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RADIOLOGICAL CHARACTERISTICS OF BREAST LESIONS DETECTED BY MAMMOGRAPHY AND ULTRASOUND WITH HISTOPATHOLOGICAL CORRELATION AT AL-THAQALAYN ONCOLOGY HOSPITAL, BASRA

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ABSTRACT

Background: Breast imaging plays a pivotal role in the early detection and characterization of breast lesions. Mammography and ultrasonography are widely used imaging modalities, while histopathological examination remains the gold standard for definitive diagnosis. Correlating radiological findings with histopathological outcomes is essential for evaluating diagnostic accuracy and optimizing patient management. **Objectives:** To assess the radiological characteristics of breast lesions detected by mammography and ultrasonography and to determine their correlation with histopathological findings among patients attending Al-Thaqalayn Oncology Hospital in Basra, Iraq. **Methods:** This retrospective cross-sectional study was conducted at Al-Thaqalayn Oncology Hospital, Basra, Iraq, between 22 April 2024 and 28 February 2026. A total of 300 female patients with breast lesions who underwent mammographic and/or ultrasonographic examination followed by histopathological evaluation were included. Demographic characteristics, imaging findings, BI-RADS categories, and histopathological diagnoses were collected and analyzed. Histopathological examination was considered the reference standard. Statistical analysis was performed using SPSS version 31, and a P value of less than 0.05 was considered statistically significant. **Results:** The mean age of the patients was 48.7 ± 11.6 years. Malignant lesions accounted for 60.7% of cases, whereas benign lesions represented 39.3%. Invasive ductal carcinoma was the most common malignant lesion (78.0%), while fibroadenoma was the most frequent benign lesion (35.6%). BI-RADS categories 3 and 5 were the most commonly assigned categories (22.0% each). A highly significant association was observed between BI-RADS classification and histopathological diagnosis (P value <0.001). The proportion of malignant lesions increased progressively with increasing BI-RADS category, reaching 98.5% among BI-RADS 5 lesions. Irregular lesion shape, spiculated margins, microcalcifications, and posterior acoustic shadowing were significantly associated with malignancy (P value <0.001). Combined mammography and ultrasonography demonstrated a sensitivity of 96.2%, specificity of 70.3%, positive predictive value of 83.3%, negative predictive value of 92.2%, and overall diagnostic accuracy of 86.0%. **Conclusions:** Mammography and ultrasonography demonstrated high diagnostic performance in the evaluation of breast lesions. A strong correlation was observed between BI-RADS classification and histopathological diagnosis, supporting the reliability of breast imaging in predicting malignancy and guiding clinical decision-making. Combined imaging modalities remain valuable tools for the early detection and characterization of breast cancer.

KEYWORDS: BI-RADS; Breast cancer; Histopathology; Mammography; Ultrasonography.

1-INTRODUCTION

Breast cancer remains the most frequently diagnosed malignancy among women worldwide and is a major cause of cancer-related mortality. According to the World Health Organization (WHO), approximately 2.3 million women were diagnosed with breast cancer globally in 2022, resulting in nearly 670,000 deaths. Despite advances in screening, diagnosis, and treatment,

breast cancer continues to pose a substantial public health challenge, particularly in low- and middle-income countries where delayed diagnosis and limited access to healthcare services contribute to poorer outcomes. Early detection remains the cornerstone for reducing breast cancer morbidity and mortality through timely intervention and improved treatment success rates.[1]

Breast imaging plays a fundamental role in the detection, characterization, and management of breast lesions. Mammography is considered the primary imaging modality for breast cancer screening and has demonstrated significant effectiveness in identifying early-stage disease before the development of clinical symptoms. However, its diagnostic performance may be reduced in women with dense breast tissue, leading to the increased utilization of supplementary imaging techniques such as ultrasonography and magnetic resonance imaging.[2]

Breast ultrasonography is widely employed as an adjunctive imaging modality for evaluating palpable breast masses, differentiating cystic from solid lesions, and characterizing mammographically detected abnormalities. Recent evidence has demonstrated that supplemental ultrasound can improve cancer detection rates, particularly in women with dense breasts, thereby enhancing overall diagnostic sensitivity.[3]

