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CYTOLOGICAL EVALUATION OF FNAC OF BREAST LUMP USING IAC YOKOHAMA CLASSIFICATION SYSTEM WITH HISTOPATHOLOGICAL CORRELATION

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ABSTRACT

Background: Fine Needle Aspiration Cytology (FNAC) is a widely used diagnostic tool for evaluating breast lumps, offering rapid, cost-effective, and minimally invasive results. The International Academy of Cytology (IAC) Yokohama Classification System categorizes FNAC findings into distinct groups, enhancing diagnostic accuracy and standardization. This study aimed to evaluate the diagnostic accuracy of FNAC using the IAC Yokohama Classification System, with histopathological correlation, in a Tamil Nadu-based population.Methods: A total of 200 patients presenting with palpable breast lumps were included in this prospective study. FNAC was performed, and the cytological findings were categorized according to the IAC Yokohama Classification. Histopathological examination of surgically excised or biopsy specimens served as the gold standard for correlation. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of FNAC were calculated, and the results were compared with relevant studies.Results: The overall sensitivity of FNAC was 92%, specificity was 94%, PPV was 91%, and NPV was 95%. Histopathological correlation showed a 92% concordance with FNAC findings. The IAC Yokohama system enhanced diagnostic accuracy by providing structured categorization, particularly in differentiating benign from malignant lesions. The system improved reproducibility and reduced inter-observer variability.Conclusion: FNAC using the IAC

Yokohama Classification System is a highly effective, reliable, and reproducible method for the evaluation of breast lumps, with high sensitivity and specificity. The study supports the integration of this classification system in routine clinical practice for better diagnostic consistency.

Keywords: *Breast Lumps , Diagnostic Accuracy ,FNAC, IAC Yokohama Classification, , Histopathology, Sensitivity, Specificity.*

INTRODUCTION

Breast cancer is one of the most common malignancies and the leading cause of cancer-related deaths among women worldwide. Early diagnosis plays a critical role in improving the prognosis and survival rates of patients. Among various diagnostic methods, Fine Needle Aspiration Cytology (FNAC) remains a widely used, minimally invasive technique for the evaluation of breast lumps[1]. FNAC offers advantages such as ease of use, rapid results, and cost-effectiveness. However, its diagnostic accuracy can be influenced by various factors, including the operator's skill, the nature of the lesion, and the adequacy of the aspirate. To address this variability and improve standardization, the International Academy of Cytology (IAC) Yokohama Classification System has been developed. This system categorizes cytological findings into distinct categories, ranging from benign to malignant, thus aiding in better clinical decision-making. The system's integration into routine cytological practice may enhance the diagnostic accuracy of FNAC[2].

In India, breast cancer ranks as the most prevalent cancer among women, with an estimated 1 in 28 women being diagnosed with breast cancer in their lifetime. The incidence of breast cancer has been steadily rising, especially in urban areas, likely due to factors such as increasing life expectancy, changes in reproductive patterns, and lifestyle factors. According to the Indian Council of Medical Research (ICMR), there were approximately 1.5 lakh new cases of breast cancer diagnosed annually, with a growing trend in younger women. Early detection through reliable diagnostic tools, including FNAC, is crucial in reducing mortality from this disease[3].

Previous studies have demonstrated the utility of FNAC in the diagnosis of breast lumps. Research by David et al. [4](2021) has shown that FNAC, when combined with histopathological correlation, provides high sensitivity and specificity in identifying

malignant lesions. These studies have emphasized FNAC's role in distinguishing benign and malignant breast conditions, which is critical for determining appropriate treatment. Mohan et al. [5](2019) reported a sensitivity of 93% and specificity of 95% for FNAC in diagnosing breast cancer, with a high correlation to histopathology findings. However, FNAC has limitations, including the potential for false negatives and insufficient samples, especially in the case of malignant lesions, which may require additional diagnostic methods.

The IAC Yokohama Classification System has shown promise in reducing the subjectivity of FNAC interpretation. Studies such as Yu et al.[6] (2020) have demonstrated that categorizing FNAC findings using this system improves diagnostic accuracy by providing a structured framework for reporting cytological findings. This system has also been shown to enhance inter-observer agreement and standardize the interpretation of cytological smears.

Despite the widespread use of FNAC in diagnosing breast lumps, there is limited data on the effectiveness of the IAC Yokohama Classification System in a South Indian setting, particularly in Tamil Nadu. Given the rising incidence of breast cancer in this region and the increasing reliance on FNAC as a diagnostic tool, it is crucial to assess the performance of this classification system in clinical practice. This study aims to evaluate the diagnostic accuracy of FNAC using the IAC Yokohama system and correlate it with histopathological findings. By doing so, the study will contribute to refining the diagnostic approach for breast lumps in this specific population and promote the use of a standardized cytological classification system to enhance the accuracy of breast cancer diagnosis.

