International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Research Article *DOI: 10.61336/im/26-3-21*

Ultrasonography Evaluation of Breast Lesions BI-RADS Grade 3 and 4 with Histopathological Correlation

Dr Priti Shinde[1], Dr P. S. Mishrikotkar[2], Dr D. B. Dahiphale[3], Dr Karanvir Singh Chhabra[4]

[1]Resident, Department of Radiology, MGM Medical College, Ch. Sambhaji Nagar, India.
[2]Professor, Department of Radiology, MGM Medical College, Ch. Sambhaji Nagar, India.
[3]HOD, Department of Radiology, MGM Medical College, Ch. Sambhaji Nagar, India.
[4] Resident, Department of Radiology, MGM Medical College, Ch. Sambhaji Nagar, India.

Correspondence:
Dr. D. B. Dahiphale

Received: **January 11, 2026**
Revised: **February 15, 2026**
Accepted: **March 09, 2026**
Published: **March 13, 2026**

Abstract

Background: Breast lesions represent one of the most common clinical findings among women presenting to surgical and radiology departments. Early and accurate characterization of these lesions is crucial for appropriate management and prevention of breast cancer progression. Ultrasonography (USG) has emerged as a valuable, non-invasive imaging modality for evaluating breast lesions, particularly in younger women and patients with dense breast tissue. The Breast Imaging Reporting and Data System (BI-RADS) classification standardizes imaging interpretation and guides further management decisions. ***Material and methods:*** The present study aimed to evaluate breast lesions categorized as BI-RADS 3 and BI-RADS 4 on ultrasonography and to correlate these findings with histopathological results. This prospective observational study was conducted over a period of three months in a tertiary care radiology department. A total of 32 female patients with clinically suspected breast lesions underwent high-resolution ultrasonography using a high-frequency linear probe (10–18 MHz). Lesions were categorized according to BI-RADS classification, and ultrasound-guided biopsies were performed for histopathological confirmation. ***Results:*** Among the 32 cases studied, 21 lesions (65.6%) were categorized as BI-RADS 3 and 11 lesions (34.4%) as BI-RADS 4. Histopathological analysis confirmed benign pathology in the majority of BI-RADS 3 lesions, including fibroadenoma, fibrocystic disease, and duct ectasia. Among BI-RADS 4 lesions, 10 cases were malignant, primarily invasive ductal carcinoma. Overall radiologic-pathologic concordance between ultrasonography and histopathology was observed in 90.6% of cases. ***Conclusion:*** The study demonstrates that ultrasonography, combined with BI-RADS classification, provides reliable diagnostic accuracy in the evaluation of breast lesions. However, histopathological examination remains essential in suspicious or discordant cases to ensure accurate diagnosis and appropriate management.

Keywords: Breast lesions, Ultrasonography, BI-RADS, Breast biopsy, Histopathological correlation

INTRODUCTION

Breast diseases constitute a significant proportion of surgical and radiological consultations worldwide, ranging from benign conditions such as fibroadenomas and cysts to malignant tumors like breast carcinoma. Breast cancer is still the most frequent malignancy in women worldwide and one of the primary causes of cancer-related death. Improving treatment results and lowering death rates depend heavily on early diagnosis and precise characterisation of breast tumors (1). Mammography, ultrasonography, magnetic resonance imaging (MRI), and digital breast tomosynthesis are among the imaging modalities that may be used to assess breast abnormalities. Because of its non-invasiveness, lack of ionizing radiation, accessibility, and affordability, ultrasonography (USG) has become more and more important among these modalities. Ultrasound is particularly useful in young women and patients with dense breast tissue, where mammography may have limited sensitivity (2).

The capacity to describe breast lesions has been increased thanks to developments in ultrasound technology, such as high-frequency probes, harmonic imaging, compound imaging, and Doppler methods. Lesion form, vascularity, borders, internal echotexture, and posterior acoustic characteristics may all be dynamically assessed with ultrasound. These characteristics help physicians differentiate between benign and malignant tumors and assess whether a biopsy is necessary (3).

