the author is a paramedic that works in the city of San Diego (Michael Wedge) referent to the Board Certified Clinical Thermography, and his work can be of help for anyone who, even in Italy, wants to dedicate himself to this new renewed field.

Additional information can also be found online under “Breast Thermography” in the form of videos on YouTube and texts and/or articles written by the best experts in the field.

REFERENCES


*The “Susan G. Komen” is a non-profit association based on charity work that fights against breast cancer since 2000, and operates in many countries, Italy included.
Chapter 1
Incidence

Data from the AIRT (Italian Association of Cancer Registry)

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<th>Maschi - Età</th>
<th>Femmine - Età</th>
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<tr>
<td>Rango</td>
<td>0-49</td>
<td>50-69</td>
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<tr>
<td>1°</td>
<td>Testicolo (12%)</td>
<td>Prostata (23%)</td>
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<tr>
<td>2°</td>
<td>Cute (melanomi) (9%)</td>
<td>Polmone (15%)</td>
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<tr>
<td>3°</td>
<td>Linfoma non-Hodgkin (8%)</td>
<td>Colon-retto (14%)</td>
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<tr>
<td>4°</td>
<td>Colon-retto (8%)</td>
<td>Vescica* (10%)</td>
</tr>
<tr>
<td>5°</td>
<td>Tiroide (7%)</td>
<td>Vie aerodigestive superiori (5%)</td>
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The first five tumors in terms of frequency and rate on the total of incident tumors, without factoring in the cutaneous carcinomas for gender and age. Tumors that affect sex organs are, in both sexes, at the top of the list, and continue to grow. In 1970 breast cancers affected ≈1 every 11 women; nowadays ≈1 every 7.6 women.

Breast cancers (Tuscany).
Area covered by the tumor registry of the Tuscany region.
Chapter 2
Anatomy (general details)

The breast consists of:

a) a glandular acinous tissue that develops up until puberty (lobules);

b) a support of infra and extra lobulated stroma;

c) a lymphatic and vascular reticulum;

d) fat;

e) an external layer;

f) a structural integrity maintained by supports, such as Cooper’s ligaments.

Therefore, the breast has complex anatomical characteristics, that, in the course of life, undergo various changes; especially related to hormonal fluctuations (period, pregnancy, breastfeeding) and it is subjected to an atrophic adipose involution due to menopause. It is also influenced by external factors (e.g. abuse of caffeine) and endogenous ones (e.g. hormonal imbalance and utero ovarian dysfunction). The glandular and adipose components constitute almost the entirety of the normal breast with a percentage of about 50% each.

The glandular system of the breast (from 15 to 20) has been compared to the appearance of a tree (arboreous appearance), in which the peripheral secretory lobules resemble the foliage, the various ducts resemble the branches and the terminal duct (or galactophorus duct) the trunk; the latter leads to the tip of the nipple, after having created a small sacciform dilation known as “lactiferous ampulla”.

Lateral and frontal view of the area of the nipple, where the ducts can be found.
Tree-like appearance of the gland.

(From: László Tabàr (Sweden), Tibor Tot (Sweden), Peter B. Dean (France) – The basis for understanding the breast in health and disease, C&C Offset Printing Co., Ltd. 2012).
Note – The female human breast can not only be analysed in anatomical terms, but also in other various aspects: in fact, it stimulates sexuality (and therefore has a very important role in the preservation of the human species); it is an aesthetic emblem of physical attraction (and so, has a considerable selective role in the improvement of the human race); with breastfeeding, it strengthens the maternal-neonatal bond (a protective purpose for the offspring). But the external appearance of this admirable organ can also have negative worth (pornography, prostitution, extreme sexual behaviour, etc.) and/or positive, causing now and then worthy emotions, like for example the loving eyes of a mother who contemplates her beautiful newborn. In the Christian iconography, it constitutes the symbol of maternity in its purest form, and it indicates the bond between the superior Entity (the Virgin Mary) and Humankind in its entirety. It can be established that the female breast has had crucial influence in the development of our species creating behaviours that go beyond its specific anatomical-functional characteristics.
Chapter 3
Pathology

Breasts can be affected by various benign pathologies (dystrophic alterations of various kinds, mastitis, hormonal imbalance, etc.) that can evolve into cancer (pre-neoplastic lesions). We know that in 70 to 80% of cases it starts in the epithelium of the DCIS (Ductal Carcinoma In Situ) or also the LCIS (Lobular Carcinoma In Situ) and then spreads locally (I, II) into EBC (Early Breast Cancer), then it can become locally invasive (III) into LABC (Locally Advanced Breast Cancer / or LIBC Locally Inflammatory Breast Cancer), and can also spread to the entire organism through the haematic and lymphatic system (IV) into – MBC (Metastatic Breast Cancer).

HISTO-PATHOLOGY (cysts and cancer – spiculet appearance like a “sea urchin”.
A – Dilated ducts occupied by fluids and/or tumoral cells – Cyst.
B – Dilated ducts with tumoral cell aggregates DCIS (0) (appearance of a sea urchin).
(From: László Tabár (Sweden), Tibor Tot (Sweden), Peter B. Dean (France) – *The basis for understanding the breast in health and disease*, C&C Offset Printing Co., Ltd. 2012).

Personalised therapeutic protocols are given at each stage, holding into consideration other factors (age, branch of the neoplasia, familiarity, hormonal imbalance, etc.).

*Histologically speaking there are many kinds, but like every type of tumor, when they evolve they modify their biological characteristics and this causes some difficulties with the treatment: this is an important critique, based on the fact that every living entity is unstable, and it reacts by trying to adapt – If it doesn’t succumb – to the changes, and even the cures should adapt to the context afoot, so that they can be as effective as possible.*
Chapter 4
Risk factors¹

Generic endogenous risk factors:

a) History of menstrual period. The duration of the female fertile period affects the possibility of breast cancer. If the menarche is premature and/or menopause is late, then the neoplastic incidence is greater, but if the time in between is less then there is less risk.

b) History of reproduction. Women with numerous children, who breastfeed are at lesser risk than nulliparas. Although it has been asserted that during pregnancy and nursing the risk of tumors increases, and then progressively decreases.

c) Excessive weight. Obesity is a generic risk factor for all neoplasia, but when it comes to breast cancer there is greater risk, especially after menopause. WCRF (World Cancer Research Fund) suggests to maintain a certain BMI (Body Mass Index) and not to go over the normal range (18.5-24.9 kg/m² of body surface area).

d) Dense Breasts (rich in glandular tissue and poor in fat).

e) Illnesses (diabetes, autoimmune thyroiditis in which the risk is greater by 3 times).

Generic exogenous risk factors

Alcohol abuse, tobacco use, various intoxications, lifestyles, eating habits, cultural levels, environment, medicine prescriptions (anti-hypertensive), hormonal treatment as a substitute during menopause, phytoestrogens, oral contraceptives (the pill), geographic areas, etc.

Note – It’s obvious that on risks such as these it is hard to concretely intervene. Too many uncountable variables operate on these risks, and the level of danger usually isn’t known; but some of these can be avoided by each and every individual especially if certain cases of familiar neoplastic are known. Regarding location²³, breast cancer is less common in women from Central Africa and East Asia, but the incidence adapts progressively to more advanced countries if we look at Europe, North America or Australia. But even in the single areas of each nation the incidence can vary: for example, in the USA it is greater in DC (District of Columbia) (143 in 100,000 inhabitants every year), but it is less common in New Mexico (110 in 100,000) with a national average of 123 in 100,000. Similar data can be found concerning mortality: it is greater in the district of Columbia (29 in 100,000) and lesser in Hawaii (15 in 100,000) (years of reference 2007-2011).

Furthermore, substantial variations were found in the USA’s races (Hispanic, Caucasian and African). Because of these differences, various factors were found: a) genetics and biology of tumors; b) dangerous environmental situations; c) socio-economic circumstances; d) delay in diagnosis, different access to cures; e) habits and lifestyles; f) diet, etc. but, essentially, the reason is unknown. Overall, all of these variables make it extremely difficult to calculate statistics that should be done by a multidisciplinary team: therefore, that explains the discordances present in literature, and it shouldn’t be excluded that there is a possibility that many of the reports are inexact, making them unreliable. But if these informations are analysed individually, they could be scientifically useful to determine causes, concomitant causes and side effects in breast cancer, but also in other different pathologies. Regarding nutrition, many particular diets have been proposed, rich in vegetables, but poor in red meat and simple sugars (common in processed foods). However, no statistically convincing proof is yet known.
Specific endogenous risk factors

Genetics and molecular diagnosis (generality) – In the last twenty years, post-mendelian genetics, has invalidated different principles that in the past were considered fundamental, like for example, the theory that for every genetic mutation there is a single precise illness. Two concepts have surfaced: “clinical heterogeneity”, a single hereditary variant can cause more than one illness; and “genetic heterogeneity”, one single pathology can depend from a mosaic of variants.

Another new concept is the one in which cells with identical DNA can give different answers to the same genetic message or have different forms and neoplastic development gradation, modifying their DNA during mitosis. The study of these processes (epigenetics) changes the concept that the genetic variations act alone, but instead introduces the concept of a “reciprocal interference”, in the sense that even the peripheral cells participate in the hereditary mechanisms. What happens then is that the genetic modification acquired in life, can translate into hereditary forms that are transmissible to future generations. That means that even nowadays we could be subjected to the influence of mutations that took place in a recent past from the survivors of the Nazi concentration camps.

