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Original Research Article

Observational study of IAC Yokohama reporting system of breast cytology along with histopathological correlation at tertiary care hospital

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ABSTRACT

Background: The International Academy of Cytology (IAC) Yokohama system categorizes FNAC reports into five clearly defined categories with each category is associated with an estimated Risk of Malignancy (ROM) and corresponding clinical management guidelines. The present study is undertaken to evaluate and categorise breast FNAC lesions and correlate these findings with subsequent histopathological diagnoses to assess the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and ROM of FNAC under the IAC Yokohama reporting framework.
Methods: Total 322 cases of cytologically diagnosed breast lesions were included in this observational cross-sectional study at Department of Pathology, Government Medical College, Majuragate, Surat, Gujarat during the period from January 2023 to June 2024 and correlated with corresponding paraffin-embedded sections, where applicable and biopsy follow up was available.
Results: ROM was highest in Category 4 and Category 5 category (100%), followed by Category 3 (60%) and Category 2 (0%). In present study, sensitivity was 100%, specificity was 96.49%, positive predictive value (PPV) was 93.55% negative predictive value (NPV) was 100% and Diagnostic Accuracy was 97.33%, evaluated by considering cases with category of Atypical (C3), Suspicious of Malignancy (C4) and Malignant (C5) as positive in cytological screening test.
Conclusions: IAC Yokohama System represents a simple system that allows greater diagnostic clarity and, consequently, better communication between pathologists and treating clinicians, with clear benefits for patient management.

Keywords: Breast FNAC, Malignancy, Risk of malignancy, Yokohama system

INTRODUCTION

Breast cancer is a significant public health concern and ranks as the most common cancer among women globally, both in developed and developing nations.[1] In India, breast cancer has witnessed a sharp increase in incidence over the past two decades, overtaking cervical cancer as the leading malignancy in women.[2] The age-adjusted incidence rate is reported to be 26 per 100,000 women, while the mortality rate stands at 13 per 100,000 women, reflecting a significant burden of disease.[3] This upward trend in breast cancer incidence in India is multifactorial. Contributing factors include increasing urbanization, late age at first childbirth, reduced parity, sedentary lifestyles, dietary changes, obesity, and hormonal imbalances.[4] Despite growing awareness, a majority of breast cancer cases in India continue to be diagnosed at advanced stages (Stage III or IV), unlike developed nations where screening and

early detection programs allow diagnosis at an earlier, more treatable stage. Hence, early detection remains the most crucial strategy to reduce mortality and improve survival in breast cancer patients.[5] The triple assessment for a lump in the breast is standard practice and the robustness of assessment towards the diagnosis of breast cancer is crucial. The combination of the modalities, physical examination, imaging (mammogram and ultrasound), and fine-needle aspiration cytology (FNAC) is more accurate than any modality alone. Fine Needle Aspiration Cytology (FNAC) has emerged as a rapid, simple, minimally invasive, and cost-effective technique for the initial assessment of palpable breast masses. It can be performed on an outpatient basis, does not require anaesthesia, and causes minimal discomfort.[8] FNAC when performed in adequate conditions has good accuracy. The aspirated specimen can also be processed as a cellblock that can then be used for immunohistochemical analysis of related biomarkers (e.g., estrogen receptor, progesterone receptor, and Her-2). Recognizing the need for standardized, reproducible, and clinically relevant cytological reporting, the International Academy of Cytology Yokohama System (IACYS) for reporting breast FNAC was introduced in 2016. The IAC Yokohama system categorizes FNAC reports into five clearly defined categories: Category 1 (C1): Insufficient/Inadequate material, Category 2 (C2): Benign, Category 3 (C3): Atypical, probably benign, Category 4 (C4): Suspicious of malignancy and Category 5 (C5): Malignant. Each category is associated with an estimated Risk of Malignancy (ROM) and corresponding clinical management guidelines.[10] The application of the Yokohama system in routine diagnostic practice has shown to improve reporting uniformity, streamline communication between cytologists and clinicians, and enhance patient outcomes by minimizing diagnostic delays and unnecessary procedures.[11] Histopathology not only confirms the presence of malignancy but also provides detailed information about tumour type, grade, lympho-vascular invasion, and hormone receptor status, which are crucial for tailoring treatment strategies.[12] Therefore correlating FNAC findings with histopathological outcomes becomes imperative to assess the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of FNAC under the IAC Yokohama reporting framework.[13] Hence, the present study is undertaken to evaluate the spectrum of breast lesions using FNAC, categorize them according to the IAC Yokohama System, and correlate these findings with subsequent histopathological diagnoses to assess the diagnostic performance of FNAC.

