Ref: Ro Med J. 2024;72(1)
DOI: 10.37897/RMJ.2025.1.13

Axillary lymph nodes status and proportion of benign lesions in BI-RADS IV and V among females

Noora F. Rajab[1], Ahmed Ziarra Khalaf[1], Mazin A. Abdulla[2]

[1]Department of Surgery, Al-Basrah Teaching Hospital, Basrah, Iraq
[2]Surgery Department, Basrah Medical College, University of Basrah, Basrah, Iraq

Ahmed Ziarra Khalaf **ORCID ID:** 0000-0003-3474-0261

ABSTRACT

Background. The status of axillary lymph nodes is a determining factor in the management and prognosis of patients with breast cancer. BI-RADS categories play an integral role in breast cancer management by ensuring accurate diagnosis, risk-appropriate interventions, and seamless communication across specialties. The aim of this study was to investigate the correlation between the status of axillary lymph nodes and BI-RAD categories IV and V.

Subjects and methods. A cross-sectional retrospective study was conducted from November 2021 to April 2022, including females attending the breast clinic for breast cancer screening at Basrah Teaching Hospital. Data were collected and reviewed from patient files; the enrolled files contained all the necessary data required to complete the questionnaire. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 25.

Results. The study included 142 mammographic records, categorized into six age groups. The mean age of patients in the BI-RAD IV category was 49.37 ± 9.78 years, while the mean age of those in the BI-RAD V category was 60.43 ± 12.72 years. Regarding age categories, most BI-RAD IV patients were in the 40-49 years age group (41.30%), while most BI-RAD V patients were in the 50-59 years age group (40.0%). In terms of lymph node status, most BI-RAD IV patients had a negative status (76.08%), whereas most BI-RAD V patients had a positive status (68.0%).

Conclusion. In comparing BI-RAD IV and BI-RAD V, the status of lymph nodes was more often positive for malignant metastasis in the latter, which emphasizes the possible correlation between BI-RAD findings and the status of axillary lymph nodes. This could be influenced by factors such as disease aggressiveness, patient age, and other risk factors. However, not all BI-RAD IV and V findings were malignant.

Keywords: breast cancer, axillary lymph nodes, BI-RAD IV, BI-RAD V

INTRODUCTION

Mammography (also known as mastography) is a diagnostic and screening procedure that involves the use of low-energy X-rays to inspect the human breast. Mammography is used to diagnose breast cancer in its early stages, usually by detecting distinctive lumps or micro-calcifications [1]. Screening mammography has been widely used in the United States for more than three decades, and there is a wealth of evidence to show that results have improved over time. Between 1990 and 2010, the breast cancer death rate decreased by 34% due to a combination of early detection and better treatment [2]. Even with advancements in treatment, screening mammography is thought to be responsible for 28–65% of the reduction in breast cancer death rates [3].

Aside from the controversy regarding mammography's effectiveness in reducing breast cancer mortality, there is continuous disagreement concerning the dangers of screening, which include patient anxiety, radiation, false positives, and over-diagnosis, particularly of ductal carcinoma in situ (DCIS) and atypia. False positives in mammography refer to women who are called back for more mammograms or breast ultrasounds, as well as women who have biopsies for lesions that turn out to be benign. Over-diagnosis is defined as the diagnosis of a disease that

Corresponding authors:
Ahmed Ziarra Khalaf
E-mail: ahmed.khalaf@uobasrah.edu.iq

Article History:
Received: 18 August 2024
Accepted: 1 March 2025

would not have shown clinically throughout a woman's lifetime [4].

Approximately 10% of women who undergo annual mammography will be recalled for further mammographic imaging or ultrasound evaluation in most clinics in the United States due to initial false-positive results. Furthermore, the vast majority of percutaneous breast biopsies reveal benign diseases. As a result, many women who do not have breast cancer will be subjected to the extra time, money, radiation, discomfort, and worry associated with false-positive mammography findings. The stress associated with false-positive mammograms has been reported in several recent studies to create long-term psychosocial impact. Over-diagnosis is defined as the diagnosis of a disease that would not have been clinically evident throughout a woman's lifetime [5,6].

The breast imaging reporting and data system (BI-RADS)

The breast imaging reporting and data system (BI-RADS) is a system that allows mammography reports to be standardized. The American College of Radiology created it in 1993 to provide clear, useful, and uniform information to referring professionals and patients across facilities. The BI-RADS system highlights significant mammographic results and defines recommended follow-up and management based on scientific evidence and established by the world's professionals in breast imaging [7].