Bruce Lipton, professor of cellular biology at University of Wisconsin’s medical school and expert in epigenetics, has formulated a hypothesis for which genes do not control themselves, but are influenced by the environment, and he quotes a recent statistic from the American Cancer Society which states that about 60% of tumors could be avoided if only healthier lifestyles were chosen. This explains many strange behaviors: the reason why certain genetic variants transmit in a dominant autosomal manner in some tumors, and a recessive autosomal manner in others; the reason why the same genotype can correspond to a different phenotypic severity (of the same family) in correspondence with an identical illness (“variable expressiveness”); ultimately, why some populations are more or less receptive than Others for certain types of pathologies and how personal existential situations (in particular those that are of greater impact on the psyche) can influence the appearance of cancer. In this viewpoint, the concept of “individual sensibilities”, can at least partly be explained, for which, not the illness is inherited, but the predisposition to the illness. This is why there are so many carriers in which the tumor or other pathologies don’t appear. It can be concluded that there are many factors that are hard to interpret (lifestyles, environment, but also existential situations, etc.), but that surely interfere with genetics’ mechanisms, to achieve a more dynamic and less static point of view of Mendel’s “peas theory”:

“The Heavens help happy people”; proverb that has also been confirmed by a study of the Wayne State University (WSU), published in “Psychological Science”, that says that happy people who smile live seven years longer than Others.

Note – This general information is necessary to the understanding of the future prospects regarding cancer, in which many of the current methods of diagnosis, based on “images” will be re-dimensioned and/or substituted with others, but they also make us grasp the reason why molecular genetics and biotechnologies are still not able to give certain answers: the variables are enormous. Often ambiguous and/or known, so the only resources left are “statistical investigation” and “stochastic”, which, even though they are formally valid, they serve as “distinction” and, sometimes, they are purposely proposed in an incorrect manner. They can vary from place to place and because of this they can’t be applied to similar contexts.
Genetics of breast cancer – On the basis of epidemiologic studies done in Europe and in the United States, it is said that at least 5 to 10% of breast cancer cases show a strong familiar coalescence that suggests a hereditary predisposition to the illness.

In 1994, two genes named BReast CAncer 1/2 (BRCA-1 and BRCA-2) were made known to the scientific community, respectively positioned in chromosome 17 and 13, and their mutations are transmitted in a dominant autosomic manner and cause together about 75% of mammary neoplasms on hereditary basis, whilst the other 25% is attributed to mutagens only partly identified. These two variants interest only about 2 to 3% of the population, but their incidence varies based on the geographic areas (greater in Northern Europe: Norway, Sweden, Germany, Iceland; minor in the countries in the equatorial area and South America) and on race (higher in Caucasian people; less in Hispanic and African).

These individuals that fall within the 2-3% of the population are predisposed to ovarian cancer, and although rarely, other organs can also be affected (colon, pancreas, thyroid, cutaneous melanoma; also “peritoneal primary carcinomatosis” which is similar to ovarian cancer for its histological characteristics). Women with mutations in the BRCA-1 and/or BRCA-2 genes are predisposed to the possibility of developing a mammary carcinoma in the course of their life in 50 to 80% of the times (if they hold one or two of the anomalies), instead for ovarian tumors the incidence is of about 20 to 40% for the BRCA-1 gene, and 10 to 20% for the BRCA-2 gene.

The mammary carcinomas that are tied to the mutations of the BRCA-1/2 genes tend to manifest at a younger age even though the risk persists for the rest of one’s life (up to 87% for women who reach or are older than 70). In normal conditions, these two genes produce proteins (“type 1 and type 2 susceptibility proteins”) that help repair the damages done to the DNA and are part of the “onco-suppressors” genes that help maintain a reproductive balance of the cells. This means that they intervene with the help of their proteins in one of the different phases that regulate the molecular multiplication, and, more precisely, in that phase called G2 that is in charge of the preparation for the next division (mitosis).

Other variants can damage this process and favour the appearance of daughter cells, with mutated DNA: this creates a “genetic susceptibility” for various pathologies (even with various degrees of penetrance), and more specifically the neoplastic type.

Type 1 and type 2. Susceptibility proteins.
Susceptibility proteins for breast cancer (respectively named BRCA-1 and BRCA-2), that intervene in controlling the cellular cycle, repairing possible ruptures and/or errors in the second filament of DNA.
Nowadays, this is the reason why a preventive bilateral mastectomy is suggested already from a young age and/or the ovariectomy around 45-47 years of age for women who result positive to these two genetic variants.

They are transmitted by each parent in equal measure (50%) to both the sexes, so even the male children have a greater probability of developing certain tumors, even breast cancer. Specifically, the risk of developing prostate cancer has been estimated 3 to 4 times more probable in whoever presents hereditary mutations in the BRCA-1 and BRCA-2 genes, instead the risk for colon cancer in both sexes is 4 to 5 times higher. The recognition through genetic research of an individual risk imposes a higher surveillance in these individuals (Active Surveillance – AS), and when possible, the elimination of all those factors that are considered to be responsible for the onset of certain tumors. For women who present a greater genetic risk for breast cancer, it is preferable to avoid the exposure of the chest to ionizing radiations, and to choose instead (when possible) other diagnostic alternatives to a mammography (eco-thermography, MRI).

The surgical removal of the ovaries or prophylactic sapling-oophorectomy in the fertile age eliminates ovarian tumors and reduces the risk of breast tumors in general, by taking away the hormonal stimulants, but it does create Others imbalances (infertility, decrease of libido, osteoporosis, etc.).

Moreover, all tumors are more frequent in people who have genetic characteristics that are predisposed to obesity and it is also possible that in these types of cases hormonal factors shouldn’t be overlooked.

There are also other genetic variants that have a certain importance in breast cancer, especially if linked to specific treatments. As a matter of fact, certain genes are known to regulate the normal progression of cells and their hormonal receptiveness. Specifically, the gene HER2/neu (“Human Epidermal grow factor Receptor 2”) is a factor of cellular growth that produces certain proteins denominated HER2. On neoplastic tissue specimens, we can isolate and identify the increase (positive HER2) or decrease (negative HER2) of these proteins. There are genetic mutations that involve an excess of these proteins in about 1 in 5 breast cancers (≈25%). In the case that an increase is notable, then specific pharmacological therapies are adopted to block the signals.

In the positive HER2 you can notice an incontrollable increase of cellular proliferation and the neoplastic variants that derive are even more aggressive.

In about 75% of women there is a particular receptiveness to estrogen (ER positive) and in about 65% also to progesterone (PR positive): this means that they have certain genetic variants that are subjected to a numeral increase of one or both of these two hormonal receptors. Therefore, medication such as Tamoxifen and Raloxifene is prescribed to these patients: in fact, those who are ER/PR positive respond to these endocrine therapies 60% of the times, while other patients (ER/PR negative) only 5 to 10% of the times. Adequate medical therapies (Tamoxifen and Raloxifene), aside from surgical therapies, can still reduce the effect of these hormones, and therefore decrease the incidence of the so-called hormonal-sensitive breast tumors.
Basically, four cases can occur: 1) ER/PR+; 2) HER2+; 3) triple negativity ER-, PR-, HER2-; 4) triple positivity ER+, PR+, HER2+.

Women who are going through menopause should avoid hormonal replacement therapy (HRT), especially those who have a positive “genetic record” even if they’ve had mastectomies. Testosterone can be used by both sexes with the purpose of reducing the incidence of breast cancer.

Medication like Tamoxifen and Raloxifene reduce the risk (chemo-prevention) of tumors even in women who are BRCA 1/2 positive, make less frequent the recurrence of contralateral breast cancer after mastectomies and, locally, after quadrantectomy or bilateral mastectomies. What should be acknowledged is that the latter procedure does not guarantee a full recovery in loco-regional recurrences, because some tissues at risk can still always reside\(^5\). Therefore, hormonal therapies are done as a preventive measure after certain surgical operations, after chemotherapeutic and/or radiotherapeutic treatments for at least 5 years, but are interrupted after menopause when the production of hormones ceases.

**Genetic research** – Genetic research is suggested for those who have a medical history of breast cancer in the family (especially if bilateral), also regarding relatives who aren’t blood related and relatives of previous generations (up to the 3\(^{rd}\)). It should also be extended to other neoplastic variants such as: ovarian tumors in women and breast cancer in men, bone sarcoma, Hebrew ancestors (in which the gene BRCA-1 is much more frequent: ~ 8-10% more frequent than the average), different multiple tumors, and also gliomas, neoplasms of soft parts and suprarenal glands, if they occur at a young age\(^6\).

*In women who are born from Others suffering from breast cancer or who have sisters that have been affected by it by the age of 45, then the risk is double compared to the rest of the population.*

Other than for the two variants responsible for ovarian and breast tumors, “genetic tests” can also be used for hereditary disorders, for example, the Lynch and Li Fraumeni syndrome increases the risk of various neoplastic types; the latter is a rare dominant hereditary pathology that affects young individuals predisposing them to different types of cancer: osteosarcomas, sarcomas of soft tissues, leukemias, lymphomas, adrenal cortex and cerebral neoplasms, but also breast cancers (clinical heterogeneity). In 70% of families in which these juvenile pathologies occur, a mutation in the genes TP53 and hCHK-2 has been found (the former is the most important and the most versatile onco-suppressor gene). In these cases (like in others), a “prenatal genetic diagnosis” is suggested and it can be done by getting a DNA sample from the chorion’s villous cells around the 10\(^{th}\) week of pregnancy – but other methods are also available.

