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ROLE OF MAMMOGRAPHY AND ULTRASONOGRAPHY IN THE EVALUATION OF BREAST LESIONS.

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Abstract

Background: Diseases of the breast, with their uncertain aetiology and often confusing treatment approaches, have intrigued physicians and medical historians for centuries. ***AIM:*** To evaluate breast lesions using digital mammography (MG) and ultrasonography (USG) independently and in combination with FNAC correlation. ***METHODOLOGY:*** This institution-based descriptive study with a cross-sectional design was conducted in the Department of Radio-diagnosis at SP Medical College and Hospital over a period of 10 months, from April 2024 to January 2025. ***RESULT:*** In this study, combined mammography and ultrasonography detected 99.5% of breast malignancies, identifying all 44 carcinoma cases, including lesions occult on mammography alone. While mammography and ultrasonography individually showed lower sensitivity, their combined use significantly improved diagnostic accuracy, approaching that of FNAC, particularly in women with dense breasts. ***CONCLUSION:*** Combined mammography and ultrasonography demonstrate significantly higher sensitivity and negative predictive value than either modality alone, achieving diagnostic accuracy comparable to FNAC in detecting breast malignancy. This combined approach reliably characterises breast lesions, reassures patients with negative findings, and helps avoid unnecessary invasive interventions.

Keywords: Mammography, Ultrasonography, Breast malignancy.

INTRODUCTION

Diseases of the breast, with their uncertain etiology and often confusing treatment approaches, have intrigued physicians and medical historians for centuries1. Among the various breast pathologies, carcinoma of the breast is the most frequently encountered and the most dreaded due to its significant morbidity and mortality. Breast cancer is currently the most common cancer affecting women in India.2 According to the National Cancer Registry Programme (ICMR) report (2001–2003), breast cancer accounts for approximately 27% of all cancers in Indian women. The crude incidence rate in India is around 85 per 100,000 women per year, with nearly 52,000 new cases diagnosed annually.3 The mortality rate is approximately 7 per 100,000 women per year, and it is estimated that one in 28 Indian women is likely to develop breast cancer during her lifetime. Globally, the American Cancer Society reports breast cancer as the second leading cause of cancer-related death among women.4 Mammography and ultrasonography remain the cornerstone imaging techniques, often followed by tissue diagnosis. Mammography is the most widely used screening tool and is the only imaging modality proven to reduce breast cancer mortality, especially in non-palpable carcinomas.5

It uses low-dose X-rays and is recommended for screening of at-risk populations due to the lack of effective preventive strategies. Routine screening mammography has been shown to reduce breast cancer mortality by up to 30%, with reported mortality reductions of 22% in women aged 50 years and above and 15% in women aged 40–49 years. Mammography enables early detection of subtle changes such as architectural distortion, asymmetric densities, neodensities, and microcalcifications, which often precede clinical palpability6. In younger women, ultrasonography plays a crucial complementary role by differentiating cystic from solid lesions, evaluating palpable masses not visualized on mammography, and assessing lesions in radiation-sensitive patients.7 Despite advances, mammography has a false-negative rate of approximately 10%, necessitating further evaluation when clinical suspicion persists. Sonographic assessment categorizes lesions into simple cysts, solid or complex masses requiring intervention, and cases with negative imaging where management is guided by clinical findings.8 Given the invasive nature of FNAC and limited data from

developing countries like India, particularly among lower socio-economic groups, this study aims to evaluate the correlation between mammography, ultrasonography, and FNAC, emphasizing the relevance of non-invasive imaging in accurate diagnosis of breast pathologies.9

AIM

To evaluate breast lesions using digital mammography (MG) and ultrasonography, (USG) independently and in combination with FNAC correlation.

METHODOLOGY

This institution-based descriptive study with a cross-sectional design was conducted in the Department of Radio-diagnosis at SP Medical College and Hospital over a period of 10 months, from April 2024 to January 2025. The study population comprised female patients presenting with breast lesions, both palpable and non-palpable, detected either on clinical examination or self-breast examination, who were referred to and attended the Radiology Department for mammography and ultrasonography of the breast. All female patients aged 40 years below and above with suspected breast lesions were included in the study. Patients were excluded if they were pregnant, had ulcerated or fungating breast growths where mammography was not feasible, were moribund, or had previously proven malignancy. Male patients were also excluded from the study.

RESULTS

Table 1:Demographic profile and background characteristics Table A1. Age distribution of the patients (n=264)

Age	Number	Percentage
Below 40 Years	78	29.6%
41–50 Years	82	31%
51–60 Years	66	25%
Above 60 years	38	14.4%
Total	264	100%

Among the 264 patients studied, the majority belonged to the 41–50-year age group (31%), followed by those below 40 years (29.6%) and 51–60 years (25%). Patients above 60 years constituted the smallest group, accounting for 14.4% of the study population.

