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RESEARCH ARTICLE
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A STUDY ON FINE NEEDLE ASPIRATION CYTOLOGY OF BREAST LESIONS ACCORDING TO IAC YOKOHOMA CLASSIFICATION AND ITS HISTOPATHOLOGICAL CORRELATION, AT TERTIARY CARE HOSPITAL, GHAZIABAD

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ABSTRACT
Breast lumps are a frequent concern among women and often present with symptoms such as pain, palpable masses, or nipple discharge. These symptoms can lead to considerable anxiety, though most breast lumps are benign. Fine Needle Aspiration Cytology (FNAC) offers a rapid, minimally invasive, and cost-effective diagnostic approach that helps differentiate between cystic and solid lesions and plays a crucial role in identifying malignancies. This study, conducted at the Pathology Department of Santosh Medical College, Ghaziabad, aimed to assess the cytomorphological patterns of breast lesions using FNAC, evaluate its diagnostic accuracy, and correlate findings with histopathological results using the IAC Yokohama classification. Over a year, 258 patients underwent FNAC, with histopathological follow-up available for 136 cases. FNAC showed high diagnostic performance, with a sensitivity of 92.86%, specificity of 100%, and overall accuracy of 93.8%. The majority of cases were benign (C2), and most lesions measured between 2–5 cm. These findings reinforce FNAC's critical role in the early, accurate, and reliable preoperative assessment of breast lesions.

KEYWORDS: Breast lesions, Fine Needle Aspiration Cytology (FNAC), Histopathology, Diagnostic accuracy, IAC Yokohama classification, Sensitivity, Specificity, Malignant lesions, Benign lesions, Cytomorphological patterns, Breast cancer, Preoperative diagnosis.

INTRODUCTION
Breast lumps are common in women and typically present with pain, a palpable mass, and nipple discharge.[1] These lumps often cause anxiety, which can be alleviated by reassuring patients that most breast lumps are benign and can be early diagnosed through fine needle aspiration cytology

(FNAC).[2,3] FNAC is an effective tool for evaluating both palpable and non-palpable breast masses, offering high accuracy, particularly for palpable lesions.[3] It is a rapid, cost-effective, and accurate diagnostic procedure that can differentiate cysts from solid tumors and even serve as a treatment method for cysts.[4] In cases of malignancy, FNAC also aids in involving the patient in decision-making and provides psychological relief when benign lesions are confirmed.[1]

Globally, a triple assessment involving physical examination, radiology (ultrasound and mammography), and cytopathology (FNAC) is recommended for evaluating breast masses.[5-7] FNAC is widely accepted for the preliminary evaluation of both palpable and non-palpable lumps (guided biopsy) and is considered simple, harmless, cost-effective, minimally invasive, and highly sensitive.[6-10] In a study by Muddegowda et al., FNAC showed excellent diagnostic accuracy (97%), specificity (98%), and sensitivity (94.5%), preventing unnecessary surgeries.[6]

FNAC, first described in the 1930s by Martin and Ellis, was advanced in the 1960s by Franzen and Zajicek at the Karolinska Hospital.[11,12] Globally, breast cancer is the most common cancer in women, leading to significant morbidity and mortality.[13,14] In India, breast carcinoma ranks as the second most common cancer, comprising 22.2% of all new cancer diagnoses and 17.2% of cancer-related deaths.[15] Specimen adequacy for FNAC in breast lesions has varying definitions, with some centers using a threshold of five epithelial cell groups as a minimum for adequacy.[4,6,7] The accuracy of FNAC is highest in centers with a multidisciplinary approach.[16-18] False-negative results are primarily due to sampling errors, especially in small lesions (<1.0 cm), which are harder to sample even with modern high-resolution ultrasonography.[19]

FNAC classifies lesions into five categories according to the International Academy of Cytology (IAC): C1 (inadequate), C2 (benign), C3 (probably benign), C4 (suspicious of malignancy), and C5 (malignant).[20,21] FNAC is widely used for diagnosing and managing breast cancer and can be especially beneficial for patients with advanced carcinoma or those unwilling to undergo surgery.[22-24] This study evaluates the cytomorphological patterns of various breast lesions using FNAC at a tertiary care center (Santosh Medical College), Ghaziabad, Uttar Pradesh.