Generally, these “genetic tests” are limited only to four variants (BRCA 1/2, TP53 and PTEN: the phosphatase enzymatic activity is a growth factor that is regulated by its proteins), however, other known but atypical variants (more than 10) can increase the risk of breast cancer: these would be proposed only in the event of recognizable instances in which the first four result negative.

Tests for BRCA 1/2 don’t always give safe answers. About 10% of women who result positive to them receive false positive results, because variants that aren’t necessarily correlated to breast cancer are detected\(^7\).
All of these factors, are statistically quantifiable, and that justifies the use of a genetic in-depth analysis to ward off the illnesses.

Note – It is also important to explain the concept of “risk”, in the sense that at least two categories can be identified: a “general risk” of pathology and a “risk pertinent to certain of its characteristics”. In fact, if a person has a risk of about 10-20% calculated on the whole population for a certain type of tumor, it is not like saying that there’s a risk of 10-20% of some of its characteristics: the variant HER2 (25%) in women with breast neoplasms (1 in 8) is very low, because it represents the percentile of a percentile. Other factors that shouldn’t be disregarded are for example the factor for which one same tumor can be common in certain environmental situations and rare in others, and so the request for “genetic tests” has to be done on the basis of appropriate and personalized parameters, and this can only be done by experts. In other words, a genetic research is justified only if it gives the possibility to eliminate or reduce potential damages, otherwise it should be avoided.

The Italian Society of Human Genetics operates in Italy in collaboration with the Working Party dedicated to Oncological Genetics. The ISHG provides, in a scientific setting, an Oncological Genetic Consultation (OGC); the result gives indications of the individual’s genetic predisposition, and it gives one the possibly to take certain specific measures regarding clinical and instrumental health monitoring following specific formalised and approved guide lines recognised nationally and internationally. Other specific reference centres for rare pathologies are available on the Internet.

Specific exogenous risk factors

Ionizing radiation (which means with a frequency ≥ 3x10^{15} Hz). The cancerogenic effect of ionizing radiation is well documented and it has been linked, not only to the age of when the individual was exposed (max within the first 20 years), but also to the amount of exposure accumulated in time (delayed effect). Animal testing has revealed that the susceptibility to ionizing radiation in the mammary tissue is higher during puberty. It then decreases, but does not entirely disappear, with the aging and transformation of the glands.

Note – Ionizing radiations are electromagnetic waves or subatomic particles that are able to ionize atoms (or molecules), thanks to their high level of energy. In doing so, they break the nucleus-electrons bond, and therefore damage, the cells, especially by water radiolysis (H_2O → HO^- + H^+) of which they are high in level. Common non-corpuscular ionizing radiations used in the healthcare sector, are represented by Roentgen rays (X-rays). Other ionizing radiations are “beta” and “gamma” rays, generated by radionuclides such as technetium and iodine 131; these are used in diagnostic and/or therapeutic procedures. Ionizing radiation has many harmful consequences and these can be attributable to DNA mutations with the potential negative effects that can produce the onset of solid tumors, of leukaemia and lymphomas, which later can also negatively influence the reproduction system. The damages caused by ionizing radiations are rarely immediate; instead it is common to have long periods of latency. The most important studies regarding breast cancer were performed mostly on: the 76,000 Japanese women who survived the Hiroshima and Nagasaki atomic bombs in 1945; the tuberculosis patients who underwent numerous fluoroscopies, tomographies and x-rays; those who underwent radiotherapeutic treatments for post-partum mastitis with doses between 70 and 1000 RAD (Radiation Absorbed Dose). In all of these cases occurring prior to the advent of screening, the increase of breast cancer patients concerned mostly women not older than thirty years of age."
These results (beyond the experiments done on lab animals) furnish us with the first clue:

“To reduce the late appearance of breast cancer and other tumoral pathologies, one must avoid – respecting, however, the principles of justification and optimisation (relationship between costs and benefits) – biomedical imaging exams especially in the chests of women under 30 years of age, as well as any type of ionizing radiation therapy.”

b) Infections – the incidence of lethal neoplasms is attributed mostly to viral infections according to geographic areas: in Africa it’s 25%, while in more advanced countries it is 10% and these are mainly caused by viral infections. Viruses that can develop neoplasms are called “onco-viruses”, and the most common is the human papilloma virus considered to be responsible for the majority of cervical cancers. The virus’ function at the early stages of breast cancer has yet to be defined. The virus that seems to be more of a direct influence is the Epstein Barr Virus (EBVirus), this virus can also cause certain nasopharyngeal lymphopaties and neoplasms. In other cases, the infective factors would operate indirectly causing inflammatory mastitis. The reason why the Epstein Barr virus has caught the attention of so many researchers dates back to the year 1944, when it was casually found in the tumoral cells of a cat 9. Moreover, it was noted that many other infectious agents (about 61), among which the human papilloma virus, can be found in 30% of breast carcinomas and prevail in the most aggressive cases (32%) compared to the less aggressive (9%) 10. In a study conducted on the women in Sudan, in which the mutations of the BRCA1/2 genes are rare, the Epstein Barr virus was found in the neoplastic cells in 55.5% of the times and in less than half (23%) in the normal reviews11. Data obtained is absolutely contradictory: from a complete absence to varying percentages relative to the presence in DNA from tissue samples (from 0% to 51%) of this onco-virus12. This is the reason why the majority of the authors believes that the etiopathogenetic component in the infectious agents is a problem that has yet to be resolved, and the viruses could constitute only as co-factors in the onset of breast cancer.

REFERENCES

Generality – it is common knowledge that the successful treatments are so thanks to early diagnosis; the mammography is considered to be one of the best diagnostic methods, because it allows to see asymptomatic nodules, even of 0.5 cm, where the tumoral cells replace the sane ones, changing the loco-regional structure. Especially in the oncological field, current technologies have caused the over-diagnosis problem: this means that the machines can detected even the smallest lesions that don’t always evolve, or they develop so slowly to basically result as innocuous, but this makes it so that medical assessments or cures aren’t necessary (overtreatments). It is well-known that, regarding DNA mutations, one single tumor can take on different development gradations that can go from chronicle forms or not that aggressive, to Others that occur suddenly and can cause death within a few months.

“Small dimensions” isn’t always a determinant parameter, instead it is only one of the many elements that influence the neoplastic dynamic; there is a grey area between benign and malignant tumors, where unknown biochemical entities operate, and in doing so histological samples become unreliable, therefore: the term “cancer” should only be used when it becomes deadly if left untreated.

Even though premature diagnosis is considered to be the foundation of modern medicine in senology, it has also been taken into consideration for other reasons: metastatic spreading without apparent primitive lesions isn’t uncommon (false negatives), while the possibility of highlighting smaller images increases the number of false positives: this requires other tests, that causes discomfort in patients, and increases the healthcare expenditure. This is most common in the diagnosis of breast cancer, because of the complex anatomical breast characteristics and the technologies used to locate millimetric tumoral aggregates.

In an editorial from “Journal of the American Medical Association (JAMA)” (July 29th 2013), there was a “Viewpoint” that sums up the work of the “National Cancer Institute (NCI)”: «Over-diagnosis and overtreatment in cancer; an opportunity for improvement». These two possibilities are more frequent than one might think, and general screening contributes to the increase of their incidence.

It is possible that current statistical researches could result unreliable or only apparently positive when done through the use of the usual temporal parameters (healing, survival and death within 5 years); this could possibly be linked to the diagnostic preview that modern technologies – mostly screening tests – allow.

It is certain, though, that the finding of pre-cancerous lesions and/or small neoplasms, is of great importance. The Pap-test, for example, (to be done periodically in women between the ages of 20 and 65) avoids the insurgence of cervical cancer in ≈95% of the times (also because it identifies viral pre-cancerous lesions), while the removal of small infiltrating cutaneal melanomas (≤ 1 mm) usually entails healing.

This does not mean that there isn’t the possibility of “over-diagnosis and overtreatment”, but in these cases, the diagnostic procedures are simple and the cures are usually less invasive and more definitive. In other words:

«It’s not worth the trouble and it’s better not to take risks». 
Different authors believe that a late diagnosis for breast cancer is preferable to an early diagnosis, because there isn’t any convincing proof that breast screening tests reduce mortality, while adequate therapies done in the early stages have the same efficiency.

Many authors believe that screening test only anticipate the diagnosis, while the mortality due to more aggressive variants remains unvaried in time.

In other words, these researchers think that: “It's not worth the trouble”.

Obviously, there are also opinions in favour of mammographic screenings, like for example the “Euro screen Group”, which in an article published in “Journal of Medical Screening (J. Med. Screen.)” in 2012 that says that screening tests reduce mortality, so they are more favourable.

An early diagnosis isn’t always possible. In fact, in the early stages tumors result as asymptomatic and if they affect important organs (liver, pancreas, lungs, stomach, brain, etc.) than they are caught too far along, when they become symptomatic: in these cases, if they aren’t too aggressive then they have a higher chance for success, and so, the size is less important than other factors, such as location, external appearance and histochemical reports.

Breast cancer diagnosis goes from the most traditional methods (inspection, palpation, etc.) to the more modern and complex (thermography, mammography, CT, MRI, PET, etc.). But despite the big technological advancement and the existence of efficient therapies: “the problem has yet to be resolved”.

In fact, breast cancer affects 1.7 million women all around the world every year and in the Western Hemisphere it is still the primary cause of tumoral death in women of all ages. In Italy, according to AIRT data relative to the years 2007-2010 (pg. 6), the incidence of breast cancer is 41% (compared to the incidence of all the other tumors) for women between 0 and 49 years of age, 35% for women between 50 and 69 years, and 21% for women over 70, with a mortality of 17.1%. Therefore, there is uncertainty regarding the efficiency of mammographic screenings considering the introduction of the Papanicolaou test or Pap-test for the cervix – applied in Italy since 1953 – that has registered a drastic incidence decrease compared to the past (only 4% between 0 and 40 years of age), and the mortality as almost vanished.

