Accuracy of Mammography and Breast Ultrasound at Chaoprayayommarat Hospital: a Retrospective Analysis

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Abstract
The purpose of this retrospective descriptive study was to evaluate the accuracy of the mammography and breast ultrasound according to the BI-RADS classification at Chaoprayayommarat hospital. It was conducted in 823 mammograms of a consecutive, unselected collective of symptomatic and asymptomatic women who came to Chaoprayayommarat hospital during January 2015, to June 2015. The BI-RADS was used for mammographic reporting and interpretations. Final assessment category ranging from 1 to 5 according to the following: category 1, “negative”; category 2, “benign finding”; category 3, “probably benign finding”; category 4, “suspicious abnormality”; and category 5, “highly suggestive of malignancy”. BI-RADS 1, 2 and 3 were considered negative and BI-RADS 4 and 5 were considered positive. Accuracy was determined by histopathologic findings or unchanged at least 24 months follow-up mammography. Total accuracy, sensitivity, specificity, negative predictive value (NPV) and positive predictive value (PPV) were also calculated. Of 523 patients, breast mass (62.91%) was the most common clinical presentations, followed by check-up (27.72%), mastalgia (6.31%), axillary mass (1.91%) and nipple discharge (1.15%), respectively, with mean age of 50.38 years. Based on the BI-RADS for mammography, BI-RADS category 2 and 3 (51.24%) representing benign and probably benign breast lesions were the most prevalent in this study. There were 345 negative studies (65.97%) and 178 positive studies (34.03%). Biopsies were performed in 208 of 523 patients (39.77%). Of these lesions, 94 were malignant and 114 were benign. There was 96.81% sensitivity, 79.72% specificity, 51.12% positive predictive value, and 99.13% negative predictive value. The total accuracy was 82.79%. In conclusion, breast evaluation by mammography, utilizing the BI-RADS classification, played an important role in the diagnostic assessment and screening of breast cancer. Benign breast lesion was more common than malignant lesion. The results of this study suggested that the combined mammography and ultrasound was very sensitive, but not as specific, with total accuracy of 82.79%, indicating benefit for evaluation of breast lesions and screening the female population to lower the misdiagnosis rate and reduce mortality of breast cancer. Further studies are needed to achieve improvement of diagnostic accuracy and cost-effectiveness of screening mammography in Thailand.

Keywords: mammography, BI-RADS, breast cancer, breast ultrasound, accuracy
Introduction

Breast cancers are the leading causes of morbidity and mortality among women worldwide\(^1\) especially in developing countries including Thailand. In 2018, there was an estimated 268,670 new cases of breast cancer in the United States and estimated 41,400 deaths from this cancer\(^1\). In Thailand, the incidence of breast cancer becomes increasingly higher over the decade. There were 4,099 deaths from breast cancer in 2016\(^2\). According to a report by the National Cancer Institute, breast cancer was the most common cancer among Thai women followed by cervical cancer and colorectal cancer\(^3,4\).

Mammography and ultrasound are the main methods for detecting early breast cancer, in order that curative treatment can be planned. Screening with mammography has been shown to reduce mortality from breast cancer\(^5\). Schoor GV et al. found an increasingly strong reduction in breast cancer mortality over time because of mammographic screening across the period 1975–2008, resulting in a 65.00% breast cancer mortality reduction in 1992–2008 compared with a 28.00% reduction in 1975–1991\(^6\). Screening mammogram can detect suspicious lesions such as asymmetry, neodensity, architectural distortion and microcalcifications, before it is palpable by clinical breast examination\(^7\). An accurate evaluation is important to maximize cancer detection and to minimize unnecessary surgical procedures\(^8\).

Breast Imaging Reporting and Data System (BI-RADS) developed by the American College of Radiology (ACR) provides standardize mammographic reports of breast lesions and also helpful in predicting benign or malignant potential. The latest edition of ACR BI-RADS was announced in 2013\(^9\).

