SRMS IMS

10.21761/jms.v10i1.05

ORIGINAL RESEARCH ARTICLE

Mammogram and Ultrasound Evaluation of Breast Lesions with Cytohistological Correlation: A Hospital-Based Observational Study

Mihir Sagar Singh[1], Sameer Rajeev Verma[2*], Namrata Singh[3], Pankaj Kaira[3]

ABSTRACT

Introduction: Breast cancer remains a significant health burden, being the second most common malignancy among women in India. Early detection through imaging, particularly mammography and ultrasonography (USG), is critical for effective management. This study aimed to assess the efficacy of mammography and ultrasonography in classifying breast lesions according to the breast imaging-reporting and data system (BI-RADS) categories and compare it with histopathology.

Material and Methods: This is an observational study conducted at SRMSIMS Hospital, Bareilly, India, over 1.5 years. The study included 90 female patients presenting with breast-related symptoms. Categorical data was shown in terms of frequency and percentage. The association between two categorical variables was assessed through the chi-square test. Data analysis was done by Microsoft Excel 2019.

Results: The majority of participants were aged 45 to 54 years, with 83.3% of lesions exhibiting high density. BI-RADS classification through mammography identified 50% of lesions as suspicious for malignancy (BI-RADS IV), while 21.1% were highly suggestive of malignancy (BI-RADS V). SONO-BIRADS classified 45.6 and 26.7% of lesions as BI-RADS IV and V, respectively. Comparison with FNAC and histopathology revealed a statistically significant correlation with MAMMO-BIRADS and SONO-BIRADS categories (p = 0.000).

Conclusion: The study concludes the critical role of mammography and ultrasonography in the early detection and correct classification of breast lesions. The frequent occurrence of BIRADS IV and V categories pointed out the need for quick biopsies. The reliability of the BI-RADS system in clinical practice is acknowledged, indicating the value of integrating mammography and ultrasound to enhance diagnostic precision and patient care.

Keywords: Mammography, BIRADS, Ultrasonography, FNAC.

How to cite this article: Singh MS, Verma SR, Singh N, Kaira P. Mammogram and Ultrasound Evaluation of Breast Lesions with Cytohistological Correlation: A Hospital-Based Observational Study. SRMS J Med Sci 2025;10(1):23-27.

Submission: 02-03-2025; **Acceptance:** 04-04-2025; **Published:** 30-06-2025

Senior Resident[1], Professor[2], Associate Professor[3]

Department of Radiology Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh, India.

[*]**Corresponding Author:** Sameer Rajeev Verma , Professor, Department of Radiology Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh, India, Email: drsam74@yahoo.co.in

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Breast diseases pose a significant global health challenge, affecting over 50% of women at some point in their lives. The most prevalent breast symptom is a breast lump.[1] Doctors have been captivated by breast cancer for an extended period of time due to its enigmatic aetiology. Following cervical carcinoma, breast cancer ranks as the second most prevalent malignancy among women in India. As it manifests as a non-painful mass, patients frequently fail to notice it and arrive at the hospital belatedly.[2] According to the Globocan data for 2020, breast cancer constituted 13.5% of all cancer cases and 10.6% of all deaths in India.[3] Early detection and prompt treatment are the most effective interventions for managing Breast Cancer, according to the World Cancer Report 2020.[4] Typically, early detection is achieved via screening; mammography, ultrasonography, and breast self-examination (BSE) are all examples of screening techniques. While not all benign masses and detected breast lesions are malignant, they do not develop into cancer; pathological diagnosis and radiological imaging can significantly improve the accuracy of the final diagnosis (mammography, ultrasonography).[5] Mammography, a technique utilized for the screening of breast cancer and the evaluation of clinically suspected breast lesions, is both cost-effective and widely accepted. High-resolution Sonography serves as a valuable supplementary modality in dense breasts, aiding in the characterization of palpable abnormalities that are not detected by mammography. The sensitivity and specificity of sonomammography or mammography is higher if USG and mammography are combined.[6] Detection of breast cancer at its earliest stages is the primary objective of breast imaging. FNAC/biopsy following mammography and USG is the conventional procedure for diagnosing a breast lump. By detecting subtle architectural distortion and microcalcifications prior to the appearance of a palpable lesion, routine mammography screening can reduce the incidence of breast cancer-related mortality by 30%. Although