As a matter of fact, this research allows to determine the conditions that can precede the onset of a tumor, or identify it when it is still in its cellular state, while with imaging researches all of this is possible only when it has reached its nodular aggregated form made up of different billion atypical cells.

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Note – before going into the various diagnosis methods, one must clarify the concepts of “sensitivity” and “specificity” in the diagnosis tests. “Sensitivity” stands for the capability of a test to generically identify a pathology, so it is as sensitive as the low number of “false negatives”. For example, the increase in blood of the Erythrocyte Sedimentation Rate (ESR) or the febrile illness is common in many pathologies, but they rarely identify the cause. “Specificity” is the capability to recognize the nature of an illness, and therefore, to reduce the number of “false positives”. The histological exam of a biopsychic sample is usually more specific because it often identifies a pathology, but it applies only after it has been generally determined.

Theoretically, a diagnostic test would be perfect if it were 100% sensitive and 100% specific. Generally, though, all diagnostic tests have a probabilistic validity so infallible analysis doesn’t exist. Problems regarding sensitivity and specificity aren’t uncommon in medicine, but they are even more common when talking of senology, and this is one of the reasons why there are controversies concerning the use or not of certain diagnostic procedures.
Breast physical exam (inspection, palpation and self-palpation)

These three non-instrumental methods allow to identify only the advanced lesions and, if one were to accept the idea that the success from these therapies depends on an early diagnosis, they would be useless. If a neoplasm is clinically visible (nipple retraction, swelling and/or cutaneal infiltration, etc.) it means that it is generally bigger than 2 cm in diameter; considering the fact that a neoplastic lump of 0.5 cm contains billions of tumoral cells. If a metastasized breast cancer is ≥ 2 cm than the chance of survival is less than two years. Even self-palpation doesn’t statistically affect survival: as a matter a fact studies haven’t proven any decrease in mortality through this method. Individual breast exams (Breast Self-Examination – BSE), in a survey conducted by “Gallup poll found”, have been shown to be done by 1 in 3 women in the USA, and the lesions that are found are 0.75% smaller than the ones that are found unexpectedly. Approximately 100% of tumoral nodules of about 2.5 cm, ¾ (75%) of 2 cm, ½ (50%) of 1.2 cm, ¼ (25%) between 0.5 and 1.2 cm, none if <0.5 cm, are located by self-palpation. The mammographic test is believed to be able to locate a mammary nodule between 2 and 4 years prior to it being palpable, but the time that intervenes between the onset of the tumor and its mammographic visibility is at least 8 years. Even for experts and well-trained medical examiners it is difficult to manually distinguish a benign lesion from a small malignant nodule, therefore it can be concluded that the physical breast exam and/or self-exam, is only for guidance purpose and it can’t be used as a routinely early diagnosis for the cancer.

Screening test

There are many controversial views regarding screening tests for early diagnosis in breast cancer. The most common one is a biennial mammography for women between 49 and 69 years of age. In some western countries (Italy included), all women are invited to participate in these tests, while in other countries it is a personal choice (USA, Canada, Balkans, Slovenia, Czechoslovakia, Ukraine); nations such as Switzerland, have stopped using these screening tests, because they are believed to be useless. Since the transition from the analog era to the digital era, many researchers believe that mammographic screening tests could be replaced with the thermographic tests: this could have its convincing reasons.

The most known supporter of this theory is Dr. Christiane Northrup of the Maine Medical Center (MMC) in Portland, Maine (USA); she is a well-known researcher and author of many publications regarding the well-being and the protection of women’s health. She believes that the thermographic diagnosis for breast cancer could be done from the onset of the tumor, while it’s still in the cellular state (like for cervical tumors), it could identify cancerogenic situations and could foresee the possibility of breast cancer far ahead (8-10 years). She states (without referring to any source) that after 90 days from the appearance of the first tumoral cell the number duplicates, after one year it becomes 16 cells, after five it becomes 1,048,576, and after 8 years it becomes an aggregate of about 4 billion cells (a doubling of 25 in 7 years).

Even though these calculations are obviously an estimation (one billion is equal to 10⁹), it’s questionable whether a neoplastic breast nodule, even of 0.5 cm, is made up of billions of cells; so this means that the diagnosis could be belated even in these cases, and it could explain the many mammographic screening test failures.
Medical thermography or Digital Infrared Thermal Imaging (DITI)  

It is a known fact that tumoral tissues are more active than normal ones, therefore, they have a greater need for oxygen and glucose (MGR – Metabolic Glucose Rate). This means that there are greater nutritional requirements, and consequently, an increased blood flow (RBF – Regional Blood Flow). To be able to maintain their growth, new blood vessels are formed (neo-angiogenesis) and this is the main reason why neoplasms emit more heat in the form of infrared compared to the healthy regions. Regional hyperemia can also be found in many other breast benign pathologies (proliferative dysplasia, phlogosis, trauma, etc.), and even though the thermographic reading is simple, there are still big interpretative problems: this is why the analysis of numerous abnormal images must be done by someone with a lot of experience and competence. Thermography isn’t used in Italy as much as in the USA (there’s the American College of Clinical Thermology (ACCT)), even for medico-legal problems; it’s even popular in many other countries (Canada, Australia, Norway, Germany, Austria, Poland, Portugal, United Kingdom, Japan); in Brazil, there’s also a specialization school just for thermography. In a study done on 16,000 women (1977), as a comparison between Mammography and Thermography, the first one identified 78% of tumors, while the second one only 17.9% of real positives (specificity) of 39% of possible positives (sensitivity). With this research, it was concluded that mammographic tests are the "gold standard" for breast cancer diagnosis, and thermography was downgraded as a "pseudoscience". Nowadays, it’s part of the Complementary Alternative Medicine (CAM).

In the last 30 years, infrared sources have been subject of study by NASA (National Aeronautics and Space Administration) and other numerous Centers (infrared astronomy). Infrared space telescopes have particular digital sensors (Quantum Well Infrared Photo detector – QWIP) that exploit the “windows” that are formed by the wavelengths that make our atmosphere transparent. These advanced researches have had relapses, especially in the military field, but also in other circumstances. As a matter a fact there are at least 20 other fields that use thermography, like the planet’s thermic mapping, the search for archeological sites, construction industry, volcanology, night vision and safety; in industry, it is especially used for the identification of wasteful energy consumption of mechanical systems.

It is understandable why thermography has caught the attention of the medical field, especially of the senology branch.

Telethermography or non-contact thermography uses one or more thermographic cameras and identifies possible pathologies of the whole body, even for more superficial organs such as skin, thyroid, and especially breasts (Breast thermography). Since the modern equipment is digitalized, there are also certain types of software to help with the diagnosis (CAD – Computer Aided Detection Systems). When we talk about an infrared camera’s sensitivity, we are talking about its capacity to visualize a good-quality image even if the thermal contrast is low (indicated with Δ); the sensitivity is reported in NETD (Noise Equivalent Temperature Difference) and expressed in degrees Kelvin (0 Kelvin (K) = − 273.15 degrees Celsius (°C)); the magnitude indicating the minimum temperature difference capable of producing a signal equal to that of the background noise of the enclosed.
Current thermographs have a sensitivity (accuracy) of 0.05 °C; in a matter of a fraction of a second they allow to visualize vast areas of the human body; they produce images between 10° and 55°C; they have a spatial resolution of 25-50μm and they have a better software to analyze specific anatomical areas of interest, like for example, breasts.

The second principle of thermodynamics asserts that heat transfers in an irreversible way from a hotter body (in this case a neoplasm) to a cooler body (in this case skin), and this process is linked to the arrow of time. Therefore, it’s understandable why a minimal increase in skin temperature can identify an underlying pathology even if it’s deep, but without being able to recognize its morphological and structural characteristics.

Stefan-Boltzmann’s law states that: “the irradiated energy $q$ emitted by a black body is proportional to the fourth power of its temperature ($q = k_B T^4$ – where: $k_B$ is the constant di Boltzmann and $T$ is the body temperature in Kelvin degrees)”; in fact, the measurement of $q$ is preferable to the direct detection of $T$, since a small variation of $T$ corresponds to proportionally much higher values of $q$.

Medical diagnosis uses passive thermography, which doesn’t require any type of external heat source, while in other cases the active thermography is required, in which the reflected infrared rays are measured, like for example with planets that are illuminated by the sun.

Another interesting method is the so-called “dynamic”, which consists in the cooling of the area of interest, and then one must measure the TRT – Thermal Recovery Time. The TRT is the different times in which the heating happens in the various tissues: it’s as if you had a local, temporary and reversible cadaveric cooling, and then a vital recovery, when taken the deep-freezing factor away. With this technique, it is possible to distinguish the minimal variations in temperature in the various phases of thermal recovery, and it is obvious that metabolically more active tissues, like tumors, heat up sooner and more intensely. Moreover, it adds specificity to the already high level of sensitivity of the normal thermography, because TRTs are different for each type of tissue.

In the USA, a “thermologist” is a specialist who reads and interprets a thermogram and is an expert in distinguishing possible diversity in symmetric models of heat (heat patterns), like for example, two breasts. Many of these thermal variants are easily explainable and don’t require further assessments.

