

Evaluation of the Symptomatic Male Breast  
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Hanavadi S, Monypenny II, Mansel RE. Is mammography overused in male patients? <i>Breast</i> . 2006;15(1):123-126.	Review/Other-Dx	220 male patients	To analyze the incidence and presentation of male breast cancers and to define the role of mammography in men referred with breast lump or other breast symptoms.	134/220 men had a mammographic examination, with majority (96%) being performed prior to their consultation with the breast clinician as per the clinic protocol. 9 patients under the age of 35 years also had a mammographic evaluation. There were 4 cases of breast cancer diagnosed during this period. Breast cancer was suspected in all patients on clinical examination and was confirmed by biopsy. Breast cancer in men can be suspected on clinical examination in the majority of cases. Mammography appears unnecessary in most men and should not be used as a routine imaging procedure.	4
2. Hines SL, Tan WW, Yasrebi M, DePeri ER, Perez EA. The role of mammography in male patients with breast symptoms. <i>Mayo Clin Proc</i> . 82(3):297-300, 2007 Mar.	Observational-Dx	198 men had 212 mammograms	To determine the contribution of mammography to the comprehensive clinical evaluation of men with breast symptoms.	9 mammograms (from 9 different men) (4%) showed suspicious findings. 8 men underwent biopsy, which yielded a breast cancer diagnosis in 2 (1%). Of the 212 mammograms, 203 (96%) showed benign findings, including gynecomastia on 132 (62%). One patient with a benign-appearing mammogram later underwent breast biopsy, and malignant disease was diagnosed. All the men with breast cancer had a dominant mass on clinical examination and other findings suggestive of breast cancer. Of the 132 mammograms showing gynecomastia, 110 (83%) were from men who had taken predisposing medications or who had predisposing medical conditions.	3

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3. Munoz Carrasco R, Alvarez Benito M, Munoz Gomariz E, Raya Povedano JL, Martinez Paredes M. Mammography and ultrasound in the evaluation of male breast disease. Eur Radiol. 20(12):2797-805, 2010 Dec.	Observational-Dx	628 patients with 518 mammograms and 423 USs were reviewed	To assess clinical variables that may be useful in differentiating gynecomastia from carcinoma and to analyze the contribution of mammography and US to the evaluation of male breast disease.	The final diagnoses were: 19 carcinomas, 526 gynecomastias, 84 other benign conditions and 25 normal. There were statistically significant differences in age, bilateral involvement, clinical presentation and physical examination between patients with carcinoma and those with gynecomastia. The diagnostic performance of physical examination was lower than that of mammography and US ( $P < 0.05$ for specificity). Mammography was the most sensitive (94.7%) and US the most specific (95.3%) for detection of malignancy ( $P > 0.05$ ). We propose an algorithm for the use of mammography and US in men.	3
4. Braunstein GD. Clinical practice. Gynecomastia. N Engl J Med. 2007;357(12):1229-1237.	Review/Other-Dx	N/A	Clinical practice on gynecomastia.	No results stated in abstract.	4
5. Greif JM, Pezzi CM, Klimberg VS, Bailey L, Zuraek M. Gender differences in breast cancer: analysis of 13,000 breast cancers in men from the National Cancer Data Base. Ann Surg Oncol. 2012;19(10):3199-3204.	Observational-Tx	13,457 men; 1,439,866 women	To examine gender-specific differences in breast cancer utilizing the National Cancer Data Base (NCDB).	Differences in overall survival were highly significant ( $P < 0.0001$ ): 83% 5-year overall survival for women with breast cancer (median survival 129 months) vs 74% for men (median survival 101 months). Women had better 5-year overall survival ( $P < 0.0001$ ) for stage 0 (94% vs 90%), stage I (90% vs 87%), and stage II (82% vs 74%) breast cancer. There were no differences in 5-year overall survival for stage III (56.9% vs 56.5%, $P = 0.99$ ) or stage IV (19% vs 16%, $P = 0.20$ ) disease.	2