BI-RADS (breast imaging-reporting and data system) categories play a critical role in the management and treatment of breast cancer by providing a standardized framework for interpreting imaging results. BI-RADS offers a uniform language (categories 0-VI) for radiologists, reducing variability in reporting. These categories direct follow-up actions [7].

The description of all relevant findings is the most extensive component of the BI-RADS classification system. There is a standard language for the many different findings that can be noticed in mammography, which is classified into five categories [8]: mass, asymmetry, architectural distortion, calcifications, and other associated features. There are subcategories under each of these primary categories that describe the findings in greater detail [7]. Different characteristics correspond to different levels of malignancy suspicion. Suspicious results include micro-lobulated and unclear borders. Spiculated margins are a strong indicator of cancer [8]. Similarly, low-density masses should elicit a low suspicion of malignancy, but high-density masses should elicit a high suspicion [9].

Asymmetries, the next category of BI-RADS results, are patches of localized fibro-glandular tissue that lack the defined edges of a mass [8]. The term "architectural distortion" refers to the deformation of normal breast architecture that occurs without the presence of a distinct mass. Architectural distortion can indicate cancer; however, it can also occur in the presence of benign scar tissue [10].

Both morphology and distribution are used to describe calcifications. Amorphous, coarse heterogeneous, fine pleomorphic, or fine linear/linear branching calcifications are morphologic descriptions. There are five different types of calcification distribution: diffuse (distributed), regional (occupying more than 2 cm of breast tissue), clustered (a few calcifications in a small area of breast tissue), linear, and segmental (appearing to be deposited in a duct) [11].

Associated features and special cases are the remaining two types of mammography findings to consider. Findings that are noticed in conjunction with the previously mentioned findings are referred to as associated features. Examples include skin retraction, nipple retraction, skin thickening, and axillary adenopathy. Special cases are findings that are so prevalent that they don't need to be described in depth. Special cases include intra-mammary lymph nodes and skin tags [12].

The radiologist must offer a final assessment after describing the findings. There are seven subcategories within the assessment categories. The lowest level is an incomplete assessment (category 0), which indicates that more imaging is required. The remaining six assessment categories are for assess-

TABLE 1. Final assessment categories

Category		Management	Likelihood of cancer
0	Need additional imaging or prior examinations	Recall for additional imaging and/or await prior examinations	n/a
I	Negative	Routine screening	Essentially 0%
II	Benign	Routine screening	Essentially 0%
III	Probably benign	Short-interval follow-up (6 months) or continued	>0% but ≤2%
IV	Suspicious	Tissue diagnosis	IVa. low suspicion of malignancy (>2% to ≤10%) IVb. moderate suspicion of malignancy (>10% to ≤50%) IVc. high suspicion of malignancy (>50% to <95%)
V	Highly suggestive of malignancy	Tissue diagnosis	≥95%
VI	Known biopsy-proven	Surgical excision when clinical appropriate	n/a

ments that have been completed (categories I, II, III, IV, V, VI). Negative and benign screening mammography are indicated by BI-RADS I and II, respectively. The BI-RADS III assessment is for diagnostic mammograms that have been assessed as likely benign [13]. BI-RADS IV denotes mammography that is suspicious for cancer, while BI-RADS V denotes a mammogram that is very suggestive of cancer [8]. The BI-RADS VI category is for women who have had a biopsy and have been diagnosed with breast cancer.

The vast majority of screening mammography will fall into the BI-RADS I and II categories. A small percentage of mammograms (about 5–9%) will require further imaging for additional assessment, short-interval follow-up, or a biopsy. A BI-RADS III assessment will be achieved in about 7% of diagnostic mammograms [14]. Only 2% of diagnostic mammograms will acquire a BI-RADS IV or V score, necessitating biopsy [12]. However, the most significant benefits of BI-RADS have been increased mammographic interpretation quality and improved communication between radiologists, referring and treating doctors, and patients.

Axillary lymphadenopathy

The aggressiveness of the tumor, which tends to expand and metastasize, and, on the other hand, the host's resistance in its attempt to contain cancer, is reflected in lymph node status. Lymph node involvement is the most important prognostic indicator for overall survival and progression-free survival, independent of other parameters like tumor size. Patients with negative nodes have a 5-year survival rate of more than 82% for all forms of cancer. When 1–3 lymph nodes are involved, this declines to 73%; 46% when 4–12 lymph nodes are involved; and 28% when more than 13 lymph nodes are involved [15].

