



# Utility of Fine Needle Aspiration Cytology in Diagnosing Breast Lesions Reported by the Yokohama System in Females: An Observational Study in a Tertiary Care Hospital of North East India

<sup>1\*</sup>Dr. Tushar Ghosh, <sup>2</sup>Dr. Pinki Chakma, <sup>3</sup>Dr. Shreyoshi Dhar, <sup>4</sup>Dr. Kulashkekhar Bhattacharjee

<sup>1</sup>MD Pathology, Senior Resident, Dept. of Pathology, Agartala Government Medical College & Gobind Ballabh Pant Hospital, Agartala (Tripura), 799006, India

<sup>2</sup>MD Pathology, Medical Officer, Indira Gandhi Memorial Hospital, Agartala (Tripura), 799001, India

<sup>3</sup>MD Pathology, Senior Resident, Dept. of Pathology, Agartala Government Medical College & Gobind Ballabh Pant Hospital, Agartala (Tripura), 799006, India

<sup>4</sup>MD Pathology, Associate Professor, Dept. of Pathology, Agartala Government Medical College & Gobind Ballabh Pant Hospital, Agartala (Tripura), 799006, India



**Correspondence:**  
Dr. Tushar Ghosh

**Received:** January 08, 2026

**Revised:** January 29, 2026

**Accepted:** February 04, 2026

**Published:** February 14, 2026

## Abstract

**Background:** Breast lesions represent a wide cytomorphological spectrum ranging from benign to malignant conditions. Fine Needle Aspiration Cytology (FNAC), when reported using the International Academy of Cytology (IAC) Yokohama System, provides a standardized framework for diagnosis and risk stratification. This study aimed to evaluate the cytological spectrum of breast lesions and assess the diagnostic performance of FNAC using histopathology as the gold standard. **Methods:** This cross-sectional observational study was conducted in the Department of Pathology, Agartala Government Medical College, Tripura, from October 2022 to September 2025. A total of 538 female patients undergoing FNAC for breast lesions were included. Smears were reviewed and categorized according to the IAC Yokohama System (Categories C1–C5). Histopathological correlation was available in 326 cases. For statistical analysis, Categories C4 and C5 were considered positive for malignancy, while C1, C2, and C3 were considered negative. **Results:** The mean age of patients was 36.43 years (range: 12–80 years). Most cases were categorized as benign (C2: 70.6%), followed by malignant (C5: 20.1%). Among benign lesions, fibroadenoma was the most common diagnosis (53.9%), whereas ductal carcinoma was the predominant malignant lesion (88%). Histopathological correlation demonstrated a sensitivity of 94.0%, specificity of 98.4%, positive predictive value of 97.7%, negative predictive value of 95.9%, and overall diagnostic accuracy of 96.6%. **Conclusion:** The IAC Yokohama System provides a reliable and reproducible framework for reporting breast FNAC. FNAC demonstrated high sensitivity and specificity in detecting malignant breast lesions, reinforcing its value as an effective, cost-efficient diagnostic tool in tertiary care settings.

**Keywords:** Breast cytology, Yokohama reporting system, Fibroadenoma, Ductal carcinoma, Sensitivity & Specificity.



This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).

## INTRODUCTION

Breast cancer has emerged as the most frequently diagnosed malignancy in the female population worldwide, with a particularly high disease burden in transitioning economies like India.<sup>1</sup> In the Indian subcontinent, the disease is characterized by a "left shift" in age distribution, with a significant proportion of patients presenting in the third and fourth decades of life.<sup>2</sup> The "Triple Assessment" protocol—integrating clinical, radiological, and pathological findings—is the standard of care for evaluating breast masses.<sup>3</sup> Fine Needle Aspiration Cytology (FNAC) remains a pivotal component of this triad, especially in resource-limited settings, due to its cost-effectiveness and rapid turnaround time.<sup>4,5</sup>