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<p>6. Mathew J, Perkins GH, Stephens T, Middleton LP, Yang WT. Primary breast cancer in men: clinical, imaging, and pathologic findings in 57 patients. AJR Am J Roentgenol. 191(6):1631-9, 2008 Dec.</p>	<p>Review/Other-Dx</p>	<p>57 patients with imaging and 187 patients without imaging</p>	<p>To describe the imaging findings in primary breast cancer in men.</p>	<p>49 patients had undergone both mammography and sonography; 6 mammography alone; and 2 US alone. 95% (54/57) of patients presented with a palpable mass and 4% (2/57) with nipple inversion. At mammography, 69% (38/55) of cancers showed a mass; 29% (16/55), mass with microcalcifications; and 2% (1/55), microcalcifications. Gynecomastia was noted in 22 (40%) of 55 patients. Mammographic features included an irregular mass with spiculated or indistinct margins. Calcifications were typically pleomorphic and segmental. Sonographic features were typically an irregular mass with microlobulated margins. Axillary nodal involvement was present in 47% of patients. Most cancers were ductal carcinoma, either invasive or in situ.</p>	<p>4</p>

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7. Morrogh M, King TA. The significance of nipple discharge of the male breast. <i>Breast J.</i> 2009;15(6):632-638.	Review/Ot her-Dx	24 male patients	The authors present their experience with male patients presenting with a chief complaint of nipple discharge.	Among 24 male patients presenting for evaluation, 14 (58%) presented with a chief complaint of nipple discharge, while the remaining 10 (42%) presented for evaluation of a palpable mass in the absence of nipple discharge. Among 14 patients presenting with nipple discharge, subsequent clinical breast examination identified a breast mass +/- nipple changes in 7/14 patients. In total, 8/14 (57%) patients had an underlying malignancy; 2/7 patients with nipple discharge alone had DCIS (median interval from onset of nipple discharge to presentation 3 weeks, range 2–4 weeks), and 6/7 patients with nipple discharge and a palpable mass had invasive disease (median interval between onset of nipple discharge and presentation 16 weeks, range 2–52). The remaining 10/24 patients presented with a painless palpable mass of whom 8 (80%) were found to have underlying invasive disease (median interval between onset of mass, and presentation was 4 weeks, range 2–20 weeks). All patients with invasive disease were node-positive. At 23.7 months median follow-up (range, 7.7–88.3 months), 14/16 cancer patients remain free of disease and 2 have died as a direct result of metastatic disease. The incidence of cancer among males presenting with nipple discharge was 57%.	4

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8. Munoz Carrasco R, Alvarez Benito M, Rivin del Campo E. Value of mammography and breast ultrasound in male patients with nipple discharge. <i>Eur J Radiol.</i> 82(3):478-84, 2013 Mar.	Observational-Dx	26 men with 21 mammograms and 19 USs	To assess the contribution of mammography and US in men with nipple discharge.	The final diagnoses were: 6 carcinomas (23.1%), 10 gynecomastias, 2 pseudogynecomastias and 8 normal breast tissues. Mammograms and USs performed on all 5 patients with infiltrating carcinoma showed a mass (categories 4 and 5). In all these patients except 1, a breast mass was also noted and the physical examination was positive or suspected malignancy. In the patient with carcinoma in situ, the only conspicuous clinical sign was bloody nipple discharge and the mammography showed calcifications (category 4) that were not visible on US. Radiological findings of all patients without malignancy were classified as categories 1 and 2. The diagnostic performance of physical examination was lower than mammography and US ( $P > 0.05$ ). Mammography was more sensitive than US (100% vs 83.3%). Both techniques showed the same specificity (100%).	3
9. Evans GF, Anthony T, Turnage RH, et al. The diagnostic accuracy of mammography in the evaluation of male breast disease. <i>Am J Surg.</i> 2001;181(2):96-100.	Observational-Dx	104 prebiopsy mammograms from 100 patients	To define the diagnostic accuracy of mammography in the evaluation of male breast disease.	The pathologic diagnoses were 12 cancers, including 1 patient with bilateral breast cancer, 70 cases of gynecomastia, 16 benign masses, and 6 normals. The accuracy data for the mammographic diagnostic categories are as follows: malignant (combined definitely and possibly malignant), sensitivity 92%, specificity 90%, PPV 55%, NPV 99%, accuracy 90%; and overall benignity (combined gynecomastia, benign mass, and normal), sensitivity 90%, specificity 92%, PPV 99%, NPV 55%, accuracy 90%. 6 cancers (50%) coexisted with gynecomastia.	2