The treatment indications are also influenced by nodal status. Due to the lack of clinical nodal involvement, the sentinel lymph node operation can be considered, avoiding unnecessary surgical dissection. Axillary lymphadenectomy is the most reliable approach for determining nodal involvement, and tumor involvement of an axillary node provides a reason for adjuvant chemotherapy and supraclavicular radiation therapy. However, it is restricted by side effects such as lymphedema, discomfort, shoulder movement restriction, and arm weakness that occur after removal. For women with tumors smaller than 20 mm, axillary lymph node dissection appears to be less beneficial, with a lesion detected in less than 15 to 20% of patients.

The sentinel lymph node operation is used to reduce the side effects of axillary dissection. The sentinel lymph node procedure has been established, which involves collecting and evaluating the breast's first axillary nodal relay. According to the American Society of Clinical Oncology's (ASCO) recommendations for the sentinel lymph node technique, the incidence of abnormal lymph node identification is greater than 90%, with a false-negative probability of less than 5% [16].

According to a review of the literature, the false-negative rate appears to be greater than expected, ranging between 5.2 and 13.6% [17]. Better selection of individuals who need an axillary lymphadenectomy and those who could benefit from the sentinel lymph node surgery could enhance these rates. Imaging can help assess the nodal condition and provide better recommendations for sentinel node indications in these scenarios.

Aim of the study: The aim of this study was to explore any correlation between the status of axillary lymph nodes and BI-RAD categories IV and V, as well as the proportion of benign lesions in BI-RAD categories IV and V.

SUBJECTS AND METHODS

Study design and population

A demographic, descriptive, cross-sectional retrospective study was conducted from November 2021 to April 2022. A total of 157 mammographic records were reviewed, of which 15 were excluded due to inconsistency with the study design or missing data, leaving 142 records for analysis.

Inclusion criteria

Patients who attended mammographic breast screening at Al-Basrah Teaching Hospital clinical center in the past 3 years (2018–2020), aged over 30 years, and who had mammographic results classified as BI-RADS IV or V.

Exclusion criteria

Records that were inconsistent with the study design in terms of mammographic classification or other variables were excluded, including those with BI-RADS 0, I, II, III and patients aged under 30 years.

Official endorsement

Approvals were obtained from Al-Basrah Medical College, the Basrah Health Directorate, and the Scientific Council of Surgical Specialists of the Arab Board of Health Specialization prior to data collection. Modifications and adjustments were made accordingly to optimize the quality of data collection.

Data collection

Before beginning data collection, a full assessment of Al-Basrah Teaching Hospital's clinical center

was performed to understand the type of patients served and the nature and volume of data available. Based on this, data collection was carried out approximately three days per week. Patient records were reviewed, and data inconsistent with the study requirements were excluded. The enrolled records contained all necessary information to fulfill the study questionnaire.

Definition of variables

- **Age:** categorized into 10-year intervals:
  - 30–39 years
  - 40–49 years
  - 50–59 years
  - 60–69 years
  - 70+ years
- **Address:** the current place of residence.
  - **Urban:** patients living in built-up areas with high population density and developed infrastructure
  - **Rural:** patients living outside of urban towns or cities
- **Marital status:**
  - Married
  - Unmarried
  - Widowed
- **Family history of breast carcinoma:** history of breast cancer in a first-degree relative.
- **BI-RADS score:** classification of mammographic findings based on BI-RADS categories.
- **Axillary lymph node status:** definitive diagnosis of lymph node involvement based on histopathological examination.

Statistical analysis

Statistical analyses were performed using SPSS version 25 (SPSS Inc.). Categorical data were presented as numbers and percentages. The chi-square test (χ^2) was used to assess differences between groups. Continuous variables were expressed as mean ± standard deviation (SD), and group differences were analyzed using the independent sample t-test. A 95% confidence interval was used, and p-values <0.05 were considered statistically significant. Biopsy procedures included either true-cut or excisional biopsy techniques.

RESULTS

This study included 142 mammographic records categorized into six age groups: <30, 30–39, 40–49, 50–59, 60–69, and ≥70 years. Most records were from patients aged 50–59 years (33.80%) and 40–49 years (33.10%). The 60–69 age group accounted for 16.20%, while the 30–39 group comprised 11.97%. The least represented age groups were <30 years (1.41%) and ≥70 years (3.52%).

Most patients were married (71.13%), while the fewest were divorced (6.34%). Urban residents made up 69.01% of the sample, compared to 30.99% from rural areas. Additionally, 61.27% of the patients had a positive past medical history, and 42.96% reported a first-degree relative with a current or previous diagnosis of breast carcinoma (Table 2).