To address the historical lack of diagnostic uniformity in breast cytology, the International Academy of Cytology (IAC) introduced the Yokohama System for Reporting Breast Cytopathology.<sup>6</sup> This framework provides a standardized five-tier reporting structure: Category 1 (Insufficient), Category 2 (Benign), Category 3 (Atypical), Category 4 (Suspicious), and Category 5 (Malignant).<sup>7</sup> By defining clear cytomorphological criteria for each category, the system aims to enhance the reproducibility of reports and improve clinician-pathologist communication.<sup>8,9</sup>

While Core Needle Biopsy (CNB) has gained popularity for its ability to provide histological architecture, recent studies demonstrate that when the

Yokohama system is applied, FNAC achieves comparable diagnostic accuracy for initial screening.<sup>10,11</sup> The present 3-year retrospective study evaluates the utility of the IAC Yokohama system in 538 female patients, focusing on the diagnostic sensitivity and specificity achieved through histopathological correlation in a tertiary care setting.

## OBJECTIVES

1. To determine the cytological spectrum of breast lesions in females.
2. To estimate the Sensitivity (Sn) and Specificity (Sp) of FNAC for the detection of malignant breast lesions in females based on the IAC Yokohama System for Reporting Breast Cytopathology, taking histopathological examination as the gold standard.

## MATERIALS AND METHODS

**Study Design-** Cross-sectional study

**Study Type-** Observational study.

**Study Setting-** The study was carried out in the Department of Pathology, Agartala Government Medical College (AGMC & GBPH), Agartala, Tripura.

**Study Period-** October 2022 to September 2025.

## RESULTS

The present observational study evaluated 538 female patients presenting with breast lesions at the cytology section of the Department of Pathology of our institute from October 2022 to December 2025.

### 1. Demographic and Clinical Profile

**Age Range:** The study cohort included females aged 12 to 80 years.

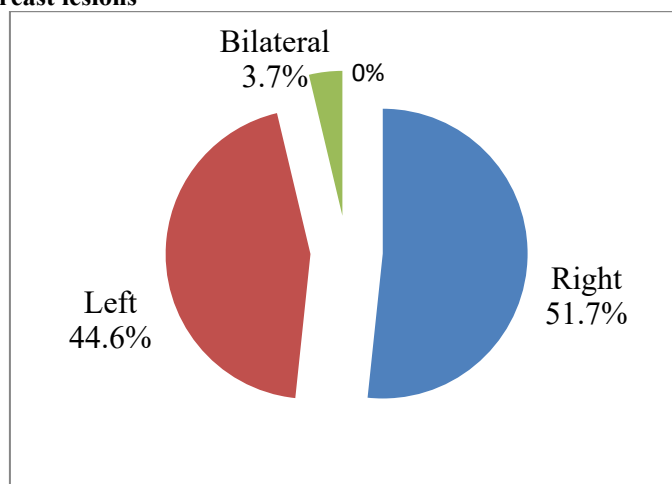
**Mean and Median Age:** The mean age was calculated at 36.43 years, with a median age of 34 years.

**Laterality:** Right breast: 278 cases (51.7%)

Left breast: 240 cases (44.6%)

Bilateral: 20 cases (3.7%)

**Pie chart 1: Laterality of breast lesions**



### 2. Distribution by IAC Yokohama Categories

All 538 cases were categorized according to the International Academy of Cytology (IAC) Yokohama System. The distribution across age groups is summarized below (Table 1):

**Study Population-** Female patients who visited the cytology section of the Department of Pathology for FNA of breast lesions as a diagnostic workup during the above period.

### Exclusion Criteria-

The cases with lost or damaged cytological materials were excluded from the study.

**Sample Size-** 538 (determined based on records of cytology section, Department of Pathology, AGMC and GBPH).

**Sampling Technique-** Census sampling.

**Study Procedure-** All cytology smears of breast lesions were retrieved, reviewed, and re-evaluated by three pathologists, and after reviewing, each case was assigned to one of the five categories after application of strict criteria given by the Yokohama System for Reporting Breast Cytopathology. The review was done blindly, independent of the previous cytological diagnosis of cases or histopathological diagnosis. All cases were evaluated in reference to the side of involvement, age of the patient, and type of lesion. The cytological diagnoses were then compared with histopathological findings, wherever available.