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10. Fentiman IS, Fourquet A, Hortobagyi GN. Male breast cancer. Lancet. 2006;367(9510):595-604.	Review/Other-Tx	N/A	Review management of male breast cancer.	Surgery is usually mastectomy with axillary clearance or sentinel node biopsy. Indications for radiotherapy, by stage, are similar to female breast cancer. Because 90% of tumors are estrogen-receptor-positive, tamoxifen is standard adjuvant therapy, but some individuals could also benefit from chemotherapy. Hormonal therapy is the main treatment for metastatic disease, but chemotherapy can also provide palliation. National initiatives are increasingly needed to improve information and support for male breast cancer patients.	4
11. Michels LG, Gold RH, Arndt RD. Radiography of gynecomastia and other disorders of the male breast. Radiology. 1977;122(1):117-122.	Review/Other-Dx	22 cases	To describe mammographic features of 22 pathologically proved cases reflecting disorders of the male breast.	2 patterns of gynecomastia were observed: a dendritic pattern seen in association with breast enlargement for 6 months or more, and a more florid triangular pattern, seen in association with breast enlargement of recent onset. Male breast carcinoma may be distinguished from gynecomastia by its eccentric location, spiculation, and in some cases, calcification or involvement of the skin and nipple. Benign conditions simulating carcinoma included a case of drug-induced gynecomastia and a case of inflamed inclusion cyst.	4
12. Foo ET, Lee AY, Ray KM, Woodard GA, Freimanis RI, Joe BN. Value of diagnostic imaging for the symptomatic male breast: Can we avoid unnecessary biopsies?. Clin Imaging. 45:86-91, 2017 Sep - Oct.	Review/Other-Dx	122 males	To review the use of diagnostic breast imaging and outcomes for symptomatic male patients.	The majority (94%) of cases had negative or benign imaging, with gynecomastia being the most common diagnosis (78%). There were two malignancies, both of which had positive imaging. Fifteen patients underwent percutaneous biopsy, and over half (53%) were palpation-guided biopsies initiated by the referring clinician despite negative imaging. Diagnostic imaging demonstrated 100% sensitivity and 96% specificity for identifying cancer.	4

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13. Sonnenblick EB, Salvatore M, Szabo J, Lee KA, Margolies LR. Incremental Role of Mammography in the Evaluation of Gynecomastia in Men Who Have Undergone Chest CT. <i>AJR Am J Roentgenol.</i> 207(2):234-40, 2016 Aug.	Observational-Dx	62 men	To determine whether additional breast imaging is clinically valuable in the evaluation of patients with gynecomastia incidentally observed on computed tomography (CT) of the chest.	Gynecomastia was statistically significantly larger on mammograms than on CT images; however, there was a high level of concordance in morphologic features and distribution of gynecomastia between mammography and CT. In only one case was gynecomastia evident on mammographic but not CT images, owing to cachexia. Two of the 62 men had ductal carcinoma, which was obscured by gynecomastia. Both of these patients had symptoms suggesting malignancy.	3
14. Cohen SL, Margolies LR, Szabo JR, Patel NS, Hermann G. Introductory pictorial atlas of 3D tomosynthesis. <i>Clin Imaging.</i> 38(1):18-26, 2014 Jan-Feb.	Review/Other-Dx	N/A	To provide an overview of digital breast tomosynthesis (DBT) technology, discusses its indications and potential drawbacks, as well as presents a case-based atlas of normal and abnormal findings.	No results stated in abstract.	4
15. Sonnenblick EB, Margolies LR, Szabo JR, Jacobs LM, Patel N, Lee KA. Digital breast tomosynthesis of gynecomastia and associated findings—a pictorial review. [Review]. <i>Clin Imaging.</i> 38(5):565-70, 2014 Sep-Oct.	Review/Other-Dx	N/A	To review the Digital breast tomosynthesis of gynecomastia and associated findings—a pictorial.	No results stated in abstract.	4