The American College of Radiology established the Breast Imaging Reporting and Data System (BI-RADS) to standardize reporting and enhance communication between radiologists and doctors. Based on imaging

features, the BI-RADS classification system classifies breast lesions and offers therapeutic suggestions. BI-RADS category 3 lesions are often treated with short-interval follow-up since they are deemed "probably benign," with a less than 2% chance of cancer. Lesions classified as "suspicious for malignancy" under BI-RADS category 4 necessitate tissue diagnosis via biopsy(4).

The gold standard for a conclusive diagnosis of breast lesions is still histological investigation, even with advancements in imaging. Accurate tissue collection with minimal invasiveness is made possible by image-guided biopsy procedures, especially ultrasound-guided core needle biopsy. For the purpose of confirming diagnosis, identifying discordant instances, and directing proper treatment planning, correlation between imaging findings and histological data is crucial(5).

The BI-RADS classification has been used in a number of studies to assess the diagnostic accuracy of ultrasonography in identifying benign and malignant breast lesions. When paired with clinical symptoms and histological correlation, prior studies have shown that ultrasonography has a high sensitivity and specificity in distinguishing benign from malignant breast masses(6,7). Furthermore, assessing whether imaging results correctly represent underlying disease or if additional research is necessary depends on radiologic-pathologic concordance.

The use of ultrasonography as a primary imaging modality for the assessment of breast lesions has grown in popularity in recent years, especially in environments with limited resources. In addition to helping with lesion characterisation, ultrasound is essential for directing interventional procedures like core needle biopsy and fine-needle aspiration. This increases the effectiveness of diagnosis and decreases needless surgical operations(8).

The goal of the current study was to compare the results of the histological investigation with the diagnostic performance of ultrasonography in evaluating BI-RADS category 3 and category 4 breast lesions. Additionally, the study seeks to demonstrate the therapeutic use of ultrasonography in directing breast biopsies and enhancing diagnostic precision in the assessment of breast lesions.

AIMS AND OBJECTIVES

Aim

To evaluate breast lesions categorized as BI-RADS 3 and BI-RADS 4 on ultrasonography and correlate them with histopathological findings.

Objectives

1. To assess the ultrasound characteristics of breast lesions categorized as BI-RADS 3 and BI-RADS 4.
2. To determine the correlation between ultrasonographic findings and histopathological diagnosis.
3. To evaluate the diagnostic accuracy of ultrasonography in identifying benign and malignant breast lesions.
4. To demonstrate the usefulness of ultrasound-guided biopsy in diagnosing breast lesions.
5. To highlight the role of ultrasonography as a cost-effective and real-time imaging modality in breast lesion evaluation.

MATERIALS AND METHODS

Study Design: Prospective observational study.
Study Setting: The study was conducted in the Department of Radiology at a tertiary care hospital.
Study Duration: 3 months.
Sample Size: A total of 32 patients with clinically suspected breast lesions were included in the study.
Study Population: Female patients presenting with palpable breast lumps or clinically suspected breast lesions and referred for ultrasonographic evaluation.

Inclusion Criteria

- Female patients with suspected breast lesions
- Lesions categorized as BI-RADS 3 or BI-RADS 4 on ultrasonography
- Patients who underwent USG-guided biopsy
- Patients willing to participate in the study

Exclusion Criteria

- Patients with previously diagnosed breast malignancy
- Patients who had undergone prior breast surgery or radiotherapy
- Patients unwilling for biopsy or histopathological evaluation

Ultrasound Equipment

Ultrasonography was performed using:

- High-frequency linear transducer (10–18 MHz)'
- Doppler capability for vascular assessment
- Advanced imaging settings including compound imaging and harmonic imaging.

Scanning Technique

All patients underwent detailed ultrasound examination using standardized protocol.