AIM AND OBJECTIVES

- To correlate FNAC and histopathological findings in breast lesions.
- To assess the diagnostic accuracy of the FNAC procedure by histopathological correlation.
- To categorize breast lesions according to IAC Yokohama classification of breast lesions.

MATERIAL AND METHOD

A retrospective study was carried out in the Pathology Department over the span of one year, during which a total of 258 patients presenting with breast lesions underwent Fine Needle Aspiration Cytology (FNAC). The FNAC results for these patients were subsequently categorized according to the Yokohama classification system, which is widely recognized for its ability to systematically classify breast lesions based on cytological findings. Among these 258 cases, 136 patients had histopathological follow-up, allowing for a direct comparison between the initial FNAC diagnoses and the final histopathological results. This comparison provided valuable insights into the diagnostic accuracy and reliability of FNAC in the assessment of breast lesions, particularly in relation to its ability to predict or confirm malignancy when compared with the definitive histopathological diagnoses. The findings from this study contribute to the ongoing evaluation of FNAC as a diagnostic tool in clinical practice, highlighting its strengths and limitations in identifying various types of breast lesions.

RESULT

Table 1: Distribution of FNAC Categories (IAC Yokohama Classification)

Category	Number of Cases	Percentage (%)
C1 (Satisfactory)	136	100%
C2 (Benign)	92	68%
C3 (Atypical)	5	3.7%
C4 (Suspicious)	3	2%
C5 (Malignant)	36	26.3%

The above table illustrates that out of the total study participants, 136 cases (100%) were classified as C1 (Satisfactory), 92 cases (68%) were classified as C2 (Benign), 5 cases (3.7%) were classified as C3 (Atypical), 3 cases (2%) were classified as C4 (Suspicious), and 36 cases (26.3%) were classified as C5 (Malignant).