In Northup’s opinion, many women that have an abnormal thermogram are at greater risk for tumors, especially in the presence of a neoplasm in the family. Vice versa women that have genetic susceptibility for breast cancer (BRCA-1 and BRCA-2) can delay the prophylactic mastectomy and avoid the preventive chemotherapy, or the one with estrogen inhibitors before the appearance of thermographic anomalies, therefore bettering their quality of life. In fact, it registers, in the form of heat, cellular activity or the inflammation that surrounds the miniscule aggregates in the cancer that is invisible to the mammography, this way it precedes its apparent appearance early on. It is also useful for recognizing and monitoring other reversible pathologies like cystic fibrosis, infections, vascular disorder, hormonal imbalance etc. Therefore, since the elaborated thermograms are made up of false colors of different intensities, you obtain a detailed topographic mapping that makes it easier to compare two breasts in between periodic check-ups, that in normal conditions should result as similar to one another. Every image captured with a thermograph is then memorized in a computer where it can be analyzed in great detail. It is a harmless, low cost test that lasts 15 minutes; it doesn’t require physical contact, and therefore, it is considered better than other types of test, especially in young women (dense breasts), or women with big breasts. Women must know that thermography is a promising and reliable technology and that it is a great way to protect one’s breast healthcare.

Other experts’ opinions in Northup’s research:

a) Susan M. Lark, M.D. (Distinguished Author and Leading Expert in Women’s Health), says that thermography provides “a complete individual colorimetric mapping of women’s breasts, and it allows to highlight, without risk, any type of possible variation in a short interval of time (months)”;

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b) **Nan Kathryn Fuche, Ph.D.** (Editor, Women’s Health Letter) believes that thermography should be used as a support for mammography, and “in the beginning in young women to avoid the accumulation of radiations”;

c) **Robert Elliot, M.D., Ph.D.** (Comprehensive Breast Care Specialist; Founder and Director EEH Breast Cancer Research and Treatment Cancer; President of the American Mastology Association) says that the computerized use of infrared radiations in breast cancer allows “early-on diagnosis and increases the chance of survival”;

d) **Jonathan Head, Ph.D.** (Tumor Cell Biologist and Pioneer in Breast Cancer Vaccines; Director of Research EEH Breast Cancer Research and Treatment Cancer; Associate Professor of Biochemistry – Tulane University) believes that thermographic images of the breast should constitute as an integral part of screening tests and are also useful as prognostic indicators.

e) **John Keyserlingk, M.D., Ph.D.** (Surgical Oncologist; Ville Marie Breast and Oncology Center; Department of Oncology – St. Mary’s Hospital, Montreal, Quebec) says that infrared images highlight many processes without structural base, don’t require contact, compression, use of radiations or venous access; instead they provide complementary practical information to access clinical exams and/or mammograms. Abnormal images can be ambiguous and nonspecific, but they can be highly suspect. Therefore, is necessary to collect additional information as a physical exam is not sufficient, with a sensitivity increment of 83%.

f) **Carol Knight, M.D.** (Private Practice – Women’s Health) asserts that thermography has helped her patients to safeguard their breasts’ health, not only because it can point out structural anomalies, but also because it reveals the conditions that are linked to the predominance of estrogen (cancer precursor) and makes it possible to intervene to restore their balance. As a matter, a fact certain thermographic signs can suggest the presence of anomalies due to the effect that estrogen has on breasts. Since it’s harmless, simple and pain-free, every woman should periodically have a normal thermogram.

**Tahoma Clinic** (North Seattle College, Washington)

Doctor Jonathan Wright⁹, coordinator of a research team at Tahoma Clinic (North Seattle College, Washington) that works with breast thermography, stresses the advantages that it would have if it were to replace mammography in screening tests, as long as it is done by qualified thermologists.
He believes it to be an excellent method to identify physiological changes generated by cystic fibrosis, mastitides, mammary dysplasia and even cancer (or risk of cancer) in the various check-ups. In his institute, they use a digital apparatus to analyze the state of health of the breasts in time, but also in the treatment protocols. Thermography was approved as a supplementary diagnosis method for breast cancer by the FDA (Food and Drug Administration) in 1982 and since 1950 there have been over a thousand publications regarding thermography. In Dr. Wright's opinion, tele-thermography is an excellent instrument to identify all kinds of pathologies.

Those who are more advantaged are young women who undergo transplants or are affected by curable pathologies, such as fibrocystic mastopathies and mastitis. In breast cancer thermography can identify the first indirect signs that lead to its formation 10 years prior, compared to mammographic tests or other procedures, and it can regress by using adequate medical treatment.

The effects of the treatments can then be monitored without any type of invasiveness: mammographic tests are included because they use X-rays and the compression of about ≈50 lbs. (∼23 kg) on each breast with the potential spreading of tumoral cells.

While the mammographic tests measure cellular aggregates (Gold Standard, to identify breast cancer early on), thermography detects infrared radiations that derive from hyperemia, angiogenesis and from the biochemical processes that occur in the breast. If used alone, mammographic tests decrease the risk of mortality by 30-40%, instead by using both methods the probability of identifying cancer in its early stages increases by 10%, specifically in the upper outer quadrant of the breast in which the mammographic tests can fail to locate, and tumors are quite common.

Neither thermography nor mammography allow an indisputable cancer diagnosis: only biopsy is decisive. Moreover, thermograms can identify a pre-cancerous condition and the presence of little initial tumors that aren't recognizable through a physical exam, a mammography or other procedures, because of the minimal caloric variations that occur due to an abnormal vascular activity.

Normal                                Fibrocystic disease                                Cancer with calcification
(From: What is breast Thermography? — American College of Clinical Thermography).
Example of thermographic monitoring: infiltrating cancer (LIBC) dislocated in the upper inner quadrant of the left breast.

Effects of the treatment: rapid decrease of the hyperemic responsive area that circumscribes the tumoral nodule, still visible in the last image (16/03/12 – 8/05/12).

Note – The FDA\textsuperscript{10} believes that thermography should not consider itself as a substitute for mammography, but only as a supplementary methodic to add with the others. Essentially, thermography and mammography are complementary. Accordingly, the majority of studies agree that to obtain a certain initial diagnosis one must perform more than one test, and that a positive thermogram in women who appear to be healthy, is just a potential risk, but there’s no indication that additional tests must be done. Other analysis, such as Dr. Wright’s, shouldn’t be overlooked; in Italian senology centres, breast thermography shouldn’t be considered “a methodic of the past”.

One of the most important critiques regarding Northrup\textsuperscript{11} can be found in “Science-Based Medicine” written by several authors (S.P. Novella, D.H. Gorsky, K.C. Atwood IV, J. Bellarmy, S. Gavura, H. Hall, M.A. Crislip) in which it is said that Northrup’s “Best Breast Test: The Promise of Thermography” is “an opportunistic promotion of charlatanism”. It isn’t correct to define generic thermographic anomalies as “a means of prevention at a cellular level”, because:

- If these were to anticipate cancer you would then have to follow the same procedure of screening tests. This means annual mammographic exams up until the non-certain appearance of a cellular aggregate;
- the suggestion of periodically repeating tests in young healthy women with the idea of identifying an initial tumor is equal to zero prevention. As a matter a fact, as long as the tests are negative, one mustn’t go on with additional check-ups, but if they become positive it is necessary to resort to option a), even though it entails some inconveniences.

There’s also another research that was performed in 2008 on 92 women using digital thermographs, resulting in 96% of sensitivity and between 12 and 44% of specificity depending on how technological the machines were. One must keep into consideration that the number of people examined (92) does not justify an extensive spreading of this methodic. Recognizing
The first stages of cancer isn’t always a good thing, because not all tumors spread and develop. There’s actually a point in which the tumor regresses on its own (probably quite high, since positive mammograms are about 1 in 5 – see later). Not keeping this fact into consideration, you are presented with two negative effects: problems regarding overdiagnosis and overtreatment and validating those who assert to cure many tumors. These authors believe that thermography has a certain level of scientific plausibility, but it hasn’t been considered a valid method in the identification of breast cancer. They do say though, that the progress in digital technology and in new software has taken thermography to the next level, making it able to incorporate the current diagnostic protocols, but only as a way to help screening tests. They also say that women shouldn’t replace mammography with thermography, but to consider it only as an “exam that doesn’t give any additional information” in preventing cancer compared to other methods (MRI, PET, etc.).

**Mammography**

Mammography is currently considered to be the most adequate instrumental exam for breast cancer diagnosis, and it allows to identify non-palpable lesions of 0.5 cm. It is used in screening tests, but also to differentiate ambiguous palpable mammary nodules. *Mammographic screening tests*\(^{12}\) aren’t exempt from problems: they present about 17% of false negatives and 3% of false positives (but in a recent study the false positives were 24%), so these tests must be done with the addition of other diagnostic exams (MRI, PET and biopsies). Moreover, there are conflicting opinions regarding the advantages that mammograms bring to the table.

Harvard University \(^{13,14}\) did a study on 39,888 Norwegian women, which is published in “Harvard School of Public Health (HSPH)”, and it says that:

> the advantages of screening tests are reduced to only one woman saved in 2,500; about 15-25% of certified tumors with the use of mammographic tests can decrease or increase and therefore all of the treatments are useless (over-diagnosis).

Other authors (P.C. Gøtzsche, M. Kalager, Sir Mike Richards, P. Autier etc.) \(^{15-19}\) have come to the same conclusion for which “mammographic tests could also not be adequate for an early diagnosis for breast cancer and it is not clear whether or not screening tests do more bad than good.”.

