DIAGNOSTIC ACCURACY OF MAMMOGRAPHY IN ASSESSMENT OF BREAST LESIONS (BIRADS IVA) TAKING HISTOPATHOLOGY AS GOLD STANDARD

Rafia Irum,[1] Aneeza Qayyum,[2] Fatima Khan[3]

ABSTRACT

Background and Objective: Breast imaging-reporting and data system (BI-RADS) is intended for standardizing mammography reporting, and class IV A represents low suspicion of malignancy. The objective of this study was to assess the diagnostic accuracy of mammography in assessment of breast lesions (BIRADS IVA) taking histopathology as gold standard.

Methods: It was a cross-sectional study conducted in the Department of Diagnostic Radiology, Sharif Medical & Dental College, Hospital, Lahore from 16/08/2023 to 16/02/2024. A total of 215 patients who fulfilled inclusion criteria were included from OPD and underwent mammography. Findings were recorded and patients were labeled as malignant or benign. Then patients underwent biopsy and histopathology was done. Reports were followed and the type of lesion was noted as malignant or benign. All the information was recorded in Proforma and analyzed using SPSS version 25.0.

Results: In this study, 215 participants were included with the mean age of 53.88 ± 9.48 years. The BMI was 26.20 ± 3.60 kg/m2. Mean size of breast lesions was 4.00 ± 1.20 cm. Among these participants, mammography identified 193 cases as BIRADS IVA, representing 89.8% of the total population. Conversely, 22 participants (10.2%) did not exhibit BIRADS IVA findings on mammography. Comparison of findings of mammography with histopathological findings produced 98.44% sensitivity, 86.36% specificity, 98.45% PPV, 86.32% NPV and 97.21% accuracy.

Conclusion: This study provided evidence for the importance of mammography in assessing BIRADS IVA breast lesions, demonstrating high sensitivity, specificity, positive predictive value, and negative predictive value and diagnostic accuracy taking histopathological findings as gold standard. Further advancements in diagnostic methods are warranted to enhance accuracy and patient care.

Key Words: Breast Feeding, Breast Lesions, BIRADS IVA, Diagnostic Accuracy, Histopathology, Mammography

One of the most prevalent malignancies in women, breast cancer claims the lives of about 0.5 million people year worldwide. Even in India, the age-adjusted incidence rate of breast cancer has risen significantly over the past ten years, standing at 258 cases per million.[12] Women are urged to get routine mammography screenings in order to improve early detection. The percentage of various tissue types in a woman's breast is known as breast density. In particular, mammography reveals that breast and connective tissues are denser than fat.[3,4]

Malignancy accounted for 21% of all lesions, making it the most common kind overall.[5,6] Mammograms are essential for the early detection of breast cancer. However, using it to identify palpable breast lesions in young individuals might

1-3. Department of Radiology Sharif Medical & Dental college / Sharif Medical City Hospital, Lahore

Correspondence:
Dr. Rafia Irum; *FCPS radiology, Associate Professor Radiology Sharif Medical & Dental College / Sharif Medical City Hospital, Lahore, Email: dr.rafiaasim@gmail.com*

occasionally be challenging.[7] Because mammography is widely accessible, widely accepted, and reasonably priced, it is the main imaging modality for breast cancer screening and diagnosis. Breast imaging-reporting and data system (BI-RADS) is intended for standardizing mammography reporting.[8] Digital mammography can identify breast cancer in its early stages and produces high-quality images with lower radiation doses, improving patient survival and prognosis.[8,9]

As the cases of breast cancer in women are significant increase in Pakistan in previous two decades and the purpose of this study was to evaluate mammograms for suspicious-looking breast lesions that histology would later confirm. Therefore, another purpose of this study is to use mammography to identify the kind of breast lesions in a local situation. The results of this study will then be implemented in a local setting according to Pakistan population and demographics. This will improve local guidelines for early and non-invasive method to confirm the type of breast lesions and replace invasive, time and cost consuming procedures.