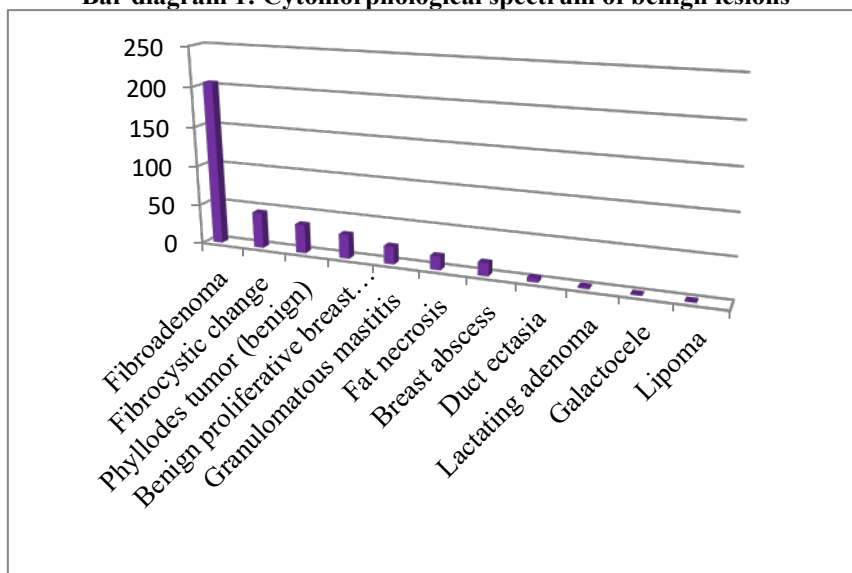
**Table 1: Category and age-wise distribution of cases**

| Age range  | Cat 1 | Cat 2 | Cat 3 | Cat 4 | Cat 5 | Total (n) |
|------------|-------|-------|-------|-------|-------|-----------|
| 0-20       | 3     | 76    | 1     | 0     | 0     | 80        |
| 21-30      | 4     | 122   | 2     | 0     | 0     | 128       |
| 31-40      | 3     | 118   | 4     | 5     | 15    | 145       |
| 41-50      | 2     | 40    | 3     | 7     | 32    | 84        |
| 51-60      | 1     | 16    | 3     | 5     | 39    | 64        |
| 61-70      | 1     | 6     | 1     | 3     | 14    | 25        |
| >70        | 0     | 2     | 1     | 1     | 8     | 12        |
| Total (n)  | 14    | 380   | 15    | 21    | 108   | 538       |
| Percentage | 2.6 % | 70.6% | 2.8%  | 3.9%  | 20.1% | 100%      |

**Table 2: Cytomorphological spectrum of benign lesions (Category C2: n=380)**

| Benign lesions                      | Number | Percentage |
|-------------------------------------|--------|------------|
| Fibroadenoma                        | 205    | 53.9%      |
| Fibrocystic change                  | 45     | 11.8%      |
| Phyllodes tumor (benign)            | 36     | 9.5%       |
| Benign proliferative breast disease | 30     | 7.9%       |
| Granulomatous mastitis              | 22     | 5.8%       |
| Fat necrosis                        | 17     | 4.5%       |
| Breast abscess                      | 16     | 4.2%       |
| Duct ectasia                        | 5      | 1.3%       |
| Lactating adenoma                   | 2      | 0.5%       |
| Galactoceles                        | 1      | 0.3%       |
| Lipoma                              | 1      | 0.3%       |
| Total                               | 380    | 100%       |

