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Original Research Article

Mammography and ultrasound evaluation of palpable breast lesion with histopathological correlation

Neha Kotiya*, Narendra Kumar Kardam, Kushal Babu Gehlot, Sandeep Kumar Ola, Mayank Choudhary

Department of Radiology, RNT MC, Udaipur, Rajasthan, India

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***Correspondence:**
Dr. Neha Kotiya,
E-mail: neha.kotiya24@gmail.com

ABSTRACT

Background: Breast cancer is one of the most common cancers and the leading cause of cancer deaths among women worldwide. Histological examination enables us to confirm the findings of mammography and sonography of the breast. Although a definitive diagnosis is possible with imaging features, histopathology and cytology are generally performed for obtaining a confirmed diagnosis. Aim of the study was to evaluate the breast lesions according to BI-RADS by using two different radiological procedures (non-invasive method) with correlation of FNAC.
Methods: This hospital-based prospective study was conducted in RNTMC Udaipur. All patients were subjected to digital mammography on HOLOGIC M-IV mammography machine in which two imaging projections of each breast, craniocaudal (CC) and mediolateral oblique (MLO) views were taken.
Results: On mammography, out of 90, 80 had palpable masses and 10 occult. Ultrasound was able to detect 88 cases and was normal in 2. Out of 88 lesions detected on sonomammography, 58 were solid and the rest were cystic or predominantly cystic lesions. Majority masses were located in the upper outer quadrant of bilateral breasts (41 masses), followed by the retro-areolar region (15 masses) and the upper inner and lower outer quadrant (10 masses) each. In upper outer quadrant 22(53.6%) out of 41 of the masses were benign while the remaining were malignant 19 (46%).
Conclusions: We conclude that with the combination of two noninvasive procedures, mammography and ultrasound; we can almost achieve the accuracy of the FNAC (invasive procedure) in detecting breast malignancy.

Keywords: FNAC, Sonomammography, Mammography, Breast lesions

INTRODUCTION

Breast cancer is one of the most common cancers and the leading cause of cancer deaths among women worldwide.[1] It is the second most common cancer in India.[2] Some recent studies have reported an increase in the trend of incidence rate of breast cancer in the Indian female population.[3] The incidence of breast cancer has increased globally from 641,000 (610,000 -750,000) cases in 1980 to 1,643,000 (1,421,000 -1,782,000) cases in 2010, an annual increase of 3.1%.[4] Over 100,000 new breast cancer patients are estimated to be diagnosed annually in India.[5]

According to GLOBOCAN (WHO), total number of new cases of breast cancer in 2020 was 22,61,419 (11.7%). 684946 (6.9%) women died in India due to breast cancer in the year 2020, more than any other country in the world.[6] Majority of patients present with complaints of breast lump, pain and discharge from the nipple. A

palpable mass in a woman's breast represents a potentially worrisome lesion and requires evaluation by proper history-taking, physical examination and imaging techniques.[7] Breast lump is the clinical presentation of various breast diseases that range from benign cystic lesions to outright malignant lesions. The differentiation of benign lesions from malignant ones is the most important aspect of patient care and in guiding further management, in order to minimize the morbidity and mortality associated with breast lesions. Early detection of breast cancer in order to improve the cancer outcome and survival remains the keystone of breast cancer control.

Mammography is considered the gold standard in the evaluation of the breast masses and is the only screening modality, which has been proven to reduce mortality from breast cancer through early detection.[8] It is a cost-effective and a widely accepted technique for evaluation of clinically suspected breast lesions, as well as for screening of breast cancers.[9] Classifying the mammographic lesions into BIRADS categories is useful in predicting the presence or absence of malignancy.[10]

The role of sonography in breast imaging has evolved over the years and it is now considered an accurate imaging modality for characterization of breast lesions.[11] It is useful in the evaluation of palpable breast masses which are not visible in radiographically dense breasts.[12] It is also useful in pregnant and lactating mothers and in young patients susceptible to radiation damage. High-resolution sonography plays an important role in guiding interventional procedures as needle aspiration, core-needle biopsy and pre-biopsy needle localization.

