Infrared thermography and non palpable breast cancers

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SUMMARY. This study is based on 30 cases of non palpable breast cancers, 22 of which were retrospective observations and 8 prospective observations. Two thirds of these patients had a palpable cancer on the other breast which had been treated or had to be treated.

In an unexpected manner, thermography seemed to produce fewer false-negatives than mammography and to he ahead in a significant proportion of cases. However X-ray images of the wedge resection sites in operative research remains an absolutely necessary guide for histological swabs.

In any patient consulting for mammary problems, especially in high risk women (particularly for the « other breast », we cannot disregard a typical mammary thermographic alarm, particularly if this is combined with abnormal mammography. The procedure for identification will prove a non palpable mammary carcinoma 4 times out of SO.

Rey words: sub-clinical breast cancers, infrared thermography, detection, surgical research.

INTRODUCTION

After doubling 20 times a breast cancer may become a millimeter in diameter; 30 time is necessary for it to have reached one centimeter and be palpable [5]. With a 3 month doubling time, a breast cancer will remain non palpable for 7 years or more. To be ahead of the normal time for diagnosis is a realizable ambition since the advent of Senology with the development of the simple radiology of the breast. Owing to mammography, we have thus identified some non palpable breast cancers between 1960 and 1970.

Infrared thermography which produces 30% of false-negatives in palpable cancers of 2 cm and less in diameter (Tl I.U.A.C. category) contributes to the active research into non palpable breast cancers. What is its value? What is its place in diagnosis?

MATERIAL AND METHODS

We do not make a systematic screening. Our 3 Senology Units are equipped with infrared high-speed cameras (AGA Thermovision) and molybdenum anode Senographs. We receive patients consulting for pain, mastopathia or anxious women who ask for voluntary screening. Our sole systematic screening takes place on the opposite breast of a breast cancer on the first side, either the first day or during a long period of follow-up.

Under these conditions, we have gathered 30 observations of non palpable breast cancers. To this section of 30 true infiltrating adenocarcinomas, we must add 4 lobular in situ carcinomas. However, these records belong to two various classes.

1) *A first retrospective period* during which we did not know how to react to radiological and thermographic signs. In 22 cases of infiltrating cancers, we waited for their clinical emergence prior to identifying them. The average time between the first radio-thermal signs and the appearance of the smallest palpable tumour was 15 months. In 4 observations we even noticed signs of fast growth

four months 'after the first paraclinical suspicions.

This retrospective period has been rich in lessons. We have learnt that the identification of non palpable breast cancers *is not an urgent* matter. We can dispose of long waiting periods of several months, and a suspected patient can be called back three or six months later for new investigations.

It also happens that non palpable breast cancers are fast growing and emerge quickly. Non palpability is not a guarantee of a good prognosis in itself. The fast growing cancers are serious whatever may be their diameter, however small they may be.

2) A second prospective period for looking for surgical action, from patients with mammary thermograms and or abnormal (suspicious or positive) mammographies, is that of non palpable breast cancers *in strictly normal breasts clinically.* This way, we have operated on 27 patients and proved S true infiltrating cancers and 3 lobular in situ cancers.

This period leads us to a better definition of the conditions for these exploratory mammotomies regarding their indication and techniques.

In total, the 30 infiltrating non palpable cancers were:

7 cases unilateral

23 cases contralateral (simultaneous with palpable cancer on the first side: 9 cases; appeared after curative treatment on the first side: 14 cases).

The only true screening that we do is « the other breast » in a woman whose high risk has been proven by the mammary malignancy on the first side.

TECHNIQUE OF SURGICAL RESEARCH IN NON PALPABLE BREAST CANCERS

This involves an exploratory mammotomy orientated by the radio-thermal pre-operative data. If thermography gives more often than not the alarm, indicating the patient and the affected side, it is radiography which locates the suspected tumours in detail and defines the mammary quadrant to be removed. Indeed, it involves a wedge resection of a fourth mammary gland. Although not really mutilating, this operation for non palpable cancer always leaves a more significant scar than the simple tumorectomy for a small size palpable cancer.

The operation must be managed with full radio-surgical cooperation and without pause; it lasts for about one hour from the skin incision and its closing. This time is necessary for the radiographic controls of the surgical sites, the swabs being guided by these negatives. It is necessary to remove the radiological abnormality (ies) to fixative (formol) and to make sure of their disappearance from the site by making new X-ray images. Everything should be done to avoid a steady constant risk which threatens the operator, the radiologist, and the microscopist: a false-negative caused by false swabs.

