

## Brief communication (Original)

# Ultrasonography and histology correlation in BI-RADS 4/5 small breast lesions among Thai patients

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**Background:** Ultrasonography is an important imaging tool in detection of small breast cancers, particularly in younger women with dense breasts. Among the ultrasonographic characteristics for the malignancy, it is unclear which are common or more predictive.

**Objective:** Analyze breast ultrasonograms and determine the common and predictive characteristics of the BI-RADS 4/5 small breast lesions that were correlated with histology-proved carcinoma among Thai patients.

**Methods:** Data were collected retrospectively between November 2006 and September 2007 at King Chulalongkorn Memorial Hospital. Forty-five BI-RADS 4 or 5 small breast lesions from 41 patients were reviewed for ultrasonographic characteristics and for correlation between each of these features and histology-proved malignancy.

**Results:** There were 15 out of 30 lesions of BI-RADS 4 and 14 out of 15 of BI-RADS 5 that were histologically proven breast carcinoma. The lesion dimension ranged from 0.27 cm to 1.5 cm (mean: 0.98 cm). The malignant signs that were common consisted of irregular shapes (70%) and posterior shadowing (35.6%). However, the most correlating signs for malignancy were vascularity of the lesion 100%, and spiculated margins 100%. The other characteristics for malignancy, in descending order, were marked hypoechogenicity 88.9%, microcalcifications within mass 85.7%, echogenic halo 83.3%, shadowing 81.3%, branched pattern 77.8%, duct extension 75%, irregular shape 72.2%, and taller than wide orientation 70%.

**Conclusion:** Irregular shape and shadowing were the two most common malignant signs that characterized BI-RADS 4, 5 small breast lesions by ultrasonography. However, the most predictive signs were increases in vascularity and spiculated margins.

**Keywords:** BI-RADS 4/5, small breast cancers, ultrasonographic feature

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Breast cancer is the most common cancer in females, and the age-standardized incidence rate is 37.4 per 1,000,000 women. In Thailand, it is a leading cause of death and the second most common cancer in women. The estimated incidence rate is 20.5 per 100,000 women [1]. Early detection of small lesions might improve survival rate of patients.

Ultrasonography is most useful for detection of small breast cancers, particularly in younger women with dense breasts that are not suitable for mammography [2]. In Japan, ultrasonography could detect 15% of mammographically occult breast

cancers [3]. The proportion of ultrasonographically detected cancers among the total number of nonpalpable cancers was 22% [4]. Overall accuracy in detection of breast malignancy by ultrasonography was approximately 70%. The most common mammographic parenchymal pattern of Thai women is dense breasts [5]. Therefore, it is an urgent task to establish ultrasonography for detection of small breast cancer in Thai women.

Ultrasonographic appearances can be useful in distinguishing benign and malignant lesions [6, 10-12]. Ultrasonographic characteristics of breast cancer that have been related to malignancy have been described as spiculation, taller than wide shape, angular margins, shadowing, branch pattern, hypoechogenicity, punctate calcifications, duct extension, and microlobulation [6].

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Previous reports supported the significance of such malignant ultrasonographic features for small lesions [4, 6]. However, among the ultrasonographic characteristics for the malignancy, it is still unclear which are common or predictive.

In this study, we analyzed ultrasonographic features of BI-RADS 4/5 small breast lesions to determine which are common or predictive of malignancy among Thai patients.

### Materials and methods

Cases were collected retrospectively between November 2006 and September 30, 2007 at King Chulalongkorn Memorial Hospital (KCMH). This study was approved by the Ethics Committee of the Faculty of Medicine, Chulalongkorn University.

Inclusion criteria were all cases of ultrasonographic BI-RADS 4 or 5 that met the operational definition of small breast lesions and that had a subsequent histologic diagnosis.

Ultrasonographic BI-RADS 4 is a suspicious abnormality that warrants biopsy but is not diagnostic for malignancy. Lesions in this category would have an intermediate probability for cancer, ranging from 3-94%. Included in this group are sonographic findings of a solid mass without all of the criteria for a fibroadenoma and of other benign lesions.

Ultrasonographic BI-RADS 5 is highly suggestive of malignancy. An abnormality identified sonographically and placed in this category should have a 95% or higher risk of malignancy so that biopsy and definitive treatment has to be considered at the outset [7].

