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A PROSPECTIVE AND COMPARATIVE STUDY OF DIAGNOSTIC ACCURACY OF RADIOLOGICAL AND CYTOLOGICAL STUDY FOR BREAST CARCINOMA IN TERTIARY CARE CENTRE

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ABSTRACT

Background: Breast cancer is most common cancer in women worldwide, contributing 25.4% of diagnosed cancer in 2018(1). Radiological and cytological pathways are the two main pathways for investigating breast lump. Radiological investigations include mammography and ultrasonography whereas cytological investigation includes FNAC and core needle biopsy (CNB). The diagnostic accuracy of the above mentioned investigations are not cent percent and have their own merits and demerits. Main aim of our study was to determine and compare the diagnostic accuracy of Mammography, USG of breasts and axillae, FNAC and Core Needle Biopsy in patients presenting with breast lumps with the final histology of excised specimen. **Methods:** 120 patients with breast lump in our tertiary care centre after meeting the inclusion and exclusion criteria were included in the study. All the patients after through clinical assessment had undergone through USG of breast, mammography, FNAC and core needle biopsy. Findings of above all investigations were compared with final histological findings to assess the sensitivity, specificity and diagnostic accuracy. **Results:** Sensitivity, specificity, PPV, NPV and diagnostic accuracy are 76.92%, 50.0%, 90.91%, 25.0% and 73.33% for USG of breast whereas mammography revealed 88.46%, 75%, 95.83%, 50% and 86.67%. In respect to FNAC as investigating tool we found sensitivity, specificity, PPV, NPV and diagnostic accuracy are 76.92%, 75.0%, 95.24%, 33.33% and 76.67% whereas core needle biopsy revealed 96.15%, 100%, 100%, 80% and 96.67%. **Conclusion:** Both radiological and cytological investigation can be well utilized in Triple Assessment method for diagnosis of breast lump with high sensitivity rate.

KEYWORDS: - Breast lump, FNAC, Mammography, Core needle biopsy

INTRODUCTION

Breast cancer is now most common cancer in women and 2nd most common cancer in both sexes worldwide, contributing 25.4% and 12.3% of the total number of new cases diagnosed in 2018.[1] Breast cancer is also most common cancer in India accounting about 1,62,468 newly diagnosed cases in 2018.[2-4] The overall incidence of breast cancer was increasing until the year 1999 because of increases in life expectancy, lifestyle changes that increase the risk for breast cancer, and improved survival rates for other diseases. After then incidence was decreased by approximately 2% per year up to the year2006. Despite significant improvements in the treatment of breast cancer approximately 87,090 Indians are expected to die from breast cancer in 2019.[1-4] In Indian scenario most of the patients presents with palpable lump or advanced stage of disease. The prognosis of breast cancer is overall good if the condition diagnosed and managed in early. Radiological and cytological investigations are the two main pillars for early diagnosis of the condition which includes mammography, USG of breast, FNAC and core needle

biopsy. The diagnostic accuracy of the above mentioned investigations are not cent percent and have their own merits and demerits.

Mammography is commonly used method for both screening and diagnosis of early breast carcinoma as it can detect architectural deformity of breast much before appearance of palpable mass. But patients with palpable breast mass and in younger patients with voluminous breast, the diagnostic gain is less marked due to a low positive predictive value (PPV) and a limited sensitivity in dense breast tissue.[5,6]

USG of breast are useful in younger patients with dense breast tissue and for guided FNAC without any radiation exposure. It can also differentiate solid or cystic mass, presence of abscess and axillary lymph node status.

FNAC is a rapid and easily performed diagnostic tool for diagnosis of palpable breast mass but it is unable to diagnose in-situ carcinoma from invasive carcinoma less suitable for nonpalpable mass.

Core needle biopsy is more suitable diagnostic test for evaluation of breast mass which can be done alone in palpable mass or with the radiologic guidance in nonpalpable mass. With this technique proper interpretation of pathology and receptor status can be obtained although it is difficult, painful and lengthy procedure.

So, main aim of our study was to determine and compare the diagnostic accuracy of Mammography, USG of breasts, FNAC and Core Needle Biopsy in patients presenting with breast lumps with the final histological diagnosis from excised specimen.

METHODS
Study was done at tertiary medical college and hospitals, Kolkata, India, from January 2017 to December 2019.