In case of abnormal mammography from clustered micro-calcification or by small stellar image (visible on several occasions and on localized negatives), it is quite easy for the radiologist to indicate to the surgeon a site section which is in connection with the skin surface. The wedge will have for section the mammary ray going through the suspicious focus. It is harder to determine the topography when it involves a thermographic sign alone, even at a high level. The hot spot or the abnormally hot surface is not always in the axis of the orthogonal projection in micro-carcinoma on the skin. The venous convection may have the message derived in an appreciable manner. In these cases, we are led to resect a third of the mammary gland.

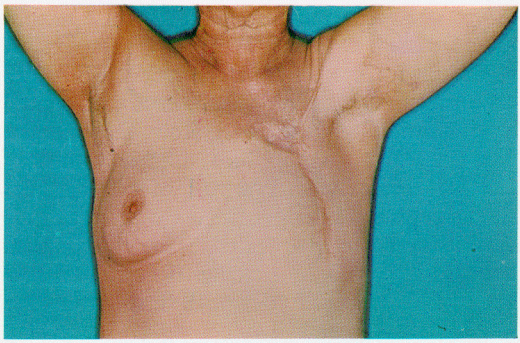
Whatever may be the paraclinical pre-operative data (radiological alone, radio-thermal or thermographic alone), the per-operative radiological images of the site are finally the sole guide of value for the histological swabs.

In every case, this involves *immediate radiology*. It is moreover remarkable that in some cases, the negatives of the areas alone are significant (Fig. 1).

In any case, an immediate biopsy is not involved. The results of the detailed microscopic study are only known 10 to 15 days later: the patient is already scarred.

RESULTS OF THE SURGICAL RESEARCH OF NON PALPABLE BREAST CANCERS

Following our own protocol, we have classified the microscopical findings into 5 categories:



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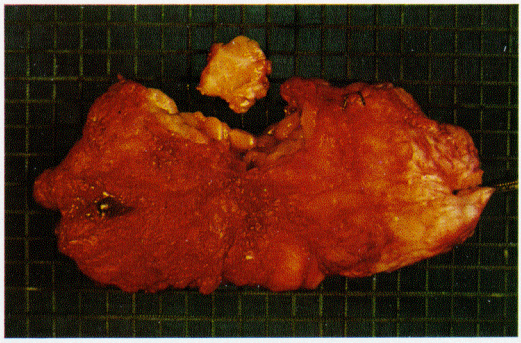

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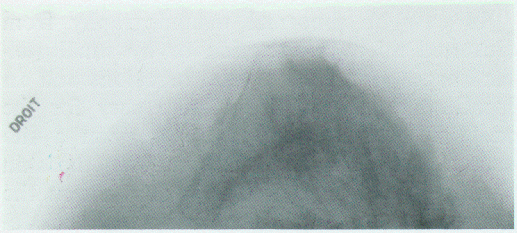

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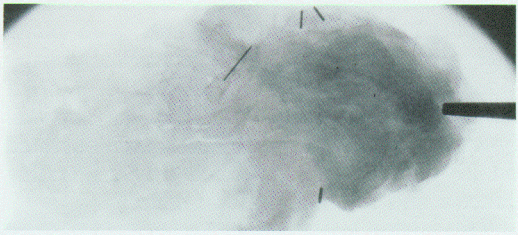

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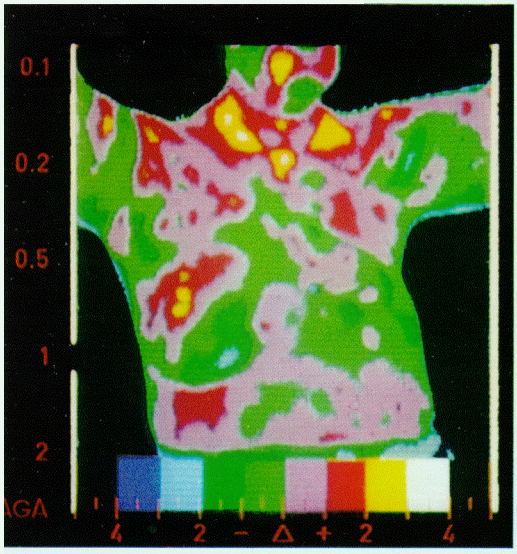

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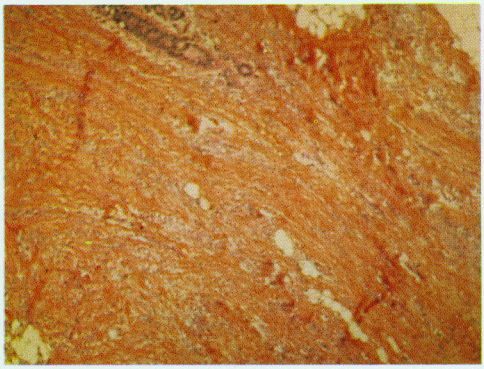

F

Fig. 1 A-B-C-D-E-F: (A) Systematic control of the remaining right breast, 7 years after amputation of the left breast for a cancer; no palpable tumour (C1 category). (B) Mammography. Any abnormal radiographic image. (C) Thermography. Upper outer right thermal alarm with a 3°C hot spot (TH1 category). (D) Surgical resection of the warm area in front of a persisting hot spot in a high-risk patient. (E) Extemporaneous X-ray image of the operative part. The needle-point shows a small stellar opacity which will be removed and subjected to serial microscopical study. (F) Histology of a swab fragment of a 3 x 5 mm infiltrating adenocarcinoma removed furthcr to radiography.

