Original Article

Mammographic Microcalcifications and Breast Cancer: A Radio-Pathological Correlation

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Background: Breast cancer is the most common cancer for women, often asymptomatic, and diagnosed from combined screening using mammography and ultrasound. Abnormal findings include microcalcifications with widely variable positive predictive values (PPVs) for malignancy, ranging from 2% to 95%. PPVs for each type of microcalcification are unknown.

Objective: To assess PPVs for all abnormal microcalcifications in Breast Imaging Reporting and Data System (BI-RADS) 4 and 5 as seen by mammography.

Materials and Methods: The present study was a retrospective study of 62 female patients with abnormal microcalcifications that underwent mammography-guided needle localized excision between September 2011 and December 2018, at Thammasat University Hospital.

Results: Of all 72 abnormal microcalcifications, PPVs were coarse heterogeneous 25%, amorphous 37.93%, fine pleomorphic 42.31%, and fine linear or linear branching 33.33%.

Conclusion: Abnormal microcalcifications rated BI-RADS 4 or 5 have greatly varying malignancy risks, thus, tissue biopsies should be considered in line with microcalcification morphology and individual patient risk factors.

Keywords: Breast cancer, Mammography, Microcalcification, Radio-pathologic correlation, Needle localized excision

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Mammography and breast ultrasound screenings are widely used and recommended for women over 35 years of age[1]. Patients with breast cancer may not show noticeable symptoms but can be diagnosed from combined screenings[2-4]. Most abnormal findings are determined not to be cancerous, and malignancy rates range from 10% to 33%[5]. One particular finding during mammography is abnormal microcalcification, which has a wide range in malignancy probability from 2% to 95%[6], thus, patients with this finding usually require tissue diagnosis.

Abnormal microcalcifications are divided into four types, amorphous, coarse heterogeneous, fine pleomorphic, and fine linear or fine-linear branching[6]. Currently, the precise positive predictive value (PPV) of malignancy in each type of abnormal microcalcification is still unknown, however, this value is crucial in determining the next steps toward treatment. The primary objective in the present study was to assess the PPV for malignancy in each type of abnormal microcalcification from mammography. The secondary objective was to assess the relationship between each type of abnormal microcalcification in Breast Imaging Reporting and Data System (BI-RADS) 4 and 5 and its pathological report (Figure 1).

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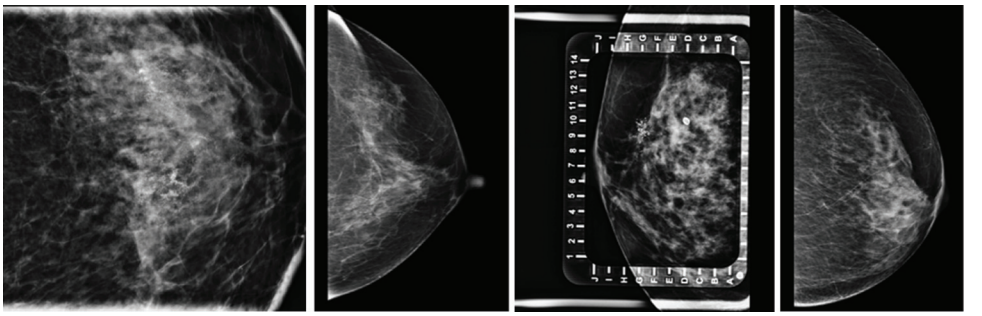
Materials and Methods

Study design

The present study was a retrospective study of all patients with abnormal microcalcifications that underwent mammography-guided needle localization excision between September 2011 and December 2018 at Thammasat University Hospital.

Patients

The Institutional Review Board gave approval and waived informed consent requirements, the



A B C D

Figure 1. Types of abnormal microcalcifications.

(A) Segmental amorphous microcalcifications at left breast, (B) Group of coarse heterogeneous calcifications at lower inner quadrant of the left breast, (C) Group of pleomorphic calcifications at upper central region of the right breast, (D) Linear branching microcalcification at subareolar region of the left breast

EC No. is 201/2018, the project No. is MTU-EC-SU-0-141/61. The authors included results from 62 women with abnormal microcalcifications. Inclusion criteria were women who had microcalcifications detected from mammography without mass from mammography or ultrasound in the same location, microcalcification(s) rated BI-RADS 4 or 5, undergone needle localization excision procedure, diagnosis confirmation from the pathological analysis of excised tissue at Thammasat University Hospital, and tissue specimens with radiographic confirmation of microcalcification. From the 77 cases of mammography, 14 were excluded as eight cases did not meet the inclusion criteria and six cases had group of punctate microcalcifications.

Imaging and evaluation

Mammography for each patient was performed on two standard image planes of mediolateral oblique and craniocaudal views, with or without additional magnification or spot compression. All mammograms were analyzed by an expert radiologist, using morphologic descriptors for microcalcification in compliance with the BI-RADS Atlas Fifth Edition[6].

Statistical analysis

Stata, version 14.2 (StataCorp LP, College Station, TX, USA) was used for statistical analysis and to report PPV and percentage value.

Results

The baseline characteristics of the 63 participants with 72 abnormal microcalcifications are listed in Table 1.

