

Positive Predictive Value and Biopsy Rate of Breast Cancer in BI-RADS Category 4 and 5 Breast Lesions คำพยากรณ์บวกของมะเร็งเต้านมและอัตราการตรวจชิ้นเนื้อ ในรอยโรคกลุ่ม BI-RADS 4 และ 5

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Abstract

Objective: To determine positive predictive values (PPV) and biopsy rates of breast cancer in lesions categorized as BI-RADS (Breast Imaging Reporting and Data System) category 4 and 5.

Materials and methods: The medical and radiological records of women which diagnosed as BI-RADS 4 and 5 breast lesions at Prachuapkhirikhan Hospital from October 1, 2013 to October 31, 2017 were retrospectively studied. PPV was calculated for women who had biopsies with subsequent pathologic results. The radiographic and pathological reports were compared. Biopsy rates of the patients diagnosed as BI-RADS category 4 and 5 were analyzed.

Result: Total of 1,596 patients who underwent mammography at Prachuapkhirikhan Hospital, 312 of women who diagnosed for BI-RADS 4 and 5 were included. One hundred ninety five of women had tissue diagnoses which biopsy rate was about 62.5%. The biopsy rates categorized as BI-RADS 4 and 5 were 58.9% and 75.8%, respectively. The mean age was 50.1 years (range, 26-85). Mass without microcalcification was the most common mammographic imaging in this study. Eighty eight women had breast cancer. The most common malignancy was invasive ductal carcinoma. One hundred and seven women had benign features. The most common benign type was fibrocystic change. PPVs for subcategories 4 and 5 were about 27.6% and 96.0% respectively.

Conclusion: BI-RADS category is useful in predicting the chance of breast cancer. Biopsy should be performed in all suspect mammographic findings because overlapping malignant and benign lesions in some radiological appearances. PPVs of malignancy in BI-RADS category 4 and 5 were 27.6% and 96.0%, respectively. The biopsy rate was 62.5%

Keywords : Breast Imaging Reporting and Data System (BI-RADS), mammography, breast cancer, positive predictive value (PPV), biopsy rate

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาค่าพยากรณ์บวกของมะเร็งเต้านม และอัตราการตรวจชิ้นเนื้อจากการรายงานผลแมมโมแกรมในรอยโรค กลุ่ม BI-RADS 4 และ 5

วิธีการศึกษา: ศึกษาย้อนหลังจากเวชระเบียนและรายงานผลแมมโมแกรมกลุ่ม BI-RADS 4 และ 5 ในโรงพยาบาลประจวบคีรีขันธ์ ตั้งแต่วันที่ 1 ตุลาคม พ.ศ. 2556 ถึง 31 ตุลาคม พ.ศ. 2560 โดยศึกษาหาค่าพยากรณ์บวกของมะเร็งเต้านม ในผู้ป่วยหญิงที่มีการตรวจชิ้นเนื้อพร้อมผลรายงานทางพยาธิวิทยา และเปรียบเทียบการรายงานผลแมมโมแกรมกับผลพยาธิวิทยา รวมถึงอัตราการตรวจชิ้นเนื้อในรอยโรคกลุ่ม BI-RADS 4 และ 5

ผลการศึกษา: จำนวนผู้ป่วยที่ได้รับการตรวจแมมโมแกรมทั้งสิ้น 1,596 ราย พบผู้หญิงที่เข้าเกณฑ์ BI-RADS 4 และ 5 จำนวน 312 ราย มีผู้หญิง BI-RADS 4 และ 5 ที่ได้รับการตรวจชิ้นเนื้อทั้งสิ้น 195 ราย คิดเป็นร้อยละ 62.5 โดยเป็น BI-RADS 4 ร้อยละ 58.9 และ BI-RADS 5 ร้อยละ 75.8 ตามลำดับ อายุเฉลี่ย 50.1 ปี (อายุระหว่าง 26-85 ปี) ลักษณะภาพรังสีที่พบมากที่สุด คือ ก้อนที่ไม่มีหินปูน พบผู้หญิงที่เป็นมะเร็งเต้านมจำนวน 88 ราย ชนิดของมะเร็งเต้านมที่พบมากสุดในการศึกษานี้ คือ invasive ductal carcinoma โดยกลุ่มที่ไม่ใช่มะเร็งจำนวน 107 ราย พบ fibrocystic change มากที่สุด ค่าพยากรณ์ผลบวกของผู้หญิงมะเร็งเต้านมในกลุ่ม BI-RADS 4 ร้อยละ 27.6 และ BI-RADS 5 ร้อยละ 96.0