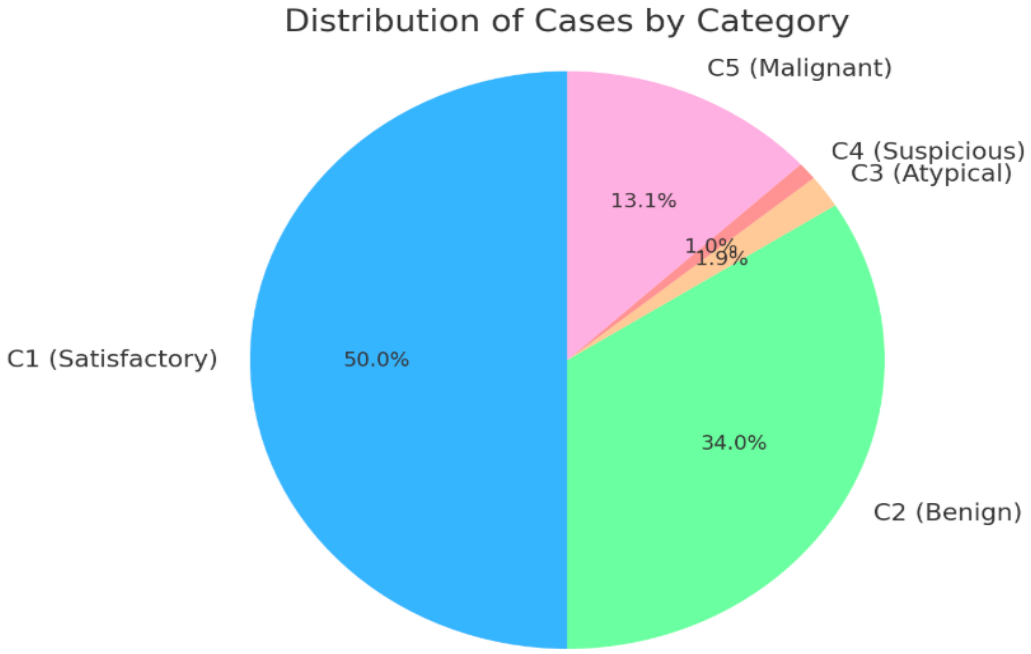


Table 2: Cyto-Histopathological Correlation

FNAC Category	Benign (Histopathology)	Malignant (Histopathology)	Total
C2 & C3 (Benign)	94 (TN)	3 (FN)	97
C4 & C5 (Malignant)	0 (FP)	39 (TP)	39
Total	94	42	136

The above table illustrates that out of the total study participants, 94 were classified as benign (C2 & C3) by FNAC, which were confirmed as benign by histopathology, and 3 were classified as benign (C2 & C3) by FNAC but were found to be malignant by histopathology. For the malignant category (C4 & C5), 39 were correctly identified as malignant by FNAC, while none were incorrectly classified as benign. The total number of participants was 136, with 94 benign and 42 malignant cases.

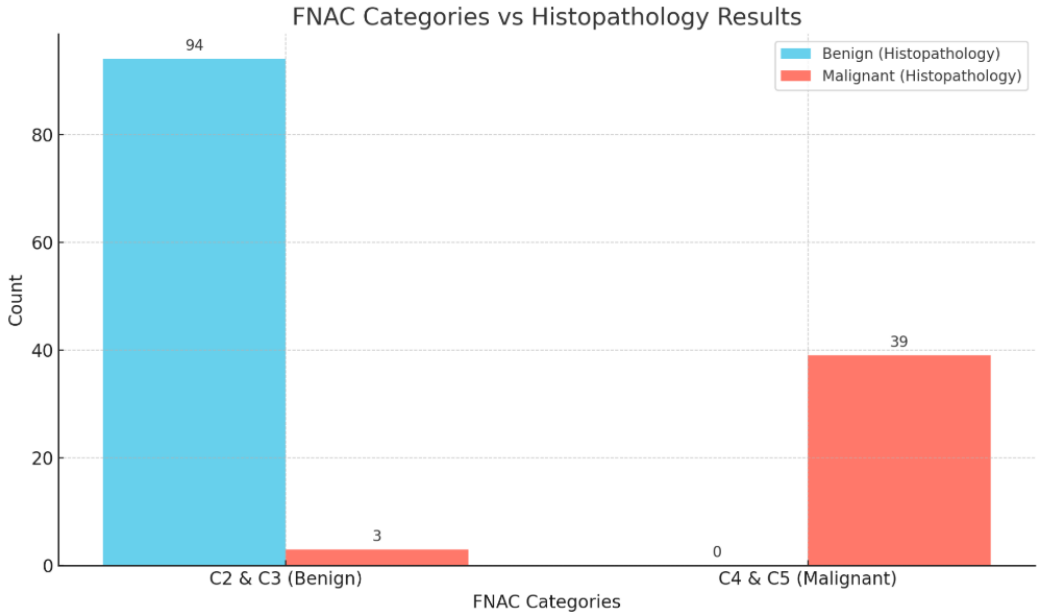


Table 3: Diagnostic Accuracy of FNAC

Parameter	**Value**
Sensitivity	92.86% (39/42)
Specificity	100% (94/94)
Positive Predictive Value	100% (39/39)
Negative Predictive Value	96.91% (94/97)
Overall Accuracy	**93.8%**

The above table illustrates that out of the total study participants, 94 were classified as benign (C2 & C3) by FNAC, which were confirmed as benign by histopathology, and 3 were classified as benign (C2 & C3) by FNAC but were found to be malignant by histopathology. For the malignant category (C4 & C5), 39 were correctly identified as malignant by FNAC, while none were incorrectly classified as benign. The total number of participants was 136, with 94 benign and 42 malignant cases.