Small breast lesions were defined as clinically non-palpable or vague lumps where the largest dimension of the nodule by ultrasonography was not more than 1.5 cm. Breast ultrasonography was performed with high frequency (10-12 MHz) linear transducers (Philip HDI 5000 and IU 22, Finland, GE voluson 730 expert, USA) by one experienced breast radiologist.

Ten characteristics (shape, orientation, margin, internal echogenicity, boundary echogenicity, posterior acoustic features, calcification, vascularity, branch pattern, and duct extension) were used to describe all studied nodules [6, 7]. The number of these characteristics were tabulated and analyzed according to histology.

### Results

Forty-five lesions from 41 women were diagnosed as ultrasonographic BI-RADS 4, 5 small breast lesions and had excisional biopsy results. There were multiple lesions in three patients. **Table 1** shows BI-RADS 4, 5 and histologic diagnostic results.

**Table 1.** BI-RADS 4, 5 and histologic diagnostic results.

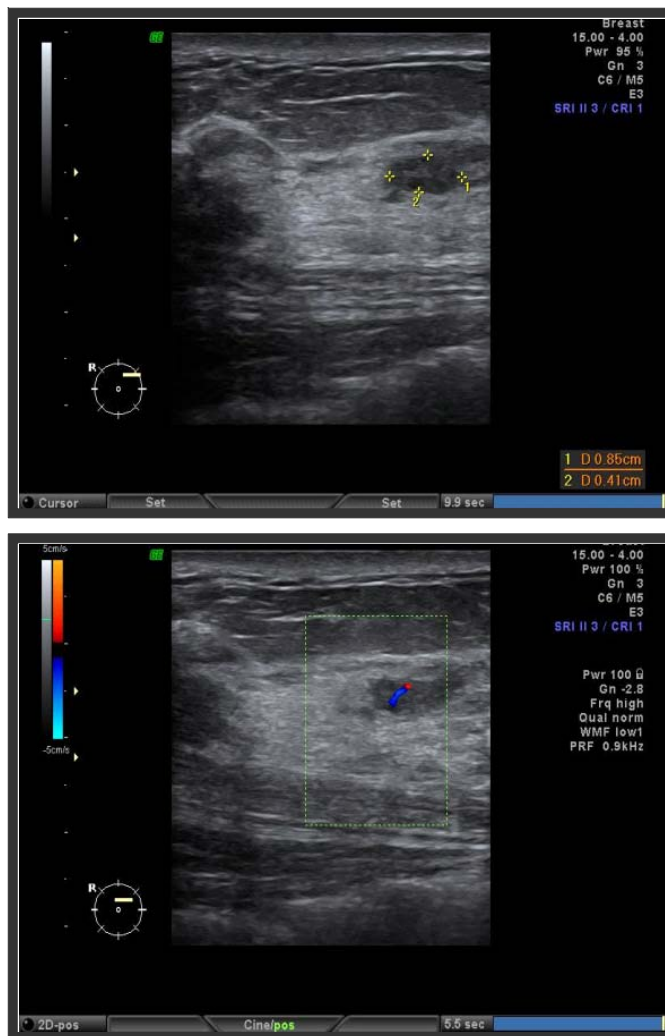
Histologic results	BI-RADS 4	BI-RADS 5	BI-RADS 4&5
<b>Malignant and benign</b>	<b>30 (66.7%)</b>	<b>15 (33.3 %)</b>	<b>45</b>
<b>Malignant</b>	<b>15 (33.3%)</b>	<b>14 (31.1%)</b>	<b>29 (64.4%)</b>
- invasive ductal carcinoma	11 (24.4%)	11 (24.4%)	22 (48.9%)
- invasive lobular carcinoma	1 (2.2%)	2 (4.4%)	3 (6.7%)
- ductal carcinoma in situ	2 (4.4%)	1 (2.2%)	3 (6.7%)
- Invasive lobular carcinoma with comedo ductal carcinoma in situ	1 (2.2%)	0	1 (2.2%)
<b>Benign</b>	<b>15 (33.3%)</b>	<b>1 (2.2%)</b>	<b>16 (35.6%)</b>
- fibrocystic change	2 (4.4%)	1 (2.2%)	3 (6.7%)
- fibroadenoma	3 (6.7%)	0	3 (6.7%)
- fibroadenoma with intraductal papilloma	2 (4.4%)	0	2 (4.4%)
- fibroadenoma with adenosis	1 (2.2%)	0	1 (2.2%)
- adenosis with flat epithelial atypia	1 (2.2%)	0	1 (2.2%)
- intraductal papilloma	1 (2.2%)	0	1 (2.2%)
- intraductal papilloma with atypical ductal hyperplasia	1 (2.2%)	0	1 (2.2%)
- fibrocystic change with sclerosing adenosis	1 (2.2%)	0	1 (2.2%)
- fibrocystic change with fibroadenomatoid hyperplasia	1 (2.2%)	0	1 (2.2%)
- radial scar	1 (2.2%)	0	1 (2.2%)
- unremarkable breast tissue	1 (2.2%)	0	1 (2.2%)