สรุป: การรายงานผลแมมโมแกรมแบบ BI-RADS มีประโยชน์ในการพยากรณ์โอกาสที่จะเป็นมะเร็งเต้านม และการตรวจชิ้นเนื้อมีความสำคัญในผู้ป่วยที่สงสัยมะเร็งเต้านมทุกราย เนื่องจากการรายงานผลแมมโมแกรมบางกรณีไม่สามารถแยกมะเร็งจากก้อนเนื้อออกธรรมดาโดยค่าพยากรณ์บวกของมะเร็งเต้านมผู้หญิง BI-RADS 4 และ 5 ในการศึกษานี้เท่ากับ ร้อยละ 27.6 และ 96.0 ตามลำดับ อัตราการตรวจชิ้นเนื้อภายหลังการรายงานผลแมมโมแกรมในการศึกษานี้ เท่ากับร้อยละ 62.5

คำสำคัญ : BI-RADS แมมโมแกรม มะเร็งเต้านม ค่าพยากรณ์ผลบวก อัตราการตรวจชิ้นเนื้อ

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Introduction

Breast cancer is the most common new cancer in the United States women.¹ In Thailand, according to National Cancer Institute, it accounts for 41.9% of all new cancer in female and is the most common cause of female cancer.² Mammography is the gold standard for early detection of breast cancer.^{3,4}

The Breast Imaging Reporting and Data System (BI-RADS) was proposed by the American College of Radiology (ACR) and has been

used for standard terminology and reporting mammographic findings. The system improved quality of radiology communication. ACR BI-RADS atlas 5th edition⁵ suggested evaluation breast lesion with multimodality, including high resolution ultrasound (US) or magnetic resonance imaging (MRI). This reporting system has been used in radiology report of mammography in Prachuapkhirikhan Hospital since 2013. Detail of BI-RADS category is revealed in Table 1.

Table 1 Details of BI-RADS category 0-6

Category	Description
0: Incomplete	Need additional imaging evaluation and/or prior mammograms for comparison.
1: Negative	No evidence of malignancy, routine screening.
2: Benign	No evidence of malignancy, routine screening.
3: Probably benign	Less than 2% chance of malignancy, follow up imaging.
4: Suspicious	2-95% chance of malignancy, biopsy.
4A: Low suspicion for malignancy	
4B: Moderate suspicion for malignancy	
4C: High suspicion for malignancy	
5: Highly suggestive of malignancy	Greater than 95% chance of malignancy, biopsy.
6: Known biopsy-proven malignancy	100% malignant, definitive treatment.

BI-RADS category is useful in predicting the chance of breast cancer. Biopsy should be performed in all suspect mammographic findings because overlapping malignant and benign lesions in some radiological appearances.

The aims of the study were to determine the positive predictive value (PPV) of mammographic findings and biopsy rate categorized as BI-RADS 4 and 5. The abnormal mammographic findings and pathologic results with BI-RADS 4 and 5 were also compared.

Materials and methods

Between October 1, 2013 to October 31, 2017 total of 1,596 patients underwent screening and diagnostic mammography at Prachuapkhirikhan Hospital. Mammography was obtained two standard views. Mediolateral

oblique (MLO) and craniocaudal (CC) views were performed by using mammographic machine (Hologic Lorads M-IV). Additional ultrasound was added in all cases by ultrasonography machine (Aloka prosound alpha 7). The BI-RADS categories from ACR guideline was assigned in radiological reports by general radiologists.

During this period, three hundred and twelve women were diagnosed BI-RADS category 4 and 5. Total of 195 women had pathologic results. One hundred and seventeen women hadn't pathologic result, because they were sent for interventions at other hospitals or follow-up by surgeons' decision.

Patients' age, clinical findings, imaging findings with categories and pathologic reports were retrospective reviewed. The biopsy rate and positive predictive value (PPV) were

calculated from all patients who were diagnosed BI-RADS category 4 and 5 with subsequent pathologic results. The radiographic and pathological reports were compared.

Age was summarized by mean with range. Categorical data were summarized by counts and percentages. All data were analyzed by Microsoft Excel version 2010. Biopsy rate was calculated in all of patients who diagnosed BI-RADS category 4 and 5 with pathologic reports. The positive predictive value was analyzed. PPV represented the probability that a patient's biopsy was positive for malignancy.

Result

Total of 1,596 patients underwent mammography at Prachuapkhirikhan Hospital between October 2013 and October 2017. BI-RADS category of all patients in this study is shown in Table 2. There were 331 women (20.7%) categorized as BI-RADS 4 and 5. However, 19 women who lost the data had observed. Of these 312 women, 195 had pathologic results which considered biopsy rate about 62.5%. The biopsy rates categorized as BI-RADS 4 and 5 were 58.9% and 75.8%, respectively. Details of biopsy rates are listed in Table 3.

