



# Mammographic and Ultrasonographic Features of Male Breast Cancer

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## Abstract

**Objective:** To determine mammographic and ultrasonographic features of male breast cancer.

**Methods:** A retrospective study was conducted on consecutive men who underwent mammography and ultrasonography at the Diagnostic Breast Cancer Center in Vajira Hospital from January 1, 2010 to December 31, 2019. Clinical information, mammographic and ultrasonographic findings, method of tissue diagnosis, and pathological results were retrospectively reviewed. Then, the incidence of male breast cancer was analyzed.

**Results:** A total of 41 men underwent mammography in the institution during the study period with a median age of 68 (interquartile range, 58–76) years. Three patients were diagnosed with breast cancer (7.3%), with circumscribed high-density mass being the most common mammographic finding in the cancer group and gynecomastia in the benign group. Ultrasonographic finding in the cancer group showed a solid hypoechoic mass in 1 patient and complex mass with solid-cystic components in 2 patients. Tissue diagnosis and pathological results were observed in 6 patients. Breast cancer was found in 3 patients (invasive ductal carcinoma in 2 and intraductal papillary carcinoma in 1 patient) and benign pathology of gynecomastia in 3 patients. The incidence of male breast cancer in this study was 7.3%.

**Conclusion :** Male breast cancer commonly presents as a high-density mass with circumscribed margin in a subareolar location on mammography and as a solid hypoechoic mass or a complex mass with solid-cystic components on ultrasonography. As a result, a circumscribed mass on mammography with cystic components on ultrasound in a male patient should be suspected of malignancy.

**Keywords:** male, mammogram, breast cancer



# ลักษณะทางแมมโมแกรมและอัลตราซาวด์ของมะเร็งเต้านมในเพศชาย

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## บทคัดย่อ

**วัตถุประสงค์:** เพื่อศึกษาลักษณะทางแมมโมแกรมและอัลตราซาวด์ของมะเร็งเต้านมในเพศชาย

**วิธีดำเนินการวิจัย:** เป็นการศึกษาเชิงพรรณนาแบบย้อนหลังในผู้ป่วยเพศชายที่ได้รับการตรวจแมมโมแกรมและอัลตราซาวด์ที่ศูนย์วินิจฉัยมะเร็งเต้านมวชิรพยาบาลระหว่าง 1 มกราคม 2553 ถึง 31 ธันวาคม 2562 ทำการทบทวนข้อมูลทางคลินิก ลักษณะที่พบจากการตรวจแมมโมแกรมและอัลตราซาวด์ การพิสูจน์ชิ้นเนื้อ และผลทางพยาธิวิทยา ประเมินอุบัติการณ์ของมะเร็งเต้านมในเพศชาย

**ผลการวิจัย:** ผู้ป่วยเพศชายทั้งหมด 41 รายที่มารับการตรวจแมมโมแกรมและอัลตราซาวด์ในช่วงที่ทำการศึกษาค่ามัธยฐานของอายุ 68 ปี (ค่าพิสัยควอไทล์ 58-76) พบมะเร็งเต้านมในผู้ป่วย 3 ราย (ร้อยละ 7.3) โดยก้อนทึบขอบเขตชัดเป็นลักษณะทางแมมโมแกรมที่พบมากที่สุดในกลุ่มมะเร็งและ gynecomastia พบมากที่สุดในกลุ่มที่ไม่ใช่มะเร็ง ลักษณะทางอัลตราซาวด์ในกลุ่มมะเร็งพบเป็นก้อนเนื้อ 1 ราย และก้อนที่มีส่วนประกอบของเนื้อและถุงน้ำ 2 ราย มีผู้ป่วย 6 รายที่ได้รับการพิสูจน์ชิ้นเนื้อและมีผลพยาธิวิทยา โดยผลพยาธิวิทยาเป็นมะเร็งเต้านมจำนวน 3 ราย (invasive ductal carcinoma 2 ราย และ intraductal papillary carcinoma 1 ราย) และผลพยาธิวิทยาไม่ใช่มะเร็งจำนวน 3 รายเป็น gynecomastia อุบัติการณ์ของมะเร็งเต้านมในการศึกษานี้เท่ากับร้อยละ 7.3