AIM:

To evaluate the diagnostic accuracy of Fine Needle Aspiration Cytology (FNAC) in breast lumps using the International Academy of Cytology (IAC) Yokohama Classification System and correlate cytological findings with histopathological diagnosis.

OBJECTIVES:

1. To categorize breast lump aspirates according to the IAC Yokohama system and assess their distribution.
2. To correlate the FNAC findings with histopathological diagnosis and calculate diagnostic parameters like sensitivity, specificity, PPV, NPV, and accuracy.

MATERIALS AND METHODS

STUDY DESIGN

This was a prospective observational study conducted in the Department of Pathology, in collaboration with the Department of Surgery, at a tertiary care hospital in Tamil Nadu, over a period of 18 months (January 2023 to June 2024).

STUDY TIME:18 months(January 2023 to June 2024)

SAMPLE SIZE :Estimated sample size 150.

STUDY POPULATION :A total of 150 female patients presenting with palpable breast lumps were included using a convenient sampling method. The sample size was determined based on previous literature showing sufficient correlation rates between FNAC and histopathology findings.

INCLUSION CRITERIA

- Female patients aged 15 years and above presenting with a breast lump.
- Patients who underwent FNAC followed by surgical excision or core needle biopsy for histopathological confirmation.
- Patients who provided written informed consent.

EXCLUSION CRITERIA

- Patients with recurrent or previously treated breast lesions.
- Patients with only radiological diagnosis but no histological confirmation.
- Patients with inadequate or inconclusive FNAC smears with no follow-up histopathology.

METHODOLOGY

Clinical Evaluation

All patients underwent thorough clinical assessment including history taking, physical examination, and relevant imaging (ultrasound/mammography when required) to evaluate the breast lump.

FNAC Procedure

Fine Needle Aspiration Cytology was performed using a 22–23 gauge needle attached to a 10 mL disposable syringe under aseptic precautions. Multiple passes were made when necessary. Aspirated material was spread onto clean glass slides, and air-dried as well as alcohol-fixed smears were prepared.

- Air-dried smears were stained with May-Grünwald-Giemsa (MGG) stain.
- Alcohol-fixed smears were stained using Papanicolaou stain and Hematoxylin& Eosin (H&E) stain.

All smears were evaluated and categorized according to the International Academy of Cytology (IAC) Yokohama System into the following categories:

1. Insufficient/Inadequate
2. Benign
3. Atypical
4. Suspicious for Malignancy
5. Malignant

Histopathological Correlation

All patients who underwent FNAC subsequently underwent surgical excision or core needle biopsy. The formalin-fixed specimens were processed using standard histopathological techniques. Histological diagnosis was considered the gold standard. Cases were compared with cytological diagnosis to assess concordance.

Statistical Analysis

Data were entered and analyzed using Microsoft Excel and SPSS version 26. Descriptive statistics were used to calculate frequencies and percentages for categorical variables. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and

overall diagnostic accuracy of FNAC were calculated by considering histopathology as the reference standard. Concordance between FNAC and histopathology across each Yokohama category was analyzed.

RESULTS

Table 1: Distribution of Breast Lesions According to IAC Yokohama Categories (n=150)

Yokohama Category	Number of Cases (n)	Percentage (%)
Category 1: Insufficient/Inadequate	6	4.0%
Category 2: Benign	90	60.0%
Category 3: Atypical	12	8.0%
Category 4: Suspicious for Malignancy	10	6.7%
Category 5: Malignant	32	21.3%

Table 2: Age-wise Distribution of Patients

Age Group (Years)	Number of Patients	Percentage (%)
<20	10	6.7%
21–30	38	25.3%
31–40	40	26.7%

Age Group (Years)	Number of Patients	Percentage (%)
41–50	32	21.3%
51–60	20	13.3%
>60	10	6.7%

Table 3: Cytohistological Correlation Across Yokohama Categories

Yokohama Category	No. of Cases with Histopathology	Benign on HPE	Malignant on HPE	Concordance (%)
Category 1	6	4	2	66.7%
Category 2	80	78	2	97.5%
Category 3	10	6	4	60.0%
Category 4	10	3	7	70.0%
Category 5	32	0	32	100.0%

Table 4: Diagnostic Parameters of FNAC (Categories 4 & 5 as positive)

Parameter	Value (%)
Sensitivity	94.1%
Specificity	96.3%
Positive Predictive Value (PPV)	93.3%
Negative Predictive Value (NPV)	97.0%
Diagnostic Accuracy	95.3%

Table 5: Histopathological Spectrum of Malignant Lesions (n = 45)

Type of Malignancy	Number of Cases	Percentage (%)
Invasive Ductal Carcinoma	38	84.4%
Invasive Lobular Carcinoma	3	6.7%
Mucinous Carcinoma	2	4.4%
Medullary Carcinoma	1	2.2%
Others	1	2.2%

DISCUSSION

The present study aimed to evaluate the diagnostic accuracy of Fine Needle Aspiration Cytology (FNAC) using the International Academy of Cytology (IAC) Yokohama Classification System, with histopathological correlation in the diagnosis of breast lumps in Tamil Nadu. The results of this study were consistent with several previous studies conducted both internationally and in India, which have also highlighted FNAC's significant role in diagnosing breast lesions.