Combined use of mammography and sonography for the evaluation of breast masses has demonstrated a near 100% negative predictive value.[13] Sensitivity and specificity of sonography or mammography is higher if these modalities are combined together.[14] The use of sonography as an adjunctive modality to mammography results in an increased diagnostic accuracy, which helps in a better characterization of the breast lesions while avoiding unnecessary investigations or surgical procedures.[15]

Histological examination enables us to confirm the findings of mammography and sonography of the breast. Although a definitive diagnosis is possible with imaging features, histopathology and cytology are generally performed for obtaining a confirmed diagnosis.[16] A systematic and thorough approach to characterization of breast lesions detected on mammography and sonomammography will reduce the need for unnecessary biopsies.[17] All detected breast lesions are not malignant and all the benign masses do not progress to cancer; never the less the precision of the final diagnosis can be greatly increased by radiological imaging (mammography, ultrasonography) and pathological diagnosis.[3] The present study is to evaluate the breast lesions according to BI-RADS (Breast Imaging Reporting and Data System) by using two different radiological procedures (non-invasive method) with correlation of FNAC (invasive method).

Aim and objective of the study was to study the mammographic and ultrasonographic characteristics of palpable breast lesions in patients and to categorize the detected palpable breast lesions according to their BI-RADS. To correlate the categorized palpable breast lesions (BI-RADS) with histopathology

METHODS

This hospital-based prospective study was conducted in the Department of Radiodiagnosis, RNT Medical College Udaipur on patients, who were referred with clinically palpable breast masses over a period of one year from August 2021 to July 2022, after approval from Institutional Ethics Committee.

The patients included in the study were evaluated by mammography and sonography, with subsequent biopsy/FNAC. Pregnant women and women with breast implants were excluded from the study.

Mammography technique

All patients were subjected to digital mammography on HOLOGIC M-IV mammography machine in which two imaging projections of each breast, craniocaudal (CC) and mediolateral oblique (MLO) views were taken.

There are a lot of differences in the equipment used in mammography and the one used in routine radiography, taking into account the wide variation in breast sizes, variation in the relative amounts of fat within the breasts, the amount of glandular and stromal tissue present, and the low inherent contrast between the normal and abnormal breast tissue. The technique used in positioning the patient for mammography also differs from that used in routine radiography. Special tubes with molybdenum or rhodium anodes, high tube current, molybdenum target and filter, movable grids, automatic exposure control devices, compression paddles and high resolution films contribute to the production of high-quality images in mammography.

Mammographic views

The standard mammographic examination consists of a medio-lateral-oblique (MLO) and cranio-caudal (CC) view of each breast. Two orthogonal images are obtained by these two views for basic imaging evaluation of the breast. a) Medio-lateral-oblique (MLO) view is obtained with the tube angled at 45° to the horizontal, with compression applied obliquely across the chest wall, perpendicular to the long axis of the pectoralis major muscle. On MLO view, more breast tissue is demonstrated than on any other view. b) Cranio-caudal

(CC) view is obtained with a vertical X-ray beam. The positioning is done by pulling the breast up and forward, away from the chest wall, with compression applied from above. This projection demonstrates the subareolar, medial and lateral parts of the breast, however, the postero-lateral aspect of the breast may not be demonstrated completely. Evaluation of the standard MLO and CC views is performed with right and left breast films "back to back" so that the symmetry of the breast tissue can be examined.

Criteria for a properly-positioned MLO view

The nipple should be visible in profile. The pectoralis muscle should extend inferior to the posterior nipple line (PNL): an imaginary line drawn from the nipple to the pectoralis muscle or film edge and perpendicular to the pectoralis muscle. An open infra-mammary fold should be visible. No superimposition of the skin folds should be seen on the breast.

Criteria for a properly-positioned CC view

The nipple should be visible in profile. The posterior nipple line (PNL) on the CC view is drawn from the nipple to the pectoralis muscle or film edge. The length of the PNL on the CC view should be within 1 cm of its length on the MLO view. Additional (Supplementary) views: In addition to the standard MLO and CC views, there are some additional views used in diagnostic breast workups. These additional views may be required to demonstrate a perceived abnormality noted on one standard projection, but not seen on the corresponding projection.