METHODS

This cross-sectional study was carried out at the Department of Diagnostic Radiology, Sharif Medical and Dental College, Lahore from August 2023 to February 2024. By using sensitivity and specificity calculator, sample size of 215 cases was calculated using 95% confidence level with percentage of malignant lesion as 21%, sensitivity of mammography as 73% and specificity of 80%.[10] Patients were selected by non-probability, consecutive sampling technique.

Females of age 40-75 years, presenting with palpable breast masses or positive family history were enrolled whereas patients with already diagnosed or treated breast malignancies or metastatic disease were excluded.

After approval from the ethical review committee, 215 patients presenting in the Outpatient Department of Radiology were enrolled and written informed consent to participate in the study was taken from each patient. Patients' age and gender were noted. Then patients underwent mammography, and reports were discussed with consultant radiologists having at least 4 years' experience in radiology. Findings were recorded and patients were labeled as malignant if there was detection of micro calcifications, irregularly shaped masses or infiltrative masses or benign if above stated parameters were not detected. Then patients underwent biopsy in the Department of Surgery. The size of the lesion was noted. Samples were sent to the Histopathology Department of the hospital. Reports were followed and the type of lesion was noted as malignant or benign. On histopathology, it was labelled positive (malignant) when >10% tumour cells attain H&E stain with irregular cells walls and absent nucleus.

Data were entered and analyzed is SPSS version 25.0. 2x2 table was generated to calculate sensitivity, specificity, PPV. NPV, and diagnostic accuracy of mammography taking histopathology as gold standard.

RESULTS

In this study, a total of 215 participants were included with a mean age of 53.88 ± 9.48 years and the mean body mass index (BMI) was 26.20 ± 3.60 kg/m2. Mean, standard deviations, frequencies and percentages of demographic variables and subject characteristics are presented in Table I.

Comparison of mammography with histopathological findings are presented in Table II. (2 x 2) table and sensitivity, specificity along with Positive & negative predictive values and accuracy.

DISCUSSION

Mean age of the patients in this study was 53.88 ± 9.48 years. The majority of participants were aged between 40 to 55 years. Previously, a little lower mean age of 50 ± 11.2 years was reported by Kurien et al.[11] However, mean age reported by some

Table 1: *Demographic Characteristics of Patients with Suspicion of Breast Lesions*

Characteristics	Participants (n=215)
Age (years)	53.88 ± 9.48
• 40-55 years	136 (63.3%)
• 56-75 years	79 (36.7%)
BMI (kg/m^2)	26.20 ± 3.60
• Normal Weight	73 (34.0%)
• Overweight	110 (51.2%)
• Obese	32 (14.8%)
Size of Lesion (cm)	4.00 ± 1.20
• 2-4 cm	108 (50.2%)
• 4.1-6cm	107 (49.8%)
Duration of Symptoms (weeks)	16.37 ± 2.16
• 12-15 week	64 (29.8%)
• 16-20 week	151 (70.2%)
Lateral Side	
• Right	113 (52.6%)
• Left	102 (47.4%)
Marital Status	
• Married	187 (87.0%)
• Unmarried	28 (13.0%)
• History of Breastfeeding	134 (62.3%)
• History of Hypertension	137 (63.7%)
• History of Diabetes	118 (54.9%)
• Family History of Malignancy	69 (32.1%)
• History of Smoking	14 (6.5%)

Table 2: *2x2 Contingency Table to Determine the Diagnostic accuracy of Mammography in assessment of Breast lesions (BIRADS IVA) taking histopathology as gold standard, n=215*

Mammography	Histopathology		Total
	Malignant	**Benign**	
Malignant	190	3	193
Benign	3	19	22
Total	193	22	215

Statistic	Value
Sensitivity	98.44%
Specificity	86.36%
Diagnostic Accuracy	97.21%
Positive Predictive Value	98.45%
Negative Predictive Value	86.32%

Pakistani studies is 58.91 ± 13.46 years reported by Shafiq et al. 12, 45.80 ± 13.39 years reported by Hanif et al. 13 and 40.27 ± 4.48 years reported by Malik et al. 14 Understanding age demographics aids in contextualizing disease prevalence and diagnostic approaches.