Materials and methods

Study population:

The retrospective descriptive study of 823 mammograms of a consecutive, unselected collective of symptomatic and asymptomatic women who came to Chaoprayayommarat hospital during January 2015, to June 2015 was performed. Data was collected from the medical records, request forms, histopathologic records, mammograms and ultrasound examinations. All patients had at least 24 months of imaging follow-up. The demographic data collection of the patients included age and presenting symptoms.

The inclusion criteria were:
1. All patients, at any age, who came to Chaoprayayommarat Hospital for either screening or diagnostic mammography to exclude possible breast cancer from January 2015, to June 2015.
2. Images were derived from the mammographic equipment (Hologic Lorad M–IV Analog Mammography) and an ultrasound machine (Toshiba’s Aplio 500 ultrasound system).

The exclusion criteria were
1. Patients who had no histological specimens to prove either the benign or malignant nature of
the lesion.

2. Patients who were lost to follow-up mammography before 24 months.

3. Patients who had no available medical records.

**Imaging protocols:**

Mammograms were performed using the mammographic equipment (Hologic Lorad M–IV Analog Mammography). Two standard examinations on each breast were obtained using craniocaudal (CC) and mediolateral oblique (MLO) views by well-trained technologists. Additional spot compression and magnification views were used for better visualization of the suspicious area and evaluation of micro-calcifications.

All breast ultrasound examinations were performed by the interpreting radiologists including real-time bilateral whole-breast scan, using an ultrasound machine (Toshiba’s Aplio 500 ultrasound system) with 7–12-MHz probes.

**Data analysis:**

The reports were classified into one category according to BI-RADS by experienced radiologists in Chaoprayayommarat Hospital. Final assessment category ranging from 1 to 5 according to the following: category 1, “negative”; category 2, “benign finding”; category 3, “probably benign finding”; category 4, “suspicious abnormality”; and category 5, “highly suggestive of malignancy”.

The positive or negative studies for malignancy were defined according to the following criteria:

1. Negative studies: if final assessment categories were BI–RADS 1, 2 and 3.
2. Positive studies: if final assessment categories were BI–RADS 4 and 5.

The accuracy of the radiologist’s report was determined by histopathologic findings or unchanged at least 24 months follow-up mammography.

Total accuracy, sensitivity, specificity, negative predictive value (NPV) and positive predictive value (PPV) were calculated. A software package (SPSS statistical software version 18) was used for statistical calculations.

**Results**

Of 823 consecutive mammograms, there were 523 patients who fulfilled the inclusion criteria (145 cases of screening mammography and 378 cases of diagnostic mammography); mean age, 50.38 ± 8.99 [SD] and range, 27–79 years. The clinical presentations of the 523 patients were summarized in Table 1.

Based on the clinical presentations, the distribution was such that breast mass predominated (329 cases, 62.91%). The other clinical presentations included mastalgia (33 cases, 6.31%), nipple discharge (6 cases, 1.15%), axillary mass (10 cases, 1.91%) and check-up (145 cases, 27.72%).

Based on the BI–RADS for mammography, the patients were classified as follows: 77 (14.72%) category 1, 167 (31.93%) category 2, 101 (19.31%) category 3, 1,176 (31.93%) category 4, and 523 (100) category 5.

**Table 1 The clinical presentations of the 523 patients who fulfilled the inclusion criteria**

<table>
<thead>
<tr>
<th>Clinical presentations</th>
<th>Frequency (n)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast mass</td>
<td>329</td>
<td>62.91</td>
</tr>
<tr>
<td>Mastalgia</td>
<td>33</td>
<td>6.31</td>
</tr>
<tr>
<td>Nipple discharge</td>
<td>6</td>
<td>1.15</td>
</tr>
<tr>
<td>Axillary mass</td>
<td>10</td>
<td>1.91</td>
</tr>
<tr>
<td>Asymptomatic (check-up)</td>
<td>145</td>
<td>27.72</td>
</tr>
<tr>
<td>Total</td>
<td>523</td>
<td>100</td>
</tr>
</tbody>
</table>
Accuracy of Mammography and Breast Ultrasound at Chaoprayayommarat Hospital: a Retrospective Analysis

category 3, 102 (19.51%) category 4 and 76 (14.53%) category 5 (Table 2). BI-RADS 1, 2 and 3 were regarded as negative studies and BI-RADS 4 and 5 were regarded as positive studies for malignancy. Therefore, there were 345 negative studies (65.97%) and 178 positive studies (34.03%).