Some of the supplementary views used in mammography are magnification view; spot compression view; extended cc view, extended MLO view; mediolateral / lateromedial view; axilla view, axillary tail view; superolateral-to-inferomedial oblique view; rolled medial/lateral view/axillary view; cleavage view / valley view. All mammography's were assessed carefully for breast density, site of lesion, margin of the lesion, shape of lesion, clustered microcalcification and overlying skin and on the basis of these features. On the mammographic findings, lesion was categorized according to BIRADS.

Sonomammograhpic equipment

Sonomammographic examination was performed using various ultrasound machines (e.g.- Philips Affiniti 70 Ultrasound system, Sonoscape P20, Esaote Mylab-40 Ultrasound systems, VINNO E10 Ultrasound system, Samsung RS80 EVO Ultrasound system) available in department by using high frequency probe (Range-5-18 MHz) especially linear probe to image the breast tissues distinctly. The Region of interest (ROI) is first evaluated and the side and Site are confirmed to be in concurrence with request given and sonomammographic findings are correlated with clinical findings.

Position of the patient

A pillow is placed under the shoulder of the side to be examined, the patient is made to lie in an oblique position with the degree of obliquity depending on the position of the breast, this aims to bring the corresponding breast to the centre of the examination field, the arm is raised above the patients, head for even distribution of the breast tissue, but not very much as to cause breast retraction. Better positioning eases examination and provides clear images.

Lesions that are felt better in the upright position may be scanned in the same position. Confirmation of fluid in cysts can be done by changing from upright to decubitus position.

The Ultrasound transducer is placed directly over the lesion after trapping the region of interest with the examiners fingers. In addition to conventional orthogonal scanning directions, scanning in the radial and antiradial planes are of value in demonstrating ductal abnormalities and to avoid mistaking fat islands as solid masses and determine the relation of the lump to the ducts.

Shape, nature of margins and surrounding tissue can be determined by evaluating the lesion in entirety including the periphery, in multiple planes.

Artifacts can be eliminated by slightly compressing the breast tissue with transducer which will make the breast tissue to spread evenly over the chest wall.

The breast is examined from the periphery to centre and finally the areola and nipple are imaged and the retroareolar tissue is also imaged in multiple planes by angling the transducer.

Lesion labeling

The position lesion is labeled on a clock face. The distance of the lesion from nipple is given in centimeters. The longest diameter is measured. Height width ratio of the lesion is obtained. On the basis of sonomammographic findings, lesions were categorized according to BIRADS.

FNAC

The histopathological evaluation consists of FNAC or biopsy of the mass lesion. FNAC was performed under USG guidance. Both the breasts were exposed and the transducer was swept in radial and anti-radial direction to look for any abnormality. The skin was disinfected and needle (22 to 25 gauge for FNAC and 14 to 18 gauge for core biopsy) was inserted near one of the short sides of the transducer and it was advanced along a trajectory lying parallel to the long axis of the transducer. Cellular material was aspirated and the tip was moved in various directions to collect multiple samples and expelled onto slides. 3 to 5 slides were prepared for each patient. The

collected specimen will be sent for histopathological examination.

Statistical analysis

The diagnostic accuracy for mammography and sonomammography was calculated individually and in combination, in terms of sensitivity, specificity, positive predictive value and negative predictive value.

RESULTS

A total of 90 female patients referred to the Department of Radiodiagnosis, RNT Medical College, Udaipur, with complaints of clinically palpable breast masses, and who satisfied the inclusion and exclusion criteria were included in the study. The patients were subjected to mammography and sonomammography, followed by histopathological examination. On mammography, 80 cases were detected out of the 90 palpable masses and 10 were occult.

Ultrasound of the breasts was able to detect 88 cases and was normal in 2 patients. Out of the 88 lesions detected on sonomammography, 58 were solid and the rest were cystic or predominantly cystic lesions.

The 80 mammographically detected masses and the 58 solid sonographically detected masses were then analyzed for individual features to characterize their benign or malignant nature. On histopathological analysis, 58 masses were found to be benign, while 32 were diagnosed as malignant. The results were tabulated and statistical analyses were performed.

Table 1: Location of palpable breast mass.