- Both breasts and axillary regions were examined
- Lesions were scanned in longitudinal and transverse planes
- Comparison with the contralateral breast was performed

Sonographic features evaluated included:

- Shape
- Margin characteristics
- Internal echotexture
- Posterior acoustic features

- Vascularity on Doppler

BI-RADS Classification

Lesions were categorized according to the American College of Radiology BI-RADS classification system.

- BI-RADS 3 – Probably benign
- BI-RADS 4 – Suspicious for malignancy

Biopsy Procedure

Ultrasound-guided core needle biopsy was performed for all lesions using sterile technique.

- Local anesthesia was administered
- A core biopsy needle was introduced under ultrasound guidance
- Multiple tissue samples were obtained
- Samples were sent for histopathological examination

Data Collection

The following parameters were recorded:

- Age of patient
- Laterality of lesion
- BI-RADS category
- Ultrasound diagnosis
- Histopathological findings

Statistical Analysis

Data were analyzed using descriptive statistics.

- Frequencies and percentages were calculated
- Radiologic-pathologic correlation was determined.

RESULTS

Table 1: Age Distribution of Patients (n = 32)

Age Group	Number	Percentage
<30 years	6	18.7%
30–50 years	18	56.3%
>50 years	8	25%

Table 1 shows the age distribution of the patients included in the study. Of the 32 patients, 18 (56.3%) were in the age range of 30 to 50. Six patients (18.7%) were under 30 years old, while eight patients (25%) were over 50. These results show that the middle-aged group of 30 to 50 years old in this research population had the highest frequency of breast lesions classified as BI-RADS 3 and 4.

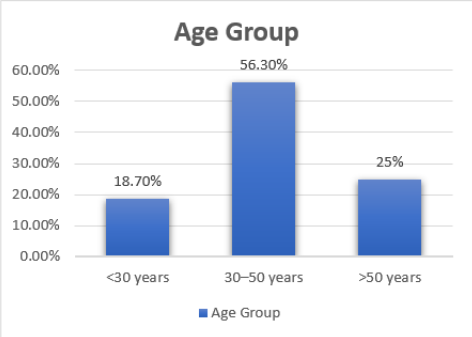

Figure 1: Age Distribution

Table 2: Distribution of Lesions by Breast Side

Breast Side	Number	Percentage
Right Breast	19	59.4%
Left Breast	13	40.6%

Right breast lesions were slightly more common.

Table 2 presents the distribution of breast lesions according to the side of involvement. Among the 32 cases studied, 19 lesions (59.4%) were found in the right breast, while 13 lesions (40.6%) were observed in the left breast. This indicates a slightly higher occurrence of breast lesions in the right breast compared to the left breast in the present study.

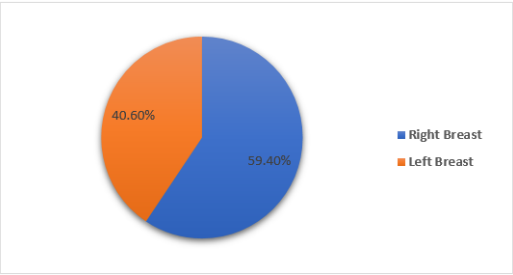

Figure 2: Distribution of breast side

Table 3: Distribution of BI-RADS Categories on Ultrasonography

BI-RADS Category	Number	Percentage
Category 3	21	65.6%
Category 4	11	34.4%

Table 3 illustrates the distribution of breast lesions based on BI-RADS categories on ultrasonography. Of the 32 lesions that were assessed, 21 instances (65.6%) were categorized as BI-RADS type 3, which denotes lesions that are most likely benign. BI-RADS category 4, which is regarded as indicate for malignancy and necessitates further histological examination, was assigned to the remaining 11 patients (34.4%). Therefore, most of the lesions in our investigation were most likely benign.