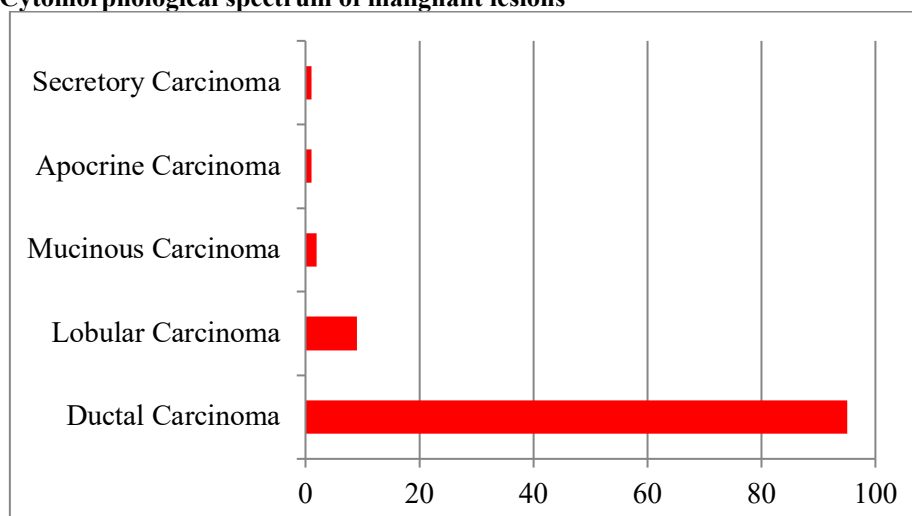
**Bar diagram 1: Cytomorphological spectrum of benign lesions**



**Table 3: Cytomorphological spectrum of benign lesions (Category C5: n=108)**

| Malignant lesions   | Number | Percentage |
|---------------------|--------|------------|
| Ductal Carcinoma    | 95     | 88%        |
| Lobular Carcinoma   | 9      | 8.3%       |
| Mucinous Carcinoma  | 2      | 1.9%       |
| Apocrine Carcinoma  | 1      | 0.9%       |
| Secretory Carcinoma | 1      | 0.9%       |
| Total               | 108    | 100%       |

**Bar diagram 2: Cytomorphological spectrum of malignant lesions**



### 3. Diagnostic Performance (Histopathological Correlation)

Out of 538 cases, histopathological correlation was available for 326 cases. For statistical analysis, Categories C4 and C5 were considered "Positive" for malignancy, while C1, C2, and C3 were considered "Negative".

**Table 4: 2x2 table for Sensitivity and Specificity**

|                          | HPE Malignant | HPE Benign | Total |
|--------------------------|---------------|------------|-------|
| FNAC Positive (C4+C5)    | 126           | 3          | 129   |
| FNAC Negative (C1+C2+C3) | 8             | 189        | 197   |
| Total                    | 134           | 192        | 326   |

Calculated Statistical Metrics:

Sensitivity: 94.0%

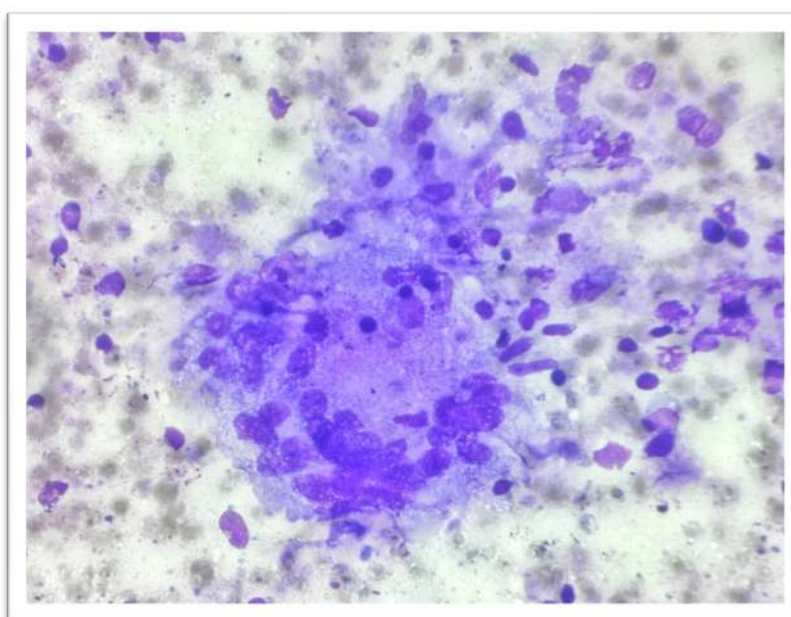
Specificity: 98.4%

Positive Predictive Value (PPV): 97.7%

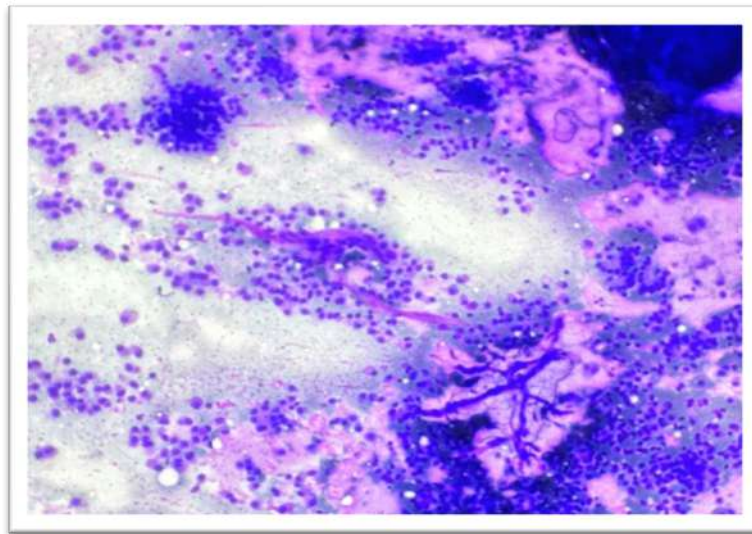
Negative Predictive Value (NPV): 95.9%

Diagnostic Accuracy: 96.6

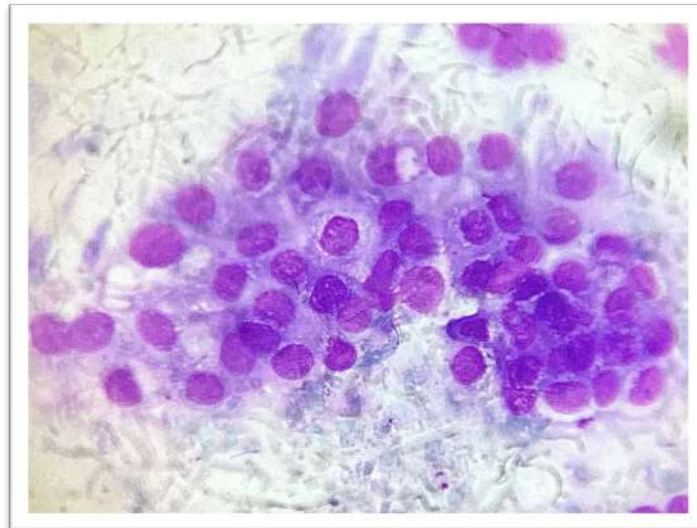
### Images



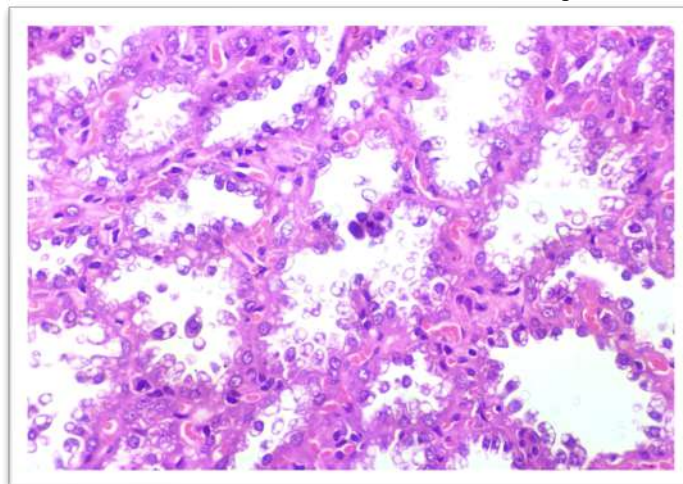
**Figure 1.** 400x view of Giemsa-stained FNAC smear of Granulomatous mastitis