Location	FNAC/HPE				Total
	Benign		Malignant		
	No.	%	No.	%	
Upper outer quadrant	22	53.6	19	46.3	41
Upper inner quadrant	8	80.0	2	20.0	10
Lower outer quadrant	8	80	2	20	10
Lower inner quadrant	5	100.0	0	0.0	5
Retroareolar	10	66.7	5	33.3	15
Multiple	5	55.6	4	4.4	9
Total	58	64.4	32	35.6	90

Table 2: Association of sonomammographic findings of benign and malignant breast masses.

Characteristics	Present study	
	Benign	Malignant
Oval	19	02
Round	02	01
Irregular	07	27
Circumscribed	48	05
Spiculated	0	10
Ill-defined	2	09
Parallel	22	05
Anti-parallel	03	22
Acoustic shadowing	05	20
Acoustic enhancement	20	04
Calcifications	02	11
Vascularity	06	24
Lymphadenopathy	02	16

Table 3: Comparison of mammography and sonomammography with histopathology.

Imaging	Benign	Malignant	Inconclusive/ Normal	Total
Mammography	52	28	10	90
Sonomammography	54	34	2	90
Combined mammography and sonomammography	54	36	0	90
Histopathology	58	32	0	90

Table 4: Accuracy of mammography and sonomammography with respect to histopathology.

Assessment	Imaging modalities		
	Mammography	Sonomammography	Combined mammography and sonomammography
Sensitivity (%)	92.3	96.1	93.0
Specificity (%)	92.9	88.8	100.0
Positive Predictive Value (%)	96.0	92.4	100.0
Negative Predictive Value (%)	86.7	94.0	88.9
Diagnostic Accuracy (%)	92.5	93.0	95.6

In our study majority of the masses were located in the upper outer quadrant of bilateral breasts (41 masses), followed by the retro-areolar region (15 masses) and the upper inner and lower outer quadrant (10 masses each). In the upper outer quadrant, 22(53.6%) out of total 41 of the masses were benign while the remaining were malignant 19 (46 %) out of 41. In our study most of the breast masses in the study were irregularly shaped (n=32). The irregular shape was frequently seen in malignant masses (n=24), while the oval shape was more associated with the benign category (n=24).

In our study, out of total 90 cases on mammography 10 cases were inconclusive while on sonomammography 2 cases were normal. On combined modality all 90 palpable cases are detected.

On histopathological examination, 88.9% of the sonomammographically malignant masses (n=32) proved to be malignant and 96.2% of sonomammographically benign masses (n=50) proved to be benign.

In our study combined mammographic with sonomammographic imaging and histopathological evaluation were concordant in 88.9% (n=32) of the cases diagnosed as malignant and in 100% (n=54) of the cases diagnosed as benign.

The sensitivity and specificity of combined imaging modalities was 93.0% and 100% respectively, which was found to be higher than sensitivity and specificity of mammography and sonomammography individually. The diagnostic accuracy, negative and positive predictive values were also found to be higher with combined mammography and sonomammography, in comparison to their use individually.

Invasive ductal carcinoma (case 1)

High resolution sonomammographic image showing presence of irregular margin multilobulated predominantly hypoechoic solid mass lesion with spiculated margins and internal vascularity, showing mild posterior acoustic shadowing and duct extention.

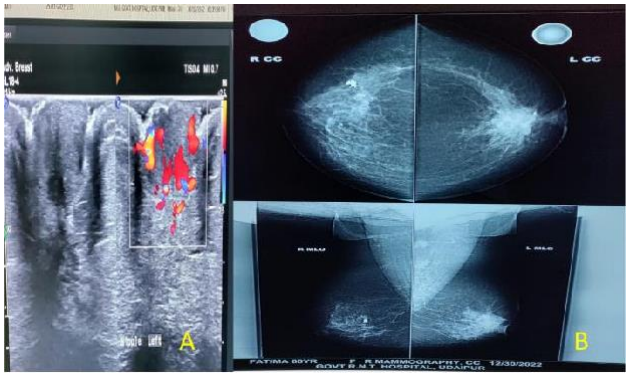

Figure 1: Invasive ductal carcinoma (case 1).

Mammographic CC and MLO of left breast showing presence of irregular high density mass lesion with irregular margin in reteroaerolar region.

On histopathological examination lesion reveals invasive ductal carcinoma.

Galactocele (case 2)

High resolution sonomammographic image showing presence of illdefined, round, anechoic cystic lesion with circumscribed margins, showing posterior acoustic enhancement showing communication with duct in left breast.