**สรุป:** ลักษณะทางแมมโมแกรมของมะเร็งเต้านมในเพศชายมักพบลักษณะเป็นก้อนทึบขอบเขตชัดอยู่บริเวณใต้หัวนม ลักษณะทางอัลตราซาวด์พบได้ทั้งก้อนเนื้อและก้อนที่มีส่วนประกอบของเนื้อและถุงน้ำ ดังนั้น ลักษณะก้อนขอบเขตชัดในแมมโมแกรมและก้อนที่มีส่วนประกอบของถุงน้ำในอัลตราซาวด์ควรจะต้องสงสัยมะเร็งเต้านมในเพศชาย

**คำสำคัญ:** เพศชาย แมมโมแกรม มะเร็งเต้านม

## Introduction

Breast cancer is the most common cancer in women worldwide<sup>1</sup>. Regarding an international comparison of male and female breast cancer incidence rates<sup>2</sup>, the highest male incidence rate was observed in Israel at 1.24 per 100,000 man-years, and the highest female incidence rate was observed in the United States at 90.7 per 100,000 woman-years<sup>2</sup>.

In Thailand, breast cancer had the highest incidence among female cancers and remains a major public health problem for women<sup>3-4</sup>. The incidence rate of breast cancer in Thailand was reported in women at 31.4 per 100,000 woman-years and incidence rate at 0.4 per 100,000 man-years for men<sup>4</sup>.

Breast cancer has traditionally been thought to be a female-specific disease, and lack of awareness on its occurrence in men may result in diagnoses at later age and more advanced stage than in women. Mammography is an available and effective tool for breast cancer screening and diagnosis. Male breast cancer is uncommon to warrant the same level of screening as female cancers. Consequently, unlike the female national screening program, the majority of imaging modality in the male breast is part of a diagnostic workup<sup>5</sup>. In the previous study by Mathew et al<sup>10</sup> reported breast cancer in men presents most frequently on mammography as a noncalcified high-density mass with an irregular shape and a spiculated or indistinct margin in a subareolar location<sup>10</sup>. Yang et al<sup>12</sup> studied the ultrasonographic features of breast cancer in eight men and found complex cystic masses in 50% of patients<sup>12</sup>.

The Diagnostic Breast Cancer Center Vajira Hospital has providing mammogram and breast ultrasound for more than 10 years, but there has not been any research on the male breast cancer. Therefore, this study aimed to determine the mammographic and ultrasonographic features of male breast cancer. The clinical data, tissue diagnostic method, pathological results, and incidence of male breast cancer were also determined.

## Methods

The Ethics Committee of the institution approved the study before its initiation. Between January 1, 2010, and December 31, 2019, all male patients who underwent diagnostic mammography at the Diagnostic Breast Cancer Center Vajira Hospital were enrolled in this study.

During this period, mammography was performed using full-field digital mammographic equipment (Siemens Mammomat Novation DR, Germany). The institutional practice generally follows the standard practice. Two standard views images, mediolateral oblique (MLO) and craniocaudal (CC) are obtained with additional views as necessary. Complementary ultrasonography was performed in all patients using 5-14 MHz linear array transducers (GE logiq 9, WI, USA). Mammographic and ultrasonographic examinations were interpreted by one of the radiologists of the institution according to the American College of Radiology Breast Imaging Reporting and Data System (BI-RADS)<sup>6</sup>.

BI-RADS categories 1, 2, and 3 were negative, benign, and probably benign, respectively. Gynecomastia was suggested as BI-RADS category 2. BI-RADS categories 4 and 5 were suspicious and highly suggestive of malignancy, respectively.

The patients' age, clinical data, imaging findings, and pathologic reports were retrospectively reviewed. Data were analyzed using SPSS statistical software, version 26.0. Continuous data were summarized as mean with standard deviation or median with ranges as appropriate. Categorical data were presented as numbers and percentages. All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY, USA: IBM Corp.). A *p*-value of <0.05 was considered statistically significant.