To standardize breast imaging interpretation and facilitate communication between radiologists and clinicians, the American College of Radiology developed the Breast Imaging Reporting and Data System (BI-RADS). BI-RADS provides a structured lexicon and assessment categories that estimate the likelihood of malignancy and guide subsequent patient management. The system has become universally accepted and serves as a critical framework for risk stratification, follow-up recommendations, and biopsy decisions.[4]

Although imaging modalities provide valuable diagnostic information, histopathological examination remains the gold standard for definitive diagnosis of breast lesions. Correlation between imaging findings and histopathological outcomes is essential for validating the diagnostic accuracy of breast imaging, assessing the predictive value of BI-RADS categories, and identifying factors associated with false-positive and false-negative interpretations. Several recent studies have demonstrated a strong association between higher BI-RADS categories and malignant histopathological findings, highlighting the importance of radiologic-pathologic concordance in clinical decision-making.[5-7]

In Iraq, breast cancer represents the most common cancer among women, and its incidence has shown a gradual increase over recent decades. However, data evaluating the correlation between breast imaging findings and histopathological diagnoses remain limited, particularly in southern Iraq. Al-Thaqalayn Oncology Hospital in Basra serves as a major referral center for cancer diagnosis and management, providing an opportunity to evaluate the performance of mammography and ultrasonography in routine clinical practice. Therefore, this study aims to assess the radiological characteristics of breast lesions detected by mammography and ultrasonography and to determine their correlation with histopathological findings among patients attending Al-Thaqalayn Oncology Hospital in Basra, Iraq. The findings of this study may contribute to improving diagnostic accuracy, optimizing patient management strategies, and enhancing the role of breast imaging in the early detection of breast cancer.

2-PATIENTS AND METHODS

Ethical approval for the study was obtained from the Scientific and Ethical Committee of Al Basra Directorate of Health. Patient confidentiality was maintained throughout the study by anonymizing all collected data and restricting access to study records. This retrospective cross-sectional study was conducted at Al-Thaqalayn Oncology Hospital, Basra, Iraq, a tertiary referral center for cancer diagnosis and treatment. The study aimed to evaluate the radiological characteristics of breast lesions detected by mammography and ultrasonography and to determine their correlation with histopathological findings. The study period extended from 22nd of April 2024 to the 28th of February 2026.

A total of 300 female patients with breast lesions who underwent mammographic and/or ultrasonographic evaluation followed by histopathological examination during the study period were included in the study. Patients aged 18 years and older with complete radiological and histopathological records were eligible for inclusion. Patients with incomplete medical records, previous definitive treatment before imaging evaluation, recurrent breast lesions diagnosed elsewhere, or male breast lesions were excluded from the study.

Data were retrospectively collected from the hospital's radiology information system, picture archiving and communication system (PACS), and pathology records. Demographic and clinical information including age, lesion laterality, lesion size, radiological findings, BI-RADS category, and histopathological diagnosis were recorded using a structured data collection form.

Mammographic examinations were performed using standard craniocaudal (CC) and mediolateral oblique (MLO) views, with additional projections obtained when clinically indicated. Mammographic features assessed included the presence of masses, lesion shape, margins, microcalcifications, architectural distortion, asymmetry, and skin or nipple abnormalities. Breast ultrasonography was performed using high-frequency linear transducers to evaluate lesion size, shape, orientation, margins, internal echogenicity, posterior acoustic features, associated calcifications, and axillary lymph node status. All imaging studies were interpreted by experienced

radiologists and classified according to the American College of Radiology Breast Imaging Reporting and Data System (BI-RADS).

Histopathological examination was considered the reference standard for diagnosis. Tissue specimens were obtained through image-guided core needle biopsy, excisional biopsy, or surgical resection, depending on clinical indications. All specimens were processed and examined by qualified pathologists, and the final diagnoses were categorized as benign or malignant according to established histopathological criteria.

The primary outcome measure was the correlation between radiological findings and histopathological diagnoses. Secondary outcomes included the distribution of BI-RADS categories, frequencies of benign and malignant lesions, and the diagnostic performance of mammography and ultrasonography in predicting malignancy.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 31. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Associations between radiological findings and histopathological diagnoses were assessed using the Chi-square test or Fisher's exact test where appropriate. Sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy were calculated using histopathological diagnosis as the gold standard. A P value of less than 0.05 was considered statistically significant.

