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Xeromammography: a Study of 59 Cancers and 204 Non-Cancerous Lesions of the Breast*)

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ABSTRACT

Of female patients who were subjected to mammary gland xeromammography at the 2nd Dept. of Surgery, Hiroshima University School of Medicine for a period from 1979 to 1983, 59 patients with palpable breast cancer and 204 non-cancerous patients confirmed pathologically were studied mainly in regard to direct signs.

The incidence of cancer was relatively high in P2 and DY (so-called high-risk) parenchymal pattern groups, indicating necessity of minute interpretation of mammograms in these two groups. As for direct signs of breast cancer, the incidence of tumor shadow was 77.9% (46/59) and that of calcification including microcalcification (21 cases) was 42.9% (25/59) in cancer patients.

The false negative rate of xerommography was 13.6% (8/59), attributable to misinterpretation in 4 cases and to mammograms themselves which were completely normal in the remaining 4 cases. The mean age of the false negative cases seemed to be younger than that of whole cancer cases (59 cases) while neither histopathological findings nor parenchymal patterns significantly correlated with the results.

INTRODUCTION

The mammography is considered as a standard technique of supplementary diagnosis of breast cancer. Equipment, films, and roentgenographic techniques have been improved greatly for the last 20 years, and especially the xeromammography which applies electlic treatment to contrast and record but not chemical treatment as in the conventional film mammography, has been used more widely since 1970s. The most remarkable characteristic of xeromammography is edge enhancement of the margin of calcification and tumor shadow, which facilitates reading of mammograms.

MATERIAL & METHOD

Confirmatory pathological diagnosis could be made for 263 cases of total female patients who underwent mammary gland xeromammography at the 2nd Dept. of Surgery, Hiroshima University School of Medicine for a period from June 1979 to June 1983. Fifty-nine patients had cancers and 204 did not. Either aspiration biopsy, needle biopsy, or open biopsy was applied to pathologically fonfirm the mammographic data. The 263 patients were studied in terms of direct signs, that is, tumor shadow and calcification. No cases of occult breast cancer nor under 30-year old were included in the study. The classification of mammographic parenchymal patterns followed that of Wolfe.

RESULTS

The incidence of breast cancer according to mammographic parenchymal pattern was significantly higher in the combination P2 and DY (so-called high-risk) parencymal patterns, compared with the combined N1 and P1 patterns (Table 1): 31.4% (38/121) in the former; and

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Table 1. Incidence of Breast Cancer: According to Parenchymal Pattern

Parenchymal Pattern	No. of Cases with Cancer	No. of Total Cases**	%
N1 & P1	21	117	17.9*
P2 & DY	38	121	31.4*

* Significant difference ($p<0.05$)
** Excluding cases of 30 years old and under

Table 2. Incidence of Tumor Shadow and Calcification in Non-Cancerous Cases

Pathological Diagnosis	Case	Tumor Shadow		Calcification	
		clear	unclear	fine	coarse
Mastopathy	93	8	4	2	7
Fibroadenoma	47	22	6	0	2
Cyst	16	5	1	0	0
Fat necrosis	11	1	0	0	1
Papilloma	7	2	1	0	0
Normal gland	26	0	0	0	2
Others	4	1	0	0	0
Total	204	39	12	2	12

17.9% (21/117) in the latter. Tumor shadow and calcification were seen in 25% (51/204) and 6.9% (14/204) of non-cancerous cases, respectively (Table 2).

In mastopathy cases, the incidence of tumor shadow was 12.6% (12/93), not different from that of other benigh lesion groups, but that of calcification was 9.8% (9/93), significantly higher compared to other groups (Table 2).

On the other hand, tumor shadow appeared in 46 of 59 cancer cases (77.9%): 16 cases (27.1%) with both tumor shadow and calcification; and 30 cases (50.8%) with only tumor shadow. Calcification was seen in 25 of 59 cases (25/59), including 21 patients with micro-calcification. Four of 59 cancer patients (6.8%) who had neither tumor shadow nor calcification showed completely normal mammograms (Table 3).

Table 3. Direct Signs in 59 Breast Cancer Cases

	T+C+	T+C−	T−C−	T−C−
No. of cases	16	30	9	4
%: Cases/total cases	27.1	50.8	15.3	6.8

T : tumor shadow C : calcification
+ : positive − ; negative

Table 4 shows incidence of direct signs in 44 patients with infiltrating carcinomas, classified as histologically common types. The direct signs appeared in all patients with papillotubular type carcinoma, compared with in 87.5% of medullotubular cases. Scirrhous cases showed a relatively low incidence of calcification.

Table 4. Direct Signs in 44 Infiltrating Carcinoma (Common Type)

Pathological Classification*	No. of Cases			
	T+C+	T+C−	T−C+	T−C−
pap. tub.	5	6	1	0
med. tub.	6	10	5	3
scirr.	1	6	1	0

T : tumor shadow C : calcification
+ : positive − : nagative

* Pathological classification was based on General Rule for Clinical and Pathological Record of Mammary Cancer 1982, The 6th edition, edited by Japan Mammary Cancer Society, Tokyo (in Japanese)

As for the incidence of direct signs according to mammographic parenchymal pattern, tumor shadow was seen in 63.1% (12/19) of the DY pattern group, significantly lower compared with 100% (9/9) of P1 and 94.7% (18/19) of P2

Table 5. Incidence of Tumor Shadow in Breast Cancer: According to Parenchymal Pattern

Parenchymal Pattern	No. of Cases with Tumor Shadow	No. of Total Cases	%
N1	8	12	66.7[a]
P1	9	9	100 [b]
P2	18	19	94.7[c]
DY	12	19	63.1[d]

a-b, a-c, a-d, and b-c : no significant difference
b-d, and c-d : significant difference ($p<0.05$)

pattern groups (Table 5). The incidence of calcification by parenchymal patterfi showed no significant difference between DY and N1, P1 or P2 pattern groups (Table 6).