The mammographic findings were positive in 178 cases (34.03%), which breast mass (n = 169, 94.94%) was the most frequent clinical presentation, followed by axillary mass (n = 5, 2.81%), check-up (n = 2, 1.13%), mastalgia (n = 1, 0.56%), and nipple discharge (n = 1, 0.56%), respectively.

Biopsies were performed in 1 of 77 patients (1.30%) who were categorized as BI-RADS 1 and revealed benign lesion. The other 76 patients showed an unchanged follow-up mammogram in a period of 24 months.

Biopsies were performed in 23 of 167 patients (13.77%) who were categorized as BI-RADS 2 and revealed fibrocystic change (n = 17) (Figure 1), carcinoma (n = 1) and other benign lesions (n = 5). The remaining 144 patients showed an unchanged follow-up mammogram in a period of 24 months.

Biopsies were performed in 19 of 101 patients (18.81%) who were categorized as BI-RADS 3 and revealed fibrocystic change (n = 7), fibroadenoma (n = 3), intraductal papilloma (n = 1), sclerosing adenosis (n = 1), abscess (n = 1), carcinoma (n = 2) (Figure 2) and other benign lesions (n = 4). The remaining 82 patients showed an unchanged follow-up mammogram within 24 months.

Biopsies were performed in 89 of 102 patients (87.25%) who were categorized as BI-RADS 4 and revealed fibrocystic change (n = 17), fibroadenoma (n = 23) (Figure 3), abscess (n = 4), carcinoma (n = 21), intraductal papilloma (n = 2), sclerosing adenosis (n = 1), lymphadenitis (n = 2), phyllodes tumor (n = 5) and other benign lesions (n = 14). The remaining 13 patients showed an unchanged follow-up mammogram within 24 months.

Biopsies were performed in all 76 patients who were categorized as BI-RADS 5 and revealed carcinoma (n = 70) (Figure 4), fibroadenoma (n = 1), fibrocystic change (n = 2), sclerosing adenosis (n = 1) and phyllodes tumor (n = 2).

Mammographic findings were further classified as true-positive (TP), false-positive (FP), true-negative (TN) or false-negative (FN) (Table 3). True-positive (TP) is defined as a positive mammogram with cancer diagnosed within 24 months of follow-up. False-positive (FP) is defined as a positive mammogram with no cancer diagnosed within 24 months of follow-up. True-negative (TN) is defined as a negative mammogram with cancer diagnosed within 24 months of follow-up. False-negative (FN) is defined as a negative mammogram with no cancer diagnosed within 24 months of follow-up.

Table 2 The mammographic findings according to BI-RADS

<table>
<thead>
<tr>
<th>BIRADS</th>
<th>No. of patients</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI-RADS 1</td>
<td>77</td>
<td>14.72</td>
</tr>
<tr>
<td>BI-RADS 2</td>
<td>167</td>
<td>31.93</td>
</tr>
<tr>
<td>BI-RADS 3</td>
<td>101</td>
<td>19.31</td>
</tr>
<tr>
<td>BI-RADS 4</td>
<td>102</td>
<td>19.51</td>
</tr>
<tr>
<td>BI-RADS 5</td>
<td>76</td>
<td>14.53</td>
</tr>
<tr>
<td>Total</td>
<td>523</td>
<td>100</td>
</tr>
</tbody>
</table>

Subsequently, the sensitivity, the specificity as well as the positive and negative predictive values (PPV and NPV, respectively) were calculated, ac-
A 50-year-old female presented with left breast mass. (A) Mammogram of left breast showed an oval-shape mass with circumscribed border in upper outer quadrant. (B) Ultrasonography revealed a cystic lesion.

Figure 1 BI-RADS category 2 lesion

A 59-year-old asymptomatic female presented for screening mammography. (A) The initial mammographic image showed grouped, amorphous, and punctate calcifications, which were considered probably benign and were categorized as BI-RADS category 3. Ultrasonography showed no significant mass (not shown). (B) A subsequent mammographic image acquired after 12 months showed an increase in the extent of fine pleomorphic calcifications with segmental distribution, which were re-categorized as BI-RADS category 5. Ultrasonography revealed a hypoechoic lesion with irregular margin. Biopsy revealed invasive ductal carcinoma.