3-RESULTS

The study included 300 female patients with breast lesions. The mean age of the participants was 48.7 ± 11.6 years. The highest proportion of patients belonged to the 40–49 years age group (32.7%), followed by the 50–59 years age group (27.7%). Patients younger than 40 years represented (24.0%) of the study population, whereas those aged 60 years and above accounted for (15.6%). As shown in Table 1.

Table 1: Age distribution of the study population (n = 300).

Age Group (years)	Number	Percent
<40	72	24.0%
40–49	98	32.7%
50–59	83	27.7%
≥60	47	15.6%
Total	300	100.0%

Table 2 demonstrated that breast lesions were slightly more frequent in the left breast, accounting for (50.7%) of cases, compared with (45.3%) in the right breast. Bilateral breast involvement was relatively uncommon and was observed in only (4.0%) of patients.

Table 2: Laterality of breast lesions (n = 300).

Laterality	Number	Percent
Right breast	136	45.3%
Left breast	152	50.7%
Bilateral	12	4.0%
Total	300	100.0%

Table 3 showed the histopathological classification of breast lesions. Malignant lesions constituted the majority of diagnosed breast lesions, accounting for (60.7%) of all cases, while benign lesions represented (39.3%).

Table 3: Histopathological classification of breast lesions (n = 300).

Diagnosis	Number	Percent
Benign lesions	118	39.3%
Malignant lesions	182	60.7%
Total	300	100.0%

Table 4 explored the distribution of benign breast lesions. Fibroadenoma was the most common histopathological diagnosis, representing (35.6%) of all benign lesions. Fibrocystic changes constituted (23.7%), followed by breast cysts (15.3%).

Table 4: Distribution of benign breast lesions (n = 118).

Diagnosis	Number	Percent
Fibroadenoma	42	35.6%
Fibrocystic changes	28	23.7%
Breast cyst	18	15.3%
Duct ectasia	12	10.2%
Intraductal papilloma	10	8.5%
Fat necrosis	3	2.5%
Sclerosing adenosis	3	2.5%
Hamartoma	2	1.7%

Table 5 explored the distribution of malignant breast lesions. Invasive ductal carcinoma was the most frequently identified tumor, accounting for (78.0%) of all malignant cases. Invasive lobular carcinoma represented (9.9%), while ductal carcinoma in situ accounted for (6.6%). Other malignant subtypes were comparatively rare.

Table 5: Distribution of malignant breast lesions (n = 182).

Diagnosis	Number	Percent
Invasive ductal carcinoma	142	78.0%
Invasive lobular carcinoma	18	9.9%
DCIS	12	6.6%
Mucinous carcinoma	6	3.3%
Medullary carcinoma	2	1.1%
Papillary carcinoma	1	0.5%
Metaplastic carcinoma	1	0.5%

Table 6 demonstrated that BI-RADS categories 3 and 5 were the most frequently assigned categories, each accounting for (22.0%) of examined lesions. BI-RADS category 4 lesions collectively represented (42.7%) of cases, highlighting the substantial number of suspicious lesions requiring histopathological confirmation.

Table 6: Distribution of BI-RADS categories (n = 300).

BI-RADS	Number	Percent
2	40	13.3%
3	66	22.0%
4A	38	12.7%
4B	44	14.7%
4C	46	15.3%
5	66	22.0%

Table 7 shows a highly significant relationship between BI-RADS category and histopathological diagnosis (P value <0.001). The proportion of malignant lesions increased progressively with increasing BI-RADS category. Nearly all BI-RADS 5 lesions (98.5%) were confirmed as malignant, whereas the majority of BI-RADS 2 and BI-RADS 3 lesions were benign. Furthermore, malignancy rates increased from (26.3%) in BI-RADS 4A lesions to (84.8%) in BI-RADS 4C lesions.

Table 7: Relationship between BI-RADS category and histopathological Diagnosis (n = 300).