Table 2 BI-RADS categories of all patients who having mammography

BI-RADS category	Number	%
1	266	16.7
2	708	44.4
3	283	17.7
4	265	16.6
5	66	4.1
6	8	0.5
total	1,596	100

Table 3 Biopsy rates of women BI-RADS category 4 and 5

BI-RADS category	Number	biopsy	Biopsy rate (%)
4	246*	145	58.9
5	66	50	75.8
total	312	195	62.5

*19 patients had recorded data at radiology department; however lost recent medical, radiologic or pathological records

The age range of 195 women was 26-85 years (mean age about 50.1 year). Indication of 10 women (5.1%) was screening mammography. One hundred and eighty five women (94.9%)

had diagnostic mammography. The most abnormal indication for imaging was palpable mass. Details of mammographic indications are shown in Table 4.

Table 4 Indications for women who had mammography and subsequent pathological results (N=195)

Indication	Number (%)
Screening	10 (5.1)
Palpable mass	169 (86.7)
Nipple discharge/retraction	6 (3.0)
Axillary mass	5 (2.6)
Abscess, inflammation	5 (2.6)
	195 (100)

Mammographic finding features according to BI-RADS category 4 and 5 are shown in Table 5. The most common finding was mass without microcalcification about 75.5%. Second most common finding was mass

with microcalcification which was about 17.4%. Other findings were microcalcification, axillary lymphadenopathy, architectural distortion and skin involvement. Skin involvement lesions included inflammatory breasts and abscesses.

Table 5 Imaging findings according to BI-RADS category 4 and 5

Mammographic features	BI-RADS 4	BI-RADS 5	Total (%)
Mass without microcalcification	122	25	147 (75.5)
Microcalcification	2	0	2 (1.0)
Mass with micro calcification	9	25	34 (17.4)
Axillary lymphadenopathy	7	0	7 (3.6)
Architectural distortion	2	0	2 (1.0)
Skin involvement	3	0	3 (1.5)
	145	50	195 (100)

After reviews of pathological results of 88 malignant features and 107 benign features according to BI-RADS category 4 and 5 in Table 6 and 7, the most common malignant type was

invasive ductal carcinoma. The most common benign type was fibrocystic change, followed by fibroadenoma. The example of a malignancy case in this study was shown in Figure 1.

Table 6 Summary of malignant pathologic results of 88 women

Pathology	BI-RADS 4	BI-RADS 5	Total (%)
Invasive ductal carcinoma	29	43	72 (81.8)
Ductal carcinoma in situ	4	2	6 (6.8)
Mucinous carcinoma	3	0	3 (3.4)
Invasive papillary carcinoma	0	2	2 (2.3)
Metastatic lesions to breast	3	0	3 (3.4)
Malignant phyllodes	1	1	2 (2.3)
	40	48	88 (100)

Table 7 Summary of benign pathologic results of 107 women

Pathology	BI-RADS 4	BI-RADS 5	Total (%)
Fibrocystic change	37	0	37 (34.6)
Fibroadenoma	28	0	28 (26.2)
Benign breast tissue	18	0	18 (16.8)
Papilloma	3	0	3 (2.8)
Benign phyllodes	3	0	3 (2.8)
Inflammation, abscess	4	0	4 (3.7)
Atypical ductal cell/distorted duct	2	2	4 (3.7)
Sclerosing adenosis	5	0	5 (4.7)
Reactive lymphoid hyperplasia	2	0	2 (2.0)
Perivascular mononuclear infiltration	1	0	1 (0.9)
Secretory calcification	1	0	1 (0.9)
Fat necrosis	1	0	1 (0.9)
	105	2	107 (100)