## Results

A total of 41 male patients who underwent mammography and ultrasonography at the Diagnostic Breast Cancer Center Vajira Hospital were enrolled in this study. The median age was 68 (interquartile range, 58–76) years. Mammography was indicated for all patients during a diagnostic workup. The most

common indication for diagnostic mammography was palpable mass (56.1%), followed by breast enlargement (39.0%) and breast pain (4.9%). For the side and position of abnormal breast imaging, this study found that 43.9% had abnormal breast imaging on the right, 36.6% on the left, and 19.5% were bilateral, with the subareolar region of the breast being the most common position (100%). A total of 37 patients were categorized as BI-RADS 2. Among them, 36 patients had gynecomastia and 1 patient had pseudogynecomastia. There were 4 patients categorized as BI-RADS 4, suspicious abnormality

(mass in 2 patients, mass with calcifications in 1, and mass with axillary lymphadenopathy in 1). All 4 patients categorized as BI-RADS 4 underwent core needle biopsy for tissue diagnosis, and pathological results were invasive ductal carcinoma in 2 patients, intraductal papillary carcinoma in 1, and gynecomastia in 1. Two patients in BI-RADS category 2 underwent tissue diagnosis (core needle biopsy in 1 patient and excisional biopsy in 1), and pathological results were gynecomastia. Patients were grouped into two categories: malignancy and benign conditions. Details of patient characteristics and imaging features are shown in Table 1.

**Table 1:**

Details of patient characteristics and imaging features (n = 41)

Characteristics	Total (n = 41)		Malignancy (n = 3)		Benign (n = 38)		p-value
	n	(%)	n	(%)	n	(%)	
All patients			3	(7.3)	38	(92.7)	
Age (years), Median (IQR)	68	(58 – 76)	58	(47 – 67)	69	(59 – 77)	0.210
Clinical							
Palpable mass	23	(56.1)	3	(100)	20	(52.6)	0.243
Breast enlargement	16	(39.0)	0	(0.0)	16	(42.1)	0.268
Breast pain	2	(4.9)	0	(0.0)	2	(5.3)	1.000
Side							
Right	18	(43.9)	2	(66.7)	16	(42.1)	1.000
Left	15	(36.6)	1	(33.3)	14	(36.8)	
Bilateral	8	(19.5)	0	(0.0)	8	(21.1)	
Position							
Subareolar	41	(100.0)	3	(100.0)	38	(100.0)	NA
Eccentric	3	(7.3)	3	(100.0)	0	(0.0)	<0.001
Imaging findings							
Gynecomastia	36	(87.8)	0	(0.0)	36	(94.7)	<0.001
Mass	2	(4.9)	2	(66.7)	0	(0.0)	0.011
Mass with microcalcification	1	(2.4)	1	(33.3)	0	(0.0)	0.073
Mass with axillary lymphadenopathy	1	(2.4)	0	(0.0)	1	(2.6)	1.000
Pseudo gynecomastia	1	(2.4)	0	(0.0)	1	(2.6)	1.000
Tissue diagnosis							
Core needle biopsy	6	(14.6)	3	(100)	3	(7.9)	0.002
Excisional biopsy	5	(12.2)	3	(100)	2	(5.3)	0.001
Excisional biopsy	1	(2.4)	0	(0.0)	1	(2.6)	1.000

Abbreviations: NA, data not applicable.

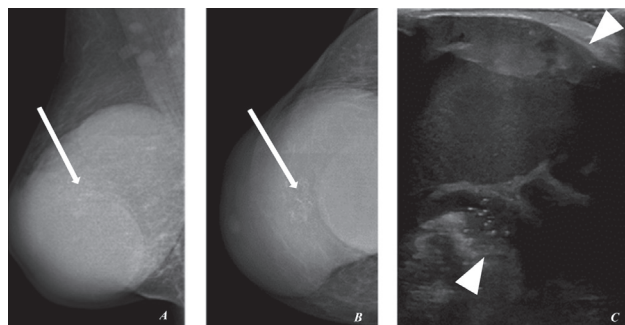
Data are presented as number (%) or Median (IQR).

p-value corresponds to Mann-Whitney U test and Fisher’s exact test.