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16. Dialani V, Baum J, Mehta TS. Sonographic features of gynecomastia. <i>J Ultrasound Med.</i> 29(4):539-47, 2010 Apr.	Observational-Dx	153 men	To identify sonographic features of gynecomastia.	Of the 237 men with breast symptoms, 79 with only mammography were excluded. Of the 158 who had sonography with or without mammography, 5 without gynecomastia were also excluded. A total of 153 men included in the study presented with pain (n = 38), a lump (n = 95), both pain and a lump (n = 17), or nipple discharge (n = 3). 9/153 with gynecomastia had a biopsy. A total of 219 sonographic examinations were performed, which revealed 73 masses (33%): 20 (27%) nodular, 20 (27%) poorly defined, and 33 (45%) flame shaped. All masses were retroareolar, with 57 (78%) hypoechoic, 54 (73%) avascular, 60 (82%) parallel to the chest wall, and 47 (64%) without posterior enhancement or shadowing. Of the 146 without masses (67%), 141 (97%) had increased anteroposterior depth at the nipple.	3
17. Ramadan SU, Gokharman D, Kacar M, Kosar P, Kosar U. Assessment of vascularity with color Doppler ultrasound in gynecomastia. <i>Diagn Interv Radiol.</i> 16(1):38-44, 2010 Mar.	Observational-Dx	108 breasts; 54 males	To analyze the presence and type of vascularity with color Doppler ultrasound (CDUS) in gynecomastia, to describe gray-scale ultrasound (US) and CDUS features in different stages of gynecomastia, and to compare these findings with the characteristic US appearances of Tanner stages	Gynecomastia was present in 78 breasts with a retroareolar thickness of 5-31 mm and symptom duration of 1-300 weeks. Fifteen breasts with gynecomastia had no arterial or venous flow. Tanner stages were found to be strongly associated with arterial and venous flow scores, duration of symptoms, and retroareolar thickness (P < 0.001).	3



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18. Yuksekkaya R, Celikyay F, Ozcetin M, Yuksekkaya M, Asan Y. Assessment of color Doppler ultrasonography findings in gynecomastia. Med. ultrasonography. 15(4):285-8, 2013 Dec.	Observational-Dx	36 breasts; 18 males	To evaluate the color Doppler ultrasound (US) findings of gynecomastia and compare them with sonographic Tanner staging to determine an additional diagnostic tool.	Gynecomastia was detected in 30 breasts, and the mean retroareolar thickness was 8.03 mm. Furthermore, arterial and venous flows were detected in 73.3% and 56.7% of the breasts, respectively. However, there was no correlation between the arterial and venous flows and the retroareolar glandular tissue thickness. The average of the mean RI values of the three regions of the breast was 0.62, and there was a statistically significantly positive correlation between the mean RI values of the breasts and the Tanner stages as established by US. Furthermore, there was a strongly significant positive correlation between the arterial and venous flow scores and the Tanner stages.	3
19. Chen PH, Slanetz PJ. Incremental clinical value of ultrasound in men with mammographically confirmed gynecomastia. Eur J Radiol. 83(1):123-9, 2014 Jan.	Observational-Dx	353 mammograms were obtained from 327 unique patients	To determine whether US is of any value in male patients presenting with focal symptoms who have classic features of gynecomastia but no concerning findings on mammography.	A total of 353 mammograms were obtained from 327 unique patients (ages 18–95, mean 51 years). Of all mammographic examinations, gynecomastia was the sole finding in 73% (259). In those 259 studies, 85% were further evaluated with US, in which 6 (2.7%) showed additional benign findings, and 4 (1.8%) showed suspicious findings for which biopsy was recommended. No malignancies were detected in those patients. Furthermore, no malignancies were detected in patients whose mammogram revealed only normal fatty parenchyma or only gynecomastia. In all cases of cancer, mammography revealed visible masses.	3