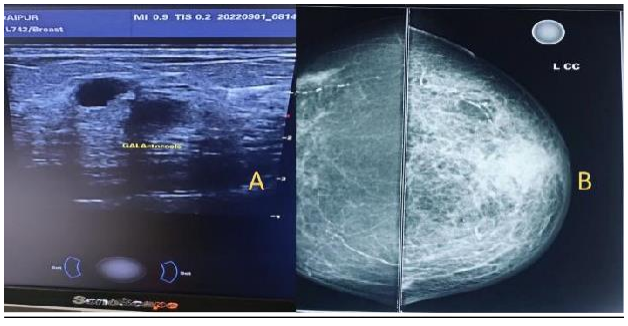

Figure 2: Galactocele (case 2).

Mammographic CC and MLO of both breast showing presence of illdefined, round, high density mass with circumscribed margins is seen in outer quadrant of left breast.

Phyllodes tumor (case 3)

High resolution sonomammographic image showing presence of a large well defined, oval shape, heterogeneously hypoechoic, solid mass lesion showing cystic component with in the lesion having circumscribed margins is seen in left breast parenchyma.

Mammographic CC and MLO of left breast showing presence of well defined oval shaped, high density mass lesion with circumscribed margins.

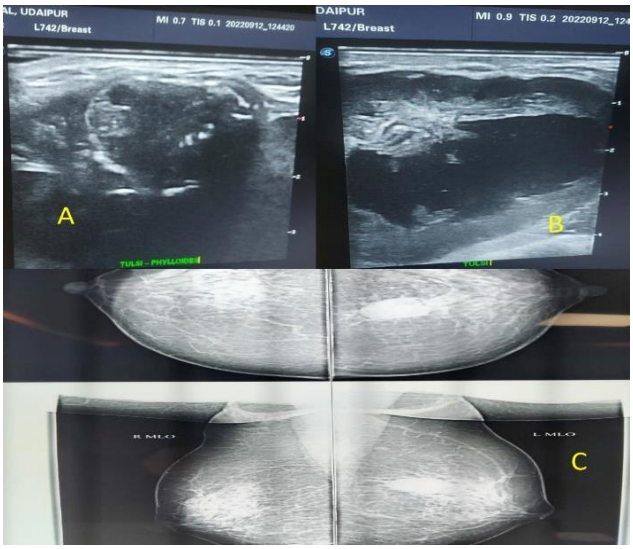

Figure 3 (A-C): Phyllodes tumor (case 3).

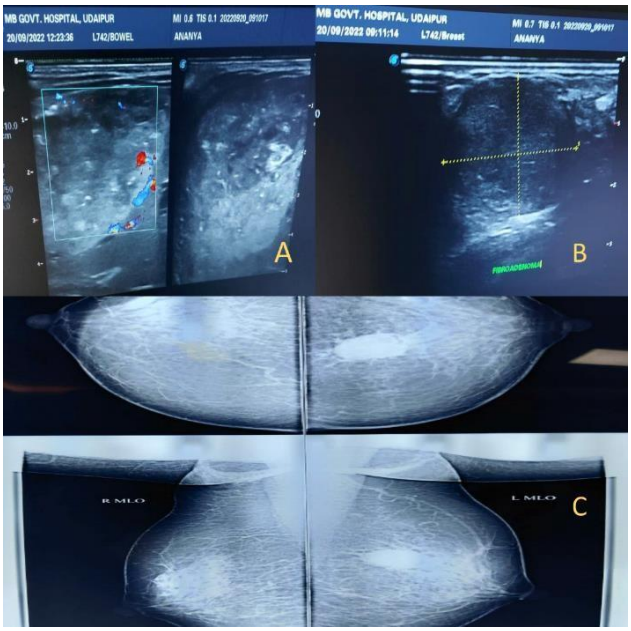

Figure 4 (A-C): Fibroadenoma (case 4).

Fibroadenoma (case 4)

High resolution sonomammographic image showing presence of a large welldefined, round shape, homogeneously hypoechoic area with peripheral vascularity, solid mass lesion with circumscribed margins is seen in left breast parenchyma. Mammographic CC and MLO of left breast showing presence of large well defined, round, high density lesion with circumscribed margins.