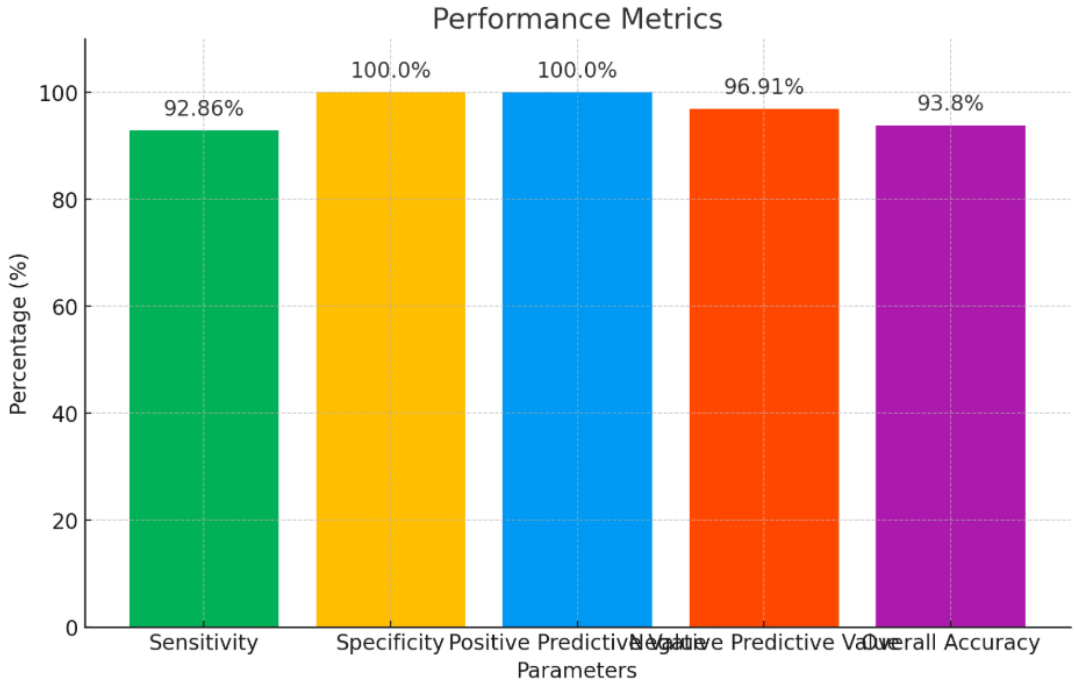


Table 4: Distribution of Histopathological Diagnoses

Diagnosis	Number of Cases	Percentage (%)
Benign	94	69.1%
Malignant	42	30.9%
Total	136	100%

The above table illustrates that out of the total study participants, 94 cases (69.1%) were diagnosed as benign and 42 cases (30.9%) were diagnosed as malignant, with a total of 136 cases.