H5 = true infiltrating mammary adenocarcinoma
H4 = lobular in situ carcinoma
H3 = frontier mastopathia
H2 = benign tumour or common dysplasia
Hl = no abnormality.

We consider [6, 10] as frontier-cystic proliferative diseases: the proliferating mammary dysplasia, the papillary cyst adenoma, the hyperplasic adenoma, the tubular adenomatosis. These images are thought of as cancerous states by some specialists.

Tab. I. **Microscopic results of radio-surgical research.**

Infiltrating adenocarcinomas	8/27	0,30
Lobular in situ carcinomas	3/27	0,11
Frontier-mastopathias	6/27	0,22
benign tumours, common dysplasias, normal breasts	10/27	0,37

We should note that looking for non palpable cancers, we may identify positive benign tumours under an unusually small volume: for example, starry adenomas of a few millimeters (Table I).

In Table I, we see that a quarter of the surgical explorations have proved an infiltrating cancer. Generally speaking, this surgery has provided:
11/27 = 40% of breast cancers
6/27 = 20% of abnormal breasts
10/27 := 40% of normal breasts.

PLACE OF TELETHERMOGRAPHY

Overall, Table II shows the compared outcome of thermography and histology. Thermography produces more false-positives than false-negatives (twice as many). From this single point of view, thermography appears to have its place in the exploration of non palpable breast cancers. However, we must note that our modest statistics are limited to identified non palpable cancers at posteriori or at priori. We ignore those which have escaped our routine investigations from the total number of patients consulting at our Senology Departments (20.000 in 6 years).

Tab. II. **Thermo-microscopical comparisons.**

		Histology		
		Negative	***Positive***	
Thermography	Positive	3	26	29
	Negative	7	4.	11
		10	30	40
False-negatives: 4/30 = 0,13				
False-positives: 3/10 = 0,30				

PLACE OF MAMMOGRAPHY

The good results of thermography were not expected by us in as many non palpable breast cancers, we are still surprised by the many failures of the most reliable traditional method: mammography. Table III shows a very high percentage of false-negatives and false-positives which is around one out of two. However, we must emphasize that the false-negative rate of radiology from the surgical site is worthless. Radiology remains the main guide for finally directing the histological swabs.

The comparisons between the two methods (Table IV) shows that thermography produces the least false-negatives and X-ray images the most false-positives.

'Tab. III. **Radio-microscopical comparisons.**

		Histology		
		Negative	***Positive***	
Radiology	Positive	4	12	16
	Negative	6	18	24
		10	30	40
False-negatives:	18/30 = 0,60			
False-positives:	4/10 = 0,40			

Tab. IV. **Thermographic and radiological false-results.**

	False-negatives	***False-positives***
Thermography	13%	30%
Mammography	60%	40%

But the unexpected primacy of thermography in the research of non palpable breast cancers is mainly thrown into relief when we only take into account the first signal (Table V). ***Nine*** *times out of ten,* thermography is abnormal as early as the first combined se-

Tab. V. Nature of the first alarm.

Thermography alone	15/20	0,50
Thermography and mammography	12/30	0,40
Mammography alone	3/30	0,10

nological examination and ***one out*** of ***two ti***mes, it is alone. Sometimes, it is only after several months that mammography shows abnormal opacities.

Is this divergence solely due to an excess of thermography sensitivity or to a resolution defect of mammography? Perhaps important functional, and in particular thermal, problems are accompanying the breast micro-cancers before they are seen radiologically.

DISCUSSION

Infrared thermography and mammography are thus able to detect a number of non palpable breast cancers. These two methods are complementary. Thermography often gives the alarm first, long in advance. The second is absolutely necessary to make valid swabs on site.

Before disregarding an single thermal alarm, we must follow-up the patient clinically and radiologically during one or two years, in order to verify that it relates to an individual's vascular structure. In case of isolated clear thermograms of TH4 category in a high-risk woman, we recommend surgical exploration. With a clear case based on several suspicious incidences with radiological anomaly, even without surface cutaneous thermographic abnormality, we must operate. This being so, surgical research will prove a non palpable breast cancer (from 2 to 5 mm in diameter) 4 times out of ten.

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