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20. Tangerud A, Potapenko I, Skjerven HK, Stensrud MJ. Radiologic evaluation of lumps in the male breast. <i>Acta Radiol.</i> 57(7):809-14, 2016 Jul.	Observational-Dx	539 male patients	To assess whether ultrasound and fine needle aspiration cytology (FNAC) are necessary investigations when mammograms show classical gynecomastia	Among the 539 male patients who underwent mammography, 483 were also examined with ultrasound, and 335 were further evaluated with FNAC. Mammograms showed gynecomastia in 350 patients, and among these subjects ultrasound was performed in 340 (97%), FNAC in 261 (75%), and core biopsies in four (1%) patients. The diagnosis gynecomastia was unchanged in all patients who underwent FNAC or biopsy. Malignant tumors were found in eight patients, six of which were invasive ductal carcinomas.	3
21. Charlot M, Beatrix O, Chateau F, et al. Pathologies of the male breast. [Review]. <i>Diagn Interv Imaging.</i> 94(1):26-37, 2013 Jan.	Review/Other-Dx	N/A	To review the pathologies of the male breast.	No results stated in abstract.	4
22. Kaneda HJ, Mack J, Kasales CJ, Schetter S. Pediatric and adolescent breast masses: a review of pathophysiology, imaging, diagnosis, and treatment. [Review]. <i>AJR Am J Roentgenol.</i> 200(2):W204-12, 2013 Feb.	Review/Other-Dx	N/A	To review the Pediatric and adolescent breast masses.	No results stated in abstract.	4

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23. Telegrafo M, Introna T, Coi L, et al. Breast US as primary imaging modality for diagnosing gynecomastia. <i>G Chir.</i> 37(3):118-122, 2016 May-Jun.	Observational-Dx	48 patients	To assess the role of breast ultrasound (US) in diagnosing and classifying gynecomastia as the primary imaging modality and to compare US findings and classification system with the mammographic ones.	The US examination revealed pseudo-gynecomastia in 4/48 (8%) and true gynecomastia in the remaining 44 (92%). Gynecomastia was bilateral in 25/44 cases (57%) and unilateral in the remaining 19 (43%). The cases of true gynecomastia included non mass shape in 26/44 cases (59%), nodular shape in 12 (27%) and flame shape in 6 (14%). The mammographic examination revealed the same results as compared with US findings. 18/44 (41%) patients affected by nodular or dendritic gynecomastia underwent cytological examination confirming the presence of glandular tissue and the benign nature of the clinical condition.	3
24. Crichlow RW, Galt SW. Male breast cancer. <i>Surg Clin North Am.</i> 1990;70(5):1165-1177.	Review/Other-Dx	N/A	To review management of male breast cancer.	No results stated in abstract.	4
25. Taylor K, Ames V, Wallis M. The diagnostic value of clinical examination and imaging used as part of an age-related protocol when diagnosing male breast disease: an audit of 1141 cases from a single centre. <i>BREAST.</i> 22(3):268-72, 2013 Jun.	Observational-Dx	1,141 cases	To assess the efficacy of triple assessment as part of an age related protocol currently used in the clinical setting.	Sensitivity for clinical examination was 64.0%, mammography 77.8%, US 92.0%. 25 cancers were diagnosed, 24 aged >40 years, 1 aged 29. 2 presented with nipple discharge. The cancer <40 years was diagnosed with clinical examination and US, all others had suspicious clinical examination and/or mammography necessitating US and biopsy.	4

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26. Mercier J, Kwiatkowski F, Abrial C, et al. The role of tomosynthesis in breast cancer staging in 75 patients. Diagnostic and Interventional Imaging. 96(1):27-35, 2015 Jan.	Observational-Dx	75 patients	To compare tomosynthesis to mammography, ultrasound, magnetic resonance imaging (MRI), and histology for the detection and staging of BI-RADS 4-5 anomalies, as a function of breast composition, lesion location, size, and histology.	The sensitivities for detection were as follows: 92.5% with MRI, 79% for ultrasound, 75% for tomosynthesis, and 59.5% for mammography. Tomosynthesis improves the sensitivity of mammography (P=0.00013), but not the specificity. The detection of multifocality and multicentricity was improved, but not significantly. Tomosynthesis identified more lesions than mammography in 10% of cases and improved lesion staging irrespective of the density, but was still inferior to MRI. The detection of ductal neoplasia was superior with tomosynthesis than with mammography (P=0.016), but this was not the case with lobular cancer. The visualization of masses was improved with tomosynthesis (P=0.00012), but not microcalcifications. Tomosynthesis was capable of differentiating lesions of all sizes, but the smaller lesions were easier to see. Lesion sizes measured with tomosynthesis, excluding the spicules, concurred with histological dimensions. Spicules lead to an overestimation of the size.	2
27. Chen L, Chantra PK, Larsen LH, et al. Imaging characteristics of malignant lesions of the male breast. Radiographics. 2006;26(4):993-1006.	Review/Other-Dx	N/A	To present the mammographic and US features of the common benign and malignant lesions of the male breast.	The majority (99%) of male breast lesions are benign. Mammography has been shown to be an accurate study for diagnosing benign gynecomastia.	4