120 patients who presents with breast lump in our tertiary care centre after meeting the inclusion and exclusion criteria were included in the study. All the patients after through clinical assessment had undergone through USG of breast, mammography, FNAC and core needle biopsy. Findings of above all investigations were compared with final histological findings to assess the sensitivity, specificity and diagnostic accuracy.

Inclusion criteria
• Patients above the age of 12 years
• Patients having one or more masses in the breasts

Exclusion criteria
• Children aged less than 12 years
• Pregnant patients
• Patients unable to undergo gold standard diagnostic procedure i.e. excision biopsy

Parameters to be studied
Demographic Parameters: - Age, duration presenting complain, Family History, menstrual and obstetrical history,
Clinical Parameters: - Detailed examination of bilateral breasts.
Cytological parameters
• FNAC - 1. Unsatisfactory 2. Benign- non specific 3. Benign – specific 4. Atypical/ intermediate 5. Suspicious 6. Malignant
• Core needle biopsy – Grading of tumor, receptor status.
Radiological parameters:-
• Mammography- Breast Imaging Reporting and Data System (**BI-RADS**) 0.Incomplete assessment 1. Negative—nothing to comment on 2. Benign finding 3. Probably benign finding 4. Suspicious abnormality 5. Highly suggestive of malignancy 6. Known biopsy
• USG of breast- 1. Benign 2. Indeterminate 3. Malignant

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Study technique
All the patients after assessment by Tumour Board in our tertiary care centre were investigated with mammography, USG of breast, FNAC and core needle biopsy. All the findings of above test were compared statistically with the final histological findings of specimen.

The data and outcome was analysed and compared using statistical software - MEDCALC SOFTWARE VERSION 16.4.2.0.

RESULTS
Table 1: Distribution of our study population according to age groups. (n=120)

Age (years)	Number of population (%)
20-29	08 (6.66%)
30-39	20 (16.66%)
40-60	80 (66.7%)
>60	12 (10%)

In our study group most of the breast mass presented in peri menopausal age group and average age of presentation was 46.6 yrs.

Table 2: Distribution of our study population according to the duration of breast lumps in months. (n=120)

Duration (months)	Number of population (%)
<12	92 (76.7%)
12-23	8 (6.7%)
24-35	8 (6.7%)
36-48	12 (10%)

In our country most of the breast lump presents late in the course of disease which is reflected in our study.

Table 3: Distribution our study population according to the age of menarche. (n= 120)

Age at menarche (Years)	Number of population (%)
10-11	32 (26.7%)
12-13	76 (63.3%)
14-16	12 (10%)

Most of our study population presented with the history of menarche at the age of 12 to 13 yrs.

Table 4: Distribution of our study population according to family history of breast carcinoma and history of exclusive breast feeding. (n=120)

	Family history of breast carcinoma	Exclusive breast feeding
Yes	8 (6.66%)	116 (96.7%)
No	112 (93.33%)	4(3.33%)

Most of our study population presented with sporadic history and breast fed their baby exclusively

Table 5: Distribution of our study population in respect to important clinical findings. (n=120)

	Nipple Areola Complex changes	Skin changes	Chest wall fixity	Palpable axillary lymph Node
Yes	16 (13.3%)	36 (30%)	8(6.7%)	96 (80%)
No	104 (86.7%)	84 (70%)	112(93.3%)	24 (20%)

On careful clinical assessment majority of population were presented with large palpable breast mass with palpable axillary lymph nodes which is a most important prognostic factor.

Table 6: Distribution of our study population according to histological findings of specimen. (n=120)

Histological findings of specimen	Number of population (%)
Atypical ductal hyperplasia	12(10%)
Invasive Ductal Carcinoma	92 (76.66%)
Medullary CA	8 (6.66%)
Mucinous CA of breast	4 (3.33%)
Proliferative breast disease with atypia	4 (3.33%)

Table 7: Distribution of study population in respect to comparison of mammographic findings and final histopathologic findings (n =120)

Mammography	Number of population (%)
FN	12 (10%)
FP	4 (3.33%)
TN	12 (10%)
TP	92 (76.77%)

