

# Comparison of Mammography, Sonography, Fine-Needle Aspiration Cytology, and Excision Biopsy for the Diagnosis of Breast Lesions

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## ABSTRACT

**Background and Objective:** Problem of invasive tests in breast lesion diagnosis can be addressed by comparing non-invasive tests with final Histopathological diagnosis obtained after excision biopsy. Present study was carried out to study diagnostic utility of mammography, sonography, FNAC compared to excision biopsy for diagnosis of breast lesions

**Methods:** Prospective Observational study was carried out among 81 women with Breast related symptoms. Digital Mammography Machine, ACUSON S3000™ Ultrasound System; FNAC and surgery for excision Biopsy were used. Sensitivity, Specificity, Accuracy, Positive and Negative Predictive values were measured and  $p < 0.05$  was considered as statistically significant.

**Results:** Sonography and FNAC composite have sensitivity, specificity, accuracy, positive and negative predictive values 100.00%, 81.40%, 90.12%, 82.61% and 100.00% respectively. Mammography+FNAC (97.3%) is not as sensitive as Sonography+FNAC (100%), Sonography combined with FNAC is equally sensitive to excision biopsy (100%) and therefore can be used for screening purpose.

**Conclusion:** Contrary to present guidelines which consider Mammography as most important screening tool for Breast Cancer, combination of Sonography and FNAC can be considered equally reliable.

**KEYWORDS:** mammography, sonography, FNAC, excision biopsy, diagnosis, breast lesions

## INTRODUCTION

Women are the pioneers of a nation. According to a report by the Secretary-General of the United Nations, women make up 50 per cent of human resources. They are the key to sustainable development and quality of life in the family. The varieties of a role, women assume in the family, are those of a wife, a leader, an administrator, a manager of family

income, and a mother. [1]

In 2018, cancers killed 4 169 387 women, with a prevalence of 8 622 539. The most common cancer in women globally is the cancer of the breast, representing nearly a quarter of all cancers with about 1.67 million recent cancer cases diagnosed in 2012. Women from less developed regions (883 000 cases) have slightly a greater number of cases compared to more developed regions (794 000). It also causes the greatest number of cancer-related deaths among women. Breast cancer is the most frequent cancer among women in India and contributes to 14 per cent of all cancers in women. According to the GLOBOCAN 2018 data, the total number of new cases recorded was 162 468 which caused 87 090 Deaths. The incidence rates in Indian women escalate in the early thirties and are maximum at 50 to 64 years of age. [2]

Overall, 1 in 28 women are prone to develop breast cancer during their lifespan. In urban areas, 1 in 22 women are liable to develop breast cancer during their lifetime as compared to rural areas where 1 in 60 women develop breast cancer in their lifetime. In India, although the age-related incidence of breast cancer is lower (25.8 per 100 000) than the United Kingdom (95 per 100 000), mortality is equivalent to that detected in the United Kingdom (12.7 vs. 17.1 per 100 000). The fundamental reasons for this observed upsurge in mortality rate are - First, the lack of adequate breast cancer screening, Second, Diagnosing the disease at an advanced stage, and finally, unavailability of medical facilities. Early detection to improve breast cancer's aftermath and survival is the keystone of its control. [3]

For the diagnosis of various types of breast lesions, we require a physical examination along with investigations like mammography and sonography in our clinical practices. But these diagnostic techniques are not sufficient for the confirmation of various kinds of breast diseases. Besides these radiological investigations, we need Fine Needle Aspiration Cytology (FNAC) and Excision Biopsy for confirming or giving

a final diagnosis for a particular lesion. [4]

Through our interviews of the participants in this study, which was actually conducted before initiating the study we found that, many patients were reluctant to undergo excision biopsy/true-cut biopsies because it was painful and invasive, which was creating a gap in the diagnosis of breast lesions.

So, the question which arises in this situation is – What combination of tests can be used, that will replace the use of Excision Biopsy without losing specificity and sensitivity? This question can be addressed by conducting a comparative study of all these tests- Mammography, Sonography, FNAC, and Excision Biopsy with the final histopathological diagnosis obtained after excision biopsy.

There have been studies that have compared the radiological techniques separately or pathological investigations among themselves. For example- Comparison between Mammography and Breast MRI for the diagnosis of Breast Lesions, or were comparing Core Needle Biopsy with FNAC. This study compares both Radiological and Pathological investigations at once with the surgical-pathological investigation (Excision Biopsy) for the diagnosis of breast lesions. [5]

## METHODS

A Prospective Observational type of Clinical study was conducted, in which investigations were done on the patients (with lump(s) in breast) approaching towards the Department of Surgery at Shadan Hospital, a tertiary care teaching hospital affiliated to Shadan Institute of Medical Sciences, a private medical college in Hyderabad, Telangana, India. Institutional ethical committee clearance was obtained before the commencement of the study with IEC No. - 069/SIMS/Admin/2019.