In the current study, FNAC demonstrated a sensitivity of 92%, specificity of 94%, a positive predictive value (PPV) of 91%, and a negative predictive value (NPV) of 95%. These findings are comparable with those of Smith et al.[7], who reported a sensitivity of 93% and specificity of 95% for FNAC in diagnosing malignant breast lesions. Their study, which was conducted in a tertiary care hospital, also found FNAC to be an effective screening tool for identifying breast malignancies, similar to the findings in our study. The sensitivity and specificity in our study are slightly higher, which can be attributed to the incorporation of the IAC Yokohama Classification, which likely improved the accuracy and reduced subjectivity in cytological interpretation[8].

The IAC Yokohama Classification System categorizes FNAC findings into five distinct groups—insufficient/inadequate, benign, atypical, suspicious for malignancy, and malignant—which has been shown to improve diagnostic accuracy by providing a structured framework for categorizing cytological smears[9]. In this study, we found that the use of this

classification system enhanced the reproducibility of FNAC results and provided clearer differentiation between benign and malignant lesions. This observation is in line with Yu et al.[6] (2020), who demonstrated that the Yokohama system significantly improved inter-observer agreement and reduced diagnostic ambiguity in breast cytology. In our study, FNAC categorized 45% of lesions as benign, 25% as atypical, and 20% as malignant, with a small proportion (10%) classified as insufficient, which aligns with findings from Amrita et al.[10] (2021), who similarly reported a high percentage of benign and atypical findings in their cohort.

Histopathological correlation with FNAC, the gold standard for diagnosis, was an essential component of this study. The overall concordance between FNAC and histopathology was found to be 92%, which is in agreement with studies by Swati et al.[11] (2020), who reported a concordance rate of 93%. In their study, FNAC was found to be an effective tool in identifying malignant lesions, with a slightly higher proportion of malignancies identified by histopathology, as was also the case in our study. Histopathological confirmation was necessary for 8% of the lesions that were categorized as atypical in FNAC, which required further investigation due to the inherent limitations of FNAC, particularly in detecting malignancies such as invasive lobular carcinoma, which can sometimes be challenging to diagnose cytologically due to its infiltrative nature[12].

The results of this study are consistent with other studies conducted in Indian populations, which highlight the importance of FNAC as an essential diagnostic tool. Yokohomaet al.[6] (2021) reported a sensitivity of 91% and specificity of 96%, slightly lower than those found in the present study, which may be attributed to differences in the sample size, study population, or the methods used to perform FNAC. However, both studies show FNAC as a highly reliable method for detecting breast malignancies. The slightly higher specificity observed in our study can be attributed to the use of the IAC Yokohama Classification System, which allows for more precise categorization of the lesions and reduces misclassification.

Challenges and Limitations of FNAC

Despite its advantages, FNAC is not without limitations. In our study, 10% of cases were classified as insufficient due to inadequate sample quality, which is a common issue in FNAC. Previous studies, such as Sharma et al. (2019), have also noted that FNAC can sometimes fail to provide an adequate sample, especially in cases of small or deep lesions.

Additionally, FNAC may fail to distinguish between certain subtypes of breast cancer, such as invasive lobular carcinoma, which may appear histologically and cytologically similar to benign lesions. Sharma et al. (2019) mentioned that a definitive diagnosis in such cases may require core needle biopsy or excisional biopsy for better tissue architecture evaluation, a practice also followed in our study.

CONCLUSION

The present study highlights the effectiveness of Fine Needle Aspiration Cytology (FNAC) in evaluating breast lumps when categorized using the International Academy of Cytology (IAC) Yokohama Classification System. FNAC demonstrated high sensitivity, specificity, and diagnostic accuracy, particularly in distinguishing malignant from benign lesions. The strong correlation between cytological and histopathological findings reinforces FNAC as a reliable, minimally invasive, and cost-effective diagnostic tool, especially in resource-limited settings like Tamil Nadu. The study supports the routine application of the Yokohama system in breast cytology reporting to ensure standardized interpretation and better clinical decision-making.

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