

Ultrasonic Diagnosis of Non-Mass Image-Forming Breast Cancer

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Summary. We investigated the characteristics of non-mass image-forming breast cancer and the relationship between non-mass image-forming breast cancer and ductal carcinoma in situ (DCIS). We reviewed 47 non-mass image-forming breast cancers and 75 ultrasonic images of DCIS. We classified non-mass image-forming breast cancers into four subtypes: a homogeneous pattern, a ductal pattern, a mottled pattern, and a geographic pattern. The 47 cases were classified into 2, 6, 12, and 27 cases, respectively. Histological findings were 24 DCIS, 19 invasive ductal carcinomas with predominant intraductal components, and 4 invasive carcinomas. The 16 of 27 cases with a geographic pattern included invasive components. The 15 of 24 geographic cases had a comedo type of intraductal component. Of the 75 cases of DCIS, 51 cases were a mass image-forming type and 24 cases were a non-mass image-forming type. The histological findings for non-mass image-forming breast cancer tend to be DCIS and/or invasive ductal carcinoma with a predominant intraductal component. The geographic pattern often contained invasive components. The geographic pattern and/or the lesion with echogenic spots often had a comedo type. These results revealed the close relationship between the progress of breast cancer and ultrasonic imaging.

Key words. Ultrasonic diagnosis, Non-mass image-forming breast cancer, DCIS

Introduction

The diagnosis of non-mass image-forming lesions is still controversial, but it is important because some cases of breast cancer present such images. The purpose of this study is to investigate the characteristics of non-mass image-forming breast cancer and particularly the relationship between non-mass image-forming breast cancer and ductal carcinoma in situ (DCIS).

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Materials and Methods

We reviewed 47 non-mass image-forming breast cancers to compare ultrasonic images and histological findings. The lesions were nonpalpable in 24 cases and palpable in 23 cases. In addition, 9 of the 24 nonpalpable cases had abnormal nipple discharge and 2 of the 23 palpable cases had abnormal nipple discharge. These cases were encountered at Tsukuba University Hospital between January 1995 and December 2002 and at Tsukuba Medical Center Hospital between May 1999 and December 2002. Ultrasonic equipment used was a Toshiba SSA-250A, a LOGOQ 700MR, an ATL HDI 5000, and an Aloka SSD 5500. In the next step, we examined 75 ultrasonic images of DCIS during the same period.

According to the echoic patterns of the mammary gland with the lesions, we classified non-mass image-forming breast cancers into four subtypes: a homogeneous pattern, a ductal pattern, a mottled pattern, and a geographic pattern. The homogeneous pattern is defined as displaying a uniform echoic pattern. The echo level varies from high to low. The ductal pattern is defined as displaying a dilated duct extending to the periphery beyond the subareolar area without extraductal mass. The mottled pattern is defined as displaying a number of small, island-like low echoic areas in the mammary parenchyma. The geographic pattern is defined as displaying an irregular low echoic area, including an aggregation of small, island-like low echoic areas (Figs. 1–5).

Results

The 47 cases were classified into 2 cases with a homogeneous pattern, 6 with a ductal pattern, 12 with a mottled pattern, and 27 with a geographic pattern. Histological findings of 47 cases were 24 DCIS, 19 invasive ductal carcinomas with predominant intraductal components (including 9 cases with microinvasive carcinoma), 3 invasive ductal carcinomas, and 1 invasive lobular carcinoma [1–3]. Twenty-four of 47 cases, 51.1%, were DCIS; 33 of 47 cases, 70.2%, were DCIS and microinvasive ductal carcinoma; 43 of 47 cases, 91.5%, were DCIS and invasive ductal carcinoma with a predominant intraductal component. These results indicate that the histological findings for non-mass image-forming breast cancer tend to be DCIS and/or invasive