DISCUSSION

Studies revealed 45.45% of benign cases were oval shaped, 39.39% were round shaped and 15.15% were of irregular shape.[18] In malignant cases majority were of irregular shape 84.21%, only 10.52% and 5.26% cases had round and oval shaped masses. The present study also correlated with another study performed by Yamakanamardi et al in 2021, which found 41.1% of irregular shaped, 19.2% of spiculated and 26% of indistinct margin lesions to be malignant, while 11.8% of oval shaped and 47.1% of circumscribed lesions to be benign. Associated features like axillary lymphadenopathy, nipple retraction and increased skin thickness was found only in association with the malignant masses.[19,20]

Of the 80 cases visualized on mammography, 52 were benign and 38 were malignant. Both the mammographic and histopathological diagnosis were concordant in 26 malignant and 48 benign cases. Among the 6 discrepant lesions, 4 were diagnosed as mammographically malignant, which subsequently proved to be benign on histopathology (fibrocystic disease and phyllodes tumor).

2 cases identified as mammographically benign lesion turned out to be malignant on histopathological examinations (invasive ductal carcinoma). Both the sonomammographic and histopathological diagnosis were concordant in 32 malignant cases and 50 benign cases. Among the 6 discrepant lesions, 4 were diagnosed as sonomammographically malignant, which subsequently proved to be benign on histopathology (Benign phyllodes and Adenomyoepithelioma). 2 cases identified as sonomammographically benign lesion turned out to be malignant on histopathological examinations (mucinous carcinoma).

In the present study, the sensitivity of sonomammography was 96% and the specificity was 88.8%, which was comparatively similar to sensitivity (79.5%) and specificity (98.3%) seen in the study by Akinnibosun-Raji et al.[21] The sensitivity, specificity, positive predictive value and negative predictive value of mammography in the present study were 92.3%, 92.9%, 96% and 86.7% respectively, which were comparable to other previous studies. The sensitivity, specificity, positive predictive value and negative predictive value of sonomammography in the present study were 96%, 88.8%, 92.4% and 94% respectively, which were comparable to the other previous studies. The diagnostic accuracy of imaging in evaluation of palpable breast masses increases after inclusion of sonomammography

with mammography. Sonomammography is able to characterize the lesions obscured by dense breast tissue on mammograms and can better delineate the internal architecture of the lesions. Mammography acts as an adjunct to sonomammography in better detection of the presence and type of calcifications within the lesions.

In the present study, combined mammographic and sonomammographic diagnosis were concordant with histopathology in 32 cases were malignant and 54 cases were benign lesions. Increased sensitivity and specificity were also achieved with combined use of mammography and sonomammography, as compared to their use independently. Combined use of mammography and sonomammography for the evaluation of palpable breast masses was shown to have a better sensitivity (93%), negative predictive value (88.9%) and specificity (100%). These findings were similar to findings of Babu et al who reported sensitivity of 85.7%, specificity of 98.5%, PPV 98.9% and NPV as 94.4% with diagnostic accuracy 94.3%.[22] These findings were supported by other study of Runjjala et al.[23]

Limitations

Small sample size was a constraint for getting better results and sensitivity and specificity of data. Sample taking and freezing of FNAC sample is of utmost importance.

CONCLUSION

The Mammography and sonomammographic are individually effective diagnostic modalities for detection of breast pathologies; however, the accuracy of detection of breast carcinoma significantly improves when mammography was combined with sonomammographic. Our study also reveals that sonomammographic is better modality for detecting lesions in mammographically dense breast. This study confirms that the mammography and sonomammographic when combined have significantly higher sensitivity and NPV than observed for a single modality in detecting the both benign and malignant lesions of the breast. We therefore conclude that with the combination of two noninvasive procedures, mammography and ultrasound; we can almost achieve the accuracy of the FNAC (invasive procedure) in detecting breast malignancy.