Figure 2 Malignant calcification previously misinterpreted as benign on screening mammography
A 56-year-old female presented with left breast mass. (A) Mammogram of left breast showed a spiculated mass in upper outer quadrant with an enlarged left axillary lymph node. (B) Ultrasonography revealed a hypoechoic lesion with irregular margin. Biopsy revealed invasive ductal carcinoma.

Figure 3 BI-RADS category 4 lesion

A 34-year-old female presented with right breast mass. (A) Mammogram of right breast shows an oval-shape mass with circumscribed border in lower inner quadrant. (B) Ultrasonography reveals a hypoechoic lesion with circumscribed margin. Biopsy revealed fibroadenoma.

Figure 4 BI-RADS category 5 lesion

A 56-year-old female presented with left breast mass. (A) Mammogram of left breast showed a spiculated mass in upper outer quadrant with an enlarged left axillary lymph node. (B) Ultrasonography revealed a hypoechoic lesion with irregular margin. Biopsy revealed invasive ductal carcinoma.
According to the equations in Table 4.

There was 96.81% sensitivity, 79.72% specificity, 51.12% positive predictive value, and 99.13% negative predictive value. The total accuracy was 82.79%.

**Discussion**

In the course of a 6-month period, 823 women presented to Chaoprayayommarat Hospital for either screening or diagnostic mammography. Breast mass was the most frequent clinical presentation for those who presented with symptoms, followed by axillary mass, mastalgia and nipple discharge. Early diagnosis of breast lesions is important. This can be helpful in accurate management of the patients and also helps to prevent patient’s anxiety. The accuracy of the mammography and breast ultrasound according to the BI-RADS classification in Chaoprayayommarat Hospital has not been evaluated. Therefore, this study sought to evaluate the accuracy of mammography.

**Table 3**  False positive, true positive, false negative and true negative results based on the histopathologic diagnosis and follow-up mammography

<table>
<thead>
<tr>
<th>Mammography and ultrasound results</th>
<th>Histopathologic diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive cancer</td>
<td>Negative cancer</td>
</tr>
<tr>
<td>Positive studies</td>
<td></td>
</tr>
<tr>
<td>Positive cancer</td>
<td>Negative cancer</td>
</tr>
<tr>
<td>Positive studies</td>
<td></td>
</tr>
<tr>
<td>Positive studies</td>
<td>91  51.12 TP</td>
</tr>
<tr>
<td>Negative studies</td>
<td>3  0.87 FN</td>
</tr>
<tr>
<td>Total</td>
<td>94  17.97</td>
</tr>
</tbody>
</table>


**Table 4**  Sensitivity, specificity, PPV, NPV and accuracy results based on the histopathologic diagnosis and follow-up mammography (n=523)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Equations</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>TP/ number of cancer cases (TP + FN)</td>
<td>91/91+3</td>
</tr>
<tr>
<td>Specificity</td>
<td>TN/ number of non-cancer cases (TN + FP)</td>
<td>342/342+87</td>
</tr>
<tr>
<td>PPV</td>
<td>TP/ number of positive mammographic</td>
<td>91/91+87</td>
</tr>
<tr>
<td></td>
<td>examinations (TP + FP)</td>
<td></td>
</tr>
<tr>
<td>NPV</td>
<td>TN/ number of negative mammographic</td>
<td>342/342+3</td>
</tr>
<tr>
<td></td>
<td>examinations (TN + FN)</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>(TP + TN) /All patients</td>
<td>91+342/523</td>
</tr>
<tr>
<td>Positive likelihood ratio</td>
<td>TP/(TP + FN)</td>
<td>91/(91+3)</td>
</tr>
<tr>
<td></td>
<td>FP/(TN + FP)</td>
<td>87/(342+87)</td>
</tr>
<tr>
<td>Negative likelihood ratio</td>
<td>FN/(TP + FN)</td>
<td>3/(91+3)</td>
</tr>
<tr>
<td></td>
<td>TN/(TN + FP)</td>
<td>342/(342+87)</td>
</tr>
</tbody>
</table>

Remark: TP: true-positive, FP: false-positive, FN: false-negative, TN: true-negative, PPV: positive predictive value, NPV: negative predictive value
mography and ultrasound in those women both in patients with cancer and in patients who do not have cancer.