There were eight cases of coarse heterogeneous

Table 1. Baseline characteristics of participants (n=62 patients, 72 abnormal microcalcifications)

Demographic data	n (%)
Age (years); mean±SD	52.53±10.24
Female	62 (100)
Clinical presentation	
Asymptomatic	42 (67.74)
• New case	24 (38.71)
• Follow-up	18 (29.03)
Symptoms	20 (32.26)
• Palpable mass	10 (16.13)
• Mastalgia	9 (14.52)
• Nipple discharge	1 (1.61)
Side	
Right	30 (48.39)
Left	32 (51.61)
BI-RADS	
4a	5 (8.06)
4b	35 (56.45)
4c	18 (29.03)
5	4 (6.45)
Breast composition	
Almost entirely fat	0 (0.00)
Scattered fibroglandular	10 (16.13)
Heterogeneously dense	35 (56.45)
Extremely dense	17 (27.42)
Microcalcification type	
Coarse heterogeneous	8 (11.11)
Amorphous	29 (40.28)
Fine pleomorphic	26 (36.11)
Fine linear/linear branching	9 (12.50)

SD=standard deviation; BI-RADS=breast imaging reporting and data system

Table 2. Pathological reports for each type of abnormal microcalcification

Pathological report	Coarse heterogeneous; n (%)	Amorphous; n (%)	Fine pleomorphic; n (%)	Fine linear/linear branching; n (%)
DCIS	6.67	18.37	20.00	14.29
Invasive ductal carcinoma	6.67	4.08	4.44	-
LCIS	-	2.04	2.22	4.76
Invasive lobular carcinoma	-	-	-	-
ADH	-	6.12	4.44	4.76
UDH	13.33	10.20	11.11	9.52
Fibrocystic change	26.66	32.65	31.11	28.57
Fibroadenoma	6.67	2.04	2.22	-
Adenosis	6.67	6.12	6.67	4.76
Sclerosing adenosis	6.67	-	-	-
Radial scar	-	2.04	2.22	4.76
Focal fat necrosis	-	2.04	2.22	4.76
Intraductal papilloma	-	-	-	-
FEA	-	2.04	2.22	4.76
Apocrine metaplasia	6.67	-	-	-
Columnar change	13.33	8.16	6.67	14.29
No diagnostic abnormality	6.67	4.08	4.44	4.76

DCIS=ductal carcinoma in situ; LCIS=lobular carcinoma in situ; ADH=atypical ductal hyperplasia; UDH=usual ductal hyperplasia; FEA=flat epithelial atypia

Table 3. Frequency of malignancy in lesion by morphologic descriptor

Descriptor	No. of ductal carcinoma in situ	No. of invasive cancer	Total No. of malignancies	Total No. of lesions	PPV (%)
Coarse heterogeneous	1	1	2	8	25
Amorphous	9	2	11	29	37.93
Fine pleomorphic	9	2	11	26	42.31
Fine linear/linear branching	3	0	3	9	33.33
Total	22	5	27	72	37.5

PPV=positive predictive value

microcalcification with 15 pathologic reports, 29 cases of amorphous microcalcification with 49 reports, 26 cases of fine pleomorphic microcalcification with 45 reports, and nine cases of fine linear or linear branching microcalcification with 21 pathologic reports. Details are described in Table 2.

Discussion

The most common pathologic report was benign with the top three findings being fibrocystic change, usual ductal hyperplasia (UDH), and columnar change. In the present study, the overall PPV of abnormal microcalcifications was 37.5%. The PPVs of each type of abnormal microcalcification from highest to lowest were fine pleomorphic (42.31%), amorphous (37.93%), fine linear or linear branching (33.33%), and coarse heterogeneous (25%) as show in Table 3. However, previous research had noted that order of PPV highest to lowest being fine linear or linear branching, fine pleomorphic, amorphous, and coarse heterogeneous[7-11]. The present study differing results may be due to small sample sizes, especially for the fine linear or linear branching and coarse heterogeneous groups.

Limitation in the present study include it being a retrospective analysis that analyzed only morphologic descriptors and did not include distribution, stability descriptors, or these in combination[8,9,12] as this would have all affected PPVs. Thammasat University Hospital does not have a stereotactic guide machine, therefore, the authors performed only needle localization excisions. The patients who preferred the first method would have been referred to another hospital and not included in the present study, creating

selection bias. In addition, patients with other type of microcalcification were excluded.

Associations between each type of abnormal microcalcification with its respective pathological report can generally help guide treatment management. Of note, abnormal microcalcifications with BI-RADS 4 to 5 typically have high PPVs, which usually indicate a need for tissue diagnosis[13]. However, in some situations, such as when elderly patients with severe medical conditions at high risk for surgery have coarse heterogeneous microcalcifications with the lowest PPV, it is quite possible that doctors should discuss the risks and benefits of any investigations and management with the patient and family. They may elect to skip tissue diagnosis and choose a follow-up mammography instead. On the other hand, young patients with low risk for malignancy having coarse heterogeneous microcalcification may choose short-term follow-up imaging to observe the stability or progression of the calcification. Therefore, doctors should analyze the data holistically, considering not only mammographic abnormalities but also patient history.

Conclusion

Abnormal microcalcifications in mammograms with a BI-RAD 4 or 5 have varying risks of malignancy and biopsy should be considered according to each type of microcalcification morphology and individual patient risk factors. A larger sample size should be studied to maximize the accuracy of malignancy prediction.

What is already known on this topic?

Abnormal microcalcification in BI-RADS 4 and 5 are recommended to do tissue biopsy for confirm diagnosis.

What this study adds?

Abnormal microcalcification in BI-RADS 4 and 5 have widely variable PPVs for malignancy. Biopsy should be considered according to each type of microcalcification morphology and individual patient risk factors.

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Conflicts of interest

The authors declare no conflict of interest.

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