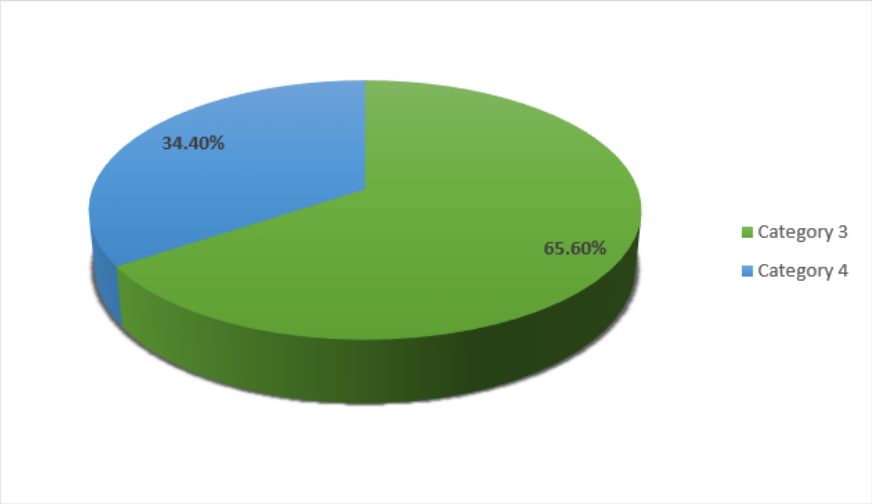

Figure 3: Distribution Of BI-RADS

Table 4: Correlation of USG Findings with Histopathology

USG Category	Histopathology Benign	Histopathology Malignant	Total
BI-RADS 3	20	1	21
BI-RADS 4	1	10	11
Total	21	11	32

Table 4 demonstrates the correlation between ultrasonographic BI-RADS classification and histopathological findings. Twenty of the twenty-one lesions that were classified as BI-RADS 3 on ultrasonography were determined to be benign on histology, while one was shown to be malignant. Histopathology revealed that ten of the eleven lesions classified as BI-RADS 4 were malignant, while one was benign. Overall, 90.6% of patients showed radiologic–pathologic concordance between ultrasonography and histological results, demonstrating the excellent diagnostic accuracy of ultrasound in assessing breast diseases.