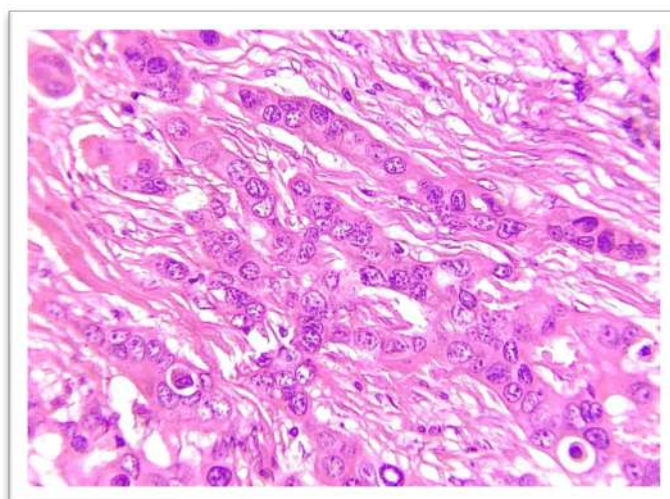
**Figure 2.** 40x view of Giemsa-stained FNAC smear of Mucinous carcinoma



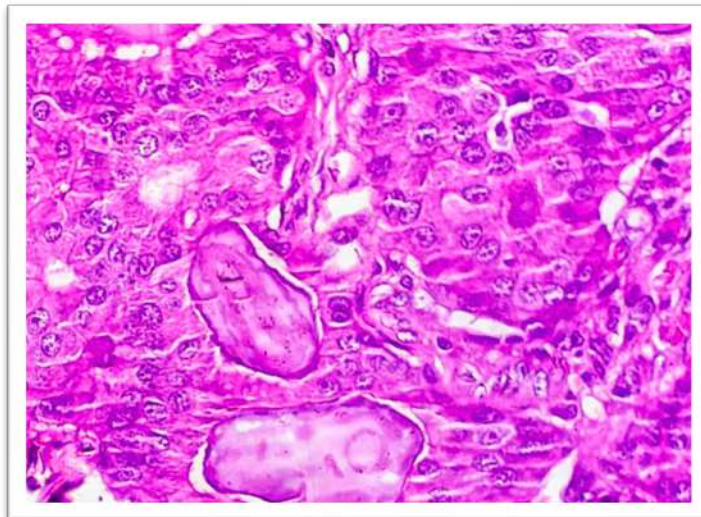
**Figure 3.** 400x view of Giemsa-stained FNAC smear of Apocrine carcinoma



**Figure 4.** 100x view of H&E stained Histopathology slide of Lactating Adenoma



**Figure 5.** 400x view of H&E-stained Histopathology slide of Lobular carcinoma



**Figure 6.** 400x view of H&E-stained Histopathology slide of Secretory carcinoma

## DISCUSSION

The present study assessed the utility of FNAC categorized according to the International Academy of Cytology (IAC) Yokohama System in 538 female patients presenting with breast lesions, with histopathological correlation available in a substantial subset of cases.

The demographic profile of the study population revealed a wide age range (12–80 years), with a mean age of 36.43 years, reflecting the younger age at presentation commonly observed in Indian women. This finding supports previous Indian studies that have highlighted a “left shift” in the age distribution of breast lesions compared to Western populations, where breast malignancies are more frequently diagnosed in older age groups.<sup>12,13</sup>

Application of the Yokohama System demonstrated that the majority of cases fell into Category C2 (Benign), accounting for 70.6% of cases, followed by Category C5 (Malignant) in 20.1%. This distribution is comparable to findings reported by Hoda et al. and Wong et al., who also documented a predominance of benign lesions when FNAC was used as the primary diagnostic modality.<sup>7,8</sup> The relatively low proportion of indeterminate categories (C3: 2.8% and C4: 3.9%) in the present study suggests good sampling adequacy and interpretative confidence, underscoring the practicality of the Yokohama system in routine cytology practice.