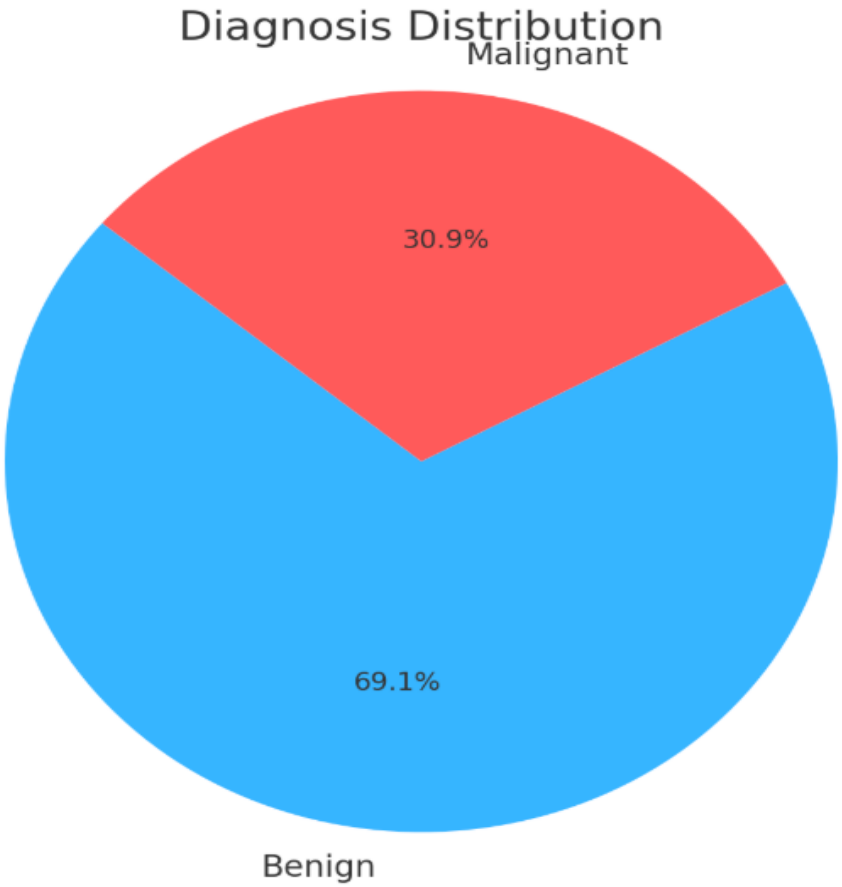


Table 5: Comparison of FNAC Categories with Histopathology

FNAC Category	Benign (HPE)	Malignant (HPE)	Total
C2 (Benign)	92	0	92
C3 (Atypical)	2	3	5
C4 (Suspicious)	0	3	3
C5 (Malignant)	0	36	36
Total	94	42	136

The above table illustrates that out of the total study participants, 92 were categorized as benign (HPE) under the FNAC category C2, 2 were categorized as atypical (C3), and 0 were categorized as suspicious (C4). Furthermore, 36 participants were categorized as malignant (HPE) under C5. The total number of study participants was 136, with 94 cases classified as benign and 42 cases classified as malignant.

