International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

BEYOND BI-RADS: Ultrasonography: Pathology Correlation of Breast Lesions in a Large Case Series

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Abstract

INTRODUCTION: Anticipating whether a breast lesion is benign or malignant based solely on clinical examination remains challenging in routine practice. Breast ultrasonography is a widely used imaging modality for the evaluation of breast lesions, particularly in young women and patients with dense breast tissue. Correlation of ultrasonographic findings with pathological outcomes is essential for accurate diagnosis and appropriate management. The present study aimed to assess the effectiveness of breast ultrasonography in predicting pathological outcomes of breast lesions.

MATERIALS AND METHODS: This was a hospital-based retrospective observational study conducted in IGGMC, Nagpur. Patients were selected based on predefined inclusion and exclusion criteria. All patients underwent breast ultrasonography using a high-frequency linear transducer, and lesions were categorized according to the BI-RADS ultrasound classification. Pathological confirmation was obtained through FNAC, core needle biopsy, or surgical excision. Ultrasonographic findings were correlated with pathological outcomes. Clinical management followed institutional protocols and was not influenced by study findings.

RESULTS: A total of 101 female patients were included in the study. Benign breast lesions accounted for 74.3% of cases, while 25.7% were confirmed to be malignant on pathological evaluation. Lesions categorized as BI-RADS II and III constituted 71.2%, of which 92.4% were benign on pathology. BI-RADS IV and V lesions comprised 28.8% of cases, with 88.6% showing malignant pathology. Overall, breast ultrasonography demonstrated a high concordance with pathological diagnosis in most cases.

CONCLUSIONS: Breast ultrasonography shows significant accuracy in differentiating benign and malignant breast lesions when standardized BI-RADS categorization is applied. The use of percentage-based risk stratification highlights the reliability of ultrasound in predicting pathological outcomes and guiding clinical decision-making.

Introduction

Accurate differentiation between benign and malignant breast lesions remains a critical aspect of breast imaging and patient management. Clinical examination alone often fails to reliably distinguish between benign and malignant masses, particularly in early disease or in patients with dense breast tissue.

Breast ultrasonography has emerged as an important imaging modality for the evaluation of breast lesions. It is especially valuable in younger women, patients with dense breasts, and in the characterization of palpable abnormalities detected clinically or on mammography. Ultrasound provides excellent soft tissue resolution and allows evaluation of lesion morphology, margins, internal echotexture, posterior acoustic features, and vascularity.

The Breast Imaging Reporting and Data System (BI-RADS) developed by the American College of Radiology standardizes the reporting and classification of breast lesions, thereby improving communication between radiologists and clinicians. BI-RADS ultrasound categories help stratify lesions according to the probability of malignancy and guide recommendations for follow-up, biopsy, or treatment.

Correlation between imaging findings and pathological diagnosis remains essential for validating imaging accuracy and improving diagnostic confidence. Ultrasonography–pathology correlation also helps identify imaging features that strongly predict malignancy or benignity.

The present study aims to evaluate the effectiveness of breast ultrasonography in predicting pathological outcomes of breast lesions by correlating BI-RADS ultrasound categorization with histopathological diagnosis in a large retrospective case series.

Materials and Methods

Study Design

A retrospective observational study.

Study Setting

The study was conducted at the Department of Radiodiagnosis, Indira Gandhi Government Medical College (IGGMC), Nagpur.

Study Population

A total of 101 female patients presenting with breast lesions were included in the study.

Inclusion Criteria

- Female patients undergoing breast ultrasonography
- Patients with detectable breast lesions on ultrasound
- Patients who subsequently underwent pathological evaluation

Exclusion Criteria

- Inadequate imaging studies
- Lack of pathological confirmation

Imaging Technique

Breast ultrasonography was performed using a high-frequency linear transducer. Both breasts and axillary regions were systematically examined.