FN= False Negative; FP= False Positive; TN= True Negative; TP= True Positive

- Sensitivity: $TP/(TP + FN) \times 100$
  $= 92/(92+12) = 92/104 = 88.46\%$
- Specificity: $TN/(TN + FP) \times 100$
  $= 12/(8+8) = 12/16 = 75.00\%$
- Positive Predictive Value: $TP/(TP + FP) \times 100$
  $= 92/(92+4) = 95.83\%$
- Negative Predictive Value: $TN/(TN + FN) \times 100$
  $= 12/(12+12) = 50.00$
- Accuracy: $(TP+ TN)/ (TP + FP + TN + FN)$
  $= (92+12)/120 = 86.67\%$
  Applying Mc Nemar's Test, 'P' value = 0.61
  Statistically not significant

Table 8: Distribution of study population in respect to comparison of ultrasonographic findings and final histopathologic findings. (n =120)

Ultrasonography	Number of population (%)
FN	24 (20%)
FP	8 (6.7%)
TN	8 (6.7%)
TP	80 (66.7%)

FN= False Negative; FP= False Positive; TN= True Negative; TP= True Positive

Sensitivity = $TP/ (TP + FN) \times 100$
$80/(80+24) = 80/104 = 76.92$
Specificity = $TN/(TN + FP) \times 100$
$8/(8+8) = 8/16 = 50.00$
Positive Predictive Value = $TP/(TP + FP) \times 100$
$80/(80+8) = 90.91$
Negative Predictive Value = $TN/(TN + FN) \times 100$

$8/(8+24) = 25.00$
Accuracy $=(TP+ TN)/ (TP + FP + TN + FN)$
$(80+8)/120 = 73.33$
Applying Mc Nemar's Test, 'P' value = 0.28
Statistically not significant.

Table 9: Distribution of study population in respect to comparison of FNAC findings and final histopathologic findings. (n =120)

FNAC	Number of population (%)
FN	24(20.0%)
FP	4 (3.3%)
TN	12 (10.0%)
TP	80 (66.7%)

FN= False Negative; FP= False Positive; TN= True Negative; TP= True Positive

Sensitivity = $TP/ (TP + FN) \times 100$
$80/(80+24) = 80/104 = 76.92$
Specificity = $TN/(TN + FP) \times 100$
$12/(12+4) = 12/16 = 75.00$
Positive Predictive Value = $TP/(TP + FP) \times 100$
$80/(80+4) = 95.24$
Negative Predictive Value = $TN/(TN + FN) \times 100$
$12/(12+24) = 33.33$
Accuracy = $=(TP+ TN)/ (TP + FP + TN + FN)$
$(80+12)/120 = 76.67$

Applying Mc Nemar's Test, 'P' value = 0.13
In our study the finding of FNAC and final histopathological findings were statistically not significant.

Table 10: Distribution of study population in respect to comparison of core needle biopsy findings and final histopathologic findings (n =120)

Core Needle Biopsy (CNB)	Number of population (%)
FN	4 (3.33%)
FP	0 (0%)
TN	16 (13.33%)
TP	100 (83.33%)
FN= False Negative; FP= False Positive; TN= True Negative; TP= True Positive	

Sensitivity = T P/ (T P + F N) × 100
100/(100+4) = 100/104 = 96.15
Specificity = T N/(T N + F P) × 100
16/(16+0) = 16/16 = 100.00
Positive Predictive Value = T P/(T P + F P) x 100
100/(100+0) = 100.00
Negative Predictive Value = T N/(T N + F N) x 100
 16/(16+4) = 80.00
Accuracy ==(T P+ T N)/ (T P + F P + T N + F N)
 (100+16)/120 = 96.67
Applying Mc Nemar's Test, 'P' value = 1.00
In our study the findings of CNB were sensitive and 100% specific but in respect to diagnostic accuracy final histopathological findings were statistically not significant.

Radiological Examinations of Combined Ultrasonography & Mammography
It is a *parallel testing* in *'OR'* manner testing, so
Sensitivity = (A)$_{sen}$ + (B)$_{sen}$ - [(A)$_{sen}$ x (B)$_{sen}$]
        = 80/104 + 92/104 – [80/104 x 92/104]
        = 1.6538 – 0.6805

        A = Ultrasonography; B = Mammography

        =0.9733=97.33
Specificity = (A)$_{spec}$ x (B)$_{spec}$
        = 8/16 x 12/16
        = 0.375 = 37.50
Applying Mc Nemar's Test, 'P' value = 0.72
 Ultrasonography and Mammography as diagnostic tests are not significantly different with respect to sensitivity but sensitivity is high with the combination.