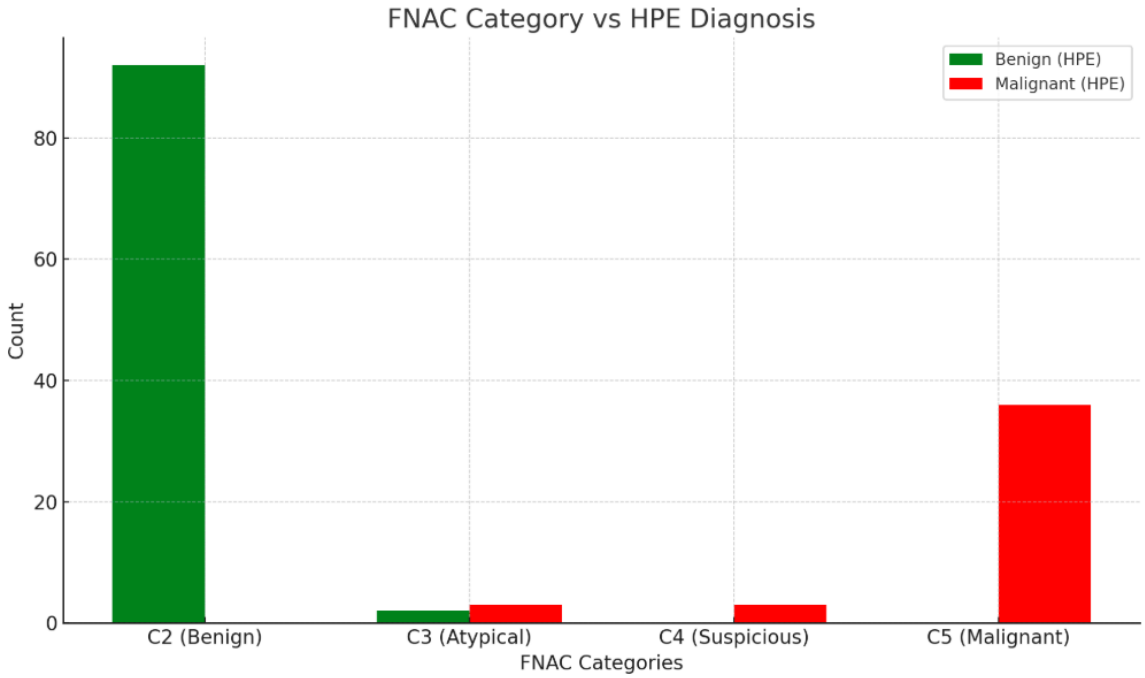
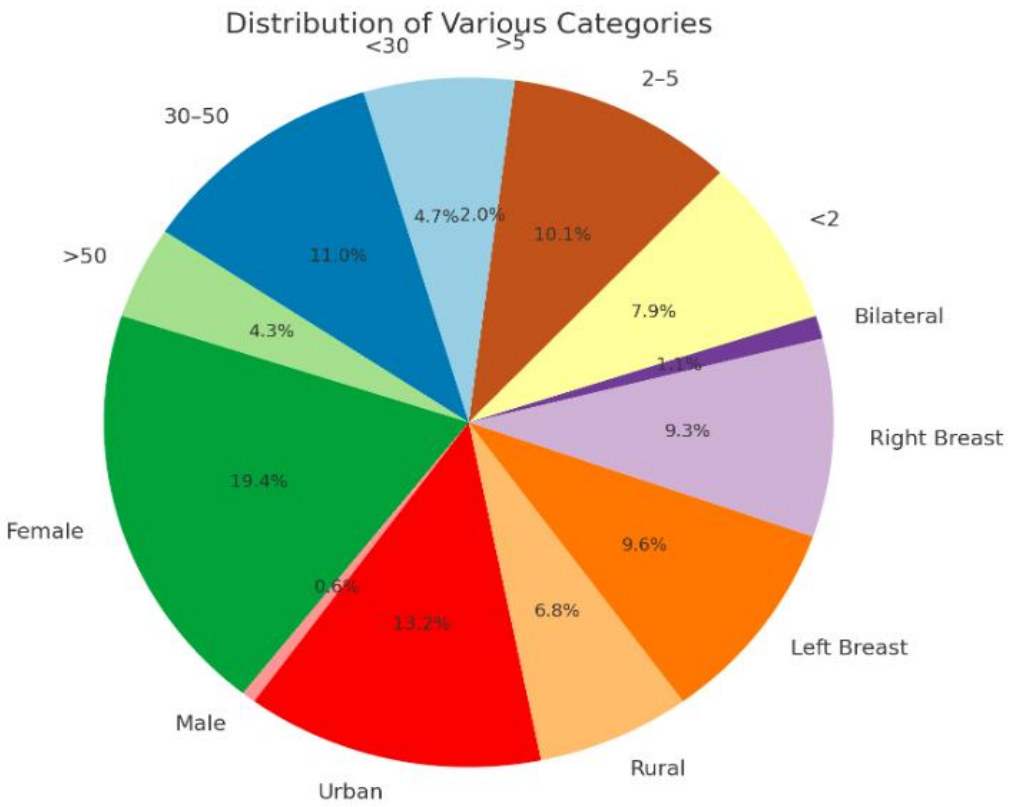


Table 6: Socio-Demographic Profile of Study Participants (n = 258)

Variable	Category	Number of Cases	Percentage (%)
Age (Years)	<30	60	23.3%
	30–50	142	55.0%
	>50	56	21.7%
Gender	Female	250	96.9%
	Male	8	3.1%
Residence	Urban	170	65.9%
	Rural	88	34.1%
Laterality	Left Breast	124	48.1%
	Right Breast	120	46.5%
	Bilateral	14	5.4%
Lesion Size (cm)	<2	102	39.5%
	2–5	130	50.4%
	>5	26	10.1%