The following sonographic features were assessed:

- Shape of lesion
- Margins
- Echotexture
- Posterior acoustic features

- Orientation
- Presence of calcifications
- Associated lymphadenopathy

All lesions were categorized according to the BI-RADS ultrasound classification system.

Pathological Correlation

- Pathological confirmation of the lesions was obtained using one of the following methods:
- Fine Needle Aspiration Cytology (FNAC)
- Core Needle Biopsy
- Surgical Excision

Ultrasonographic findings were correlated with pathological results.
Clinical management decisions followed institutional protocols and were not influenced by the study analysis.

Results

Study Population

Total patients included: 101 female patients

Pathological Distribution

Benign lesions: 74.3%
Malignant lesions: 25.7%
Thus, the majority of breast lesions in this study were benign in nature.

BI-RADS Distribution

BI-RADS II and III: 71.2%
BI-RADS IV and V: 28.8%

BI-RADS II and III Lesions

Among lesions categorized as BI-RADS II and III, 92.4% were benign on pathological evaluation.

BI-RADS IV and V Lesions

Lesions categorized as BI-RADS IV and V constituted 28.8% of cases, of which 88.6% were confirmed malignant on pathology.

Imaging–Pathology Concordance

Overall, breast ultrasonography demonstrated high concordance with pathological diagnosis, supporting the reliability of ultrasound-based BI-RADS classification in predicting the nature of breast lesions.

Discussion

Breast imaging plays a crucial role in the early detection and characterization of breast lesions. Among available imaging modalities, ultrasonography has gained widespread acceptance due to its accessibility, absence of radiation exposure, and ability to evaluate lesions in dense breast tissue.

In the present study, benign lesions constituted 74.3% of cases, while 25.7% were malignant. This distribution reflects the commonly observed clinical scenario in which the majority of breast lesions detected on imaging are benign.

The BI-RADS classification system serves as a standardized method for categorizing breast lesions according to their likelihood of malignancy. In this study, 71.2% of lesions were categorized as BI-RADS II and III, and 92.4% of these lesions were confirmed to be benign on pathology. This finding highlights the reliability of ultrasound in identifying benign breast lesions and potentially reducing unnecessary biopsies.

Conversely, BI-RADS IV and V lesions accounted for 28.8% of cases, with 88.6% confirmed malignant on pathological evaluation. These results demonstrate the strong predictive value of suspicious BI-RADS categories and emphasize the importance of prompt tissue diagnosis in such cases.

Previous studies have also reported high diagnostic accuracy of ultrasound in differentiating benign and malignant breast lesions. Stavros et al. demonstrated that specific sonographic features such as irregular margins, nonparallel orientation, and posterior shadowing are strongly associated with malignancy. Similarly, Berg et al. highlighted the complementary role of ultrasound in breast lesion detection, particularly in dense breast tissue.

Imaging–pathology correlation remains an essential component of breast imaging practice. Discrepancies between imaging and pathology should prompt careful review and, when necessary, repeat biopsy or additional imaging.

Overall, the findings of the present study reinforce the clinical value of breast ultrasonography combined with BI-RADS classification in guiding diagnostic decision-making and patient management.

Conclusion

Breast ultrasonography demonstrates significant accuracy in differentiating benign and malignant breast lesions when standardized BI-RADS categorization is applied.

In this study:

- Benign lesions accounted for 74.3% of cases, while 25.7% were malignant.
- BI-RADS II and III lesions showed a high probability of benign pathology (92.4%).
- BI-RADS IV and V lesions demonstrated a strong association with malignancy (88.6%).

The use of percentage-based risk stratification highlights the reliability of ultrasound in predicting pathological outcomes and guiding clinical decision-making.

Breast ultrasonography therefore remains a valuable, non-invasive, and widely accessible imaging modality in the evaluation of breast lesions.

Limitations

- Retrospective study design
- Single-center study
- Histopathological confirmation method varied among patients

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