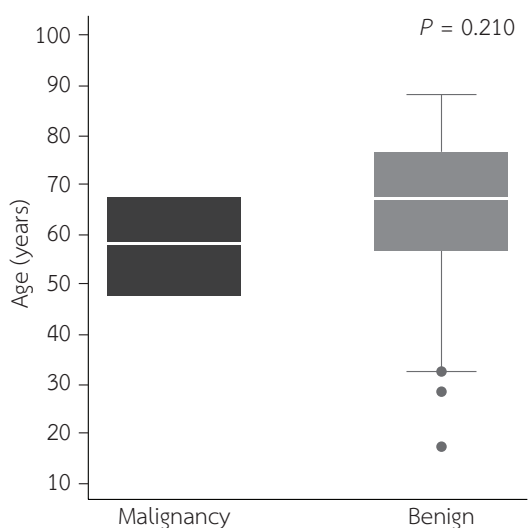
Regarding the malignancy group, breast cancer incidence was found in 7.3% of patients in this study and typically presented as a palpable mass. On mammography, masses had generally high density. Two lobular and one round shape masses were observed. All masses had circumscribed and partially indistinct margins. The masses were characteristically located in the subareolar region (figure 2, 3, and 4). Pleomorphic calcifications were present in 1 patient (figure 2).

On ultrasonography, complex cystic mass was observed in two of three lesions: one had a mixed cystic and solid appearance (figure 2C) and the other one had a predominantly cystic with a soft tissue mass projecting into the cyst lumen (figure 3C). The one remaining solid lesion showed

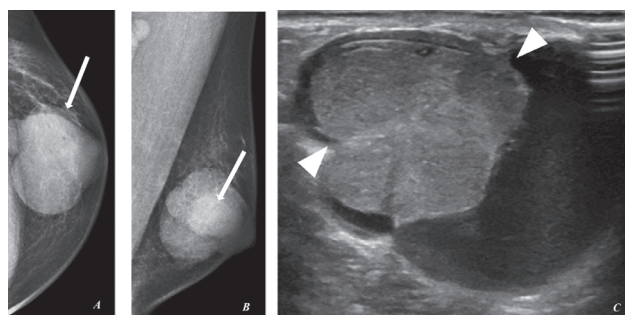
a heterogeneous hypoechoic pattern (figure 4C). In all three patients, masses were identified in the subareolar region, eccentric to the nipple.



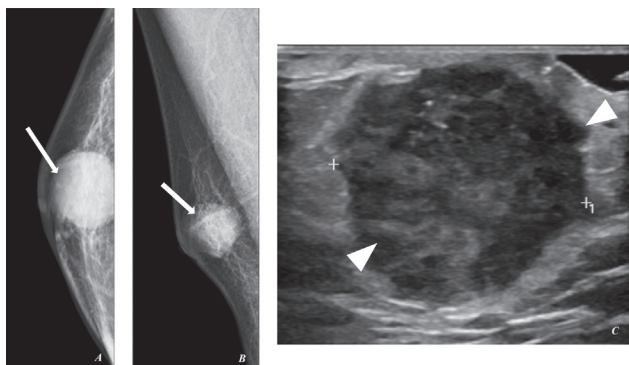
**Figure 2:** A 57-year-old man had a palpable mass in the right breast. Mammogram (figure A, B) demonstrated a large lobulated hyperdense subareolar mass associated with pleomorphic microcalcifications at the center of the mass (arrow). This mass appears as an inhomogeneous mass with mixed cystic and solid appearance on ultrasound (figure C, arrowhead). The pathological diagnosis was invasive ductal carcinoma.



**Figure 1:** Box and whisker plot of age distribution between benign and malignancy subgroups. Age is demonstrated in the box (median IQR) and whiskers plots for patients in the malignancy (n = 3) and benign groups (n = 38). Although a statistically significant difference was lacking between the two groups (p = 0.210), none of the patients in the malignancy group were <40 years old.



**Figure 3:** A 57-year-old man presented with a palpable mass in the left breast. Mammogram (figure A, B) demonstrated high-density, lobular subareolar mass with circumscribed margin (arrow). This mass appears as a complex cystic mass with predominantly cystic soft tissue mass projecting into the cyst lumen on ultrasound (figure C, arrowhead). The pathological diagnosis was intraductal papillary carcinoma.