The current study found that the mammography was very sensitive (96.81% sensitivity), but not as specific (79.72% specificity), with 51.12% positive predictive value, 99.13% negative predictive value and 82.79% total accuracy.

The sensitivity of mammography in this group was high (96.81%); therefore, it is a reliable tool for evaluation of breast lesions and screening the female population to lower the misdiagnosis rate and reduce mortality of breast cancer. Nevertheless, this study included both screening and diagnostic cases who mostly presented with breast mass that may have resulted in high positive studies and high sensitivity in these groups. Shetty MK et al. reported sensitivity of 100.00% and specificity of 80.10% in 411 patients in whom combined mammographic and sonographic evaluation had been performed for palpable breast lumps (10). Harini G et al. reported sensitivity of 97.80% in combined mammographic and sonographic modalities (11). Their findings are comparable with the present findings of sensitivity of 96.80% and specificity of 79.72%. However, it was not very specific (79.72% specificity) compared with 100.00% specificity reported by Harini G et al. (11) and 98.60% reported by Gewefel H et al. (12).

The false-positive result is one of the harms of mammography screening (13). Increased false-positive mammogram leads to increased additional medical cost and a patient’s anxiety about breast cancer. This also leads to a higher rate of recommendations for biopsy and a higher rate of biopsies for benign lesions. As a result, risk-benefit analysis for mass screening of breast cancer using mammography should be considered carefully before the national mammography program is introduced (14).

Approximately 72.28% of patients presented with significant symptoms, which were predominantly breast mass, mastalgia, nipple discharge and axillary mass; therefore, the high sensitivity in this group was probably due to more cautious radiological practice. If radiologists face with patients with symptomatic problems at the time they read the mammogram, attention is paid to subtle features of malignancy in order to prevent lesions being missed. Therefore, the increased rate of patients with significant symptoms probably explains the high sensitivity in this group, which has also resulted in low specificity and decrease the positive predictive value of mammography.

Possible explanation for this low positive predictive value might be that this study included both BI-RADS 4 and 5 in the same positive studies for malignancy. The current study revealed that 66.67% of BI-RADS 4 had benign results which are comparable to results obtained by Raza S et al. was 75.20% (15) and Mustafa AA was 68.30% (16). However, the high negative predictive value was achieved regardless of whether the patients were experiencing significant symptoms or not.

The negative predictive value in this study was high (99.13%), which is comparable to results obtained by Soo MS et al. was 99.80% in the setting of palpable lesions (17); therefore, these combined mammography and sonography can be reassuring to the clinician if follow-up is planned when the physical examination is not highly suspicious. However, if there is a high degree of clinical suspicion, biopsy should be performed (17).

The total accuracy was 82.79%, which was lower than previous reports of Harini G et al. (11) and Gewefel H et al. (98.10%) (12). The accuracy of breast imaging studies may be affected by technical aspects, characteristics of the population under study, patient’s age, breast density,
radiologist’s experience, and the variability in the interpretation by the radiologist utilizing BI-RADS\(^{(18-19)}\). The accuracy of mammography is high for population-based breast cancer screening in women, although the sensitivity is lower in women with dense breasts\(^{(20)}\). It is particularly important to apply adequate compression in women who have high breast density to enable the separation of possibly superimposed densities.

Another explanation for this less accuracy might be that all mammographic images in the present study were derived from analog mammography equipment. Digital mammography was significantly better and more accurate than analog mammography at detecting breast cancer in young women, premenopausal and perimenopausal women, and women with dense breasts\(^{(21)}\). Analog mammography should be replaced by digital mammography, which provides good quality images using reduced radiation doses and can detect breast carcinoma in its earlier stages, resulting in a good prognosis and improved patient survival\(^{(22)}\).