mammography is regarded as the gold standard for breast cancer screening and detection, it can produce false-negative results in patients with dense breast tissue. Possible causes for missed breast cancers include dense parenchyma obscuring a lesion, poor positioning or technique, perception error, incorrect interpretation of a suspect finding, subtle features of malignancy, and slow growth of a lesion. Therefore, when mammography fails to detect a lesion in patients with dense breast tissue, USG is a valuable alternative. Additionally, USG assists in distinguishing solid from cystic lesions.[7] The purpose of this research is to assess the efficacy of mammography and ultrasonography in classifying different types of breast lesions. Enhance early detection and treatment of breast cancer, ultimately improving outcomes for women in the targeted region.

MATERIAL AND METHODS

Study Duration: 1.5 years (1st Aug 2022 to 31st Jan 2024)
Study Design: Hospital-based Observational Study
Study Location: Department of Radiodiagnosis, SRMSIMS Hospital, Bareilly, India
Subjects and Selection: Female patients referred for imaging with breast lump, pain, or nipple discharge.

Patients with breast-related complaints and breast lesions on mammography and ultrasound were included in the study. Patients not giving consent, pregnant women, Patients without cytohistological evaluation and patients with known breast malignancy (BI-RADS 6) were excluded. Sample size calculation done by using the formula: $n= z^2 PQ/d^2$ where P = 25% (Prevalence), Q = 75%, d = 10% (Relative error). This comes out to be 85, with an added 10% for non-response.

Data Collection

Data was acquired using Siemens Acuson Juniper, S2000, NX3 Elite, Sequoia ultrasound equipment, and Mammomat 1000 MA for mammography. This data was obtained by informed consent, comprehensive history, imaging, and completion of a proforma. The imaging findings were compared and matched with the cytological and histological results.

Statistical analysis

A pilot research including 9 patients was conducted to validate the methodology, with approval from the Institute's Ethics Committee. The data was collected and then evaluated using frequency and percentage for the categorical variable. The results were visually presented using charts and graphs. Additionally, prediction values were produced to determine the effectiveness of the imaging techniques.

RESULTS

Table 1 shows demographic and radiological characteristics of breast lesions. The age distribution of the participants reveals that the majority are in the 45 to 54 age group, comprising 43.3% of the sample (39 patients). This is followed by the 35 to 44 age group with 27.8% (25 patients). The 55 to 64 age group accounts for 14.4% (13 patients), while the 65 to 74 age group includes 8.9% (8 patients). The smallest group is the 25 to 34 age group, representing 5.6% of the participants (5 patients). When considering the family history of cancer, 18.9% of the participants (17 patients) reported having a family history of cancer.

In the breast density category, Type A had no patients, Type B included 46.7% of the patients, Type C included 51.1% of the patients, and Type D included 2.2% of the patients. Regarding the shape of the lesions, 75.6% of the lesions were oval, 11.1% were round, and 13.3% had no defined shape. The margin characteristics of the lesions 32.2% (29 patients) had indistinct margins, 7.8% had microlobulated margins, 14.4% had no defined margins, 27.8% had spiculated margins, and 17.8% had well-defined margins.

The lesion density was high in 83.3% of the cases. Additionally, 1.1% had fat-containing lesions, 1.1% (1 patient) had low-density lesions, and 14.4% (13 patients) had no defined density. The total number of participants in the study was 90. Among the total of 90 participants, the most prevalent observation is the absence of calcifications, with 83.3% of participants exhibiting no calcifications.

Fine pleomorphic calcifications are observed in 11.1% of participants, followed by coarse and punctate types, each representing 2.2 and 1.1%, respectively. Only one participant each demonstrates amorphous and vascular calcifications, each accounting for 1.1% of the sample (Figure 1).