TABLE 2. General demographical data analysis of the enrolled participants

Variables		Frequency (N =142)	Percentage
Age	<30	2	1.41
	30-39	17	11.97
	40-49	47	33.10
	50-59	48	33.80
	60-69	23	16.20
	≥70	5	3.52
Marital status	Married	101	71.13
	Single	15	10.56
	Divorced	9	6.34
	Widow	17	11.97
Residency	Urban	98	69.01
	Rural	44	30.99
Past medical history	Present	87	61.27
	Absent	55	38.73
Family history of breast carcinoma	Present	61	42.96
	Absent	81	57.04

The mean age of BI-RADS IV participants was 49.37 ± 9.78 years, while the mean age of BI-RADS V participants was 60.43 ± 12.72 years, a statistically significant difference ($p < 0.031$).

Regarding age distribution, in the BI-RADS IV group, most patients were aged 40–49 years (41.30%), followed by 50–59 years (30.43%), 30–39 years (17.39%), 60–69 years (7.60%), <30 years (2.17%), and ≥70 years (1.08%).

In the BI-RADS V group, the majority were aged 50–59 years (40.0%), followed by 60–69 (32.0%), 40–49 (18.0%), ≥70 (8.0%), and 30–39 (2.0%). No BI-RADS V cases were recorded in patients under 30. Age groups <30, 30–39, and 40–49 were statistically significant ($p < 0.05$).

Regarding family history of breast carcinoma, 78.0% of BI-RADS V patients had a positive family history, compared to 23.91% in the BI-RADS IV group (Table 3).

The study showed that malignant breast lesions were most common in BI-RADS V (86.0%), followed by BI-RADS IV (75.0%). Benign lesions were found in 14.0% of BI-RADS V and 25.0% of BI-RADS IV cases.

TABLE 3. Age and family history distribution regarding the BI-RADS categories

Variables		BI-RADS IV (N=92)	BI-RADS V (N=50)	P-value	Total
Age (mean±sd)		49.37±9.78	60.43±12.72	0.031	--------
Age	<30	2 (2.17%)	0 (0.00%)	0.07	2
	30-39	16 (17.39%)	1 (2.0%)	0.002	17
	40-49	38 (41.30%)	9 (18.0%)	0.041	47
	50-59	28 (30.43%)	20 (40.0%)	0.09	48
	60-69	7 (7.6%)	16 (32%)	0.25	23
	≥70	1 (1.08%)	4 (8.0%)	0.06	5
Family history of breast carcinoma		22 (23.91%)	39 (78.0%)	0.12	61
Total		92	50		142

TABLE 4. Histopathological results distribution regarding the BI-RADS categories

Variables	Breast lesion		Lymph node status	
	Benign	Malignant	Positive	Negative
BI-RAD IV	23 (25.0%)	69 (75.0%)	22 (23.91%)	70 (76.08%)
BI-RAD V	7 (14.0%)	43 (86.0%)	34 (68.0%)	16 (32.0%)
p- value	0.037		0.042	
Total	30	112	56	86

This difference was statistically significant (p = 0.037).

For axillary lymph node status, 76.08% of BI-RADS IV patients had negative nodes, while 23.91% had positive nodes. In contrast, 68.0% of BI-RADS V patients had positive lymph nodes, and 32.0% had negative nodes—also statistically significant (p = 0.042) (Table 4).

The benign lesions identified in this study included fibroadenoma, duct ectasia, galactocele, breast abscess, and mastitis. The median age was highest among those with duct ectasia (35 years), followed by mastitis (30 years), and lowest in fibroadenoma and breast abscess (25 years).

Most benign lesions were classified as BI-RADS V, except for fibroadenoma and breast abscess. All lesions measured 3 cm in size, except fibroadenoma, which was 2 cm. All lesions had negative lymph node status by both imaging and histopathology, except fibroadenoma, which had positive lymph nodes confirmed by both methods.

All benign lesions were diagnosed via imaging, except mastitis, which was confirmed by biopsy to rule out mastitis carcinomatosis (Table 5).

DISCUSSION

Many earlier researchers have emphasized the significance of BI-RADS as a highly sensitive and specific test. The findings of several studies utilizing mammography were quite consistent when BI-RADS categories were compared to histology results. The efficacy of BI-RADS mammography in the identification of breast cancer is highlighted by this comparative evidence from earlier investigators [18].