In an article of 2013 published in the “Journal of the American Medical Association (JAMA)” it is said that it is necessary to use adequate screening protocols, trying to find new strategies aimed at the different types of risk and to invest afterwards in research with the purpose of identifying only the lesions that could develop. Currently, there is a team in the USA which is managed by M. Kalager that is trying to find a way to make a distinction between “progressive tumors” and “non-progressive tumors”; while in a study done in 2013 it was said that the effects that screening tests had on mortality were quite modest (P.C. Gøtzsche and Others)\(^{15}\).

Finally, S. Fletcher and J.G. Elmore assert that new sophisticated imaging techniques can aggravate the risks of overdiagnosis and overtreatment.

Dr. Maureen Roberts\(^{20}\), director of the “Edinburgh Breast Screening Project” from 1979 to 1988 wrote:

> “We all know that mammography is an unsuitable screening test: it is technologically difficult to perform, the pictures are difficult to interpret, it has a high false positive rate, and we don’t to carry it out. We can no longer ignore the possibility that screening may not reduce mortality in woman of any age, however disappointing this may be.”.
While Umberto Veronesi has always believed that screening tests are useful, Professor Gianfranco Domenighetti (Italian Swiss University – USI), on the other hand, believes that: “considering the scientific data, mammographic tests shouldn’t be thought of as a successful method, but quite the opposite”.

In the digital mammographic tests, the radiographic film is replaced by a detector that absorbs the X-rays and converts them into electronic signals that will then be memorized into a computer. The image then appears on a high definition monitor where it can be elaborated and stored onto a DVD. Reading and interpreting mammographies can be difficult and could be done by two experienced (10 years) radiologists (dual reading).

By decreasing the Mas, and by increasing the kV in digital mammographies there is a decrease in the absorbed amount of about ¾ compared to the analogical tests (from about 1 RAD to about ¼ RAD), and this makes it so that the test doesn’t have to be done a second time after an erroneous exposure.
There are also certain types of software that help with the diagnosis (CAD) and they identify images that aren't quite clear, but they aren't used a lot by senologists because they believe them to be unreliable.

Mammographic screening tests are currently considered to greatly reduce mortality due to breast cancer in women over the age of 50; but in women between 40 and 49 years of age they aren’t as useful because it all comes down to the anatomical features of the breast (dense breasts). Moreover, neoplasms that are diagnosed in people of this age are quite aggressive, so an early diagnosis isn’t considered useful.

There are also mammograms that allow to obtain 3D images. After the breast has been compressed and firmly fixed, one must locate the area of interest and then we proceed with the acquisition, from various angles, of multiple tomographic sections (from 10 to 20). They are then assembled and translated into 3D images (“Breast Tomosynthesis”).

This technique entails that there must be an increase in radiations, but it makes it easier to interpret mammograms.

Some authors believe that breast compression (about 23 kg) could cause the diffusion of tumoral cells through the rupture of blood vessels of a small cancer that has yet to be diagnosed.

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Note – In Italy, before 84 years of age, at least 1 in 8 women receive a breast cancer diagnosis and 1 in 3 dies because of this tumor (mortality rate in 2006: 53/100,000 women). The data recovered from the AIRT (Associazione Italiana Registro Tumori) between 2007 and 2010, shows that for every 100,000 inhabitants 152 of them are patients that are treated annually and are affected by neoplasms (except skin neoplasms) with 36,000 new cases. Breast cancer makes up for 24.9% of these neoplasms with a mortality rate of 17%. The global incidence of all tumors is increasing, but mortality within 5 years is proportionally inferior. Breast neoplasms follow the same course, with a mortality rate that is in first place in women of all ages: in Italy 29% of deaths are due to breast cancer between 0 and 49 years of age, 23% between 50 and 69 and 16% in women over 70. Incidence and mortality rate due to tumors don’t have a homogeneous distribution, but a staining one. According to a western model elaborated by the AIRT, the incidence of breast cancer decreases progressively from the north towards the south: in the north it is 123.4/100,000 women, in central Italy 103.8/100,000, in the south and islands 93.1/100,000; with a national average of 106.7/100,000. In 2002, the average incidence was 90.25/100,000, but between 2007 and 2010 it increased to 106.7/100,000, which means that in the course of 6 and a half years it increased by 16.45 per 100,000 women. Mortality (source ISTAT) has gone from 11.250 cases in 2002 to 11.950 in 2011, this means that it has increased, but in an inferior measure. In Italy, from the end of the 80s, there has been a moderate decrease in mortality (little more than 1.0% every year) due to breast cancer. This tendency has been found also in other western countries, but while in the USA it has been attributed to a minimal use of substitutive hormonal treatments during menopause, in Italy it has been associated with a more extensive diffusion of screening tests programs, especially in the south and in the islands. The secretary of the AIRT, Eugenio Paci, believes that the increase of the elderly population makes it so that the number of deaths increases, but with the use of a statistical trick (standardization of rates) the effect of aging is cancelled and it can prove that, thanks to screening tests, the mortality in women has decreased compared to 40 years ago (see page 16 – AIRT).

According to this data, it is thought that the current secondary methods of prevention are inadequate (considering also the uncertainties concerning the real value of mammographic screening tests). If the data brought forward by prestigious research centres (Harvard Medical
School; Washington University; Nordic Cochrane Collaboration Copenhagen; National Cancer of UK) were to be confirmed (like is said in literature), one must conclude that many of the surgeries, chemotherapies, and radiotherapies, have been and still are, useless (over-diagnosis and overtreatment) \(^{15-18}\). Risks due to the exposure to X-rays were underestimated, especially at the time of analogical thermography (J. Gofman and Others).

According to a recent statistical study (2016) conducted by a team of Canadian researchers, tumors caused by screening tests with the current digital mammograms, increase only in women that are in perimenopause (breasts abundant in glandular tissue) and in those with big breasts (richer amounts of radiations), while in other women the increase isn’t as significant\(^2\). A premature diagnosis, based on the mammographic screening tests supported by other researches (usually an MRI), isn’t decisive and there isn’t any strong evidence to support the fact that it could reduce mortality.

Any instrumental methodic allows to document only aggregates, even if they’re small, because they are made up of billions of cells; therefore, it shouldn’t be excluded that there’s a possibility of diffusion, this concerns all neoplasms.

Micro-calcifications (found in about 60% of CDIS cases) due to necrosis aren’t reliable and they create problems of over-diagnosis.

P.C. Gøtzsche and O. Olsen of the North Cochrane Centre of Copenhagen \(^{15,17}\) believe that the majority of the international studies that assert the validity of mammograms and justify the involvement of the countries in the sector, are faulty, incomplete and most of all “completely inadequate”.

Muir Gray, president of the national committee of the United Kingdom, says that screening tests deny the effectiveness of the statement put out by the two Danish authors; while J. Gordon McVie asserts that the usual screening tests make it possible to save the lives of about 18,000 women in Europe every year \(^{22}\), and H. Weedon-Fejjaer, P.R. Romundstad, L.J. Vatten\(^23\) state that “modern Mammography screening” reduce the mortality of 28%; Gøtzsche and Olsen believe that 6 in 8 operations are basically useless and say that “the mammographic screening test is an unjustified test”.

Recent studies have proved that screening tests can result positive even in healthy women that would have never had breast cancer symptoms and that the treatments that they undergo increase the risk of death for other illnesses (for example, cardiac, mental or tumors in other parts of the body). The problem with pathologies related to the mammographic screening tests, is a much-discussed one, and some have come to the conclusion that: “they are a preventive measure that do more damage than good and mammographic tests don’t save human lives” (CANCERactive)\(^{24}\).

Apparently the problem has yet to be resolved, since:

a) a preventive measure at the cellular level still hasn’t been found, like for the cervix, that through the use of the pap-test, the connection with the neoplastic pathology and/or pre-neoplastic is direct like in biopsies, and isn’t mediated by instrumental researches.

b) It currently isn’t possible to differentiate the developmental tumors from the non-developmental ones.
In light of these uncertainties it isn’t easy to give an appropriate answer, so the decision to whether or not participate in the screening test program, is a decision that can only be made by the person affected by it: this means women, and it is only right to inform them of the possible risks and advantages, this way they can make an informed decision.

Based on recent trials, it is said that screening tests don’t affect mortality due to breast cancer as much, that there are quantifiable risks due to radiations and that this research could also be responsible for other additional pathologies, without keeping into consideration the supplementary costs as a result of overdiagnosis. Therefore, the fact that women, between the ages of 45 and 74 (Region of Tuscany) are urged to take advantage of mammographic screening tests, doesn’t have any valid explanation.

As a matter a fact, women between the ages of 45 and 49, the risks due to radiations increase and mammography certainly isn’t the way to go, because of the anatomical characteristics of breasts, while in women over the age of 69, the development of the tumor is usually slower and life expectancy is lower.

<table>
<thead>
<tr>
<th>AGE</th>
<th>AVERAGE TUMOUR DOUBLING TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 50</td>
<td>80 days</td>
</tr>
<tr>
<td>Age 50 -70</td>
<td>157 days</td>
</tr>
<tr>
<td>Over age 70</td>
<td>188 days</td>
</tr>
</tbody>
</table>


REFERENCES

24. Breast Cancer Screening – National Cancer Institute – 06/05/2015 (USA).
Based on international literature, it is clear that there are contrasting opinions regarding mammographic screening tests: those who support the efficiency of them, and those who don’t. The two most common diagnostic imaging methods (mammography and ultrasound scanning) don’t provide information at a “cellular level”.