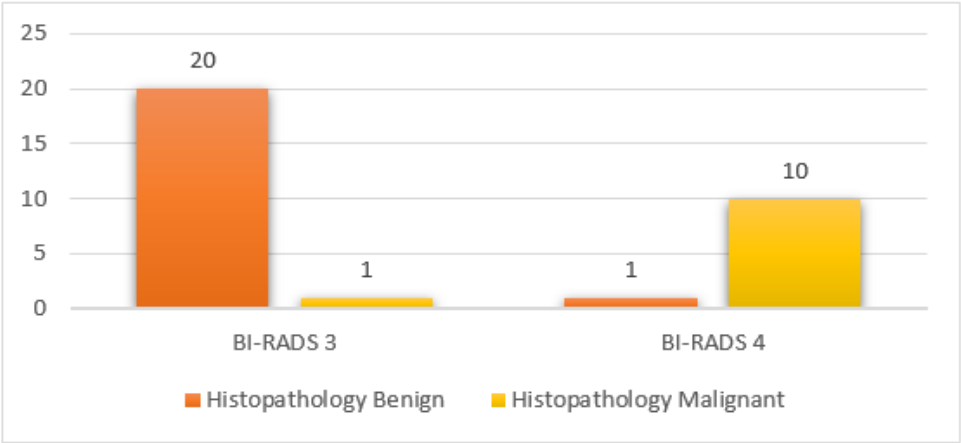

Figure 4: USG category

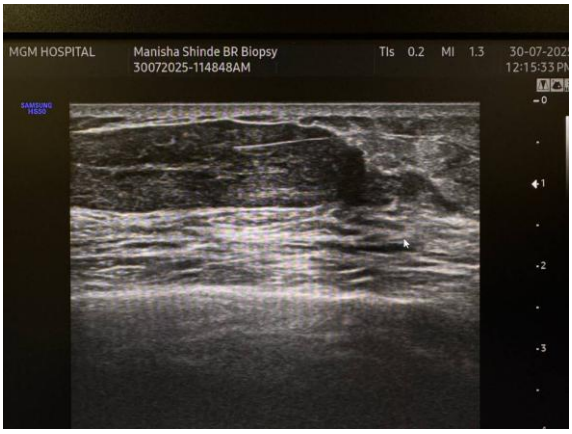

Figure 5

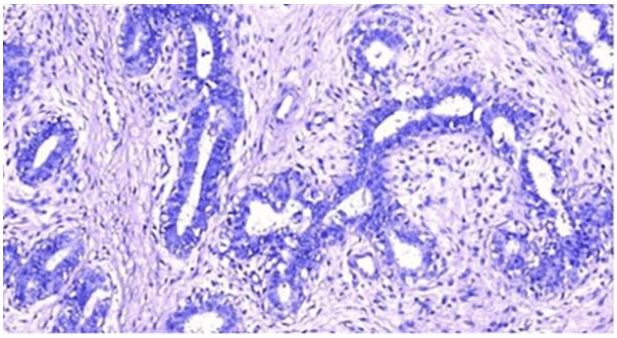

Figure 6

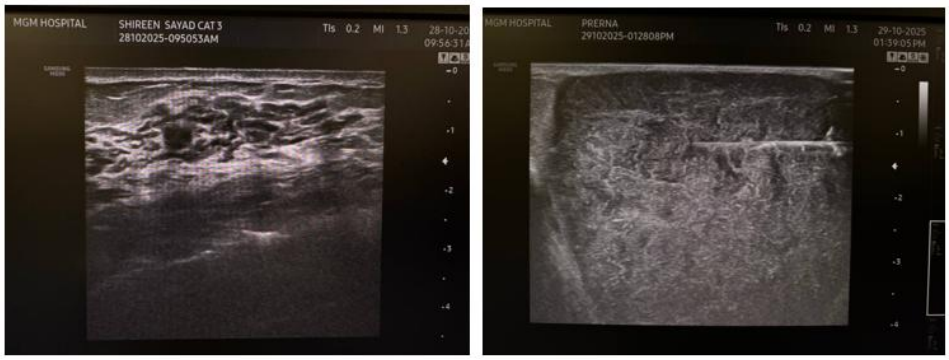

Figure 7

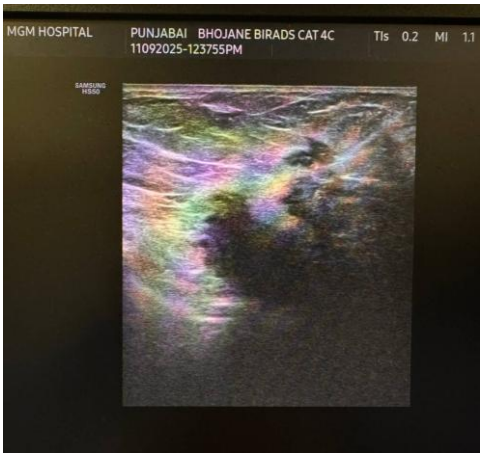

Figure 8

DISCUSSION

Breast lesions represent a significant diagnostic challenge in clinical practice. Early differentiation between benign and malignant breast lesions is crucial for timely treatment and improved patient outcomes. When assessing breast problems, imaging modalities such magnetic resonance imaging, ultrasonography, and mammography are crucial. Due to its affordability, accessibility, and capacity for real-time imaging, ultrasonography has become one of the most significant of these (6). BI-RADS category 3 and category 4 breast lesions were assessed by ultrasonography in the current investigation, and the results were compared with histological findings. There were 32 female patients in all, with an average age of about 44 years. The bulk of patients were between the ages of 30 and 50, which is in line with other research showing that benign breast lesions frequently affect women who are of reproductive age (7).