Mendez et al. analyzed BI-RADS categories III–V with pathology findings in 2004 and discovered that the rate of malignancy rose accordingly with higher BI-RADS categories. They found the incidence of malignancies among individuals with BI-RADS IV mammograms was 15% [19], which is considerably lower than our result (75.0%). Furthermore, the incidence of malignancies among BI-RADS V individuals was 79.4%, with benign lesions accounting for 20.4%—a distribution comparable to our findings of 86.0% malignant and 14.0% benign.

In line with these results, Gweon et al. reviewed cases of patients who underwent surgery after biopsy and found that the cancer rate increased with higher BI-RADS categories [20].

In 2021, Abdulsamad et al. [21] studied BI-RADS I and II cases that underwent mammography screening in Al-Basrah between 2014–2020. Similar to our findings, they reported that the percentage of malignant cases increased with higher BI-RADS categories. Interestingly, they also found that 9.4% of BI-RADS I and 11.6% of BI-RADS II cases were malignant, contrary to expectations. These anomalies were attributed to mammography's limited sensitivity in dense

TABLE 5. Clinical and imaging features of benign lesions in BI-RADS IV and V categories

Variables	Fibro adenoma	Duct ectasia	Galactocele	Breast abscess	Mastitis
Number	7	5	4	8	6
Age (median)	25	35	28	25	30
BI-RAD	4	5	5	4	5
Lesion average (cm)	2	3	3	3	3
+VE lymph node by ultrasound or mammogram	All	None	None	None	None
+VE lymph node by histopathology	all	None	None	None	None
+VE lymph node by both	+ve	-ve	-ve	-ve	+ve
Benign by biopsy or mammogram	Benign by imaging	Benign by imaging	Benign by imaging	Benign by imaging	Benign by biopsy

breast tissue due to overlapping fibro-glandular structures.

In our study, patients with BI-RADS V had a higher mean age (60.43 ± 12.74) compared to those with BI-RADS IV (49.37 ± 9.78). Kim et al. reported similar findings with mean ages of 51.67 and 49.35 for BI-RADS V and IV, respectively [22]. Age-related risk of malignant breast disease also increased with age in BI-RADS V cases. Hu et al. (2018) and He et al. (2019) observed similar trends, reporting that the positive predictive values in BI-RADS IV subcategories (especially IVa and IVb) increased with age. This aligns with the established fact that age is the most significant risk factor for breast malignancy. In Western countries, over 75% of breast cancer cases affect women over age 50 [23,24].

We also observed a much higher rate of positive family history among BI-RADS V patients compared to BI-RADS IV. Leblebici et al. similarly found that a positive family history was significantly associated with higher cancer risk. They even recommended reclassifying some BI-RADS III cases to IVa in the context of positive family history [25]. Family history is a major risk factor for breast cancer and can cause significant anxiety. Accurate assessment is therefore crucial to guide both prediction models and patient counseling. Multiple studies have used detailed family history features, especially first-degree relatives, to estimate breast cancer risk more effectively [26,27].

In mammography, intra-mammary and low-lying axillary lymph nodes are common findings. Their size can change due to inflammation, infections, or malignancy [28]. We found that axillary lymphadenopathy was present in 68.0% of BI-RADS V patients, compared to 23.91% in BI-RADS IV patients. These are significantly higher than values reported by Kim et al., who noted only 1% and 4.1% for BI-RADS IV and V, respectively [22]. Michaels et al. emphasized the importance of including lymph nodes in the diagnostic process, especially when oval-shaped nodes appear in the upper outer quadrant or show fatty hilum on ultrasound [29].

The relatively higher incidence of malignancy and lymph node involvement in our study compared to others may be attributed to delayed or limited access to screening mammography, particularly among high-risk populations in Iraq [30]. Abdulsamad et al. also noted decreased attendance to screening clinics in 2019–2020, likely due to the COVID-19 pandemic [21].

Benign lesions recorded in this study included fibroadenoma (7 patients), duct ectasia (5), galactocele (4), breast abscess (8), and mastitis (6). The median age was highest among those with duct ectasia (35), followed by mastitis (30), and lowest among those with fibroadenoma and breast abscess (25). BI-RADS V scores were seen in most benign lesions, except for fibroadenomas and abscesses. All lesions had a size of 3 cm, except for fibroadenomas, which were 2 cm. Lymph nodes were negative on both imaging and histopathology for all lesions except one fibroadenoma case. Most lesions were diagnosed by imaging; however, mastitis was confirmed by biopsy to rule out carcinomatous mastitis (Table 5).

These findings highlight the possibility of benign pathology in BI-RADS IV or V cases, emphasizing the importance of biopsy to confirm malignancy, as per current guidelines.