The fMRI (functional Magnetic Resonance Imaging or CE-MRI – Contrast Enhancement Magnetic Resonance Imaging) can determine the possible local metabolic increase and the subsequent blood flow increase, like thermography in the early stages of tumors, but for various reasons it isn’t applicable in routine screening tests.

Mammography (even with future improvements) will never be resolutive, and it absolutely isn’t true – common mistake – that its negativity (false negatives) can guarantee the absence of a tumor.

Thermography seems to be able, already today, to identify the first glandular anomalies, and one day could even decipher them.

In fact, some attempts have already been made, either by pairing it with other energetic sources (for example microwaves)¹ or with medicines: the active administering of sex hormones (only receptive cells ER/PR positive), while other products such as Tamoxifen and Raloxifene reduce the activity. Therefore, there could be the possibility in identifying generic thermographic variations only where there are hormone-dependent tumoral cells.

One thing that remains unclear is the possible progressiveness of the small cellular aggregates; those who disapprove of thermography believe that if you disclose the diagnosis early on, the number of over-diagnosis and overtreatment increases, and one mustn’t forget to keep into consideration that the small size of the areas of interest doesn’t provide histological findings.

As we can see, we are presented with a strange paradox: there are certain cellular aggregates, identifiable through the use of current technologies, that will never be lethal, and then there are fatal cellular mutations that can remain unknown for years.

Almost all of the authors agrees with the fact that:

“cancer is more common in women with benign and reversible chronical breast pathologies (for example dominating estrogen), and it is in this condition that thermography plays a significant role.”


“Even with the use of a normal thermogram there’s still a chance of there being a tumor, because thermography isn’t a standardized test, and even though it is an excellent method it still shouldn’t be considered a definitive one. As a matter a fact, even though it has a negative predictive value of 95%, its specificity is low (positive predictive value) and therefore, it must
be performed with additional tests. It can also be useful in the presence of ambiguous mammographic images to distinguish benign and malignant tumors."

Reversible Benign Pathology.
Breast at risk in young woman.

Bilateral Symmetry Hyperemia due to Estrogen Prevalence.

Similar characteristics are also determined by: substitutive hormonal therapies in menopause, phytoestrogens etc.

From: Pink Image High Resolution Breast Thermography.
Located in San Diego, California.

if you accept the following equation:

**NORMAL THERMOGRAM = HEALTHY BREASTS**

then breast thermography can be used as a primary method for diagnosis at any age, up until the appearance of generic anomalies so that risks due to radiations can be limited, especially in women pre-menopause. It can also assist in planning a course of action in women whose genetic history is questionable. In addition, it will allow the beginning of preventive measures in those patients who are BRCA 1/2 positive – this will certainly enhance their quality of life.

The major uncertainties can be about the so-called “range of reference or normality”: as a matter a fact, if it were to be too limited, the number of women whose thermogram results are negative would be small, and therefore, possible inopportune thermographic check-ups could actually increase the number of false positives.

An expert thermologist should be able to visibly confront two breasts and look for possible abnormalities. If there are ever any doubts there’s always the possibility to compensate by using thermograms (without causing any harm), but done in short periods of time (weeks-months). The goal is to understand which ones are definitely the normal-resulting thermograms. By doing this, it is then possible to start a thorough surveillance similar to that of other patients at risk, unless there happens to be a spontaneous normalization or one that is cure-induced in certifiable cases of reversible benign pathologies.

Thermography is then acceptable in lesions conformed to the enhancement with contrast, that is obtained through the use of other methodics, because there’s a correlation between the amount of infrared emitted energy and their degree of iroration: this can allow to distinguish
the benign forms from the malignant ones, already identified through the use of other basic exams, like MRI and CT.
Because it has been verified that mammographic screening tests have a low incidence on long-term death (over 10 years), especially in less older women (40-59 years of age), one should also avoid the local therapeutic excesses (extended mastectomies and radiotherapies, etc.). As a matter a fact, the breast isn’t a vital organ, like for example the brain, in which it is important to delay or avoid recurrences altogether; death due to breast cancer generally depends on late metastasis, and over-diagnosis and useless cures occur on a regular basis. Some excessive procedures aren’t, in fact, able to avoid metastatic spreading, but it is certain that they could be responsible for other additional pathologies (heart conditions, anxiety psychosis, weakening of the immune responses, etc.).

After a careful global revision of the existing literature (2013), Cochrane Collaboraton came to the conclusion that:

“therefore, it doesn’t seem reasonable to perform the screening test for breast cancer at any given age. Moreover, it hasn't been proven whether the MRI has more advantages than disadvantages than the traditional mammography.”

And:
“Woman invited to screening be full informed of both the benefits and harms.”

Therefore, a significant decrease in mortality due to the secondary prevention, doesn’t seem to be suitable for the commonly used current technologies.

<table>
<thead>
<tr>
<th>Active Cancer Cells Double in Number Every 90 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 days</td>
</tr>
<tr>
<td>1 year</td>
</tr>
<tr>
<td>2 years</td>
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<tr>
<td>3 years</td>
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<td>4 years</td>
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<tr>
<td>5 years</td>
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<tr>
<td>6 years</td>
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<tr>
<td>7 years</td>
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<tr>
<td>8 years</td>
</tr>
<tr>
<td>*Normally detectable by Mammogram at this stage</td>
</tr>
<tr>
<td>40 Doublings (Aprox 10 Years) considered lethal.</td>
</tr>
</tbody>
</table>

Since the neoplastic transformations is gradual, the only alternative is to intervene in the phases of normal hyperplasia or abnormal hyperplasia and maybe even in DCIS (Ductal Carcinoma In Situ).
In these stages (considered reversible) there’s already an angiogenesis with local increased blood afflux that thermography, and also the fMRI, can unveil. These forms are usually associated with endocrinous imbalances or other curable benign pathologies; they are also more frequent in young women, and represent the basis on which the cancer can then evolve and spread.

It is in this setting that thermography plays an important role, while in other cases it only has a complementary validity, often ameliorative regarding the quality of life, but not necessarily substitutive.
START AND EVOLUTION OF A DUCTAL CARCINOMA IN SITU (DCIS).
Note the arrow of potential reversibility also in DCIS.

Copyright: Wolters Kluwer Health/Lippincott Williams & Wilkins – 2011.

Thermography and mammography are based on different premises: the first, like the Pap test, tends to identify pre-tumoral situations at risk, reversible and curable; the second, in correlation to other imaging methodics, identifies cellular aggregates, even if minimal, but potentially lethal.

Important: “different clinical trials believe that the use of thermography increases the long-term survival by 61% when confronted with other procedures.”

Note – Vasodilatation in tumors is mainly due to the excess of the Nitric Oxide Synthesis (NOS). Nitric Oxide (NO) is a powerful peripheral vasodilator that operates on certain dislocated receptors of the endothelium of arteries and arterioles. The neoformation of vessels is, instead, due to the excess of a protein (Angiogenesis Factor – AS) that favors the formation of new endothelial cells. These two molecules increase in the initial phases (normal and abnormal hyperplasia); therefore, they represent the first step that eventually leads to the neoplastic formation: this explains why the first thermographic anomalies precede the tumor. Both molecules then increase further on because of the metabolic growth of the tumor, and as they develop on the outside, they trigger the surrounding caloric effect: this explains the reason why a thermogram is already obviously positive even in tumors that aren’t visible to a mammographic test.

It’s important to underline the fact that the thermo-vascular activity is proportionate to the aggressiveness of the tumor, and so the prognosis is better in cancers with a low caloric index.

As a matter a fact, they only identify aggregates of billions of cancer cells, that are usually dislocated in areas of the breast that are highly vascularized and sensitive to the proliferative effect of the sexual female hormones.
Lastly, cancer awareness (slogans, t-shirts, colored ribbons) brings in a lot of money.

It is estimated that all of the tumors put together, brings in a total of 6 billion dollars per year, of which 1 billion is for breast cancer, to add to the enormous costs for research, diagnostics, medicine, etc. Therefore: “this pathology has been included in the main elements that make up the global economy, like weapons, the oil and car industries, etc.”


REFERENCES


* The Cochrane Collaboration is a non-profit international enterprise, created with the purpose of gather, critically evaluate and spread information regarding the efficiency and the security of the sanitation interventions.
When discussing diagnosis and screening tests, we didn’t stop to mention other instrumental methodics (ECOGRAPHY, MRI, CT, PET, SCINTIMAMMOGRAPHY, etc.) because they are inadequate for the diagnosis, and are only complementary in certain situations. Invasive techniques are mainly specialistic, while others are more futuristic methods (Proton Spectroscopy (PS), Positron Emission Mammography (PEM), 7.0 Tesla-MRI, etc.) that are still being studied. The basal 7.0 Tesla-MRI allows to obtain in the DCIS admissible images instead of the histological ones (better signal/noise ratio), and they are already being used experimentally in certain medical centers.

**Echography** is mainly used in young women who have breasts that are richer in glandular tissue (dense breasts). Specifically, it allows to differentiate the solid nodular formations from the cystic ones; it can be used as a guide for possible future biopsies or to identify non-palpable lymph nodes in strategic areas, like in the axillary cavity ("sentinel lymph node"). Even if we pair it with the Eco-Color-Doppler or 3D images, it still doesn’t allow to identify small tumors, and this is why it is normally used in dense breast, or as a complementary test to mammography. **Thermo-echography** has re-made its appea-rence. This pairing can favour the echography diagnosis in senology (>sensitivity / specificity. **CT** (Computerized Tomography) is generally used for any possible metastasis, but not for an early-on diagnosis for breast cancer.