Among benign lesions, fibroadenoma was the most frequently encountered diagnosis (53.9%), followed by fibrocystic change and benign phyllodes tumor. This pattern mirrors the established epidemiology of breast lesions in young females and agrees with multiple Indian and international studies.<sup>14,15,16</sup>

Ductal carcinoma emerged as the most common malignant lesion (88%), followed by lobular carcinoma (8.3%). This distribution aligns well with the known prevalence of invasive ductal carcinoma as the dominant histological subtype worldwide.<sup>17</sup> The low frequency of special carcinomas such as mucinous, secretory, and apocrine carcinoma is consistent with their recognized rarity.

Histopathological correlation, available in 326 cases, allowed robust evaluation of the diagnostic performance of FNAC. When Categories C4 and C5 were considered positive for malignancy, FNAC demonstrated a high sensitivity (94.0%) and specificity (98.4%), with an overall diagnostic accuracy of 96.6%. These values are comparable to, and in some instances exceed, those reported in earlier studies evaluating FNAC using the Yokohama system.<sup>8,9,18,19,20</sup> False-negative cases in the present study were largely attributable to sampling error and overlapping cytomorphological features in low-grade malignancies, a limitation well-documented in breast cytology.<sup>21</sup>

## CONCLUSION

The findings of this observational study underscore the high diagnostic utility of the IAC Yokohama System for Reporting Breast Cytopathology in a tertiary care setting. By applying a standardized five-tier framework to a cohort of 538 cases, the system facilitated clear communication between pathologists and clinicians, effectively bridging the gap between initial screening and definitive management.

The demographic analysis revealed a significant prevalence of benign breast lesions in younger females, particularly those under 30 years of age, where Fibroadenoma was the most common diagnosis and malignancy was notably absent. Conversely, the likelihood of malignancy increased sharply with age, with Ductal Carcinoma (NST) emerging as the predominant malignant subtype in older age groups.

Based on the histopathological correlation of 326 cases, the IAC Yokohama System demonstrated exceptional diagnostic performance:

**Sensitivity:** 94.0%, indicating high efficiency in detecting malignant lesions.

**Specificity:** 98.4%, highlighting the system's reliability in identifying benign conditions and preventing unnecessary surgical interventions.

**Overall Diagnostic Accuracy:** 96.6%.

In conclusion, the IAC Yokohama System is a robust, reproducible, and highly accurate method for reporting breast FNAC. Its implementation in routine practice, especially in high-volume hospitals, enhances diagnostic precision and ensures safer, more efficient patient care.

## REFERENCES

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin.* 2021;71(3):209-49.
2. Mehrotra R, Yadav K. Breast cancer in India: Present scenario and the challenges ahead. *World J Clin Oncol.* 2022;13(3):209-18.
3. Hermansen C, Skovgaard Poulsen H, Jensen J, Langfeldt B, Steenskov V, Frederiksen P, et al. Diagnostic reliability of combined physical examination, mammography, and fine-needle puncture ("triple-test") in breast tumors. A prospective study. *Cancer.* 1987;60(8):1866.
4. Mitra S, Dey P. Fine-needle aspiration and core biopsy in the diagnosis of breast lesions: A comparison and review of the literature. *Cytojournal.* 2016;13:18.
5. Mendoza P, Lacambra M, Tan PH, Tse GM. Fine needle aspiration cytology of the breast: the nonmalignant categories. *Patholog Res Int.* 2011;2011:547580.
6. Field AS, Raymond WA, Rickard M, Arnold L, Brachtel EF, Chaiwun B, et al. The International Academy of Cytology Yokohama System for Reporting Breast Fine-Needle Aspiration Biopsy Cytopathology. *Acta Cytol.* 2019;63(4):257-73.
7. Hoda RS, Brachtel EF. International Academy of Cytology Yokohama System for Reporting Breast Fine-Needle Aspiration Biopsy Cytopathology: A Review of Predictive Values and Risks of Malignancy. *Acta Cytol.* 2019;63(4):292-301.
8. Wong S, Rickard M, Earls P, Arnold L, Bako B, Field AS. The International Academy of Cytology Yokohama System for Reporting Breast Fine Needle Aspiration Biopsy Cytopathology: A Single Institutional Retrospective Study of the Application of the System Categories and the Impact of Rapid Onsite Evaluation. *Acta Cytologica.* 2019;63(4):280-91.