To achieve improvement of diagnostic accuracy, further studies are needed to clarify the relationships between fellowship training in breast imaging, radiologist’s years of experience, reader volume, and interpretive performance\(^{(23)}\). Radiologists with fellowship training in breast imaging were significantly associated with greater sensitivity in cancer diagnosis and higher overall accuracy compared with those of radiologists without specialized training\(^{(24)}\). All mammograms obtained in Chaoprayayommarat Hospital are interpreted by general radiologists who have no fellowship training in breast imaging. Therefore, the emphasis on the performance of general radiologists is important.

In the present study, not all malignancies were BI-RADS category 4 or 5 according to both mammography and ultrasound. Three patients with BI-RADS categories 2 and 3 came to Chaoprayayommarat Hospital due to palpable mass lesions were found to have cancer. Although, the BI–RADS categories 2 and 3 means that the mammograms is negative or probably benign appearance, there is still approximately 2 percent chance of cancer. The BI–RADS category 3 – probably benign finding was given with the management decision of a short-interval follow-up, usually at 6 months. However, many of these lesions are instead recommended for biopsy\(^{(25)}\). Referring physician or patient concern may exist if these lesions change at follow-up and there could be a substantial risk of malignancy; therefore, ultimately biopsy is performed. Twenty-three patients with BI-RADS category 2 and 19 patients with BI-RADS category 3 underwent biopsy despite negative imaging findings because of palpable mass lesions and a high degree of clinical suspicion.

The most common histopathologic diagnoses of benign lesions biopsied in this study were fibrocystic changes (43 cases, 20.67%) and fibroadenoma (27 cases, 12.98%), which were similar to previous reports\(^{(26)}\) (fibrocystic disease in 22 (41.50%) cases and fibroadenoma in 16 (30.18%) cases). The most common histopathologic diagnoses of malignant lesions in this study were invasive ductal carcinoma. Therefore, this study demonstrated that benign breast lesion was more common than malignant lesion. BI–RADS category 2 and 3 (n = 268, 51.24%) were the most prevalent in this study.

The other 91 cancer patients within BI–RADS category 4 and 5 came to Chaoprayayommarat Hospital with palpable masses in 89 cases, nipple discharge in 1 case and for screening for breast cancer in 1 case,
which reflects that mammography is an important imaging modality for evaluating breast lesions and could detect 1 cancer case out of 145 screening patients in this study.

However, a majority of women in Thailand cannot access screening mammography because of its limited availability and the relatively high cost despite its significance in breast cancer management. Although, the sensitivity, specificity and accuracy of both mammography and ultrasound were acceptable, these were not the only factors in making both modalities practical and beneficial for nationwide mass cancer screening. Other factors need to be considered such as financial cost, population selection, screening interval, breast density, experience of trained radiologists, and mammography equipment. Therefore, the cost–effectiveness of screening mammography in Thailand should be further evaluated as a way of reducing mortality from breast cancer.

Conclusions

In conclusion, breast evaluation by mammography, utilizing the BI–RADS classification, plays an important role in the diagnostic assessment and screening of breast cancer. Benign breast lesion was more common than malignant lesion. The results of this study suggested that the combined mammography and ultrasound was very sensitive, but not as specific, with total accuracy of 82.79%, indicating benefit for evaluation of breast lesions and screening the female population to lower the misdiagnosis rate and reduce mortality of breast cancer. Further studies are needed to achieve improvement of diagnostic accuracy and cost–effectiveness of screening mammography in Thailand.

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References


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กลุ่มงานรังสีวิทยา โรงพยาบาลเจ้าพระยา-ยมราช จังหวัดสุพรรณบุรี
วารสารวิชาการสาธารณสุข 2562;28:941-52.