**The MRI (Magnetic Resonance Imaging)** is mainly used as a confirmation for other procedures or – before a surgery – to identify additional pathologies as multicentric/multifocal localizations. Because the fMRI has a sensitivity of 85-97% in DCIS, it is also used in women at high risk and in short-term check-ups. The fMRI already has an important role in diagnostic senology, but since it’s a secondary type of investigation, it has low impact on mortality. Its use is limited at the moment, due to costs, to the necessity to use the gadolinium as contrast (Contrast Enhancement MRI), but also due to the limited availability of the machines.
CT (Computerized Tomography) is generally used for any possible metastasis, but not for an early-on diagnosis for breast cancer.

PET (Positron Emission Tomography), PET/CT and the SPECT (Single Photon Emission CT) are especially used for the staging and the follow-up of tumors, but like all nuclear medicine researches, they have high costs, create discomforts in patients, aren’t so available, and imply risks due to radiations.

Recently thermo-echography has made its appearance. This pairing can help the echography diagnosis in senology (> sensitivity/specificity).

One must keep in mind that if you add all of the instrumental methods, you are presented with negative and/or positive predictive values that are inferior to 100%. Only histology is generally considered resolutive.
Chapter 8
Future expectations

Image-based diagnostic is evolving towards new frontiers. Health demand and the possible potential damages caused by external energetic sources or improper physical contacts (compressions, means of contrast, etc.) is orienting users towards alternative methods instead of the current ones. The unmoderated use of certain methods like CT, PET, and MRI, that up until now have been considered harmless or of moderate risk, is convincing people to review them.

An example of development that doesn’t keep count of the potential negative effects that it has on someone’s health or doesn’t create excessive amounts of discomfort doesn’t seem so desirable.

Echography, thermography and the 3D Full Body Bio-Electro-Scan or Full Body Functional Scan are considered to be harmless methodics, that can be defined as physiological or functional. The latter is a very advanced technology that allows to obtain numerous vital parameters with an accuracy of 89% besides the tridimensional representations of internal organs like with the use of CT or MRI. Since its physical presupposition is the measurement of the bio-impedence of the internal interstitial fluids, it doesn’t use any additional energetic source: therefore, it is considered an emerging harmless methodic along with digital thermography.

Advanced software that is admissible to the neuronal web, has already brought some qualitative improvements to the traditional images, but the challenge for the future, especially regarding tumors, is to recognize pre-neoplastic situations.

Thermography is potentially already able to identify local hyperemia before the tumor (cellular hyperplasia), but improvements and in-depth analysis are still being studied. Such as: the simultaneous or differentiated use of infrared bands of low, medium and high frequency; the insertion of different types of spectral filters; the possibility of deciphering, through the use of mathematical procedures and graphical representations (for example fractal analysis), the characteristics of the different thermographic images with their respective informative content.

Non-invasive melanoma diagnosed with the multispectral use of images (histological examination).
Latvia University
Riga Leetonia.

Algorithms that could allow the use of computerized screenings are being studied for breast exams. An important field of research is that of spectroscopy in the thermal band of infrared rays (hyper-spectroscopy), and it is considered to be able to directly identify tumors.

Lastly, nanotechnologies already allow the use of small, manageable, and low cost thermocameras, with the purpose of a future use in routine diagnostic application.
Images obtained with a *thermocamera for Android “FlirOne”*. 

*It is a scanning thermo-camera that can be used with iOS devices (smartphones and tablets – connector lightning).*

**NORMAL BREAST**

Main characteristics:

- size: L. 72 mm x D. 26 mm x H. 18 mm – weight: 78 grams;
- VGA camera with thermic interval of 0,1°C;
- operating temperature: from 0°C to 35°C;
- sensor: 160 x 120 points;
- palette colors: white/black, rainbow, contrast, hot/cold, iron.
- Cost: about 300 €.

**BENIGN BREAST DISEASES**

- Post traumatic hematomas (the broadest to left).
- Partial resolution after 6 days.
- Heat emission nodular to the right.
  Benign aspect. Fibroma.

**PAINFUL SYNDROME**

- Right shoulder pain.
  Left peri-arthritis.
- Bilateral low back pain.
  (RX: arthrosis).
- The III and IV finger left foot.
  Trauma (RX: negative).
Chapter 9
Image processing

Bilateral mammary carcinoma.

Image obtained with GIMP 2.6. Microcalcification also visible in the left breast.

Better resolution, after the processing, in the neoplastic breeding ground and in the calcifications. (Additional false colors).

With the use of particular graphic programs (Adobe Photoshop, GIMP, etc.) radiographic images can now be manipulated: this often allows to enhance the quality and make them more intelligible.

Even in the medical field, the 3D scanner can obtain tridimensional thermograms, that some believe, could be used in the preventive diagnostic of breast cancer.

Software is used at the same time with additional technologies (synchronous technology), and is able to study the so-called “solid systems” (buildings, objects, precision instruments, etc.).
The tomb of Mary of Aragon, Marchese of Vasto (1503-1568), can be found in the Convent of St. Dominic Major in Naples. She was mummified and the exhumed remains have been objects of study at the Paleopathology Branch of the University of Pisa, directed by Prof. Gino Fornaciari\textsuperscript{1}.

**Results:** obesity, syphilis, genital condyloma. The exam done on the residual breast has allowed to identify the presence of calcifications and micro-calciﬁcations in the upper quadrants of both breasts, with the result of a presumable pre-neoplastic condition (mammography and histology). The remains of soft parts are very rare, especially if associated to specific pathologies.

*In the Cristian iconography, the Virgin Mary represents maternity in its purest form, but, mainly, it allows to perceive the relationship between a Higher Entity and mankind.*

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**REFERENCES**

Chapter 11
Thermography in medicine

From:
MEDICAL INFRARED IMAGING
PRINCIPLES AND PRACTICES
Edited by: Mary Diakides • Joseph D. Bronzino • Donald R. Peterson.
Medical applications of thermography:
- Oncology (breast, skin, etc.)
- Pain (management/control)
- Vascular disorders (diabetes, DVT)
- Arthritis/rheumatism
- Neurology
- Surgery (open heart, transplant, etc.)
- Ophthalmic (cataract removal)
- Tissue visibility (burns, etc.)
- Dermatological disorders
- Monitoring efficacy of drugs and therapies
- Thyroid
- Dentistry
- Respiratory (allergies, SARS)
- Sport and rehabilitation medicines.

From: “Total Body Thermography LLC”
- Unexplained pain
- Artery Inflammation
- Breast disease
- Disc Disease
- Fibromyalgia
- Sprain/Stain
- Referred Pain Syndrome
- RSD
- Stroke Screening
- Digestive Disorders Whiplash
- ESE
- Dental and TMJ
- Inflammatory Pain
- Referred Pain Syndrome
- Nerve damage
- Vascular disease
- Skin Cancer
- Arthritis
- Back Injuries.

From: “ebme” – MEDICAL THERMOGRAPHY
- Breast Pathologies
- Extra-cranial Vessel Disease
- Neuro-musculo-Skeletal
- Lower Extremity Vessel Disease
- Respiratory Dysfunctions
- Digestive Disorders
- Urinary Diseases
- Cardiovascular and Circulatory Disorders
- Lymphatic Dysfunction
- Reproductive Disorders
- Nervous Dysfunction
- Endocrine Disorders
- Locomotors Disorders
- Surgical Assistance
- Skin Problems
- Ear, Nose, and Throat Dysfunction
- De
Examples

In comparison: obtained with thermocamera “FlirOne”.

A centre of reference in Italy can be found at the Institute of Advanced Biomedical Technologies (ITAB) of the University of G. D’Annunzio in Chieti and Pescara, where they also do propaedeutic courses of thermography (medicine, veterinary medicine, etc.).
Summary

The argument presented is of actuality because some traditional prevention paths have been questioned: there are, in particular, controversies regarding the real utility of “mammographic screening”. In fact, according to many authors, there would be no convincing evidence that screenings reduce mortality, and there are also those who claim that they are harmful. Mammographic diagnosis mustn’t be considered an early one, because it identifies aggregates (not less than 0.5 cm) of billions of cells. 20-25% of nodules may, for reasons still unknown today, regress or stabilize – this means that many women undergo unnecessary treatments. There are also other carcinogenic factors, such as X-ray accumulation (greater in women with big breasts and younger women) and the compression of the breasts that could promote the spread of cancer cells by breaking blood vessels in tumors that have yet to be diagnosed. Nowadays, breast cancer in Italy affects ≈1 in 7.6 women, and although screenings have been promoted for many years by the public health, this disease remains the first cause of neoplastic death in women (≈17.1%).

A partial alternative, is the use of digital tele-thermography which, in the case of a normal result, it has a “very negative predictive index” (95%), while, if the result is abnormal, it can predict the occurrence of a breast cancer well in advance (8-10 years): it allows to identify the first cellular abnormalities that precede the neoplastic aggregation (cellular and non-structural diagnosis). However, since it has a low “positive predictive value” – other breast disorders have generic thermal abnormalities – it is often necessary to supplement it with other tests. This is a simple and inexpensive method (about $200); is harmless, painless and doesn’t require any sort of physical contact; it can positively affect mortality, survival and quality of life. The biggest problem is to understand what its “normal range of normality” is because – if it is too small – then the number of women with negative thermograms would be small and, consequently, unsuitable on a practical level. Conversely, if it is high, as it is said to be in the United States, the findings that follow – not necessarily based on instrumental technologies – allow the selection of the pre-neoplastic and malignant variants (like Pap-test), while all other women with negative thermograms remain excluded.