

Diagnostic Accuracy of Mammography and Ultrasonography in Assessment of Breast Cancer

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ABSTRACT

Introduction: Diagnostic efforts for breast cancer are critical because the disease has a high rate of successful outcomes with early identification and treatment. The mammography (MG) and ultrasonography (USG) are individually effective diagnostic modalities for palpable abnormalities of the breast. This prospective hospital based study was carried out with aim to evaluate breast lesions using mammography and ultrasonography individually and in combination with fine needle aspiration cytology (FNAC) correlation.

Material and Methods: Study participants were all women with palpable and non palpable breast lesions detected on clinical examination/self breast. Total 53 patients were studied, based on inclusion/ exclusion criteria. Study tools were mammography machine (Digital Mammography Novation DR. SIEMENS) and USG machine (WIPRO G E Health care Ultrasound LOGIC –P5). Mammography was performed in a stand type Siemens Novation which is a radiographic stand to radiograph the subject in a standing or sitting position in combination with mammographic x-ray tube assembly with compression paddle.

Results: The sensitivity, specificity, Positive predictive value (PPV) and Negative Predictive value (NPV) of mammography in detecting carcinoma breast were 77.8%, 97.7%, 87.5% and 95.6% respectively. The sensitivity, specificity, PPV and NPV of USG in detecting carcinoma breast were 55.6%, 97.7%, 83.3% and 91.5% respectively. In our study population 83.0% breast lesion were benign and out of them 77.27% were diagnosed by mammography alone and 72.7% were diagnosed by USG alone. When these modalities were combined, 97.7% of the lesions were diagnosed. The correlation coefficients of mammography alone (0.79), USG alone (0.63) and mammography and USG combination (0.88) with FNAC are all positive, and P values are significant of all the modalities.

Conclusion: This study confirms that the mammography and ultrasonography when combined have significantly higher sensitivity and negative predictive value than observed for a single modality in detecting the palpable abnormalities of the breast.

Keywords: Mammography, Ultrasonography, Palpable abnormalities of the breast.

clinically non-palpable stage. Screening and diagnostic efforts for breast cancer are critical because the disease has a high rate of successful outcomes with early identification and treatment.⁵ Today's medical radiographers performed several studies of the breast including mammography (MG), ultrasonography / ultrasound (USG), magnetic resonance imaging (MRI), and dedicated nuclear isotope scans. Mammography is the most commonly used imaging method and is the only currently known means of proven effectiveness especially in patients with non palpable carcinoma.^{6,7} The US Preventive Services Task Force analysis of seven randomized trials of mammographic screening found that the point estimate of the reduction in mortality from screening mammography was 22% in women aged 50 years or older and 15% among women between 40 and 49 years.⁸ This is because breast changes like asymmetry, neodensity, distortion of fibro glandular architecture and micro calcifications are picked up earlier than lesions that become clinically palpable, or are sometimes detected by self-examination.^{9,10} In patients with palpable breast lesions and in patients younger than 50 years of age the diagnostic gain from mammography is less marked due to a low positive predictive value and a limited sensitivity in dense breast tissue.^{7,11} USG plays a key role in differentiating cystic and solid masses. It is useful in the evaluation of palpable masses not visible in radiographically dense breasts, abscesses, masses that are not completely evaluable with MG and in young patients susceptible to radiation damage.^{10,12} Both MG and USG methods have been used in attempts to reduce the negative to positive biopsy ratio. This cross-sectional prospective hospital based study was carried out with aim to evaluate breast lesions using digital mammography (MG) and ultrasonography (USG) independently and in combination with FNAC correlation.

MATERIAL AND METHODS

This prospective cross sectional hospital based study was carried out at department of Radio diagnosis in a tertiary care hospital of West Bengal for one year. Study participants were all women with palpable and non palpable breast lesions detected on clinical examination/self breast examination and referred for mammography and women in high risk groups (family history of breast cancer, previous history of breast cancer and disease

INTRODUCTION

Of the various pathologies that afflict the breast, cancers are most often encountered and are the most dreaded.^{1,2} Breast cancer is the second most common cancer in Indian women.^{3,4} Based on National Cancer Registry Programme (ICMR), report of (2001-03), about 25% of the total cancer cases among Indian women constitutes of breast cancer. The crude incidence rate of breast cancer at India level is about 85 per 100,000 women per year and about 52000 females develop breast cancer in India per year.^{3,4} Despite the gloomy prognosis, increased morbidity and reduced survival time, it can be controlled if detection and diagnosis are made in the earliest stages i.e., in the pre-invasive and

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	Cytology	Mammography Alone	USG Alone	Combined
Fibrocystic disease	22	18	21	22
Infection	2	1	2	2
Fibroadenoma	16	12	5	15
Cyst	3	2	3	3
Carcinoma	9	8	6	9
Lipoma	1	1	1	1
Total	53	42(79%)	38(72%)	52(98%)

Table-1: Comparative analysis of mammography, USG and combined study in detection of different breast lesions

Mammography	FNAC proven-Carcinoma	FNAC proven - No carcinoma
Carcinoma	7	1
No carcinoma	2	43
Total	9	44

Sensitivity of mammography detecting carcinoma— $7/9 \times 100 = 77.77$; Specificity of mammography detecting carcinoma— $43/44 \times 100 = 97.72$; Positive predictive value— $7/8 \times 100 = 87.5$; Negative predictive value— $43/45 \times 100 = 95.55$