Table 2:Distribution of the study subjects according to complaints (n=264)

Complains	Number of the patients	Percentage
Mobile breast lump	124	47%
Pain in breast	55	20.8%
Hard lump	32	12.1%
Breast heaviness	24	9.1%
Nipple discharge	15	5.7%
Nipple retraction	9	3.4%
Lump with fever	5	1.9%

Among the patients, 124 patients complained of mobile breast lump, 55 patients suffered from breast pain, 32 patients felt hard lump. Breast heaviness was reported by 24 patients, nipple discharge in 15 patients, nipple retraction in 9 patients & lump with fever was complained in 5 patients.

Table 3: Distribution of the study subjects diagnosed as carcinoma breast according to presence of risk factor (n=44)

Risk factor		
HRT	10	22.7%
Late Menopause	9	20.5%
Family History	5	11.4%
OCP use	4	9.1%
Nil	16	36.4%

Among the 44 patients diagnosed as carcinoma breast ten patients give history of hormone replacement therapy (HRT) after menopause. Nine patients have a history of late menopause. Family history positive in five patients and history of oral contraceptive pill intake seen in four patients. There is no obvious risk factor found in sixteen patients.

Table 4:Mammographic parenchymal density pattern (according to BIRADS category) of the patients (n=264)

Consistency of the breast	Benign	Malignant	Total
Type 1	72	20	92
Type 2	88	15	103
Type 3	50	5	55
Type 4	10	4	13

The lesions which were diagnosed only by mammography are analyzed on the basis of their location (relation to their quadrant), number, margin, surrounding halo, calcifications (both macro and micro calcification), overlying skin thickening and distortion of the surrounding breast parenchyma. On the basis of the findings, the cases were categorised according to the BIRADS classification.

Table 5:Comparative analysis of mammography, USG and combined study in detection of different breast lesions (n=264)

	Cytology	Mammography Alone	USG Alone	Combined
Fibrocystic disease	109	90	105	109
Infection	10	8	10	9
Fibroadenoma	81	62	28	79
Cyst	15	10	15	14
Carcinoma	44	35	31	44
Lipoma	5	5	5	5

A total of 264 breast lesions were diagnosed in cytology, including fibrocystic disease (109), fibroadenoma (81), carcinoma (44), cyst (15), infection (10), and lipoma (5). Mammography alone detected 90 fibrocystic disease, 62 fibroadenoma, 35 carcinoma, 10 cyst, 8 infection, and 5 lipoma cases, while USG alone detected 105 fibrocystic disease, 28 fibroadenoma, 31 carcinoma, 15 cyst, 10 infection, and 5 lipoma cases; the combined use of mammography and USG improved detection to 109 fibrocystic disease, 79 fibroadenoma, 44 carcinoma, 14 cyst, 9 infection, and 5 lipoma cases.

Table 6:Analysis of results of combined mammography and sonography diagnosing benign and malignant lesions

Mammography	FNAC proven carcinoma	FNAC No carcinoma
Carcinoma	35	5
No carcinoma	9	215
USG		
Carcinoma	31	7
No carcinoma	13	213
MG+USG		
Carcinoma	44	9
No carcinoma	0	211

Sensitivity of mammography detecting carcinoma: 35/44x100=79.54 Specificity of mammography detecting carcinoma: 215/220x100=97.72 Positive predictive value: 35/40x100=87.5,Negative predictive value: 215/224x100=95.98

Sensitivity of detecting USG carcinoma: 31/44 x 100=70.55% Specificity of USG detecting carcinoma: 213/220x100=96.81 Positive predictive value: 31/38x100=81.58%

Negative predictive value: 213/226x100=94.25%

Sensitivity of combined MG & USG detecting carcinoma: 44/44x100 =100% Specificity of combined MG & USG detecting carcinoma: 211/220x100 = 95.9% Positive predictive value: 44/53x100 = 83.02 %

Negative predictive value: 211/211x100 =100 %.

Table 7:Correlation between the findings of mammography, Ultra-sonography (USG) and combined approach (mammography and USG) with FNAC findings

		Mammography	**USG**	**Mammography + USG**
FNAC	Correlation of coefficient	0.731	0.684	0.892
	P value	0.0103	0.0096	0.0001

Results showed that the combined mammography and USG had the highest test-retest reliability (Spearman rho = 0.892), when compared with mammography alone and USG alone (Spearman rho = 0.731 and 0.684 respectively). It signifies all of them are the effective diagnostic procedures of detecting breast malignancy, but amongst the three procedures the combination of mammography with ultrasonography shows strongest correlation with the finding of FNAC.

DISCUSSION

Breast cancer is one of the most prevalent cancers in the world among women. Breast masses are common and usually benign, but effective evaluation and prompt diagnosis can rule out malignancy.
Among the 264 patients included in the study, the largest proportion belonged to the 41–50-year age group (31%). Patients below 40 years accounted for 29.6%, while those aged 51–60 years constituted 25% of the study population. Individuals above 60 years formed the smallest group, comprising 14.4% of cases.