Table 2 represents the categorization of breast lesions based on BI-RADS classifications from mammograms and ultrasounds. For mammograms, 14 (15.6%) of the lesions were classified as BI-RADS I (Negative). BI-RADS II (Benign) was 3 (3.3%) of cases, suggesting benign lesions. BI-RADS III (Probably Benign) was 10% of the lesions. The majority of lesions were classified as BI-RADS IV (Suspicious of Malignancy), accounting for 50% of the cases (45 patients). Lastly, 21.1% of the lesions (19 patients) were categorized as BI-RADS V (Highly Suggestive of Malignancy).

While the SONO-BIRADS findings showed 5.6% of cases (5 patients) were in BI-RADS I (Negative). BI-RADS II (Benign) was noted in 12.2% (11 patients), indicating a higher proportion of benign findings compared to mammograms. BI-RADS III (Probably Benign) was present in 10% of cases (9 patients), the same proportion as seen in mammograms. BI-RADS IV (Suspicious of

Malignancy) was reported in 45.6% of cases (41 patients). BI-RADS V (Highly Suggestive of Malignancy) was found in 26.7% of the cases (24 patients).

Table 3 shows that among participants categorized as benign by MAMMO-BIRADS, 26 lesions were identified. Out of these, 12 (70.59%) were confirmed as benign on FNAC and histopathology, while 14 (19.18%) were found to be malignant upon further investigation. Conversely, among participants categorized as malignant by MAMMO-BIRADS, 64 lesions were identified. Out of these, 59 (80.82%) were confirmed as malignant on FNAC and histopathology, while 5 (29.41%) were unexpectedly benign. The p-value associated with this comparison is 0.000, indicating a statistically significant association between MAMMO-BIRADS classification and biopsy findings. Among participants categorized as benign by SONO-BIRADS, 25 lesions were identified.

DISCUSSION

The current study included 90 participants to investigate the age distribution among individuals with breast lumps. The findings revealed that the majority of participants were between the ages of 35 and 54, with 27.8% falling into the 35 to 44 age group and a significant 43.3% falling into the 45 to 54 age bracket. Furthermore, participants aged 55 to 64 accounted for 14.4% of the total, while those aged 25 to 34 and 65 to 74 accounted for smaller proportions (5.6 and 8.9%, respectively). When comparing the distribution of the 45 to 54 age group across studies, significant similarities and differences emerge. Roca A *et al*.[8]found that 25% of participants were between the ages of 40 and 49, which is consistent with the current study. 18.9% who reported a positive family history of the disease, which closely matches those of the Patro S *et al*.,[9] study, where 28% of participants reported a positive family history of cancer. Kakarla *et al*.,[10] on the other hand, showed a different distribution, with 47.06%

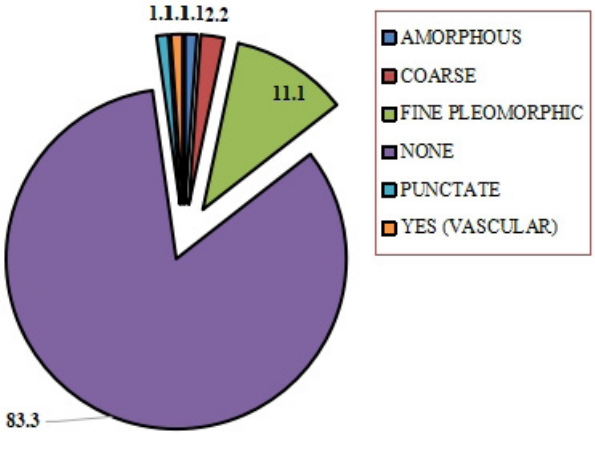

Figure 1: Distribution of calcification types among participants on mammography

Table 1: Demographic and radiological characteristics of breast lesions according to BI-RADS