Table-2: Analysis of results of mammography diagnosing benign and malignant lesions

like fibrocystic disease, excessive exposure to ionising radiation and history of endometrial, ovarian or colonic carcinoma. Ulcerated and fungating breast growth were excluded because mammography is not possible. Pregnant women, moribund patients and proven cases of malignancy and male patients were also excluded from study. Total 53 patients were studied, based on inclusion/ exclusion criteria. Study tools were mammography machine (Digital Mammography Novation DR. SIEMENS) and USG machine (WIPRO G E Health care Ultrasound LOGIC –P5). Mammography was performed in a stand type Siemens Novation which is a radiographic stand to radiograph the subject in a standing or sitting position in combination with mammographic x-ray tube assembly with compression paddle. Mediolateral oblique and cranio-caudal images were obtained and assessed carefully. USG was performed on a Logic P-5 (GE), real time scanner with a hand held linear electronic array transducer. The transducer could be operated in the frequency range of 7.5 MHz. Parameters studied were (a) On mammography the site of the lesion, margin of the lesion, surrounding halo, clustered micro calcification, surrounding parenchymal distortion and thickening of the skin. (b) On USG the size, shape, margins, echo texture, homogeneity of internal echoes, lateral shadowing, posterior effect, calcification, infiltration across tissue space and surrounding fat were studied.

STATISTICAL ANALYSIS

Data were collected and statistically analyzed using descriptive statistics like mean and percentages with the help of Microsoft Office 2007. Comparison between variables was done with the help of chi square test and Correlation coefficient.

RESULT

The study included 53 females out of which 45 were from Hindu religion, 5 from Muslim and 3 from Christian religion. Among the patients 25 patients complains of mobile breast lump, 12 patients suffered from breast pain, 5 patients felt lump, nipple discharge in 3 patients and nipple retraction and lump with fever was the complains of two patients each. Among the

diagnosed cases of the carcinoma breast age of one patient is between 30-40 years, three patients are within 41-50 year group, two patients are between 51-60 year group and three patients belong to 61 and above group.

Among the 53 patients, mammography individually detected 8 lesions and missed 2 lesions of carcinoma breast, which were subsequently detected in USG and confirmed in FNAC. One of the 8 patients detected for suspicious lesions in mammography, subsequently proved benign in USG and FNAC (Table 1). The sensitivity, specificity, Positive predictive value (PPV) and Negative Predictive value (NPV) of mammography in detecting Ca breast are 77.77%, 97.72%, 87.5% and 95.55% respectively (Table 2). USG independently detected 6 patients as suspicious of breast carcinoma and missed 4 lesions, which were subsequently proved as carcinoma. USG falsely detected one patient as suspicious lesion, which proved benign in other studies. The sensitivity, specificity, PPV and NPV of USG in detecting Ca breast are 55.55%, 97.72%, 83.33% and 91.48% respectively. Two malignant lesions which were occult in mammography due to dense breast parenchyma and were detected in USG. The four cases of carcinoma breast which could not be picked up in USG were diagnosed by mammography.

In 22 FNAC proven cases of fibrocystic diseases, mammography alone detected 18 cases and USG detected 21 cases. Combined approach detected all the cases correctly. In 16 FNAC proven cases of fibroadenomas, mammography alone detected 12 cases, USG detected 5 cases and combined approach detected 15 cases. Out of 3 benign cysts, mammography detected 2 cases, however USG detected all correctly. In 2 cases of infective pathology, mammography detected one case correctly and one case as suspicious (false positive); however USG correctly diagnose those 2 cases. In our study population 83.01% breast lesion were benign and out of them 77.27% were diagnosed by mammography alone and 72.72% were diagnosed by USG alone. When these modalities were combined, 97.72% of the lesions were diagnosed.

The correlation coefficients of mammography alone (0.792), USG alone (0.631) and mammography and USG combination (0.884) with FNAC are all positive, and P values are significant of all the modalities, which signify that, all are the effective diagnostic procedures of detecting breast malignancy, but amongst the three procedure the combination of mammography with ultrasonography shows strongest correlation (Correlation coefficient = 0.884) with the finding of FNAC.

DISCUSSION

Patients with palpable breast masses commonly present for imaging evaluation. Unfortunately, false-negative mammographic (MG) findings in the setting of a palpable breast

mass have been estimated at between 4% to 12%.¹⁰⁻¹² Therefore, malignancy cannot be excluded when mammographic findings of a palpable mass are negative. USG is used as an adjunct to mammography to further evaluate palpable masses, especially in women with mammographically dense breasts. USG often detects cysts or solid lesions that are obscured on the mammogram by the surrounding fibro-glandular tissue and can reduce the number of surgical biopsies required when cysts are identified. It was found from the literatures that MG and USG are well-established diagnostic modalities for the breast. They have high diagnostic yield, but is not 100 % sensitive and specific.^{13,14} MG when combined with USG can yield very significant improvement in sensitivity and specificity for diagnosing different breast lesions and our study strongly supports this evidence.

The value of combined mammographic and sonographic imaging in symptomatic patients has been studied previously. Moss et al¹⁵ reported sensitivity of 94.2% in 368 patients. Shetty MK and Shah YP¹⁶ reported a sensitivity of 100%. Barlow et al¹⁷ reported a sensitivity of 87%. Their findings are comparable with present findings - sensitivity of 100 % in case of malignant lesions and case detection rate of 97% in cases of benign lesions. 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.

Although USG is not considered a screening test, it is more sensitive than MG in detecting lesions in women with dense breast tissue. 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.¹⁸ In this study, 2 patients (22.22%) out of 9 are diagnosed cancer in USG, which were occult in mammography.

CONCLUSION

The mammography and USG are individually effective diagnostic modalities for detection of breast pathologies. In our study, detection of breast carcinoma is higher in mammography in comparison to USG; however the accuracy of detection of breast carcinoma significantly improves when MG was combined with USG. The study also implies that, in comparison to mammography USG is better modality for detecting lesions in mammographically dense breast.

This study confirms that the mammography (MG) and ultrasound (USG) 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.

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