**Citation:** Ghosh T, Chakma P, Dhar S, Bhattacharjee K Utility of Fine Needle Aspiration Cytology in Diagnosing Breast Lesions Reported by the Yokohama System in Females: An Observational Study in a Tertiary Care Hospital of North East India. *Int. J. Med.*, 2026;**8**(2):133-144.

---

9. Montezuma D, Malheiros D, Schmitt FC. Breast Fine Needle Aspiration Biopsy Cytology Using the Newly Proposed IAC Yokohama System for Reporting Breast Cytopathology: The Experience of a Single Institution. *Acta Cytol.* 2019;1-6.
10. Ahmed HG, Ali AS, Almobarak AO. Utility of fine-needle aspiration as a diagnostic technique in breast lumps. *Diagn Cytopathol.* 2009;37:881-4.
11. Agarwal A, Singh D, Mehan A, Paul P, Puri N, Gupta P et al. Accuracy of the International Academy of Cytology Yokohama system of breast cytology reporting for fine needle aspiration biopsy of the breast in a dedicated breast care setting. *Diagn Cytopathol.* 2021;49(2):195-202.
12. Malvia S, Bagadi SA, Dubey US, Saxena S. Epidemiology of breast cancer in Indian women. *Asia Pac J Clin Oncol.* 2017;13(4):289-95.
13. Chopra R. The Indian scene. *J Clin Oncol.* 2001;19(18 Suppl):106S-11S.
14. Tiwari M. Role of fine needle aspiration cytology in diagnosis of breast lumps. *Kathmandu Univ Med J (KUMJ).* 2007;5(2):215-7.
15. Chakravarthi DS, Shankar SV, Bhargavi NV. A study on modified triple assessment (clinical breast examination, ultrasonography, and fine needle aspiration cytology) in the diagnosis of palpable breast lumps. *Indian J Appl Res.* 2022;12(11):36-7.
16. Pandey D, Singh NK, Usha, Kotashane VD. Clinico-pathological study of breast lesions at a tertiary care teaching institute. *Int J Acad Med Pharm* 2023; 5 (5); 479-85.
17. Schnitt SJ, Collins LC. Biopsy interpretation of the breast. 2nd ed. Philadelphia: Wolters Kluwer; 2013.
18. Yadav A, Singh A, Madaan S, Pujani M, Raychaudhuri S, Agarwal C, et al. International Academy of Cytology Yokohama System for Reporting Breast Cytology and the ACR Breast Imaging Reporting and Data System (BIRADS): Are they Concordant? *Iran J Pathol.* 2024 Fall;19(4):400-7.
19. Madubogwu CI, Ukah CO, Anyanwu S, Chianakwana GU, Onyiaorah IV, Anyiam D. Sub-classification of Breast Masses by Fine Needle Aspiration Cytology. *Eur J Breast Health.* 2017 Oct 1;13(4):194-9.
20. Kane G, Fleming C, Heneghan H, McCartan D, James P, Trueick R, et al. False-negative rate of ultrasound-guided fine-needle aspiration cytology for identifying axillary lymph node metastasis in breast cancer patients. *Breast J.* 2019;25(5):848-52.
21. Orell SR, Sterrett GF, Whitaker D. Fine Needle Aspiration Cytology. 5th ed. Philadelphia: Churchill Livingstone Elsevier; 2012.