Variable	*Frequency*	*Percent*
Age group		
25–34	5	5.6
35–44	25	27.8
45–54	39	43.3
55–64	13	14.4
65–74	8	8.9
Family history of cancer		
Yes	17	18.9
No	73	81.1
Breast Density		
A	0	0
B	42	46.7
C	46	51.1
D	2	2.2
Shape		
None	12	13.3
Oval (Ellipsoid)	68	75.6
Round	10	11.1
Margin		
Indistinct	29	32.2
Microlobulated	7	7.8
None	13	14.4
Spiculated	25	27.8
Well defined	16	17.8
Lesion density		
Fat containing	1	1.1
High	75	83.3
Low	1	1.1
None	13	14.4
Total	90	100

of participants reporting a positive family history. The majority of the study participants. i.e., 51.1% fell into Category C according to the distribution of breast density which is consistent with research by Baig B *et al*.[11] (55%) and Lalchan S *et al*.,[12] 11.1% had round-shaped lesions, and 13.3% had no discernible shape for their lesions and 75.6% had oval shape similar to study conducted by Lalchan S *et al*.,[12] 83.3% of the patientsexhibit lesions with High density which was consistent to research by Patro S. *et al*.,[9] and Roca A. *et al*.,[13] also found that lesions with high density were highly prevalent in their samples, ranging from 75 to 90%. Lalchan S *et al*.,[12] and Tiwari P *et al*.,[14] reported a lower percentage of participants with no calcifications and higher distributions of coarse and

Table 2: Distribution of MAMMO-BIRADS categories among participants

BIRADS Category	Mammo-birads		Sono-birads	
	Frequency	Percent	Frequency	Percent
BIRADS I (Negative)	14	15.6	5	5.6
BIRADS II (Benign)	3	3.3	11	12.2
BIRADS III (Probably Benign)	9	10	9	10
BIRADS IV (Suspicious of Malignancy)	45	50	41	45.6
BIRADS V (Highly suggestive of malignancy)	19	21.1	24	26.7
Total	90	100	90	100

Table 3: Comparison of mammographic (MAMMO-BIRADS) and Ultrasonographic (SONO-BIRADS) Categories with Fine Needle Aspiration Cytology (FNAC) & Histopathology Findings

BIRADS	Category	FNAC+ Histopathology finding		Total	p-value*
		Benign	Malignant		
Mammo-BIRADS	Benign	12	14	26	0.000
		70.59%	19.18%	28.89%	
	Malignant	5	59	64	
		29.41%	80.82%	71.11%	
SONO-BIRADS	Benign	13	12	25	
		76.47%	16.44%	27.78%	
	Malignant	4	61	65	0.000
		23.53%	83.56%	72.22%	
Total 100.00%		17	73	90	
		100.00%	100.00%		

**Chi-square test*

punctate calcifications. Among 90 participants, 15.6% were classified as BIRADS I (negative findings) and 3.3% as BIRADS II (benign, no follow-up required). BIRADS III (probably benign, follow-up needed) was seen in 10%, BIRADS IV (suspicious of malignancy, biopsy warranted) in 50%, and BIRADS V (highly suggestive of malignancy, requires biopsy/surgical intervention) in 19% of cases. Kakarla H *et al*.[10] concluded that the majority of other studies reported a higher percentage of highly suggestive of malignancy findings (26%). In this study of 90 participants, 78.9% had oval-shaped breast lesions on ultrasonography, consistent with findings by Patro S *et al*.,[9] Lalchan S *et al*.,[12] Tiwari PK *et al*.,[14] and Mandal *et al*.[15] This prevalence indicates a consistent trend across multiple studies. In this study of 90 participants, 86.7% had hypoechoic breast lesions, with complex solid cystic, anechoic, and hyperechoic lesions observed in 4.4, 5.6, and 3.3% respectively. This prevalence of hypoechoic lesions aligns with findings by Patro S *et al*.[9] In this study, 45.6% of participants were categorized as BIRADS IV, indicating potential breast cancer, while 26.7% were BIRADS V, indicating strong malignancy suspicion. BIRADS II, III, and I categories accounted for 12.2, 10.0, and 5.6% of cases, respectively. This differs from other studies, such as Patro S *et al*.[9], which found BIRADS II most common (55%), and Lalchan S *et al*.,[12] which found BIRADS III most prevalent (39.6%). Patro S. *et al*.[9] discovered a noteworthy association ($p < 0.05$) between MAMMO-BIRADS and histopathological results, which was similar to the current study, indicating a greater proportion of malignant lesions detected in categories indicating malignancy. Additionally, Lalchan S *et al*.[12] found significant correlations ($p < 0.05$) between the histopathological findings and the MAMMO-BIRADS and SONO-BIRADS categories, highlighting the predictive value of both imaging modalities in identifying malignancy.