The above table illustrates that out of the total study participants, 23.3% were under 30 years of age, 55.0% were between 30 and 50 years, and 21.7% were over 50 years of age. In terms of gender, 96.9% were female and 3.1% were male. Regarding residence, 65.9% of participants were from urban areas, while 34.1% were from rural areas. The laterality distribution showed that 48.1% had lesions in the left breast, 46.5% in the right breast, and 5.4% had bilateral lesions. For lesion size, 39.5% of participants had lesions smaller than 2 cm, 50.4% had lesions between 2–5 cm, and 10.1% had lesions larger than 5 cm.



DISCUSSION

In our study, all samples were classified as satisfactory (C1), reflecting good quality in sample collection and processing. Most cases (68%) were benign (C2), indicating that non-cancerous lesions are predominant. Atypical findings (C3) were rare, observed in 3.7% of cases, while suspicious lesions (C4) accounted for only 2%. Malignant cases (C5) made up 26.3% of the cohort, highlighting the importance of cytological evaluation for detecting cancer. These results underline the value of cytology in differentiating benign, atypical, suspicious, and malignant lesions, guiding appropriate management and treatment decisions. Panwar H et al.,[25] concluded that the IAC grading system on cytology showed variable results. For C1 (non-diagnostic), 1 case was benign, and 2 had non-representative samples. In C2 (benign), 74 cases were benign, with 112 cases showing no follow-up. C3 (atypical) had 10 benign cases and 3 with no follow-up. C4 (suspicious for malignancy) showed 3 malignant cases and 1 non-representative sample. C5 (malignant) had 19 malignant cases, all confirmed on histopathology. Overall, the IAC grading system was effective for diagnosing malignancy, especially in C5, but follow-up and handling of non-representative samples remain crucial.

In our study, we evaluated the diagnostic accuracy of FNAC in detecting breast lesions, comparing it to histopathological findings. Out of 136 cases, 97 were categorized as benign (C2 & C3) on FNAC, with 94 confirmed as true negatives (TN) by histopathology. Three cases were false negatives (FN). Among the malignant cases (C4 & C5 FNAC category), 39 were true positives (TP), and there were no false positives (FP). The findings suggest that FNAC is highly reliable in detecting malignancy, with a minimal rate of false negatives and no false positives in our study population. We did not find any relevant study which relates to Cyto-Histopathological Correlation.

In our study, the diagnostic accuracy of Fine Needle Aspiration Cytology (FNAC) was found to be highly promising. The sensitivity was 92.86%, meaning that FNAC correctly identified 39 out of 42 true positive cases. The specificity was 100%, indicating no false positives among the 94 true negative cases. The positive predictive value was also 100%, showing that all positive FNAC results were accurate. Additionally, the negative predictive value was 96.91%, reflecting a high rate of correctly identifying true negatives. Overall, the FNAC method demonstrated an impressive accuracy of

93.8%, supporting its reliability as a diagnostic tool. Brahmaiah J et al.,[26] concluded that the diagnostic performance of different scenarios was evaluated based on sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy. When considering C3, C4, and C5 as malignant, sensitivity was found to be 86.90%, with high specificity (95.10%) and NPV (96.30%). The diagnostic accuracy in this scenario was 93.30%. In contrast, when only C5 was considered malignant, the sensitivity decreased significantly to 34.80%, but the specificity and PPV remained perfect at 100%. This shows that while focusing on fewer categories of malignancy reduces sensitivity, it increases specificity and PPV.