Eighty-One patients took part in the study. All women who came to the out-patient department with a lump in the breast were included. Patients who did not undergo all 4 investigations, those who had a previous history of breast disease and who did not give consent, were excluded. The data was collected over a period of two months (June and July) in 2019.

The investigations were performed at Shadan Hospital. All study patients underwent imaging by mammography and ultrasonography of the breast. Mammograms were taken using Digital Mammography Machine (GE Healthcare, Essential E, 19x23 cm field view). Sonography was performed with ACUSON S3000™ Ultrasound System. The lesions were classified as benign or malignant based on the American College of Radiology Breast Imaging Reporting and Data System (BI-RADS) lexicon [6], with a score of 1-3 noted as benign lesions and 4-6 malignant (for mammography) as seen in Figure 1, and 0-3 as benign and 4-6 as malignant (for sonography). Fine Needle Aspiration Cytology of the patients was done in the Department of Pathology using a 22-Gauge Needle.

Finally, Excision Biopsy followed by histopathological analysis was performed. These investigations were conducted on all the study subjects.

The investigations were performed after explaining the procedure and the need for that investigation to the patient and getting their consent. Sociodemographic variables were noted along with clinical history and examination of the breasts. The preference of the patients concerning invasive vs non-invasive investigations was also noted.

Data was entered in MS Excel 2016 and was analyzed using IBM-SPSS software version 18. Sensitivity, Specificity, Accuracy, Positive, and Negative Predictive values were calculated. [7] P value of less than 0.05 was considered as statistically significant.

## RESULT :

In this study, all the 81 patients had a lump in breast tissue, out of which 22.2 per cent (18 patients) were suffering from pain in their lump. When the clinical history was correlated with menstruation, 18.5 per cent (15 of 81) of patients were menstruating at the time of presentation to the Hospital.

Based on the Clinical Diagnosis made by the surgeons at our hospital, 39.5 per cent (32 of 81) of the lesions were classified as Malignant and 60.5 per cent (49 of 81) Benign. After histopathological confirmation, 38 lesions were found to be malignant, out of which 19 (50 per cent) were present on the right breast and 19 (50 per cent) on the left breast. Within the Breast, it was found that almost half of the lesions i.e., around 49 per cent (40 of 81) were found in the Upper Lateral side of the Breast, which is followed by Upper medial side i.e., 18.5 per cent (15 of 81), then Central or Retro-alveolar area i.e., 13.6 per cent (11 of 81), followed by Lower Lateral side – 10 per cent (8 of 81), and lastly the Lower Medial side i.e., 9 per cent (7 of 81). The minimum and maximum age of this study population were 16 and 79 years, with the mean age being 53 years.

The attitude of patients towards investigations revealed a preference for non-invasive methods, i.e., Sonography (35 of 81) and Mammography (27 of 81); over invasive methods, i.e., FNAC (14 of 81) and Excision Biopsy (5 of 81).

In this study, when we compared the various diagnostic techniques which were used on our patients, it was found that the highest number of malignancy rates were indicated by Sonography, followed by FNAC and Biopsy, and lastly Mammography, as seen in Table 1 .

The various diagnostic methods and their combinations were compared with the final histopathological diagnosis (which was done after Excision Biopsy) for sensitivity, specificity, accuracy, positive and negative predictive values, which are noted in Tables 2 and 3 T respectively (Here we considered: sensitivity, specificity, accuracy, positive and negative predictive value of Excision Biopsy as 100 percent).

The most sensitive technique in our study is Sonography, most specific is Mammography, and most accurate is Sonography. The one with the highest positive predictive value is Mammography, and the one with the highest negative predictive value is Sonography.

Investigations	Malignant		Benign	
	n	n%	n	n%
Mammography	34	42	47	58
Sonography	43	53.1	38	46.9
FNAC	38	46.9	43	53.1
Excision Biopsy	38	46.9	43	53.1

n indicate the number of patients and n% = (n\*sample size)/100. FNAC, Fine Needle Aspiration Cytology; P<0.050 (n = number of lesions; n% = percentage of lesions)

**Table 1: Neoplastic Status of Lesions as per Different Investigations.**

## DISCUSSION

The maximum numbers of cytologically benign lesions were seen in the age group ranging from 46 to 79 years which is contradictory to the findings by Sankaye et al [8], Khemka et al [9] who had maximum cytologically benign cases in the age groups 19-50 years, 15-44 years, and 14-40 years, respectively. Malignant lesions were common in the age groups 45-79 years in the present study, 35-84 years in the study by Khemka et al. [9]

Pain or its absence is clinically important since it can indicate the absence or presence of malignancy. Because of a well-known fact that a painful lump usually indicates a benign lesion. In this study, since a majority of the participants were having no pain, there is a possibility of having malignancies and therefore the risk of missing the diagnosis rises – therefore as one of the conclusions of the study, all women should go for regular screening or should conduct self-examination of breast frequently even when they do not have any pain in their breasts.