Ultrasonographic characteristics of the lesions were tabulated in **Table 2**.

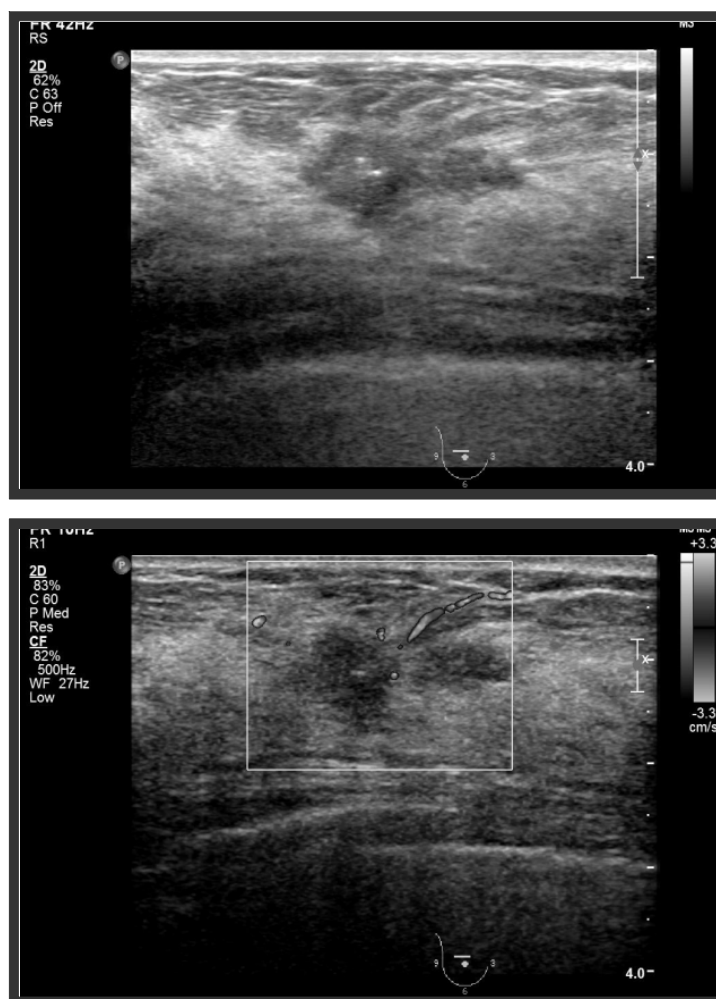
**Figure 1** and **2** show several malignant ultrasonographic features of small breast lesions that had malignant histologic diagnostic results.

**Table 2.** The correlation between ultrasonographic features of BI-RADS 4, 5 small breast lesions and malignant histologic diagnostic results.

Characteristics	Malignant lesions/total lesions
Vascularity in lesion	6/6 (100%)
Spiculated margin	2/2 (100%)
Markedly hypoechoic	8/9 (88.9%)
Microcalcifications within mass	6/7 (85.7%)
Echogenic halo	5/6 (83.3%)
Shadowing	13/16 (81.3%)
Branch pattern	7/9 (77.8%)
Duct extension	9/12 (75%)
Irregular shape	26/36 (72.2%)
Taller than wide orientation	7/10 (70%)



**Figure 1.** Ultrasonographic images showing three malignant characteristics. The lesion has irregular shape, duct extension, and vascularity in lesion. Biopsy result revealed invasive ductal carcinoma.



**Figure 2.** Ultrasonographic images showing four malignant characteristics. The lesion has irregular shape, duct extension, microcalcification within lesion and vascularity in lesion. Biopsy result revealed invasive ductal carcinoma.