In our study, the histopathological diagnoses revealed that the majority of cases (69.1%) were benign, while 30.9% were malignant. The fine needle aspiration cytology (FNAC) categories showed that out of the 94 benign cases, 92 were categorized as benign (C2), with two cases categorized as atypical (C3). For the malignant cases, 36 were categorized as malignant (C5), and three were suspicious (C4). The presence of atypical (C3) and suspicious (C4) categories reflects the diagnostic challenges that can arise, though the majority of cases in both benign and malignant categories were clearly defined by FNAC. The malignant group showed a higher proportion of C5 cases, which is consistent with the need for more aggressive diagnostic measures in such cases. Overall, this distribution emphasizes the diagnostic value of FNAC in identifying benign and malignant lesions, aligning with standard clinical expectations. Ibikunle DE et al.,[27] compared the diagnostic outcomes of fine needle aspiration cytology (FNAC) and histological evaluation, we observed a notable consistency and some disparities between the two methods. The FNAC identified 98 cases (60.9%) as benign (C2), which was slightly lower compared to 113 cases (70.2%) confirmed by histology. Notably, FNAC was unable to provide sufficient material in 2 cases (1.2%), categorized as C1, where histology had no such instances. Suspicious lesions potentially benign (C3) and potentially malignant (C4) were reported in 14 (8.7%) and 6 (3.7%) of FNAC cases, respectively, but these categories were not substantiated by histological findings. Malignant lesions (C5) were identified in 41 cases (25.5%) by FNAC and in 48 cases (29.8%) by histology, indicating a slightly higher detection rate in the latter. These findings highlight the complementary roles of FNAC and histology, where FNAC serves as a preliminary, less invasive technique, while histology provides a more definitive diagnosis, essential for planning appropriate management strategies.

In our study, the majority of cases were in the 30-50 age group, accounting for 55% of the participants, followed by those under 30 years (23.3%) and over 50 years (21.7%). This suggests that breast lesions are most common in women within the 30-50 year age range. A significant gender disparity was observed, with 96.9% of cases being female, highlighting the predominance of breast-related issues in women. Geographically, a higher proportion of patients resided in urban areas (65.9%) compared to rural areas (34.1%), which may reflect differences in access to healthcare facilities. In terms of laterality, 48.1% of cases involved the left breast, 46.5% the right, and 5.4% were bilateral, indicating that unilateral involvement is more common. Regarding lesion size, 50.4% of the cases had lesions between 2-5 cm, while smaller (<2 cm) and larger (>5 cm) lesions were found in 39.5% and 10.1% of cases, respectively. These findings offer insights into the characteristics of breast lesions in our population. Khanam KF et al.,[28] examined the distribution of breast lesions across various age groups among 50 patients. Most notably, individuals aged 12-20 years showed a high incidence of benign lesions (41.8%) with no cases of malignancy. This trend of predominantly benign cases persisted up to the 30-40 year age bracket. However, a significant shift was observed in the 41-50 year age group, where 57.1% of the lesions were malignant, contrasting with earlier age groups where malignancy was rare or absent. The size of the breast lump also provided critical insights; lumps measuring 2.1 to 3 cm exhibited the highest percentage of malignancy (26.32%), suggesting that larger lumps could be more prone to malignancy. Furthermore, the distribution of lumps was mostly in the upper-outer quadrant of the breast (48%), aligning with common clinical observations. These findings underscore the importance of vigilant screening and differential diagnosis in patients presenting with breast lumps, particularly in those over 40 years and those with lumps larger than 2 cm.

CONCLUSION

The findings of our study demonstrate the effectiveness of FNAC in diagnosing breast lesions. The majority of cases were classified as benign (C2) by FNAC, with 92% correctly identified, while 36 cases were classified as malignant (C5). Histopathological correlation further validated FNAC's accuracy, with 39 malignant cases and 94 benign cases confirmed. The diagnostic performance of FNAC was strong, with a sensitivity of 92.86%, specificity of 100%, and an overall accuracy of 93.8%. The socio-demographic profile of the study participants revealed that 96.9% were female, with a significant proportion (65.9%) residing in urban areas. In terms of lesion size, the majority had lesions in the 2–5 cm range (50.4%), with a smaller number of cases having lesions larger than 5 cm (10.1%). These results highlight the reliability of FNAC in both benign and malignant diagnoses, reinforcing its role as a key diagnostic tool in clinical practice for breast lesions.

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