Minimally Invasive Pathological Techniqes of Combined FNAC & Core Needle Biopsy.

Sensitivity = (C)$_{sen}$ + (D)$_{sen}$ - [(C)$_{sen}$ x (D)$_{sen}$]
        = 80/104 + 100/104 – [80/104 x 100/104]
        = 1.7307 – 0.7396
        =0.9911=9.11   C = FNAC; D = Core Needle Biopsy
Specificity = (C)$_{spec}$ x (D)$_{spec}$
        = 12/16 x 1
        = 0.750 = 75.00
Applying Mc Nemar's Test, 'P' value = 0.22

Thus, FNAC and Core Needle Biopsy as diagnostic tests are not significantly different with respect to sensitivity but sensitivity is almost cent percent with the combination.

DISCUSSION
Accurate preoperative diagnosis of carcinoma breast is necessary so that patients may be counseled appropriately, and a majority may require a single therapeutic operation.[7]

In our country, due prevailing social stigmata patients are usually presents late in the course of disease with palpable lump with or without features of advanced disease. In this context we need some tests which are rapid, easy to perform, economic with high sesitivity and specificity for rapid and accurate diagnosis and management.

In our study all the patints of breast mass were investigated with mammography, USG of breast, FNAC and core needle biopsy for preoperative diagnosis of exact pathology.

Radiological investigation
In radiological investigation we found sensitivity, specificity, PPV, NPV and diagnostic accuracy were 76.92%, 50.0%, 90.91%, 25.0% and 73.33% for USG of breast whereas mammography revealed 88.46%, 75%, 95.83%, 50% and 86.67%.

According to Nandan Kumar et[8] al the sensitivity and specificity of breast ultrasound in categorizing breast lesions as benign and malignant was 85.4% and 89.31%, which is slightly greater compared to our study.

Devolli-disha et al[9] mentioned in their study that ultrasonographic sensitivity was 71.1% among women with predominantly fatty breast and 57.0% for heterogeneous dense breasts which is more or less similar to our study.

The sensitivity, specificity, PPV and NPV of USG in detecting carcinoma breast were 55.6%, 97.7%, 83.3% and 91.5% respectively in a series conducted by P.K. Tiwari et al which less sensitive and more specific than our study.[10] The author also mentioned that the sensitivity, specificity, PPV, and NPV of MG in detecting carcinoma breast were 77.77%, 97.72%, 87.5%, and 95.55%, respectively and sensitivity was increased up by 97.7% with combination of USG breast.

In our study specificity was low as compared to other study but sesitivity was similarly high (97.33%) when we use both.

Cytological investigation
In respect to FNAC as investigating tool we found sensitivity, specificity, PPV, NPV and diagnostic accuracy were 76.92%, 75.0%, 95.24%, 33.33% and 76.67% whereas core needle biopsy revealed 96.15%, 100%, 100%, 80% and 96.67%.

Puja B. Jarwani et al[11] and Ambedkar Raj, KulandaiVelu et al,[12] mentioned that FNAC had a sensitivity ranging from 82% to 97.5% and specificity of more than 99%, which is slightly higher than the values of our study.

Most of the standard health care journals mentioned that sesitivity of CNB is arround 86% in freehand technique and 98% with image guided technique.[13] As the procedure is painfull and difficult to perform false negetive results are common in freehand technique. Specificity of CNB is very high all previous studies which is similar in our study also.

In our study FNAC and Core Needle Biopsy as diagnostic tests were not significantly different with respect to sensitivity but it was almost cent percent with the combination.

B Lieske, D Ravichandran et al mentioned in their study that sensitivity of FNAC and CNB were 83%, 93% and it was 98% with the combination which is comparable to our study.

CONCLUSION
Both radiological and cytological investigation can be well utilized in Triple Assessment method for diagnosis of breast lump with high sensitivity rate. Diagnostic accuracy of USG breast and Mammography are statistically not different but the accuracy became very high when we used as a combination. This statement also holds true for the FNAC and core needle biopsy as cytological investigation.

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