BI-RADS	Benign n (%)	Malignant n (%)	Total
2	39 (97.5%)	1 (2.5%)	40
3	60 (90.9%)	6 (9.1%)	66
4A	28 (73.7%)	10 (26.3%)	38
4B	18 (40.9%)	26 (59.1%)	44
4C	7 (15.2%)	39 (84.8%)	46
5	1 (1.5%)	65 (98.5%)	66

Table 8 showed a highly statistically significant association between patient age and histopathological diagnosis (P value <0.001). The proportion of malignant lesions increased with advancing age, rising from (36.1%) among patients younger than 40 years to (78.7%) among patients aged 60 years and above. Conversely, benign lesions were more frequently observed in younger patients.

Table 8: Association between age group and histopathological diagnosis (n= 300).

Age Group	Benign	Malignant	P value
<40	46 (63.9%)	26 (36.1%)	**<0.001**
40–49	40 (40.8%)	58 (59.2%)	
50–59	22 (26.5%)	61 (73.5%)	
≥60	10 (21.3%)	37 (78.7%)	

Several radiological characteristics demonstrated significant associations with malignant histopathological findings. Irregular lesion shape, spiculated or ill-defined margins, microcalcifications, and posterior acoustic shadowing were significantly more frequent among malignant lesions than benign lesions (P value <0.001 for all comparisons). In contrast, oval-shaped lesions with circumscribed margins were predominantly associated with benign pathology. As shown in Table 9.

Table 9: Radiological features according to histopathological diagnosis (n= 300).

Feature	Benign	Malignant	P value
Irregular shape	22 (18.6%)	158 (86.8%)	**<0.001**
Spiculated margins	24 (20.3%)	144 (79.1%)	**<0.001**
Microcalcifications	12 (10.2%)	94 (51.6%)	**<0.001**
Posterior shadowing	10 (8.5%)	102 (56.0%)	**<0.001**

Comparison of imaging diagnoses with histopathological findings demonstrated that breast imaging correctly identified 175 of the 182 malignant lesions and correctly excluded malignancy in 83 of the 118 benign lesions. Only seven malignant lesions were incorrectly classified as negative by imaging assessment.

Table 10: Diagnostic performance of mammography and ultrasonography (n=300).

Imaging Diagnosis	Malignant	Benign	Total
Positive	175	35	210
Negative	7	83	90
Total	182	118	300

Evaluation of diagnostic performance revealed that mammography and ultrasonography achieved a sensitivity of (96.2%), specificity of (70.3%). The positive predictive value and negative predictive value were (83.3%) and (92.2%), respectively. Overall diagnostic accuracy reached (86.0%).

Table 11: Diagnostic indices of breast imaging.

Parameter	Value (%)
Sensitivity	96.2%
Specificity	70.3%
Positive predictive value	83.3%
Negative predictive value	92.2%
Accuracy of the test	86.0%

4- DISCUSSION

The Present study evaluated the radiological characteristics of breast lesions detected by mammography and ultrasonography and correlated these findings with histopathological diagnoses among 300 female patients attending Al-Thaqalayn Oncology Hospital in Basra, Iraq. Histopathological examination demonstrated that malignant lesions constituted 60.7% of all cases, while benign lesions accounted for 39.3%. Furthermore, a highly significant association was observed between BI-RADS classification and histopathological diagnosis, confirming the value of breast imaging in predicting malignancy and guiding clinical management.

The mean age of the study population was 48.7 ± 11.6 years, with the highest proportion of patients belonging to the 40–49-year age group. This finding is comparable to the study conducted by **Mohan *et al***. in 2024, which reported that most patients presenting with breast lesions were in the fourth and fifth decades of life.[8] Similar observations were reported by **Khan *et al***., who documented a mean age of approximately 47 years among women undergoing breast imaging assessment.[9] These observations support the well-established association between increasing age and the occurrence of breast neoplasms.