Key insights and clinical relevance

1. Diagnostic challenges and false-positive risks:

BI-RADS IV and V categories are considered suspicious or highly suspicious for malignancy, with positive predictive values of 23–34% (IV) and 80–97% (V) [31]. Still, up to 30% may prove benign on biopsy, leading to discordant results. Clinical axillary examination alone has a false-positive rate of 41%, underscoring the need for confirmatory imaging or biopsy [32].

2. Clinical implications of discordant findings:

Unnecessary invasive procedures: Misclassification may lead to unnecessary axillary lymph node dissection (ALND) or sentinel lymph node biopsy (SLNB), increasing the risk of lymphedema, shoulder dysfunction, and sensory loss [33].

Repeat biopsies: When benign histology contradicts suspicious imaging or nodal findings, repeat biopsies are often necessary. Studies report that 50% of such re-biopsies in BI-RADS IVc/V reveal malignancy [31].

Psychological burden: Patients with benign breast pathology but suspicious lymph nodes face prolonged uncertainty and stress.

3. Strategies to mitigate risks:

Multimodal imaging: Combining conventional ultrasound with shear-wave elastography (SWE) or strain elastography (SE) improves specificity. SWE values such as Emax >59.3 kPa or Eratio >4.56 are highly correlated with malignancy [34].

Correlation of clinical, imaging, and histopathological findings is essential. For example, oval-shaped lesions are more common in benign pathology, while posterior shadowing is less frequent [31].

Axillary US-guided biopsy of abnormal nodes (e.g., cortical thickness ≥3 mm) can reduce false positives and prevent unnecessary ALND [35].

4. Clinical relevance of benign breast disease with positive lymph nodes:

Reactive lymphadenopathy: Benign conditions like mastitis or fibrocystic changes can cause lymph node enlargement that mimics metastasis [31].

Staging implications: False-positive axillary findings can lead to upstaging, prompting inappropriate systemic therapy.

Follow-up: Patients with discordant results require close long-term monitoring to rule out missed malignancies or progression.

Limitations

Our study has several limitations. First, only biopsy-confirmed BI-RADS categories were included, introducing potential selection bias. Second, inter-observer agreement could not be assessed due to the retrospective nature of the data collection. Third, radiologists were not blinded to the patient ages, which may have introduced bias. Lastly, the small sample size and single-center setting limit generalizability.

In comparing BI-RADS IV and BI-RADS V, the status of axillary lymph nodes tends to be more frequently positive for malignant metastasis. This emphasizes a potential correlation between the BI-RADS category and lymph node involvement, which may be influenced by factors such as disease aggressiveness, patient age, and associated risk factors.

CONCLUSION

However, not all BI-RADS IV and V findings represent malignancy. In our study, 25% of BI-RADS IV and 14% of BI-RADS V lesions were benign. These findings highlight the importance of cautious interpretation of imaging results.

The presence of positive axillary lymph nodes (ALNs) in BI-RADS IV/V patients with ultimately benign breast disease underscores the necessity of accurate nodal assessment to avoid overtreatment. In such cases, the following key steps are recommended:

1. Combine elastography with conventional ultrasound to improve specificity.
2. Consider repeat biopsies in cases of imaging-pathology discordance.
3. Utilize multidisciplinary team discussions to correlate imaging, histopathology, and clinical findings.
4. Ensure patient-centered communication to reduce anxiety and provide appropriate guidance for follow-up.

Recommendations

A large-scale, multicenter study is recommended to validate these findings and enhance the generalizability of results. Expanding the sample size and involving multiple breast centers will provide more comprehensive insights and stronger statistical significance.

Acknowledgments

The authors express their sincere gratitude to the staff members of the Breast Clinic, and the Departments of Radiology and Surgery at Al-Basrah Teaching Hospital for their invaluable support and assistance throughout the course of this research.

Financial support:

The authors declare no financial support.

Conflict of interest:

The authors declare no conflict of interest.