Breast lesions, particularly those classified as BIRADS IVA, significantly impact health outcomes, highlighting the crucial necessity for accurate diagnostic tools. Although histopathology serves as the gold standard for definitive diagnosis, it is invasive and subject to sampling errors.[15,16]

Mammography, widely utilized yet contentious in interpretation, underscores the urgent need for enhanced diagnostic strategies to optimize disease management and treatment decisions.[17] This study aimed to address these challenges by improving diagnostic accuracy in assessing BIRADS IVA lesions, ultimately striving for better patient care and outcomes through more reliable diagnostic methodologies.[2,18]

In our study, the mean size of breast lesions was 4.00 ± 1.20, with an equal distribution between lesions sized 2-4 cm (50.2%) and 4.1-6 cm (49.8%). Previously Rehman et al.[19] reported lesion size of 2-3cm (4.9%), 3.1-4 cm (14.6%), 4.1-5 cm (14.6%) and 5.1-6cm (51.2%).

Participants reported a mean duration of symptoms of 16.37 ± 2.16 weeks. Hanif et al.[13] reported mean duration of 2.88 ± 1.31 months in their study population while Rehman et al.[19] reported it 12-14 weeks in 26.8% patients, 15-17 weeks in 29.3% patients and 18-20 weeks in 29.3% patients. Breast lesions were noted to occur almost evenly on both sides, with 52.6% on the right and 47.4% on the left. However, previously, 46.8% breast lesions were reported on the right side of the patients.[19]

Among these participants, mammography identified 193 cases as BIRADS IVA lesions, representing 89.8% of the total cohort. Conversely, 22 participants (10.2%) did not exhibit BIRADS IVA findings on mammography. Similar findings were noted on mammography. The comparison of mammography findings with histopathological

results in this study revealed 190 true positive, 3 false positive, 3 false negative, and 46 true negative cases, yielding sensitivity of 98.44%, specificity of 86.36%, positive predictive value (PPV) of 98.45%, negative predictive value (NPV) of 86.32%, and diagnostic accuracy of 97.21%. In contrast, Kurien et al., reported higher sensitivity (93.1%) and specificity (100.0%), along with perfect PPV and NPV for mammography in diagnosing breast lesions using histopathology as the gold standard.[11]

Hanif et al.[13] reported lower specificity (76.5%) but comparable sensitivity (92.5%) and diagnostic accuracy (88.5%). Mohapatra et al.[12] demonstrated high sensitivity (98.7%) but lower specificity (47.6%) and NPV (90.9%), 9 while Shafiq et al., reported moderate sensitivity (69.64%) and specificity (84.09%), with notable variability in PPV and NPV. Variations in sensitivity, specificity, and diagnostic accuracy across studies highlight the importance of interpreting mammography findings cautiously and considering individual patient characteristics for accurate breast lesion diagnosis and management.

According to studies, mammography's sensitivity to the index cancer varied from 63% to 98%, and in thick breasts, it has been found to be as low as 30% to 48%. This lowered the mammography's accuracy in diagnosing breast cancer. However, the mammogram's overall sensitivity and specificity for identifying malignant breast lesions were 73.0% and 80.0%, respectively. One more study found that sensitivity and specificity for mammogram were 60.9%, and 94.4% respectively to diagnose malignant breast lesions.[10,22]

The strengths of this study lie in its robust sample size and comprehensive use of both mammography and histopathology for assessing BIRADS IVA breast lesions. The study's focus on diagnostic accuracy metrics like sensitivity, specificity, PPV, and NPV adds rigor to the findings. However, limitations include potential selection bias due to the single-center design and challenges related to interobserver variability in mammography interpretation, which could impact the generalizability of results.