## Discussion

There are some controversies regarding the utility of ultrasonography when evaluating solid breast masses for the likelihood of malignancy [8, 9]. However, several studies have suggested that sonographic appearances are most useful for differentiating benign from malignant solid breast masses [6, 10-12]. This study has assessed the ultrasonographic features with histology correlation in small breast cancer to identify reliable malignant features of help in the early detection of breast cancer.

In our study, the characteristic ultrasonographic features (vascularity in the lesion, spiculated margin, markedly hypoechoic, microcalcifications within mass, echogenic halo, posterior shadowing, branch pattern, duct extension, irregular shape, and taller than wide orientation) were the important imaging clues to

establish the diagnosis of early breast cancer, matching other reports [6, 10, 12]. Among the characteristics, the vascularity in lesion and spiculated margin were the most significant features for diagnosis of small breast cancer as correlated with the histology. Although the growth of tumor depends on vascularization, some studies have demonstrated that the detection of color Doppler signals showed no correlation with the size of the tumor [13]. This suggests that early formation of abundant microvasculature in small tumors might be important factors. Therefore, detection of the vascularity is significant for confirmation of small breast cancer. It must be noted that vascularity cannot be detected in all malignant lesions, and the detectability of tumor vascularity depends on the ultrasound equipment. On the other hand, spiculation is an imaging feature of

infiltrating tentacles of tumor that extend into the surrounding tissues [6]. This feature correlates well with small breast cancer in our study. In addition, the spiculation within the fibrous tissue surrounding a cancer, especially small breast lesion, may be inconspicuous mammographically and ultrasonography can be very helpful in such cases.

The imaging features of markedly hypoechoic, micro-calcifications within the mass, echogenic halo, shadowing, branch pattern, duct extension, irregular shape and taller than wide orientation could be present in both benign and malignant lesions. However, they are much more common features in malignant lesions and should be considered as malignant characteristics [6]. We have found that 88.9% of small breast cancers are markedly hypoechoic compared to fat. Therefore, a markedly hypoechoic feature is a worrisome finding for small breast cancer. Sensitivity of ultrasonography for demonstration of microcalcifications is less than with mammography [14-16]. However, the currently used high-frequency transducers can show a higher percentage of visible calcifications than the previously used lower-frequency transducers [14-16]. We have found that the majority of small breast cancer is markedly hypoechoic, and enhances our ability to identify the bright calcification echoes. Conversely, benign calcifications within a background of normal breast tissue, including large amount of hyperechoic and heterogeneous fibrous tissue, are difficult to detect sonographically [19]. Therefore, even though the sensitivity of ultrasonography for calcifications is very low compared with mammography, calcifications that are seen sonographically within a solid mass are more likely to be malignant [6]. The echogenic halo was strongly predictive of malignancy in some studies [17, 18]. However, the identification of the echogenic halo can be difficult if the tumor nidus is surrounded by hyperechoic fibroglandular tissue. The shadowing is an ultrasonographic feature of malignant nodules that has been frequently discussed in many reports papers [19-24]. In this study, shadowing was seen in a high percentage of small breast cancers (81.3%). Variable presentation of shadowing in malignant lesions might depend on the tumor grading and type [6, 11, 22, 24]. Our finding of either duct extension or a branch pattern suggests that a process might be spreading along the ductal system, increasing the likelihood of malignancy [6]. However, such extension may indicate the presence of an invasive tumor around the duct as well as an intraductal tumor [6]. An irregular shape has

been a frequently reported finding and one of the most reliable findings for malignancy [11, 23, 26]. An irregular shape can indicate inconsistent growth and advancement of the lesion edge [25]. It has been reported that nodules that are taller than wider are likely to be malignant [18, 24]. Taller-than-wider orientation on ultrasonography can suggest spread of the lesion through tissue-plane boundaries [25]. In our study, 70% of malignant lesions showed taller-than-wider lesions. Therefore, this worrisome ultrasonographic feature is more likely to be associated with small breast cancer.

In our study, the evaluation of the cases was retrospective and findings were interpreted from the static images leading to description that is more difficult to do. Therefore, although reporters were blinded to biopsy results, the observers were aware that their descriptions and assessments in BI-RADS 4/5 lesions may have been biased effecting their characterization of the lesions.

In conclusion, ultrasonography was most useful in the characterization of small breast lesion and could be helpful in evaluation of small breast lesions for malignancy.

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The authors have no conflict of interest to declare.

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