Histopathological examination demonstrated that malignant lesions constituted 60.7% of all cases, while benign lesions accounted for 39.3%. This finding may be attributed to the oncology referral nature of the study center. A similar predominance of malignant lesions was reported by **Chukwuegbo *et al***.[10] whereas **Sultan *et al.***

observed a lower proportion of malignant lesions in a mixed hospital-based population.[11]

In the present study, invasive ductal carcinoma represented 78.0% of malignant tumors and was the most common histopathological subtype. This finding is consistent with previous reports demonstrating that invasive ductal carcinoma remains the predominant breast cancer subtype worldwide.[12-13]

Among benign lesions, fibroadenoma was the most common diagnosis, followed by fibrocystic changes and breast cysts. Similar findings have been consistently reported in recent studies evaluating benign breast pathology, where fibroadenoma remains the predominant benign breast tumor, particularly among younger women.[8-9] The predominance of fibroadenoma in the current study supports previous observations that this lesion represents the most frequent benign breast abnormality encountered in breast clinics and imaging departments

One of the most important findings of the present study was the highly significant correlation between BI-RADS category and histopathological diagnosis (P value <0.001). The likelihood of malignancy increased progressively with increasing BI-RADS category, reaching 98.5% among BI-RADS 5 lesions. This observation is consistent with the findings of **Ciurescu *et al***., who reported a very high malignancy rate among BI-RADS 5 lesions and demonstrated a strong relationship between BI-RADS classification and pathological outcomes.[4] Likewise, **Vardhan *et al.*** confirmed the utility of BI-RADS in predicting malignancy and reported excellent concordance between radiological and histopathological findings.[5]

The present study also demonstrated a significant association between age and malignancy, with the proportion of malignant lesions increasing steadily across older age groups. Women aged 60 years and above exhibited the highest frequency of malignant lesions. These findings are in agreement with current epidemiological evidence indicating that breast cancer incidence rises substantially with age owing to cumulative genetic alterations, hormonal influences, and prolonged exposure to environmental risk factors.[4, 8]

Several radiological features were significantly associated with malignant pathology. Irregular lesion shape, spiculated or ill-defined margins, microcalcifications, and posterior acoustic shadowing were observed more frequently among malignant lesions than benign lesions. Similar observations have been reported in recent studies evaluating breast ultrasound and mammographic findings. **Ciurescu *et al***. identified spiculated margins, pleomorphic microcalcifications, and posterior acoustic shadowing as strong predictors of malignancy.[4] Furthermore, **Chukwuegbo *et al.*** demonstrated that specific BI-RADS sonographic descriptors reliably differentiate benign from malignant breast lesions.[10]

Diagnostic performance analysis revealed a sensitivity of 96.2%, specificity of 70.3%, positive predictive value of 83.3%, negative predictive value of 92.2%, and overall accuracy of 86.0%. The high sensitivity observed in the current study indicates that combined mammography and ultrasonography were highly effective in detecting malignant breast lesions. Comparable findings were reported by **Sultan *et al***., who demonstrated high diagnostic accuracy for combined mammography and ultrasonography when interpreted according to BI-RADS criteria.[11] Similarly, **Jaber *et al.*** reported strong diagnostic performance of ultrasound BI-RADS classification when correlated with histopathological findings among Iraqi women.[12]

Despite of the study strengths, this study has several limitations. The retrospective design may have introduced selection bias, and the study was conducted in a single tertiary oncology center, which may limit the generalizability of the findings to the wider population. In addition, the relatively high proportion of malignant lesions reflects the referral pattern of the institution and may not represent the prevalence of breast malignancy in community-based settings. Nevertheless, the inclusion of a large sample size and the use of histopathological diagnosis as the reference standard enhance the validity and clinical relevance of the results.

5- CONCLUSION AND RECOMMENDATION

This study demonstrated that malignant breast lesions were more common than benign lesions among patients attending Al-Thaqalayn Oncology Hospital, with invasive ductal carcinoma being the most frequent malignant subtype and fibroadenoma the most common benign lesion. A highly significant correlation was observed between BI-RADS classification and histopathological diagnosis, with the likelihood of malignancy increasing progressively across higher BI-RADS categories. Combined mammography and ultrasonography showed high diagnostic performance, confirming their important role in the detection and characterization of breast lesions and supporting the reliability of BI-RADS as a valuable tool for predicting malignancy and guiding clinical management. The routine use of combined mammography and ultrasonography is recommended for the evaluation of breast lesions, with strict adherence to BI-RADS reporting and histopathological confirmation of suspicious lesions. Greater emphasis should be placed on early screening and awareness programs, particularly among women aged 40 years and older. Furthermore, larger multicenter studies incorporating advanced imaging modalities are recommended to further improve breast cancer diagnosis and patient outcomes in Iraq.

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