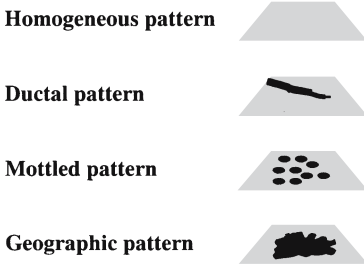
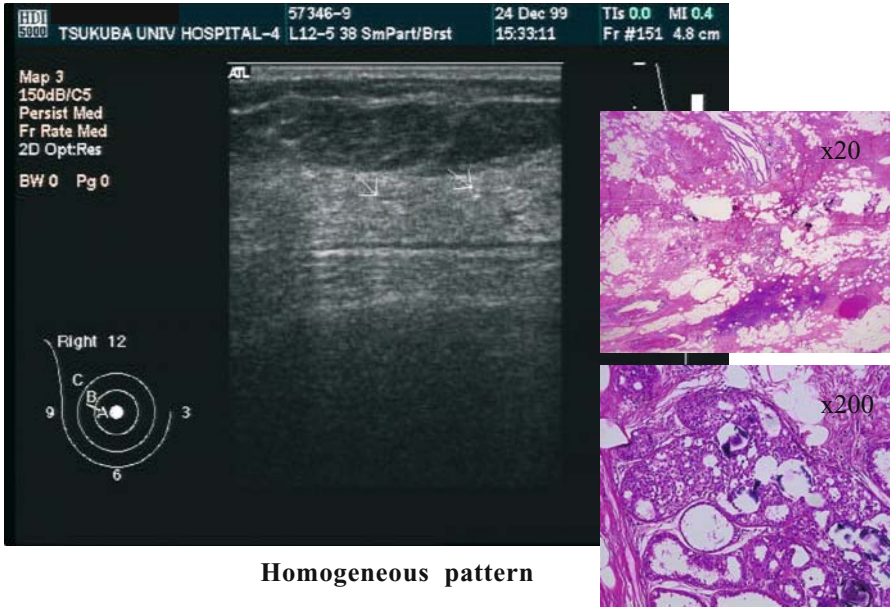
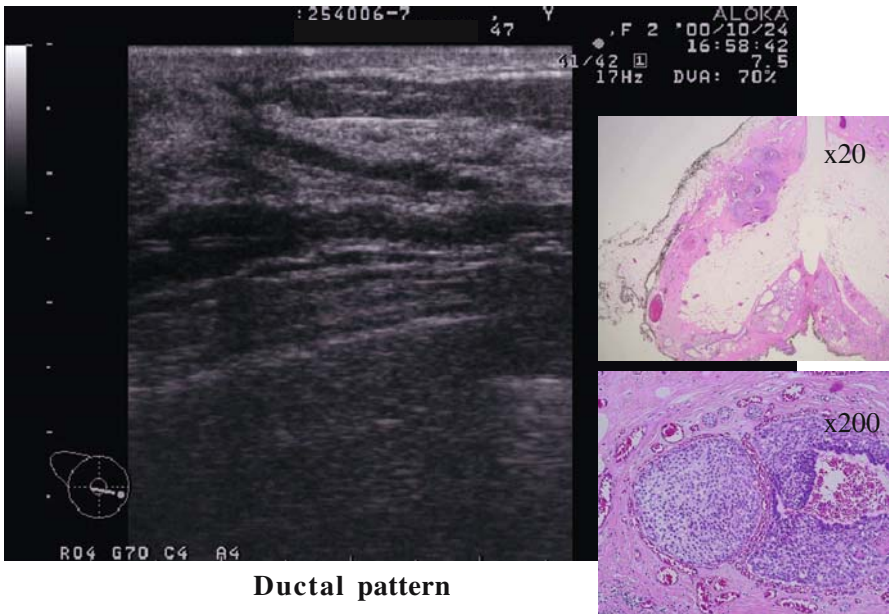


FIG. 1. Subtypes of ultrasonic images



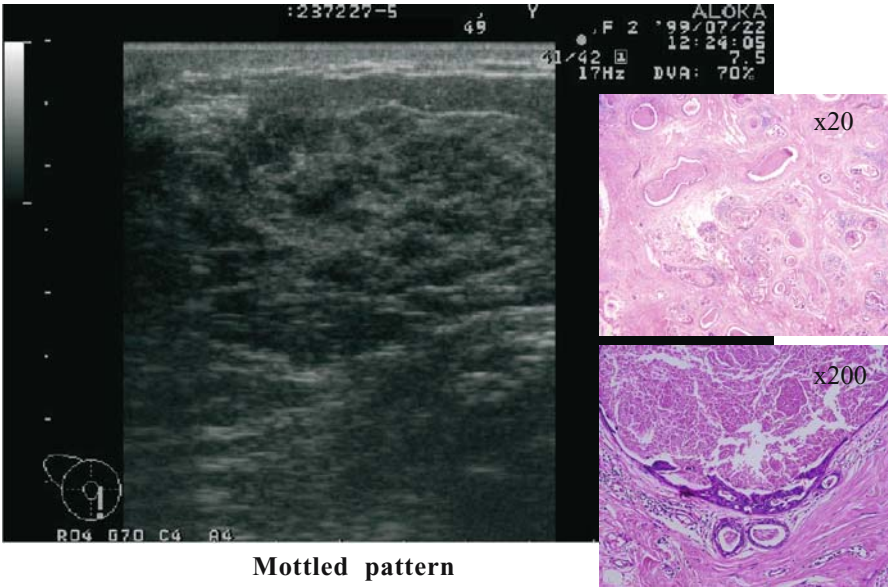
Homogeneous pattern

FIG. 2. A case with a homogeneous pattern. The patient is 56 years old. Echogenic spots are seen in the uniform mammary parenchyma. The histological diagnosis was a non-comedo type of ductal carcinoma in situ (DCIS)