On ultrasonography, 21 lesions (65.6%) in our research were classified as BI-RADS 3. In the majority of these instances, histopathological analysis revealed benign pathology, such as fibroadenoma, fibrocystic disease, duct ectasia, and phyllodes tumor. On histology, only one patient that had been initially identified as BI-RADS 3 was subsequently found to have a BI-RADS 4 lesion. These results confirm the well-established knowledge that BI-RADS 3 lesions may frequently be treated with short-interval follow-up imaging and have a very low likelihood of being malignant(8).

Ten of the eleven tumors classified as BI-RADS 4 had malignancy verified by histology. The most prevalent kind of breast cancer, invasive ductal carcinoma, accounted for the bulk of these cases. A diagnosis of borderline stromal sarcoma was made in one instance. These results emphasize the need of biopsy in BI-RADS 4 lesions since these lesions have suspicious characteristics that call for histological confirmation (9). The current study's total radiologic-pathologic concordance was 90.6%, demonstrating ultrasonography's high diagnostic accuracy in assessing breast lesions. Park et al. obtained similar results, showing that when imaging results are associated with histology, ultrasound-guided breast biopsy has good diagnostic reliability (5).

The ability of ultrasonography to direct less invasive treatments like core needle biopsies is another significant benefit. With ultrasound-guided biopsy, malignancies may be precisely targeted without endangering nearby tissues. According to studies, ultrasound-guided core needle biopsy greatly minimizes the need for surgical biopsy and has a high sensitivity and specificity for identifying breast lesions (11). Ultrasonography has various drawbacks despite its benefits. Diagnostic accuracy may be impacted by operator dependence and interpretation variability. Furthermore, certain malignant tumors may appear on ultrasonography as benign characteristics, producing false-negative findings. Thus, radiologic-pathologic correlation is still necessary to guarantee a correct diagnosis (12).

Accurate diagnosis may be further enhanced by combining several imaging modalities. Research indicates that using sono-elastography, ultrasonography, and mammography together improves sensitivity in distinguishing benign from malignant breast tumors (13). In particular, elastography can help identify malignant tumors by providing information regarding tissue stiffness.

The results of this study highlight the significance of interdisciplinary cooperation between pathologists, surgeons, and radiologists. Frequent meetings for radiologic-pathologic correlation aid in the identification of discordant patients and enhance the precision of diagnosis. In the end, these cooperative methods improve clinical judgment and patient care (14). All things considered, the current study shows that ultrasonography is a trustworthy imaging technique for assessing breast lesions. A structured framework for evaluating ultrasonography results and directing clinical therapy is provided by the BI-RADS categorization system. For a conclusive diagnosis, histological investigation is still the gold standard, especially in instances that are questionable or inconsistent.

CONCLUSION

Ultrasonography demonstrates good sensitivity and specificity in diagnosing BI-RADS category 3 and category 4 breast lesions. The BI-RADS categorization system offers a trustworthy approach to risk assessment and aids in directing suitable clinical management choices. Since the majority of BI-RADS category 3 lesions in this research were determined to be benign, routine follow-up imaging rather than urgent invasive operations can safely handle these lesions. BI-RADS category 4 lesions, on the other hand, are more likely to be malignant and need histological confirmation in order to be definitively diagnosed. In order to guarantee diagnostic precision and direct the proper treatment of breast lesions, radiologic–pathologic correlation is essential. Additionally, efficient cooperation between pathologists, radiologists, and surgeons greatly enhances diagnosis accuracy and improves patient outcomes.

LIMITATIONS OF THE STUDY

The present study had certain limitations. There were just 32 patients in the study, which may have limited how far the results may be applied. Furthermore, the short research period limited the opportunity to examine long-term consequences or follow-up data. Because the study was only carried out at one location, institutional bias

may have been introduced, and the results may not be as applicable in other contexts. The fact that ultrasonography is an operator-dependent imaging modality and that the diagnosis accuracy may differ based on the radiologist's skill level is another drawback. To further confirm the results and enhance the diagnostic value of ultrasonography in assessing breast lesions, additional research with bigger sample numbers, multicenter participation, and longer follow-up periods are advised.