การศึกษาเป็นการศึกษาหลังชี้วัดของผลการตรวจแมมโมแกรมและอัลตร้าซาวด์เต้านมในโรงพยาบาลเจ้าพระยา-ยมราช เกี่ยวกับการตรวจแมมโมแกรมในกลุ่มที่ตรวจ 823 คน ทั้งที่มีอาการและไม่มีอาการ ที่ได้รับการตรวจตามระบบไบแรดส์ชิ้นเนื้อทางพยาธิวิทยาและผลการตรวจจากการตรวจตรงที่ส่งผลการตรวจสองครั้ง ทุกคน ที่มีการตรวจด้วยแมมโมแกรมและอัลตร้าซาวด์เต้านม จะได้รับการตรวจด้วยแมมโมแกรมต่อไปอย่างน้อย 24 เดือน วิเคราะห์โดยการทำค่าความถูกต้องแม่นยำา ความไว ความเจาะจง ค่าการผลบวก และ ค่าการผลลบ ผลการศึกษาพบว่า ผู้ป่วยทั้งสิ้น 523 ราย ถูกรวบรวมเข้าในการศึกษา ลักษณะทางคลินิกที่พบมากที่สุดได้แก่ ก้อนที่เต้านม 329 ราย (ร้อยละ 62.91) รองลงมาคือ ตรวจคัดกรองมะเร็งเต้านม 145 ราย (ร้อยละ 27.72) เจ็บเต้านม 33 ราย (ร้อยละ 6.31) ก้อนที่รักแร้ 10 ราย (ร้อยละ 1.91) และ น้ำคัดหลั่งออกจากหัวนม 6 ราย (ร้อยละ 1.15) ตามลำดับ อายุเฉลี่ยของกลุ่มตัวอย่างคือ 50.38 ปี การแปลผลการตรวจตามระบบไบแรดส์พบว่า ในแต่ละชนิดที่ 2 และ 3 (ร้อยละ 51.24) ซึ่งถือว่ามีความผิดปกติที่ไม่มีข้อสงสัย และความผิดปกติที่ไม่เป็นมะเร็ง พบมากที่สุดในการศึกษา ผลการตรวจที่ให้ผลลบมีทั้งสิ้น 345 ราย (ร้อยละ 65.97) และผลการตรวจที่ให้ผลบวกมีทั้งสิ้น 178 ราย (ร้อยละ 34.03) ผู้ป่วยที่ได้รับการตรวจชิ้นเนื้อทางพยาธิวิทยาทั้งสิ้น 208 ราย (ร้อยละ 39.77) พบว่า 94 รายเป็นมะเร็ง ส่วนอีก 114 ราย ไม่ใช่มะเร็ง ความถูกต้องแม่นยำาของการรายงานผลอยู่ที่ร้อยละ 82.79 ความไวร้อยละ 96.81 ความเจาะจงร้อยละ 79.72 ค่าพวกผลลบร้อยละ 51.12 และ ค่าพวกผลบวกร้อยละ 99.13 โดยสรุป การตรวจเต้านมด้วยแมมโมแกรมโดยการตอบแบบBOVEP จะมีค่าที่สูงใน การวินิจฉัยและตรวจโรคมะเร็งเต้านม กลุ่มที่ไม่ได้เป็นมะเร็งพบอยู่ที่ร้อยละ 99.13 โดยมีไบแรดส์กลุ่มที่มั่นใจว่ามีการตรวจที่มีความไวสูง แต่ความเจาะจงจะไม่สูงกว่าการศึกษาอื่น โดยมีความถูกต้องแม่นยำาของการตรวจอยู่ที่ร้อยละ 82.79 ซึ่งแสดงให้เห็นว่าแมมโมแกรมเป็นการตรวจที่มีประโยชน์มากในการคัดกรองผู้ป่วยมะเร็งเต้านมในระยะเริ่มต้น เพื่อลดการเสียชีวิตจากมะเร็งเต้านม นอกจากนี้ ยังสนับสนุนการศึกษาเพื่อพัฒนาคุณภาพเพิ่มเติม เพื่อหาแนวทางที่จะช่วยให้การวินิจฉัยมีความถูกต้องแม่นยำามากยิ่งขึ้น และศึกษาความคุ้มค่าในการตรวจคัดกรองมะเร็งเต้านมในประเทศไทย

คำสำคัญ: แมมโมแกรม, มะเร็งเต้านม, อัลตร้าซาวด์เต้านม, ความถูกต้องแม่นยำา