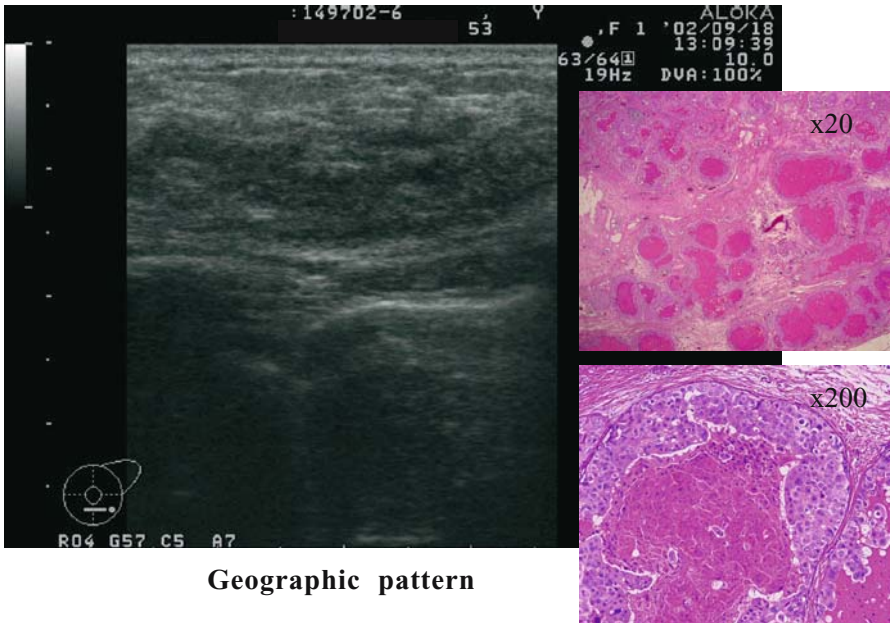
Ductal pattern

FIG. 3. A case with a ductal pattern. The patient is 47 years old, with bloody nipple discharge. A single dilated duct with internal echoes is seen. The histological diagnosis was a solid type of DCIS



Mottled pattern

FIG. 4. A case with a mottled pattern. The patient is 49 years old. Some small island-like low echoic areas are seen in the mammary parenchyma. The polarity of the low echoic area is disturbed. The histological diagnosis was microinvasive ductal carcinoma, and intraductal components were a comedo type



Geographic pattern

FIG. 5. A case with a geographic pattern. The patient is 53 years old. An irregular low echoic area is seen. The histological diagnosis was microinvasive ductal carcinoma, and intraductal components were a comedo type

TABLE 1. Relationship between ultrasonic images and histological findings

Pattern	DCIS	IDC with a predominant intraductal component		IDC	ILC	Total
		Microinvasive	Others			
Homogeneous	2	0	0	0	0	2
Ductal	5	1	0	0	0	6
Mottled	6	4	1	0	1	12
Geographic	11	4	9	3	0	27
Total	24	9	10	3	1	47

DCIS, ductal carcinoma in situ; IDC, invasive ductal carcinoma; ILC, invasive lobular carcinoma

ductal carcinoma with a predominant intraductal component. Another important point is that, with attention to the subtypes of the ultrasonic images, 16 of 27 cases with a geographic pattern, 59.3%, included invasive components. Cases with a geographic pattern had a high rate of having invasive components (Table 1).

We divided intraductal components into either a non-comedo type or a comedo type. With attention to the subtypes of the ultrasonic images, 15 of 24 geographic cases, 62.5%, had a comedo type of intraductal component. There was a high rate of the comedo type in cases with a geographic pattern. Twenty-four cases had echogenic spots. Fifteen of 24 cases, 62.5%, had a comedo type of intraductal component (Fig. 6). In conclusion, the geographic pattern and/or the lesion with echogenic spots tends to have a comedo type of intraductal component (Table 2).

Of the 75 cases of DCIS, 51 cases, 68%, were a mass image-forming type and 24 cases, 32%, were a non-mass image-forming type. Of the 51 cases that were a mass image-forming type, 39 cases formed an image of a mass, 7 cases formed an image of duct dilatation and a mass, and 5 cases formed an image of an intracystic mass. Previously we have explained that 51.1% of the non-mass image-forming breast cancer was DCIS. On the other hand, nearly 70% of DCIS presented with the mass image-forming type, with features that were mainly small and/or multiple masses (Table 3).

Discussion

From these results, we considered the relationship between the progress of breast cancer and ultrasonic imaging.