REFERENCES

1. Mainiero MB, Moy L, Baron P, Didwania AD, diFlorio RM, Green ED, et al; Expert Panel on Breast Imaging. ACR Appropriateness Criteria® Breast Cancer Screening. *J Am Coll Radiol.* 2017 Nov;14(11S):S383-S390. doi: 10.1016/j.jacr.2017.08.044.
2. Liu LY, Wang F, Yu LX, Ma ZB, Zhang Q, Gao DZ, et al. Breast cancer awareness among women in Eastern China: a cross-sectional study. *BMC Public Health*. 2014 Sep 26;14:1004. doi: 10.1186/1471-2458-14-1004.
3. Berry DA, Cronin KA, Plevritis SK, Fryback DG, Clarke L, Zelen M, et al. Effect of screening and adjuvant therapy on mortality from breast cancer. *N Engl J Med.* 2005 Oct 27;353(17):1784–92. doi: 10.1056/NEJMoa050518.
4. Nelson HD, Tyne K, Naik A, Bougatsos C, Chan BK, Humphrey L; U.S. Preventive Services Task Force. Screening for breast cancer: an update for the U.S. Preventive Services Task Force. *Ann Intern Med*. 2009 Nov 17;151(10):727-37, W237-42. doi: 10.7326/0003-4819-151-10-200911170-00009.
5. Figueroa JD, Pfeiffer RM, Brinton LA, Palakal MM, Degnim AC, Radisky D, et al. Standardized measures of lobular involution and subsequent breast cancer risk among women with benign breast disease: a nested case-control study. *Breast Cancer Res Treat.* 2016 Aug;159(1):163-72. doi: 10.1007/s10549-016-3908-7.
6. Brodersen J, Siersma VD. Long-term psychosocial consequences of false-positive screening mammography. *Ann Fam Med.* 2013 Mar; 11(2):106–15. doi: 10.1370/afm.1466.
7. D'Orsi CJ, Hall FM. BI-RADS lexicon reemphasized. *AJR Am J Roentgenol.* 2006 Nov;187(5):W557. doi: 10.2214/AJR.06.5090.
8. Magny SJ, Shikhman R, Keppke AL. Breast imaging reporting and data system. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 [cited 2021 Aug 31].
9. D'Orsi CJ, Kopans DB. Mammography interpretation: the BI-RADS method. *Am Fam Physician.* 1997 Mar 1;55(5):1548–51.
10. D'Orsi CJ, Newell MS. BI-RADS decoded: detailed guidance on potentially confusing issues. *Radiol Clin North Am.* 2007 Sep; 45(5):751–63. doi: 10.1016/j.rcl.2007.06.003.
11. Baker JA, Kornguth PJ, Floyd CE Jr. Breast imaging reporting and data system standardized mammography lexicon: observer variability in lesion description. *AJR Am J Roentgenol.* 1996 Apr;166(4):773–8. doi: 10.2214/ajr.166.4.8610547.
12. Barazi H, Gunduru M. Mammography BI-RADS grading. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Aug 2 [cited 2021 Aug 2].
13. Rao AA, Feneis J, Lalonde C, Ojeda-Fournier H. A pictorial review of changes in the BI-RADS fifth edition. *Radiographics*. 2016 May;36(3): 623–39. doi: 10.1148/rg.2016150178.
14. Thomassin-Naggara I, Tardivon A, Chopier J. Standardized diagnosis and reporting of breast cancer. *Diagn Interv Imaging.* 2014 Jul;95(7–8):759–66. doi: 10.1016/j.diii.2014.06.006.