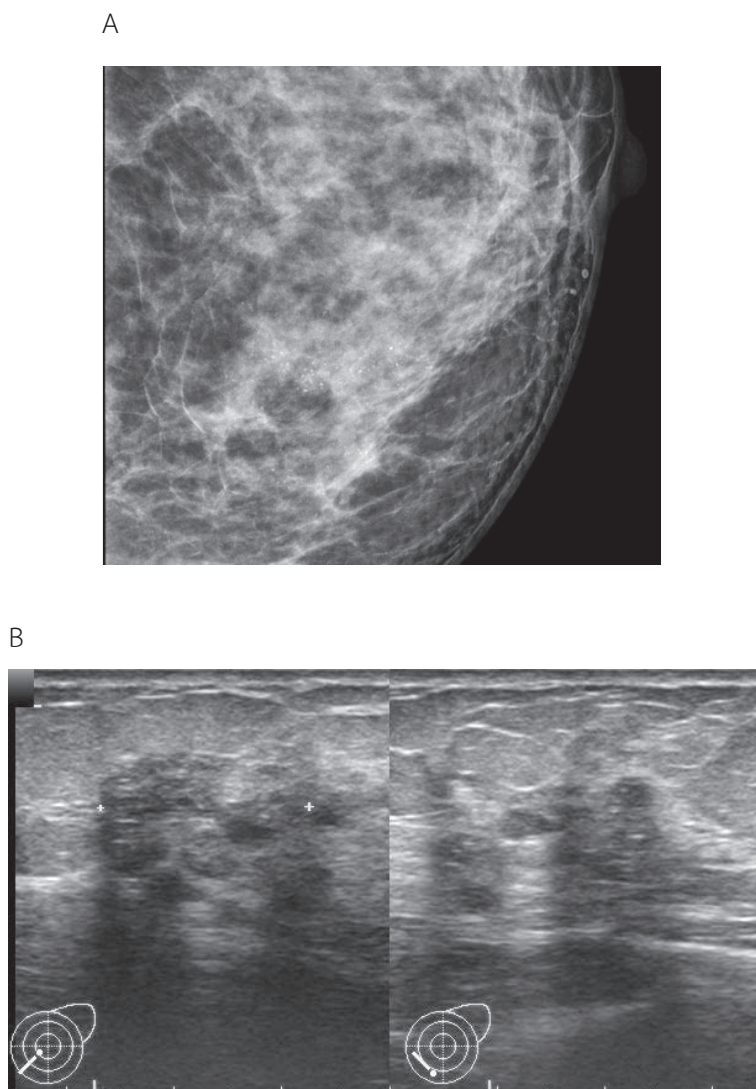


Figure 1 A 55 years old woman presented with left breast mass. Mammogram (A) showed segmental amorphous microcalcifications. Ultrasonogram (B) demonstrated an irregular solid mass with indistinct border and internal calcifications. BI-RADS 4C was diagnosed. Pathologic diagnosis was invasive ductal carcinoma.

In this study, 40 of 145 women with BI-RADS 4 turned out to be malignant while 48 of 50 women with BI-RADS 5 were malignant. The PPVs for breast cancer subcategories

BI-RADS 4 and 5 were about 27.6% and 96.0%. About 107 of 195 women in BI-RADS 4 and 5 were benign lesions. The false positive was about 54.9%. The data were listed in Table 8.

Table 8 BI-RADS category 4 and 5 according to pathologic status of lesions

BI-RADS category	Status of lesions		Number (%)
	Benign	Malignant	
4	105 (72.4)	40 (27.6)	145 (74.4)
5	2 (4.0)	48 (96.0)	50 (25.6)
Total (%)	107 (54.9)	88 (45.1)	195 (100)

Discussion

Most common presentation of women in this study, who were sent to diagnostic mammogram, was palpable breast mass. Most common imaging finding was mass without microcalcification. The imaging findings were similar to the previous studies.⁶⁻⁸ All of cases were reported by using BI-RADS categories from ACR guideline.

BI-RADS categorization is useful for predicting breast cancer in female population and the BI-RADS category 4 and 5 are determined with high risk of malignancy.

In this study, 195 of 312 lesions after mammogram had pathologic results, calculating in a 62.5% biopsy rate. Biopsy rates of category 4 and 5 were 58.9% and 75.8%, respectively. The previous study⁶ in Thailand reported biopsy rate of BI-RADS category 4 about 75%. In this study, biopsy rates of category 4 and 5 were below standardization. This might do to some patients had mammography results but no pathological data from other hospitals or follow-ups about 6 months with breast ultrasound by surgeons' decision as BI-RADS category 3. Actually BI-RADS 4 category classification (4A, 4B and 4C) is

associated with a higher risk of malignancy (low, moderate and high suspicion), and biopsy should be considered. However, overall decisions of interventions in this study were accepted by surgeons and their patients.

The PPVs of BI-RADS category 4 and 5 in previous study⁷⁻¹⁰ were ranging from 26.6-52.7% and 89.5-100%, respectively. The PPVs for breast cancer subcategories BI-RADS 4 and 5 in this study were about 27.6% and 96.0%. The results of this study were in the ranges previously reported.

The most common type of malignancy was invasive ductal carcinoma. Common types of benign were fibrocystic change and fibroadenoma. The pathologic findings were similar with previous studies.^{11,12}

Conclusion

BI-RADS category is useful in predicting the chance of breast cancer. Biopsy should be performed in all suspected mammographic findings because overlapping malignant and benign lesions in some radiological appearances. The PPVs of breast cancer subcategorized 4 and 5 in this study were in ranges of previous reports.

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