First, breast cancer occurs at the terminal duct lobular units (TDLU) of a single segment of the mammary gland and proliferating cells fill the ducts [4, 5]. When cancer cells proliferate intraductally in a relatively localized area, the image displays a small mass. When the cancer cells spread predominantly to the central side with the accumulation of secretion, the image displays a ductal pattern. In DCIS, the cancer cells proliferate within the ducts without acquiring infiltrating ability [6]. According to the grade of proliferation of cancer and interaction between the intraductal component and the stroma, they present a homogeneous pattern, a mottled pattern, or a



Echogenic spots +

FIG. 6. This case has echogenic spots. This is a geographic pattern. The patient is 42 years old. The histological diagnosis was invasive ductal carcinoma with a predominant intraductal component, and the intraductal component was comedo type

TABLE 2. Relationship between intraductal component and ultrasonic images

Pattern	Non-comedo type	Comedo type
Homogeneous	2 (2)	0 (0)
Ductal	2 (0)	4 (1)
Mottled	8 (2)	3 (2)
Geographic	9 (5)	15 (12)
Total	21 (9)	22 (15)

Number of cases with echogenic spots is indicated in parentheses

geographic pattern. In many cases with a mottled pattern or a geographic pattern, the cancer cells spread widely. If calcification exists, echogenic spots are visible regardless of the pattern. If infiltrating ability is acquired after spreading, the image displays a mass plus dilated duct, a mottled pattern, or a geographic pattern [7]. If infiltrating ability is immediately acquired after the development of cancer, it displays a mass image, which is the most common type of breast cancer (Fig. 7).

TABLE 3. Ultrasonic images of ductal carcinoma in situ (DCIS)

Mass image-forming type	51 (68.0%)
Mass (small, multiple etc)	39
Duct dilatation + mass	7
Intracystic mass	5
Non-mass image-forming type	24 (32.0%)
Total	75 (100%)

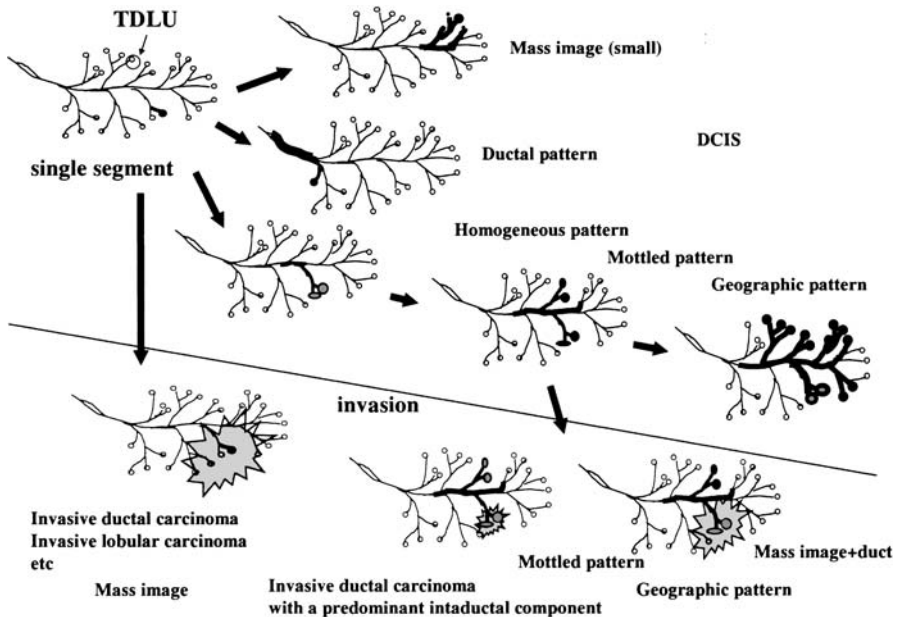


FIG. 7. Schema of the relationship between the progress of breast cancer and ultrasonic imaging

Conclusions

1. Although mass image-forming lesions are commonly seen in breast cancer, there are some cases with a non-mass image-forming type. In this study, we investigated the characteristics of non-mass image-forming breast cancer. With non-mass image-forming breast cancer, more than 50% was DCIS, about 70% was DCIS and micro-invasive carcinoma, and about 90% was DCIS and invasive ductal carcinoma with a predominant intraductal component. In contrast, about 30% of DCIS was non-mass image-forming breast cancer.

2. According to the echoic pattern of the mammary gland with the lesion, we classified non-mass image-forming breast cancers into four subtypes: a homogeneous

pattern, a ductal pattern, a mottled pattern, and a geographic pattern. Forty-seven cases were classified into 2 with a homogeneous pattern, 6 with a ductal pattern, 12 with a mottled pattern, and 27 with a geographic pattern.

3. The geographic pattern often contains invasive components.

4. The geographic pattern and/or the lesion with echogenic spots often has a comedo type of intraductal component.

5. These results revealed the close relationship between the progress of breast cancer and ultrasonic imaging.

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