CONCLUSION

This study provided evidence for the importance of mammography in assessing BIRADS IVA breast lesions, demonstrating high sensitivity, specificity, positive predictive value, and negative predictive value and diagnostic accuracy taking histopath-ological findings as gold standard. Further advancements in diagnostic methods are warranted to enhance accuracy and patient care.

Ethical Approval

Approval was obtained from Institutional ethical review board of Sharief Medical and Dental College Lahore with Reference no. SMDC/SMRC/336-24.

Conflict of Interest:	*None*
Funding Source:	*None*

Author's Contribution

Conceptualization study design	RI RI, FK
Data Acquisition	RI, FK, AQ
Data Analysis/ interpretation	RI, AQ
Manuscript drafting	FK, AQ, RI
Manuscript review	RI, FK, AQ

All authors read and approved the final draft.

REFERENCES

1. Heer E, Harper A, Escandor N, Sung H, McCormack V, Fidler-Benaoudia MM. Global burden and trends in premenopausal and postmenopausal breast cancer: a population-based study. Lancet Glob Health. 2020 ;8(8):e1027-e1037. doi: 10.1016/-S2214-109X(20)30215-1. PMID: 32710860.

2. Shetty R, Mathew RT, Vijayakumar M. Incidence and pattern of distribution of cancer in India: A secondary data analysis from six population-based cancer registries. Cancer Res Stat Treat. 2020;3(4):678–82. doi:10.4103/crst.crst_290_20.

3. Kinkar KK, Fields BKK, Yamashita MW, Varghese BA. Empowering breast cancer diagnosis and radiology practice: advances in artificial intelligence for contrast-enhanced mammography. Front Radiol. 2024 ;3:1326831. doi: 10.3389/fradi.2023.1326831. PMID: 38249158; PMCID: PMC10796447.

4. Pereira RO, Luz LAD, Chagas DC, Amorim JR, Nery-Júnior EJ, Alves ACBR, et al. Evaluation of the accuracy of mammography, ultrasound and magnetic resonance imaging in suspect breast lesions. Clinics (Sao Paulo). 2020;75(1):e1805. doi: 10.6061/clinics/2020/e1805. Epub 2020 Jul 22. PMID: 32725074; PMCID: PMC7362717.

5. Mukhtar R, Hussain M, Mukhtar MA, Haider SR. Prevalence of different breast lesions in women of southern Punjab, Pakistan, characterized on high-resolution ultrasound and mammography. Egypt J Radiol Nucl Med. 2021;52(1):1–6. doi:10.1186/-s43055-021-00633-8.

6. Zeeshan M, Salam B, Khalid QSB, Alam S, Sayani R. Diagnostic Accuracy of Digital Mammography in the Detection of Breast Cancer. Cureus. 2018;10(4):e2448. doi: 10.7759/cureus.2448. PMID: 29888152; PMCID: PMC5991925.

7. Yamakanamardi S, Hiremath B. Accuracy of mammography and sonomammography and its correlation with histopathology in the detection of breast cancer. Int Surg J. 2021;8(2):624–30. doi:10.18203/2349-2902.isj20210374.

8. Joshi P, Singh N, Raj G, Singh R, Malhotra KP, Awasthi NP. Performance evaluation of digital mammography, digital breast tomosynthesis and ultrasound in the detection of breast cancer using pathology as gold standard: An institutional experience. Egypt J Radiol Nucl Med. 2022;53:1–11. doi:10.1186/s43055-021-00675-y.

9. Mohapatra SK, Das PK, Nayak RB, Mishra A, Nayak B. Diagnostic accuracy of mammography in characterizing breast masses using the 5th edition of BI-RADS: A retrospective study. Cancer Res Stat Treat. 2022;5(1):52–8. doi:10.4103/-crst.crst_224_21.

10. Lehman CD, Lee CI, Loving VA, Portillo MS, Peacock S, DeMartini WB. Accuracy and value of breast ultrasound for primary imaging evaluation of symptomatic women 30-39 years of age. AJR Am J Roentgenol. 2012 ;199(5):1169-77. doi: 10.2214/AJR.12.8842. PMID: 23096195.