15. Fisher B, Bauer M, Wickerham DL, Redmond CK, Fisher ER, Cruz AB, et al. Relation of number of positive axillary nodes to the prognosis of patients with primary breast cancer. An NSABP update. *Cancer*. 1983 Nov 1;52(9):1551–7. doi: 10.1002/1097-0142(19831101)52:9<1551::aid-cncr2820520902>3.0.co;2-3.
16. Lyman GH, Giuliano AE, Somerfield MR, Benson AB 3rd, Bodurka DC, Burstein HJ, et al. American Society of Clinical Oncology guideline recommendations for sentinel lymph node biopsy in early-stage breast cancer. *J Clin Oncol.* 2005 Oct 20;23(30):7703–20. doi: 10.1200/JCO.2005.08.001.
17. Hindié E, Groheux D, Brenot-Rossi I, Rubello D, Moretti JL, Espié M. The sentinel node procedure in breast cancer: nuclear medicine as the starting point. *J Nucl Med.* 2011 Mar;52(3):405–14. doi: 10.2967/jnumed.110.081711.
18. Orel SG, Kay N, Reynolds C, Sullivan DC. BI-RADS categorization as a predictor of malignancy. *Radiology*. 1999 Jun;211(3):845–50. doi: 10.1148/radiology.211.3.r99jn31845.
19. Mendez A, Cabanillas F, Echenique M, Malekshamran K, Perez I, Ramos E. Mammographic features and correlation with biopsy findings using 11-gauge stereotactic vacuum-assisted breast biopsy (SVABB). *Ann Oncol.* 2004 Mar;15(3):450–4. doi: 10.1093/annonc/mdh088.
20. Gweon HM, Son EJ, Youk JH, Kim JA, Chung J. Value of the US BI-RADS final assessment following mastectomy: BI-RADS 4 and 5 lesions. *Acta Radiol.* 2012 Apr;53(3):255–60. doi: 10.1258/ar.2011.110597.
21. Al-Hawwaz MH, Abdulsamad HH, Mahmoud RA. Breast cancer among women in Basrah, Iraq: a descriptive study in BI-RADS 1 & 2 screened cases. *Basrah J Surg*. 2021 Jun 30;27(1):51–8. doi: 10.33762/bsurg.2021.168438.
22. Kim JY, Jung EJ, Park T, Jeong SH, Jeong CY, Ju YT, et al. Prognostic importance of ultrasound BI-RADS classification in breast cancer patients. *Jpn J Clin Oncol.* 2015 Feb 10;45(5):411–5. doi: 10.1093/jjco/hyv018.
23. Guo Y, Hu Y, Qiao M, Wang Y, Yu J, Li J, Chang C. Radiomics analysis on ultrasound for prediction of biologic behavior in breast invasive ductal carcinoma. *Clin Breast Cancer.* 2018 Jun;18(3):e335–44. doi: 10.1016/j.clbc.2017.08.002.
24. Pape R, Spuur KM, Wilkinson JM, Umo P. Correlation of the BI-RADS assessment categories of Papua New Guinean women with mammographic parenchymal patterns, age and diagnosis. *J Med Radiat Sci.* 2020 Dec;67(4):269–76. doi: 10.1002/jmrs.422.
25. Leblebici İM, Bozkurt S, Eren TT, Ozemir IA, Sagiroglu J, Alimoglu O. Comparison of clinicopathological findings among patients whose mammography results were classified as category 4 subgroups of the BI-RADS. *North Clin Istanb.* 2014;1(1):1. doi: 10.14744/nci.2014.21931.
26. Colditz GA, Kaphingst KA, Hankinson SE, Rosner B. Family history and risk of breast cancer: nurses' health study. *Breast Cancer Res Treat.* 2012 Jun;133(3):1097–104. doi: 10.1007/s10549-012-1985-9.
27. Brewer HR, Jones ME, Schoemaker MJ, Ashworth A, Swerdlow AJ. Family history and risk of breast cancer: an analysis accounting for family structure. *Breast Cancer Res Treat.* 2017 Aug;165(1):193–200. doi: 10.1007/s10549-017-4325-2.
28. Cao MM, Hoyt AC, Bassett LW. Mammographic signs of systemic disease. *Radiographics*. 2011 Jul;31(4):1085–100. doi: 10.1148/rg.314105205.
29. Michaels AY, Birdwell RL, Chung CS, Frost EP, Giess CS. Assessment and management of challenging BI-RADS category 3 mammographic lesions. *Radiographics.* 2016 Sep;36(5):1261–72. doi: 10.1148/rg.2016150231.
30. Al-Attar W, Sattar SA, Al Mallah N, Wardia WI. Factors influencing mammography participation in Iraqi women. *J Nurs Health Sci.* 2016;5(5):43–9.
31. Rjoop W, Rjoop A, Almohtaseb A, Bataineh L, Nser Joubi Z, Gharaibeh M, et al. Pathological and radiological assessment of benign breast lesions with BIRADS IVc/V subtypes. should we repeat the biopsy? *BMC Womens Health.* 2025 Feb 3;25(1):47. doi: 10.1186/s12905-025-03569-7.
32. Specht MC, Fey JV, Borgen PI, Cody HS 3rd. Is the clinically positive axilla in breast cancer really a contraindication to sentinel lymph node biopsy? *J Am Coll Surg.* 2005;200(1):10–4. doi: 10.1016/j.jamcollsurg.2004.09.010.
33. Euhus DM. Management of the clinically positive axilla. *Breast J.* 2020;26(1):35–8. doi: 10.1111/tbj.13719.
34. Elmesidy DS, Eissa MAGAM, Hamed ST, Youssef OZ, Nada OM, Hashem LMB. Axillary lymph node status in BI-RADS 4–5 female patients: can shear wave and strain ultrasound elastography help? *Egypt J Radiol Nucl Med.* 2021;52:176. doi: 10.1186/s43055-021-00560-8.
35. Malhaire C, Umay O, Cockenpot V, Selhane F, Ramtohul T, Reyal F, et al. Predicting axillary residual disease after neoadjuvant therapy in breast cancer using baseline MRI and ultrasound. *Eur Radiol.* 2025 Feb 8. doi: 10.1007/s00330-025-11408-4.