METHODS

Total 322 cases of cytologically diagnosed breast lesions were included in this observational cross-sectional study at Department of Pathology, Government Medical College, Majuragate, Surat, Gujarat during the period from January 2023 to June 2024 after obtaining ethical approval. All the breast lump FNAC done between January 2023 to June 2024 were included within the study and patients not giving consent were excluded from the study. The FNAC of breast lump was done after obtaining consent of patient, demographic details, relevant clinical history, clinical diagnosis and local examination findings and smears were stained using Haematoxylin-Eosin (H&E), Papanicolaou (PAP) stains and May-Grunwald Giemsa stain (MGG). For histopathological examination, tissue biopsy was received in 10% neutral-buffered formalin, processed as per routine protocol, stained with haematoxylin and eosin stain. The records of patient and cytopathology and histopathology (whenever available) findings were retrieved.

The cases were classified into C1 to C5 categories using the IACYS, cytopathological diagnosis according to Yokohama system was correlated with histopathological diagnosis whenever possible.

ROM was calculated for each category and compared with other studies.

RESULTS

Three hundred and twenty-two (322) cases of cytologically diagnosed breast lesions were included in this study and biopsy follow up was available in 86 cases (26.70%).

Table 1: Age wise distribution of breast lesion.

Age group in years	No of cases	Percentage of cases
11-20	78	24.22
21-30	111	34.47
31-40	72	22.36
41-50	31	9.63
51-60	17	5.28
61-70	6	1.86
71-80	4	1.24
81-90	3	0.93
Grand total	322	100.00

In this study the age of the patients ranged from 14-86 years, most common age group being 21-30 years (Table 1).

In this study, majority patients were female (320, 99.38%) and only 2 patients were male (0.62%).

The FNAC results showed that most common IACYS category was Benign (259 cases, 80.43%) in which fibroadenoma was most common diagnosis (Figure 1).

The ROM was calculated by dividing the total number of cases turned out to be malignant on histopathology out of total number of cases whose histopathological follow-up was available in each category. ROM was highest in C4 and C5 category (100%), followed by C3 (60%), C2 (0%)

and was not available in C1 due to loss to follow-up (Table 2).

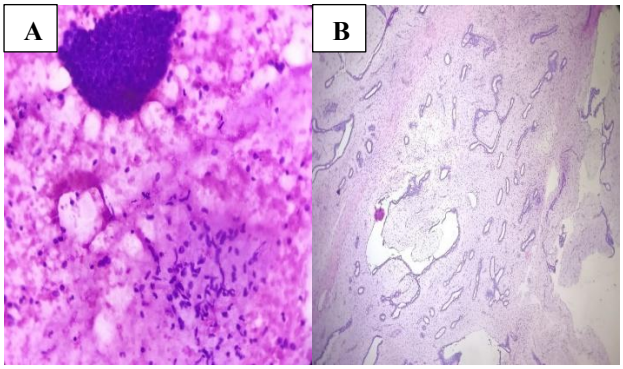

Figure 1: (A) Cytology of fibroadenoma (C2) with typical pattern of large tissue fragments and stroma (H&E, 20X); (B) Histopathology slide of Fibroadenoma showing ductal and myoepithelial cells arranged in peri-canalicular and intracanalicular pattern in fibro-myxoid stroma (H&E, 4X).

The sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and diagnostic accuracy were evaluated by considering cases with IACYS category of Atypical (C3), Suspicious of Malignancy (C4) and Malignant (C5) as Positive in cytological screening test and those with Inadequate (C1) and Benign (C2) as Negative in cytological screening test. The cases which were malignant on histopathology were considered positive in gold standard test and those with benign histopathology were considered as negative in gold standard test.

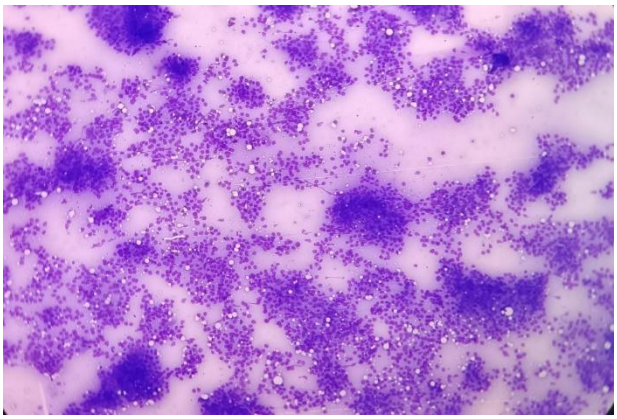

Figure 2: Cytology of Malignancy (C5) case showing ductal epithelial cells arranged in discohesive groups.