Table 6. Incidence of Calcification in Breast Cancer: According to Parenchymal Pattern

Parenchymal pattern	No. of Cases with Calcification	No. of Total Cases	%
N1	7	12	58.3[a]
P1	3	9	33.3[b]
P2	5	19	26.3[c]
DY	9	19	47.6[d]

No significant difference among a, b, c, and d.

Table 7 shows the accuracy of our data obtained from xeromammography which revealed cancers in 59 out of 59 cancer patients (true positive rate: 86.4%, 51/59), and failed to reveal cancers in the remaining 8 cases (false negative rate: 13.6%, 8/59). The faults were resulted from misinterpretation in 4 cases and mammograms themselves which were completely normal in other 4 cases. The false positive rate in xeromammography was 1.5% (3/204), acceptably low.

Table 7. Accuracy in Xeromammography

Pathology	M	M	B	B
Xeromammography	M	B	M	B
No of Cases	51	8	3	201

M : diagnosis as Malignant lesion
B : diagnosis as Benign lesion

Table 8 shows the incidence of false negative case according to mammographic parenchymal pattern: the incidence was 21.1% (4/19) in DY pattern group, slightly higher but not significantly different from that in N1, P1, or P2 pattern group.

Table 8. Incidence of False Negative Case in Breast Cancer: According to parenchymal Pattern

Parenchymal Pattern	No. of Cases of False Negative	No. of Total Cases	%
N1	1	12	8.3[a]
P1	1	9	11.1[b]
P2	2	19	10.5[c]
DY	4	19	21.1[d]

No significant difference among a, b, c, and d.

DISCUSSION

The following advantage of xeromammography over conventional film mammography were pointed out by other researchers[11,24,25,33]: (1) enhancement of margins of lesions; (2) highlightening of microcalcification and (3) ability to penetrate dense dysplastic breasts. However, a number of researchers[14,27,28] demonstrated that with the aid of microfocal spot roentgenography, the conventional film mammography could reveal lesions as delicate as those discovered by xeromammography.

Wolfe classified mammograms into four groups (N1, P1, P2, and DY) according to the roentgenographic appearance of breast parenchyma, that is, prominent duct and dystrophy, demonstrated a significantly greater cancer incidence in the P2 and DY pattern groups compared with N1 or P1 groups[35,36]. Since his reports, considerable retrospective and prospective studies were made to confirm the correlation between parenchymal patterns and risk factor for present or future breast cancer.

Doyle[6], Moskowitz[22], Tabar[31], Weich[32], etc found no correlation between them. Egan[7] stated that the mammographic parenchymal patterns were not reliable indicators for initial cancer or developing cancer and that the apparently high incidence of developing cancer in dense fibroglandular cases might be attributable to overlook small cancers at the first examination.

Boyd[2], however, contradicted Egan's statement[7], demonstrating particularly close correlation between dysplasia and breast cancer in his age-matched case control study. He also suggested that benign lesion cases included in cotrol groups might lead to negative data regarding parencymal pattern and breast cancer. Others[3,4,6,12] were also in favor of Wolfe's hypothesis.

Our study in 59 cancer cases and 204 benign

lesion cases including 26 cases with normal mammary glands showed the cancer incidence in the P2 and DY group (32.4%, 38/121) was higher than that in the N1 and P1 group (17.9%, 21/117). As pointed out by Parsons[24] and Egan[7], it is difficult to interpret mammograms of the P2 and Dy groups, suggesting that a minute interpretation particularly on delicate lesions is necessary in these groups.

Two major signs of breast cancer on mammograms are tumor shadow and microcalcification. The tumor shadow generally occurs as an indeterminate shape with irregular margin, but it is known that patients with colloid type and medullary type breast cancers rarely have tumor shadow with completely smooth border[11, 26]. Microcalcification is also a sign indictating the development of serious cancer. Radiography of cancer specimens is known to detect microcalcification at the incidence of 60-80%[8, 21], compared with 30-50% on mammograms[1, 34].

Our data of xeromammography, that is, 13.6% (8/59) of false negative rate and 1.5% (3/204) of false positive rate, were almost consistent with other reports[5, 9, 18, 23, 29, 30]. Xeromammograms of 8 false negative cases consisted of 4 completely normal ones and 4 misinterpreted ones, including 2 cases with tumor shadow, 1 with microcalcification, and 1 with skin change revealed by retrospective study.

Martin[19] demonstrated an analysis result of 48 false negative cases that no abnormal radiography finding was seen in 37% (16/48), clear abnormal findings were overlooked in 29% (14/48), and subttle indirect signs were overlooked in 38% (18/48), and pointed out that interpretation of subttle indirect signs is important to improve diagnositic rate of mamography. Lesnick[17] stated that 63% of 52 breast cancer cases of 45 years old and under showed no abnormality on their mammograms. In general, it seems that cancers in patient showing mammary dysplastic changes or dense breasts (often seen in younger patients) are liable to be overlooked[7, 24].

Our analysis of the 8 false negative cases revealed a trend that their mean age was slightly younger than that of the total cancer cases (45.9±5.7 years old vs 49.6±10.4 years old) but found no significant correlation with histopathological findings or parenchymal patterns.

We make it a rule to perform aspiration cytology in all patients with palpable mass or abnormal findings in xeromammography. Our study including 59 palpable cancer cases found 13.6% of false negative cases in xeromammography, supporting the view of Niloff[23] and Mann[20] that xeromammography should be positively performed concomitantly with aspiration cytology or open biopsy in patients showing normomammograms but clinically suspected sings of cancer.

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