11. Kurien NA, Krishnan V. Efficacy of mammography in detecting breast masses using histopathology as gold standard. J Med Sci Clin Res. 2017;5(4):20080–4. doi:10.18535/jmscr/v5i4.57.

12. Shafiq M, Shamshad L, Ahmed N, Saleem S, Shahid R, Mazhar MA. Diagnostic accuracy of mammography versus ultrasound in prediction of malignancy with palpable breast lesion. Pak J Med Dent. 2022;11(3):11–6. doi:10.36283/PJMD11-3/003.

13. Hanif N, Babar A, Amin I, Goraya A, Mohsin B, Habib U. Sensitivity, specificity and diagnostic accuracy of mammography in breast carcinoma. Pak J Med Health Sci. 2020;14(1):67-9.

14. Malik N, Rauf M, Malik G. Diagnostic Accuracy of Ultrasound Bi-RADS Classification Among Females Having Breast Lumps, by Taking Histopathology as Gold Standard. J Soc Obstet Gynaecol Pak. 2020;10(1):13-6.

15. Quratulain S, Bibi S, Gul S, Khatoon S, Mahmood H, Sadia H. The diagnostic accuracy of conventional breast ultrasound in diagnosing malignant breast lesions taking histopathology as gold standard: diagnostic accuracy of breast ultrasound in malignant lesions. Pak J Health Sci. 2024;5(6):36-41. DOI: 10.54393/pjhs.v5i06.1657.

16. Ezeana CF, Puppala M, Wang L, Chang JC, Wong STC. A comparative efficacy study of diagnostic digital breast tomosynthesis and digital mammography in BI-RADS 4 breast cancer diagnosis. Eur J Radiol. 2022;153(1):110361. doi: 10.1016/j.ejrad.2022.110361. Epub 2022 May 17. PMID: 35617870; PMCID: PMC10347302.

17. Varshney T, Verma K, Kaur A, Puri SK. Enhanced Breast Cancer Classification: A Novel Fusion of Deep Features, Shape Features and GCLM Features. Proced Comp Sci 2025;258(1):3500-9. doi: https://doi.org/10.1016/j.procs.2025.04.606.

18. Zhao H, Zou L, Geng X, Zheng S. Limitations of mammography in the diagnosis of breast diseases compared with ultrasonography: a single-center retrospective analysis of 274 cases. Eur J Med Res. 2015 ;20(1):49. doi: 10.1186/s40001-015-0140-6. PMID: 25896757; PMCID: PMC4406115.

19. Rehman H, Raza S, Aziz S, Ahmad AM, Tahir S. Diagnostic Accuracy of Sonoelastography in the Non-Invasive Diagnosis of Malignant Breast Cancer Compared to Histopathology as a Gold Standard. J Coll Physicians Surg Pak. 2017 ;27(5):267-270. PMID: 28599685.

20. Hussein H, Abbas E, Keshavarzi S, Fazelzad R, Bukhanov K, Kulkarni S, et al. Supplemental Breast Cancer Screening in Women with Dense Breasts and Negative Mammography: A Systematic Review and Meta-Analysis. Radiology. 2023 ;306(3):e221785. doi: 10.1148/radiol.221785. Epub 2023 Jan 31. PMID: 36719288.

21. Bodewes FTH, van Asselt AA, Dorrius MD, Greuter MJW, de Bock GH. Mammographic breast density and the risk of breast cancer: A systematic review and meta-analysis. Breast. 2022 ;66:62-68. doi: 10.1016/j.breast.2022.09.007. Epub 2022 Sep 26. PMID: 36183671; PMCID: PMC9530665.

22. Badu-Peprah A, Adu-Sarkodie Y. Accuracy of clinical diagnosis, mammography and ultrasonography in preoperative assessment of breast cancer. Ghana Med J. 2018 ;52(3):133-139. doi: 10.4314/gmj.v52i3.5. PMID: 30602798; PMCID: PMC6303551.