CONCLUSION

The study concludes crucial importance of imaging, particularly mammography and ultrasonography, in promptly identifying and precisely classifying breast abnormalities. The significant occurrence of BIRADS IV and V categories highlights the necessity of immediate biopsies and further diagnostic measures. The significant occurrence of BIRADS IV and V highlights the importance of immediate biopsy and other diagnostic procedures, confirming the dependability of the BI-RADS method and affirming its usefulness in clinical settings. Hence, the importance of integrating mammography and ultrasound in breast lesion evaluation to enhance diagnostic accuracy and patient management. Together, these

studies highlight the importance of using ultrasound and mammography in the assessment of breast abnormalities, with each BIRADS category acting as a useful tool in the prediction of histopathological results and the direction of appropriate management approaches.

REFERENCES

1. Abbasi F, Zia MK, Usmani MS, Majeed S, Tahseen H, Khan IA. Frequency of clinically palpable breast lumps in an urban medical center: Importance of a surgeon-run breast clinic. Pak J Med Health Sci. 2023;17(2):414.
2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, *et al*. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2021;71(3):209–249.
3. Maurya AP, Brahmachari S. Current status of breast cancer management in India. Indian J Surg. 2021;83(2):316–21.
4. World Health Organization. World cancer report: cancer research for cancer development. Lyon: IARC; 2020.
5. Johnson OE. Awareness and practice of breast self-examination among women in different African countries: A 10-year review of literature. Niger Med J. 2019;60(5):219–25.
6. Bukhari MH, Arshad M, Jamal S, Niazi S, Bashir S, Bakhshi IM, *et al*. Use of fine-needle aspiration in the evaluation of breast lumps. Pathol Res Int. 2011;2011:689521.
7. (Duplicate of above – deleted for conciseness; keep only one) NEEDS ADJUSTMENT IN REFERENCE NUMBERS IN MANUSCRIPT
8. Phurailatpam J, Prasad C, Kumar BK, Hegde P. Evaluation of mammography, sonomammography in correlation with fine-needle aspiration of breast lumps. Int J Biol Med Res. 2014;5(3):4370–6.
9. Patro S, Das S, Mohapatra SS. A comparative study of mammography and sonomammography with FNAC correlation in evaluating palpable breast masses. Ann Rom Soc Cell Biol. 2021;25(6):14429–39.
10. Kakarla H, Gudipati P, Voruganti MR, Kanuru C, Samanthula C, Mdanapalli L. Evaluation of breast diseases by clinico-pathological and radiological assessment. J Dr YSR Univ Health Sci. 2023;12(4):327–32.
11. Baig R, Desai R, Tabassum M, Mughni MA, Hamza S, Quadri SZR. Comparison of mammography, sonography, fine-needle aspiration cytology, and excision biopsy for the diagnosis of breast lesions. Perspect. 2022;10(2):52.
12. Lalchan S, Thapa M, Sharma P, Shrestha S, Kc S, Pathak M, *et al*. Role of mammography combined with ultrasonography in evaluation of breast lump. Am J Public Health Res. 2015;3(5):95–8.
13. Farras Roca JA, Tardivon A, Thibault F, Rouzier R, Klijanienko J. Correlation of ultrasound, cytological, and histological features of 110 benign BI-RADS categories 4C and 5 nonpalpable breast lesions: The Institut Curie's experience. Cancer Cytopathol. 2021;129(6):479–88.
14. Tiwari P, Ghosh S, Agrawal VK. Evaluation of breast lesions by digital mammography and ultrasound along with fine-needle aspiration cytology correlation. J Cancer Res Ther. 2018;14(5):1071–4.
15. Mandal A, Jana P, Bakshi S, Mandal RK. A comparative clinicopathological study between ultrasonography, mammography, FNAC and core needle biopsy of breast lump. (JOURNAL NAME NOT GIVEN IN REFERENCE PROVIDED)