In our study the most common presenting complaint was a mobile breast lump, observed in 47% of patients. Breast pain was reported by 20.8% of cases, followed by a hard lump in 12.1% and breast heaviness in 9.1%. Nipple discharge and nipple retraction were noted in 5.7% and 3.4% of patients, respectively. Lump associated with fever was the least common complaint, seen in 1.9% of cases.

In our study Hormone replacement therapy was the most common risk factor identified, present in 22.7% of patients, followed by late menopause in 20.5%. Family history of breast cancer and oral contraceptive pill use were noted in 11.4% and 9.1% of cases, respectively. No identifiable risk factor was observed in 36.4% of the study population.
In our study, we examined every breast lesion by mammography and USG independently and then compared their result with the FNAC result. According to Ying-Hua Yu et al.10 FNAC is an accurate biopsy for evaluating breast malignancy if rigorous criteria are used.

In our study, we used digital mammography as the diagnostic tool. Because of the low sensitivity of the mammography in younger women due to dense breast tissue and also low incidence of breast carcinoma in 53 women less than 40 years . Mahesh K. Shetty11, et four hundred eleven consecutive cases showed that 40.1% had a benign assessment; 58.7% of the benign lesions were visible on both mammography and sonography; 40% of benign lesions were mammographically occult and identified at sonographic evaluation.

In our study,83.33 % are benign lesions among 264 patients and out of which 79.54% of the lesions are diagnosed by mammography alone and 74.09% are diagnosed by USG alone. When these modalities are combined, 98.18% of the lesions are diagnosed. Out of 44 malignant lesions confirmed by FNAC, mammography individually detected 35 and USG detected 31 lesions . But when these modalities are combined, there is 99.5 % detection of cancer. Combined mammographic and sonographic assessment was shown to be very helpful in identifying benign as well as malignant lesions causing palpable abnormalities of the breast.Skaane P et al.12 found a total of 97.5% of the palpable and 67.9% of the non-palpable malignant neoplasms were detected as tumours on ultrasounds. A negative predictive value of 100% in palpable and 96% in non-palpable tumours was achieved using strict ultrasound criteria.

In our study the sensitivity of the USG to detect the malignant lesion is 70.55 % in both palpable and non-palpable breast lesions and specificity is 96.81 %. The negative predictive value is 94.25%.Thomas M. Kolb et al13. Studied 221 women and among them 246 cancers were found. Sensitivity, specificity, negative and positive predictive values, and accuracy of mammography were 77.6%, 98.8%, 99.8%, 95.8%, and 98.6%, respectively; and those of ultrasonography, 75.3%, 96.8%, 99.7%, 20.5%, and 96.6%, respectively.

In our study, the sensitivity, specificity, NPV and PPV of mammography are 79.54%, 97.72%, 95.98% & 87.5% respectively. The sensitivity, specificity, NPV and PPV values of USG are 70.55%,96.81 ,81.58%,94.25% respectively.Corsetti V et al14 showed that ultrasound detects early stage cancers in women with mammography negative dense breasts, with higher contribution in women younger than 50 years.

In our study seven cancer lesions were missed in mammographic dense breasts which were picked up clearly in USG. Moss et al15 reported that sonography increased cancer detection by 14% in symptomatic patients who were evaluated with both mammography and sonography. In retrospective analysis of 293 palpable malignant lesions, sonography detected all cancers; 18(6.1%) of these 293 cancers were mammographically occult .

In our study, combined mammography and ultrasound detected all the 44 patients of carcinoma breast and did not miss any malignant lesions. In a study by Dennis et al. 16 study suggested that breast biopsy may be avoided in women with palpable abnormalities when both ultrasonography and mammography depict normal tissue at the lump site.

In our study we estimated correlation coefficient and P value using Spearman's rho test and this statistical finding leads us to the conclusion that with the use of the combination of the two non-invasive procedures (i.e. mammography +USG) we can almost achieve the accuracy FNAC in detecting Breast Malignancy.The sensitivity of mammography or ultrasonography alone is lower than that of their combined use, particularly in younger women with dense breasts. Although mammographic sensitivity may not depend solely on breast density, adjunctive ultrasonography improves cancer detection

irrespective of breast density. Given the limitations of mammography and restricted accessibility of MRI, combined imaging remains essential, as negative mammographic findings cannot reliably exclude malignancy in palpable breast masses.

CONCLUSION

This study confirmed that the mammography and ultrasound when combined have significantly higher sensitivity and negative predictive value than observed for a single modality in detecting the both benign and malignant lesions of the breast. The statistical finding leads us to the conclusion that with the use of the combination of the two non-invasive procedures (i.e. MG+USG) we can almost achieve the accuracy of the FNAC in detecting breast malignancy. Thus combined use of mammography and sonography plays an important role in the management of breast lesions.Its applications include characterisation of the breast lesions as well as avoiding unnecessary interventions in which imaging findings are unequivocally benign.Negative findings on combined mammographic and sonographic imaging have very high specificity and are reassuring to the patient.

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