**Figure 4:** A 44-year-old man with a palpable right breast mass. Mammogram (figure A, B) demonstrated a round-shape high-density subareolar mass with circumscribed margin (arrow). This mass appears as a hypoechoic mass with spiculated margins on ultrasound (figure C, arrowhead). The pathological diagnosis was invasive ductal carcinoma.

## Discussion

Male breast cancer is a rare disease. During the 10-year period, a total of 41 male patients underwent diagnostic mammography at Diagnostic Breast Cancer Center Vajira Hospital. This low number may reflect the rarity of breast cancer symptoms in men. Breast cancer incidence was found in 7.3 % in this study which is not significantly different from the 6% in the study by Gunhan-Bilgen et al<sup>11</sup>, and 7.3% in the study by Lawson P et al.<sup>13</sup> Male breast cancer incidence is extremely low to justify screening mammography similarly with that of female breast cancer. In contrast to the female national screening program, most imaging in the male breast is part of a diagnostic workup<sup>5</sup>.

In this study, the most common presentation of men who were sent to diagnostic mammography was palpable breast mass. The most common imaging finding in the cancer group was mass lesion (66.7%), followed by mass with microcalcifications (33.3%). On mammography, these are typically high-density masses with well-defined contours (figure 2, 3, and 4).

The mammographic findings of male breast cancer in this study are consistent with those in previous reports of malignant masses in men<sup>7-9</sup>. These masses typically occur in the subareolar region with well-defined, ill-defined, or spiculated margins. All masses in this study had circumscribed and partially indistinct margins. Breast cancer in men may be round, oval, irregular, or lobulated.

Calcifications are infrequent and present in only one patient in this study (figure 2). Other studies noted calcifications occurring in 13%-31% of breast cancer in men<sup>8-10</sup>.

The findings of this study regarding the mass location and contour are consistent with those of Mathew et al.<sup>10</sup> and Gunhan-Bilgen et al.<sup>11</sup> According to the literature, well-circumscribed masses should be considered with suspicion in men because they can be cancer<sup>9-11</sup>.

Male and female breast cancer have similar ultrasound characteristics. One of two patients with invasive ductal carcinoma had nonparallel, discrete, hypoechoic mass. The margin was microlobulated or spiculated (figure 4C). Ultrasound is useful to determine the mass's relationship to the nipple. A retroareolar mass on mammography may be observed as clearly eccentric to the nipple on ultrasound (figure 3C, 4C). In this study, two of three patients with cancer presented with both solid and cystic components on ultrasound (figure 2C, 3C), and pathological results were invasive ductal carcinoma and intraductal papillary carcinoma, respectively. Other studies<sup>5,12</sup> also reported male breast cancer presenting as complex mass (solid-cystic), with papillary ductal carcinoma in situ being the most common histopathological result. As a result, a circumscribed mass on mammography with cystic component on ultrasound in a male patient should be suspected of malignancy.

In this study, no patients in the malignancy group were younger than 40 years (figure 1), consistent with a previous study by Lawson P et al.<sup>13</sup> in which all patients aged <40 years had a benign mass, mostly gynecomastia. In this study, 3 of 38 patients in the benign group underwent a biopsy for tissue diagnosis and pathological confirmation of gynecomastia. When gynecomastia is observed, a biopsy should be performed only if a coexisting lesion is suspected in clinical or imaging findings<sup>13</sup>.

Limitations of this study included a small number of patients, and data from a single institution were collected retrospectively from a prospectively maintained database. Male patients were not enrolled in a follow-up program, whereas female patients are examined annually. As a result, no long-term follow-up data was obtained in most patients with apparently benign conditions.

## Conclusion

Breast cancer in men most commonly presents as a high-density mass with circumscribed margin in a subareolar location on mammography and as a solid hypoechoic mass or a complex mass with solid-cystic components on ultrasonography. Therefore, the clinical implications of this study are that a circumscribed mass on mammography with cystic components on ultrasound in a male patient could be associated with cancer. As a result, radiologists should be aware of these findings to avoid misdiagnosing cancer in men as a benign lesion.

## Conflict of interest

No potential conflict of interest relevant to this article was reported.

## Acknowledgement

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