When clinical history was correlated with menstruation, the patients who were menstruating at the time of presentation of the lump, were recalled after 5 days to examine them. Normal ovarian hormonal influences on breast glandular elements frequently produce cyclic mastalgia in phase with the menstrual cycle which can often lead to misdiagnosis.

Out of the 81 cases taken into consideration, less than half of them were malignant after histopathological diagnosis, out of which 50 per cent were on the right breast and 50 per cent on the left breast. Upper lateral quadrants were the most commonly involved quadrant in the present study. This is in agreement with the findings of other studies by Zuk et al [10] (42.20 per cent), Meena et al [11] (54 per cent) and

Clegg-Lamptey and Hodasi [12] (42.40 per cent). The reason behind this is that the upper lateral quadrant of the breast has denser tissue.

In our study, a majority of patients chose non-invasive methods over invasive methods. This may be because non-invasive methods are painless as compared to the invasive methods; this gap might be one of the causes of missing cases of breast cancer, which becomes a threat to the society. This gap must be filled by lesser painful techniques which are actually preferred by the study population.

Based on the Clinical Diagnosis made by the surgeons at our hospital, 39.5 per cent (32 of 81) of the lesions were Malignant and 60.5 per cent (49 of 81) were Benign. The sensitivity of clinical diagnosis (71.05 per cent) is higher than previous studies - 17.9 per cent [13] and 18 per cent. [14] The sensitivity of mammography in this study coincides with those of previous studies like 83.7 per cent [14], but is opposing the findings of some studies, ranging from 13 to 55.5 per cent. [15, 16] The specificity of this study coincides with the findings ranging 99.1 – 98.8 per cent [17, 18], but is dissimilar to another finding – 68.5 per cent. [19] Accuracy of this study is lower than the accuracies of other studies 77.1 to 98.6 per cent. [20] Positive Predictive Value of this study is higher than the PPVs of studies ranging from 35.8 to 67.8 per cent. [21] Negative Predictive Value of this study supports the NPV of 84.1 per cent [16], but is lower than the negative predictive value of 100 per cent. [21]

The sensitivity of sonography in this study is similar to others, i.e., 92.9 – 96.6 per cent. [17-21] One study had 100 per cent sensitivity. [21] Some studies had lower sensitivities, 13 - 78 per cent. [16, 22] The specificity of this study was similar to others, 79.1 – 96.8 per cent. [23, 24] Our finding was higher than a study showing 54.5 per cent [21] specificity. Accuracy of this study is similar to 96.6 per cent [25] and 91.4 per cent. [24] Positive Predictive Value of this study is higher than others, 19.7 – 79.2 per cent [19, 21, 23] but lower than a study showing 100 per cent. [22] Negative Predictive Value of our study is in support of others, 90.9 - 100 per cent. [19, 21]

The sensitivity of FNAC in this study is similar to other studies showing 87 – 97.5 per cent [24, 25] Specificity of this study is similar to 81.8 – 89.6 per cent [26-28] but is lower than others, 98 - 100 per cent [25, 29-31] Accuracy of this study is in the range of others, 97 per cent. [30] Positive Predictive Value is lower than other studies, 95.8 - 100 per cent [25, 29-31]

The variation in findings found among these studies might be because of the difference in quality of the diagnostic equipment used and also the variance in the level of expertise of the doctors and technicians who have conducted these procedures.

Sonography combined with FNAC is as sensitive as excision biopsy (100 per cent) but is less specific (81.4 per cent). Since this combination is having a sensitivity of 100 per cent, it can be used for screening purposes. Moreover, when a combination of Mammography, Sonography, and FNAC is

Diagnostic method	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Clinical Diagnosis	71.05	88.37	84.38	77.55	80.25
Mammography	81.60	93.00	91.20	85.10	59.00
Sonography	94.70	83.70	83.70	94.70	92.60
FNAC	89.50	90.70	89.50	90.70	82.90

NPV, negative predictive value; PPV, positive predictive value.

**Table 2: Comparison of various diagnostic methods for preoperative prediction of histologically confirmed malignancy or benign disease**

Diagnostic methods	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Mammography + Sonography	94.74	83.72	83.72	94.74	88.89
Mammography + FNAC	97.37	90.70	93.83	90.24	97.50
Sonography + FNAC	100.00	81.40	82.61	100.00	90.12
All three methods combined	100.00	81.40	82.61	100.00	90.12

NPV, negative predictive value; PPV, positive predictive value.

**Table 3: Comparison various combinations of three diagnostic methods for preoperative prediction of histologically confirmed malignancy or benign disease**

used the findings are identical to the Sonography + FNAC combination, therefore it can be concluded that Mammography is an unnecessary procedure for the diagnosis of breast lesions which is contrary to the current guidelines available for screening of Breast cancer. [32]

#### CONCLUSION:

A combination of Sonography and FNAC excluding Mammography can be considered reliable for screening breast lesions. Moreover, since this combination is comparatively painless, it can fill up the gap of the missing cases of breast cancer. A larger community-based study is required with a 5 year follow up to study this effect and to ensure that there are no errors in the conclusion.

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