REFERENCES

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021 May;71(3):209-249.
2. Berg WA. Breast imaging and screening. Radiology. 2018;289:343-352.
3. Magny SJ, Shikhman R, Keppke AL. Breast Imaging Reporting and Data System. 2023 Aug 28. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan–. PMID: 29083600.
4. Spak DA, Plaxco JS, Santiago L, Dryden MJ, Dogan BE. BI-RADS® fifth edition: A summary of changes. Diagn Interv Imaging. 2017 Mar;98(3):179-190. doi: 10.1016/j.diii.2017.01.001. Epub 2017 Jan 25. PMID: 28131457.
5. Park VY, Kim EK, Moon HJ, Yoon JH, Kim MJ. Evaluating imaging-pathology concordance and discordance after ultrasound-guided breast biopsy. Ultrasonography. 2018 Apr;37(2):107-120.
6. Evans A, Trimboli RM, Athanasiou A, Balleyguier C, Baltzer PA, Bick U, Camps Herrero J, Clauser P, Colin C, Cornford E, Fallenberg EM, Fuchsjaeger MH, Gilbert FJ, Helbich TH, Kinkel K, Heywang-Köbrunner SH, Kuhl CK, Mann RM, Martincich L, Panizza P, Pediconi F, Pijnappel RM, Pinker K, Zackrisson S, Forrai G, Sardanelli F; European Society of Breast Imaging (EUSOBI) , with language review by Europa Donna–The European Breast Cancer Coalition. Breast ultrasound: recommendations for information to women and referring physicians by the European Society of Breast Imaging. Insights Imaging. 2018 Aug;9(4):449-461..
7. Łukasiewicz S, Czeczelewski M, Forma A, Baj J, Sitarz R, Stanisławek A. Breast Cancer-Epidemiology, Risk Factors, Classification, Prognostic Markers, and Current Treatment Strategies-An Updated Review. Cancers (Basel). 2021 Aug 25;13(17):4287.
8. Crystal P, Koretz M, Shcharynsky S, Makarov V, Strano S. Accuracy of sonographically guided 14-gauge core-needle biopsy: results of 715 consecutive breast biopsies with at least two-year follow-up of benign lesions. J Clin Ultrasound. 2005 Feb;33(2):47-52.
9. Archana B, Dev B, Varadarajan S, Joseph LD, Sheela MC, Pavithra V, Sundaram S, Srinivasan JP. Imaging and pathological discordance amongst the plethora of breast lesions in breast biopsies. Indian J Pathol Microbiol. 2022 Jan-Mar;65(1):13-17.
10. Olayinka O, Kaur G, Agarwal R, Staradub V, Chacho MS, Vidhun R. Impact of multidisciplinary radiologic-pathologic correlation conference for benign image-guided breast biopsies on discordance rates and patient outcomes in a community teaching hospital. Ann Diagn Pathol. 2022 Apr;57:151864.
11. Guo R, Lu G, Qin B, Fei B. Ultrasound Imaging Technologies for Breast Cancer Detection and Management: A Review. Ultrasound Med Biol. 2018 Jan;44(1):37-70.
12. Stavros AT. Breast ultrasound. Lippincott Williams & Wilkins.
13. Barr RG. Breast Elastography: How to Perform and Integrate Into a "Best-Practice" Patient Treatment Algorithm. J Ultrasound Med. 2020 Jan;39(1):7-17. doi: 10.1002/jum.15137. Epub 2019 Oct 16. PMID: 31617225.
14. D'Orsi CJ. Breast imaging reporting and data system. ACR.
15. Magny SJ, Shikhman R, Keppke AL. Breast Imaging Reporting and Data System. 2023 Aug 28. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan–. PMID: 29083600.