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28. Patterson SK, Helvie MA, Aziz K, Nees AV. Outcome of men presenting with clinical breast problems: the role of mammography and ultrasound. <i>Breast J.</i> 2006;12(5):418-423.	Observational-Dx	165 consecutive symptomatic men	To determine the outcome of men presenting with clinical breast problems for breast imaging and to evaluate the role of mammography and US in the diagnosis of benign and malignant breast problems.	Sensitivity for cancer detection (mammography) was 100% and specificity was 90%. PPV (mammography) was 32% (6/19) and the NPV was 100%. US was performed in 68/165 men (41%). 3/3 cancers (100%) were solid sonographic masses. There were 9/68 false-positive examinations (13%). Sensitivity and NPV for cancer detection (US) was 100% and specificity was 74%. The most common clinical indication for referral was mass/thickening (56%). Mammography had excellent sensitivity and specificity for breast cancer detection and should be included as the initial imaging examination of men with clinical breast problems. The NPV of 100% for mammography suggests that mammograms read as normal or negative need no further examination if the clinical findings are not suspicious. A normal US in these men confirms the NPV of a normal mammogram.	3
29. Iuanow E, Kettler M, Slanetz PJ. Spectrum of disease in the male breast. [Review]. <i>AJR Am J Roentgenol.</i> 196(3):W247-59, 2011 Mar.	Review/Other-Dx	N/A	To review the Spectrum of disease in the male breast.	No results stated in abstract.	4

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<p>30. Adibelli ZH, Oztekin O, Gunhan-Bilgen I, Postaci H, Uslu A, Ilhan E. Imaging characteristics of male breast disease. Breast J. 16(5):510-8, 2010 Sep-Oct.</p>	<p>Observational-Dx</p>	<p>164 male patients</p>	<p>To describe the imaging findings of male breast disease.</p>	<p>The radiologic and pathologic diagnoses in 164 cases of this series were 13 cancers (8%), including one ipsilateral and one contralateral breast cancers, 147 cases of gynecomastia (90%), one fibroadenoma (0.6%), two cases of fibrocystic disease of the breast (1.2%), and one epidermoid inclusion cyst (0.6%). Three mammographic patterns were adequate to describe all 147 cases of gynecomastia in our series: 53 patients (36%) had nodular gynecomastia, 46 patients (31%) had dendritic gynecomastia, and 48 patients (33%) had diffuse gynecomastia. Gynecomastia was unilateral in 65% of cases (n=95), and bilateral in 35% of cases (n=52). On physical examination, two of the malignant lesions had no clinic features of malignancy (15%). On mammography, 11 of 13 malignant masses were demonstrated (85%). A mass with microcalcifications was seen on mammograms in one case (9%). The contours of the masses were irregular in nine cases (82%), well-circumscribed in two cases (18%). The location of the masses was retroareolar in seven cases (64%) and eccentric to the nipple in four cases (36%). The size of the masses varied between 0.5 cm and 5 cm (mean 2.4 cm). Nipple retraction was evident in five cases (45%), and skin thickening in four cases (36%). All of the malignant masses were demonstrated on ultrasound; however, one of them was seen retrospectively after mammography. All of the masses were hypoechoic and solid, the contours were well-defined and smooth in two masses (15%), and irregular in 11 masses (85%), and five masses (39%) had posterior prominent shadowing. Axillary</p>	<p>3</p>