Table 2: Frequency (percentage) of breast lesion according the IACYS on FNAC and ROM (risk of malignancy).

IACYS Category	No of cases	Percentage of cases	Malignancy confirmed histologically	ROM (%)
C1: Insufficient	3	0.93	0	NA
C2: Benign	259	80.43	0	0
C3: Atypical	12	3.73	3	60
C4: Suspicious of malignancy	10	3.11	1	100
C5: Malignant	38	11.80	25	100
Total	322	100.00		

Table 3: IACYS Category-wise distribution of breast lesion (in percentage) in various studies.

Studies	C1	C2	C3	C4	C5
Aithmia et al[1]	9.8	67.63	3.46	6.93	12.10
Sunitha et al [2]	6.89	72.46	3.28	3.28	14.09
Nargund et al [3]	7.00	24.00	7.00	3.00	59.00
Kamatar et al[4]	5.00	71.00	1.00	2.00	21.00
Present study	0.93	80.43	3.73	3.11	11.80

Table 4: ROM of different categories of IAC Yokohama system in various studies.

Studies	C1	C2	C3	C4	C5
Aithmia et al[1]	0	2.27	50	50	100
Sunitha et al [2]	0	2	0	71.43	100
Nargund et al [3]	7.69	15.26	65.38	83.33	99.18
Kamatar et al[4]	0	4	66	83	99
Present study	NA	0	60	100	100

DISCUSSION

The categories utilized in the IACYS are: Insufficient/inadequate, benign, atypical, suspicious of malignancy, and malignant.

In the present study, we adopted the newly proposed IACYS for reporting breast FNAC and categorized into breast lesions in 5 above mentioned categories.

The most common age group in our study was 21-30 years which is similar to study by Aithmia et al.[1]

Rate of inadequate (0.93%) sample in our study was less as compared to study by Aithmia et al (9.8%), Sunitha et al (6.89%), Nargund et al (7.00%) and Kamatar et al (5.00%).[1-4] The IAC reporting system recommends that operators should aim for an inadequate sample rate of <5%, our study fulfils this recommendation.

Proportion of benign (80.43%) cases in our study was more and proportion of malignancy (11.80%) cases were less than study by Nargund et al (benign=24.00%, malignant=59%) because their institute was tertiary referral cancer centre for the state.[3]

Proportion of atypical (3.73%) cases in our study was slightly higher than study by Kamatar et al (1.00%) but less then study by Nargund et al (7.00%).[4,3]

Proportion of suspicious of malignancy (3.11%) cases in present study were slightly lower than study by Aithmia et al (6.93%) (Table 3).[1]

In the present study, ROM was not calculated in insufficient category due to loss of follow-up.

The present study showed ROM of benign category of 0%, which is lower in contrast to studies by Aithmia et al (2.27%), Sunitha et al (2%), Kamatar et al (4%) and Nargund et al (15.26%).[1-4]

ROM of atypical category in present study was 60% which was higher than study by Sunitha et al (0%), which may reflect either a conservative classification or limited malignant outcomes in follow-up.[2]

ROM in suspicious of malignancy category in the present study was 100% ROM, which is higher than study by Aithmia et al (50%) and other studies which may indicate variation in categorization thresholds.[1] The present study reported a ROM of 100% in malignant category, a finding echoed by Aithmia et al and Sunitha et al, Nargund et al and Kamatar et al (Table 4).[1-4]

Limitation

One limitation of this study is the lack of adequate health education among patients, which contributed to poor follow-up, particularly in those with small benign breast lesions.

CONCLUSION

Our study assessing the performance of IAC Yokohama System in breast cytopathology demonstrated 100% sensitivity and negative predictive value, along with high specificity (96.49%), positive predictive value (93.55%), and overall diagnostic accuracy (97.33%). These findings indicate a strong concordance between cytological and histopathological diagnoses. Thus, the Yokohama System reinforces its strength in ruling out malignancy, making it a highly effective screening tool, representing a simple and structured classification system that enhances diagnostic clarity and, consequently, improves communication between pathologists and treating clinicians, ultimately providing clear benefits for patient management.

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