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REFERENCES

1. Abdullah P, Malik A, Zahir N, Zahur-ur-Rehman Abdus S, Mehmood A. Breast lumps-what they actually represent. J College Physicians Surgeons Pakistan. 1999;9:46-8.
2. Consolidated Report of Hospital Based Cancer Registries 2007-2011. National Cancer Registry Programme, ICMR, 2013.
3. Asthana S, Chauhan S, Labani S. Breast and cervical cancer risk in India: anypdate. Indian J Public Health. 2014;58:5-10.
4. Mohammad H. Breast cancer and cervical cancer in 187 countries between 1980 and 2010: a systemicanalysis. The Lancet. 2011;8:193-341.
5. National Cancer Registry Programme Consolidated report of the population-based cancer registries 1990–1996. Indian Council of Medical Research 2001.
6. Breast cancer, India. Breast cancer India; 2014: Available at http://www.breastcancerindia.net. Accessed on 14 July 2023.
7. Popli M. Ultrasound characterization of breast masses. Indian J Radiol Imaging. 2009;19: 242-7.
8. Tabar L, Vitak B, Chen TH, et al. Swedish two country trial: impact ofmammographic screening on breast cancer mortality during 3 decades. Radiology. 2011;260(3):653-63.
9. Barton MB, Elmore JG, Fletcher SW. Breast symptoms among women enrolled in a health maintenance organization: frequency, evaluation and outcome. Ann Intern Med. 1999;130: 651-79.
10. Orel SG, Kay N, Reynolds C, Sullivan DC. BIRADS Categorization as a Predictor Malignancy. Radiology. 1999;211:845-50.
11. Jha AK, Sah RG. Accuracy of USG in stratifying palpable breast lesions: correlative study using fine needle aspiration for cytology. Original Int J Sci. 2015; 2(1):9-15.
12. Gokhale S. Ultrasound characterization of breast masses. Indian J Radiol Imaging. 2009;19(3):242-7.
13. Phurailatpam J, Sakalecha A, Prasad CSBR, Kumar BNK, Hegde P. Evaluation of mammography, sonomammography in correlation with fine needle aspiration of breast lumps. JMSCR 2014;2(5):990-1005.
14. Sabine M, Susanne W, Achim S. Comparison of written reports of mammography, sonography and magnetic resonance mammography for preoperative evaluation of breast lesions, with special emphasis on magnetic resonance mammography. Breast Cancer Res. 2001;3(1)55-80.
15. Mujagić S, Burina M, Mustedanagić-Mujanović J, Šarkanović G. The importance of combining of ultrasound and mammography in breast cancer diagnosis. Acta Medica Academica. 2011;40:27-33.
16. Berg WA, Gutierrez L, NessAiver MS, Carter WB, Bhargavan M, Lewis RS, Ioffe OB. Diagnostic accuracy of mammography, clinical examination, US, and MR imaging in preoperative assessment of breast cancer. Radiology. 2004;233(3):830-49.
17. Brem RF, Tabár L, Duffy SW, Inciardi MF, Guingrich JA, et al. Assessing improvement in detection of breast cancer with three-dimensional automated breast US in women with dense breast

tissue: the SomoInsight Study. Radiology. 2015;274(3):663-73.
18. Abhinaya KSL. Evaluation of breast lesions with Ultrasonography and Mammography in Correlation with FNAC/HPE. J Dental Med Sci. 2020;19(7):46-55.
19. Yamakanamardi S, Hiremath BV. Accuracy of mammography and sonomammography and its correlation with histopathology in the detection of breast cancer. Int Surg J. 2021;8:624-30.
20. Akinnibosun-Raji HO, Saidu SA, Mustapha Z, Ma'aji SM, Umar M, Kabir FU, et al. Correlation of Sonographic Findings and Histopathological Diagnoses in Women Presenting with Breast Masses. J West Afr Coll Surg. 2022;12(2):109-14.
21. Marri RK, Palleboina S. Evaluation of breast lumps by ultrasound and its correlation with FNAC findings in a teaching hospital in Telangana. J Evidence Based Med Healthcare. 2015;7(47):2772-6.
22. Babu S, Sainudeen A, Eksana A. Retrospective analysis of mammogram, sonomammogram and its histopathological correlation as an aid for diagnosis of breast lesions. Int J Sci Res. 2021;10(1):4-7.
23. Runjjala K, Naidu YT. Combined Mammographic and Sonomammographic Evaluation of Breast Masses. Int J Contemp Med Surg Radiol. 2020;5(1):162-5.

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