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				lymphadenopathia was detected in two cases (15%). One patient had a previous contralateral breast cancer, and one had an ipsilateral. On mammography, breast cancer characteristically exhibits an irregular subareolar mass, nipple retraction, and skin ulceration or thickening, but sometimes breast cancer has a well-circumscribed contour and punctuated microcalcifications	
31. Doyle S, Steel J, Porter G. Imaging male breast cancer. [Review]. Clin Radiol. 66(11):1079-85, 2011 Nov.	Review/Other-Dx	N/A	To review the Imaging male breast cancer.	No results stated in abstract.	4
32. Lapid O, Siebenga P, Zonderland HM. Overuse of imaging the male breast-findings in 557 patients. Breast J. 21(3):219-23, 2015 May-Jun.	Observational-Dx	557 patients	To assess the utilization and outcome of imaging with mammography or ultrasound of the male breast in a university hospital's department of radiology.	The most common indication was enlargement of the breast, described as gynecomastia or swelling in 74% of patients, followed by pain in 24% and "lumps" in 10%. The modalities used were mammography in 65%, ultrasound in 51% and both in 26%. Most examinations, 519, were BI-RADS 1 or 2, and 38 were BI-RADS 3 or higher. Altogether 160 patients had additional fine-needle aspiration or biopsy. Malignancies were diagnosed in five patients (0.89%). Imaging had a sensitivity of 80% and a specificity of 99%. The positive predictive value was 44% and the negative predictive value 99.8%. Malignancies are rare in the male breast. The probability of finding cancer when performing imaging of clinically benign findings in the male breast is negligible. Imaging is not warranted unless there are suspicious abnormalities.	3
33. Ryu SW, Ho K, O'Toole SA, Green A, Kim HW. Case report of male breast cancer detected on magnetic resonance imaging. J Med Imaging Radiat Oncol. 61(3):369-371, 2017 Jun.	Review/Other-Dx	N/A	To review the Case report of male breast cancer detected on magnetic resonance imaging.	No results stated in abstract.	4

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34. Morakkabati-Spitz N, Schild HH, Leutner CC, von Falkenhausen M, Lutterbey G, Kuhl CK. Dynamic contrast-enhanced breast MR imaging in men: preliminary results. <i>Radiology</i> . 2006;238(2):438-445.	Observational-Dx	17 consecutive male patients	To prospectively evaluate whether the descriptors of lesion features and the diagnostic criteria that have been established for breast MRI in female patients may be used for differential diagnosis with breast MRI in male patients as well.	24 breast abnormalities were diagnosed. 3 patients had invasive breast cancer (5 tumors), 11 had gynecomastia (6 unilateral, 5 bilateral), 2 had pseudogynecomastia, and 1 had a benign solid tumor (angiolioma). All malignant tumors appeared as irregular masses with heterogeneous internal architecture or rim enhancement and showed rapid initial enhancement (mean value, 137% +/- 23) followed by a washout time course (Breast Imaging Reporting and Data System [BI-RADS] category 5). Diffuse and nodular gynecomastia showed slow initial and persistent enhancement with normal-appearing parenchymal architecture (BI-RADS category 2; 15/16 breasts in 10/11 patients). In 1 patient with biopsy-proved bilateral gynecomastia, an area with segmental enhancement was classified as suspicious for ductal carcinoma in situ. Pseudogynecomastia did not enhance at all. The angiolioma showed benign morphologic features and slow initial and persistent enhancement (BI-RADS category 2).	3
35. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: <a href="https://www.acr.org/-/media/ACR/Files/Appropriateness-Criteria/RadiationDoseAssessmentIntro.pdf">https://www.acr.org/-/media/ACR/Files/Appropriateness-Criteria/RadiationDoseAssessmentIntro.pdf</a> .	Review/Other-Dx	N/A	Guidance document on exposure of patients to ionizing radiation.	No results stated in abstract.	4



## Evidence Table Key

### Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
  - a. The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
  - b. The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
  - c. The study is an expert opinion or consensus document.
- Meta-analysis
  - a. *Good quality* – the study design, methods, analysis, and results are valid and the conclusion is supported.
  - b. *Inadequate quality* – the study design, analysis, and results lack the methodological rigor to be considered a good meta-analysis study.

## Abbreviations Key

Dx = Diagnostic

Tx = Treatment