

Role of International Academy of Cytology Yokohama reporting system in breast lesions at a tertiary care center in Central India

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Abstract

Background: The International Academy of Cytology (IAC) Yokohama System to report breast cytopathology can effectively categorize breast diseases into different cytological groups. Fine needle aspiration (FNAC) from the lesions in the breast has been regarded as an effective method of diagnosing breast cancer, particularly in rural settings. The principal purpose of this study was to validate the diagnostic accuracy of breast FNA utilizing the IAC Yokohama system in future endurances. Histopathological evaluation was also performed to corroborate the correctness of the FNA of the breast.

Methods: Research on patients getting core-needle/incisional/excisional biopsy of breast lesions between January 1st, 2021, and December 31st, 2021, was conducted at a tertiary care center in central India. 216 breast FNAs were recorded utilizing the IAC Yokohama system, and the most appropriate category was assigned for every case.

Results: The new "International Academy of Cytology (IAC) Yokohama system" was used to categorize 216 patients into five categories based on the cytologic diagnosis. That C1: insufficient material (8.7%), C2: benign (65.7%), C3: atypical (1.8%), C4: suspicious of malignancy (2.7%), and C5: malignant (20.8%). To examine diagnostic accuracy, FNACs were associated with ancillary testing and histological diagnosis. The overall specificity, sensitivity, negative predictive value, and positive predictive value, along with the accuracy, were calculated with the risk of malignancy

Conclusion: With high specificity and sensitivity, for each type of situation, for all tumors, and each analyzed BIRADS category show that the IAC Yokohama system provides excellent accuracy for Breast FNA.

Background

Fine needle aspiration biopsy (FNAB) cytology is a quick, minimally invasive, reliable, and affordable breast biopsy procedure with a long history of effectiveness when used with ultrasound guidance for both palpable and impalpable lesions [1-4]. Core needle biopsy (CNB), which was first developed to evaluate calcifications and lesions found by mammography, has replaced and, in some circumstances, challenged FNAB [5, 6]. The two procedures are complementary when utilized as a part of the "triple test," which consists of a clinical examination, imaging, and biopsy. This application may vary between women presenting with a clinical or imaging lesion and women coming with a screening found mammographic lesion [7-9].

Except in specific situations like pregnancy, it is ideal to evaluate the vast majority of breast lesions clinically first, followed by bilateral mammography, ultrasound, and, if necessary, FNAB, which may be guided by ultrasound. Rapid on-site evaluation (ROSE) of the FNAB direct smears reduces the rates of insufficient samples and unusual and suspicious samples. It increases the rates of benign and malignant diagnoses concurrently [10]. In addition, ROSE permits instant triage of the lesion based on the results of the FNA.

The objective of the study was to standardize and enhance the reporting of breast cytology in tertiary care facilities in central India by developing best practice guidelines, improving training in breast cytology performance and interpretation, and also by enhancing communication between cytopathologists and breast clinicians. Last but not least, it intended to connect this data system with patient management to provide the best breast care possible.

Reporting format details

The report should include a statement of “cellularity” that measures the material's adequacy. A “cytological description” that contains any diagnostic criteria or feature checklist, as well as a brief discussion of the findings that support several probable diagnoses. There must be a short comment or conclusion that offers the most precise diagnosis possible or the most likely diagnosis with a differential diagnosis if this is not possible. A remark indicating whether or not the tumor is fully benign, such as “No malignant cells are observed”. A “category or code” can be included in the body of the report but not in conclusion.

Materials And Methods

Between January 2021 and December 2021, a prospective evaluation was done on all instances of breast tumors seen at the Gandhi Medical College in Bhopal's Department of Pathology. The best Yokohama category was awarded to 216 breast FNAs, and only 48 of those instances had histopathological correlations. After documenting the pertinent clinical information, FNAC was carried out with informed consent and aseptic precautions using a disposable 20 ml syringe with a 22-needle gauge. Local anesthesia was not used. Characteristics of the substance were noted. Regular smears were made and fixed in ethyl alcohol. Staining was done with Papanicolaou and hematoxylin and eosin stain. Recently proposed IAC, Yokohama reporting method of breast cytology was used to report the smear results.

The IAC Yokohama System divides patients into five groups based on their cancer risk (ROM) (Table 1).

Table 1. IAC Yokohama System		
S. No.	Cytological categories	Explanation
1	C1	Insufficient/inadequate
2	C2	Benign
3	C3	Atypical
4	C4	Suspicious of malignancy
5	C5	Malignant

Previously, C1 was termed as unsatisfactory, but that is now replaced as insufficient or inadequate, which is the more appropriate term. Also, C3 was previously termed as suspicious, probably benign, as it creates

confusion for clinicians between categories C3 and C4; thus, C3 is now termed as atypical.

The histopathological evaluation is considered the gold standard for diagnosis, as compared to the cytology results. Based on the final histological diagnosis, specificity, sensitivity, negative predictive value (NPV), positive predictive value (PPV), and diagnostic accuracy along with ROM were evaluated.

This study included patients of all ages with breast lumps referred by the Surgery department who were willing to have FNAC performed and cases with a histopathological diagnosis. Cases without a corresponding histological diagnosis were eliminated when determining the risk of malignancy, sensitivity, and specificity.

All sarcomas, invasive carcinomas, Phyllodes tumors (borderline and malignant), Ductal carcinoma in situ (DCIS), and lymphomas were categorized as malignant for statistical analysis in the present study. Acute/chronic inflammatory diseases, Benign Phyllodes tumors, papilloma, atypical ductal hyperplasia (ADH), fibroadenomas, fibrocystic changes, and fibroadenoma were all regarded as benign lesions.

Statistical Analysis: For each category, the malignancy risk was estimated. For three diagnostic circumstances (Table 2), the accuracy of breast FNAC in detecting cancer was determined.

Table 2. Calculation of specificity, sensitivity, PPV, NPV, and accuracy in different scenarios	
Scenarios	Explanation
First scenario	Only the benign category in FNAC was categorized as benign (non-malignant), whereas atypical lesions, suspected of malignancy, and malignant categories were labeled as malignant
Second scenario	Benign and atypical categories were considered non-malignant but suspected of malignancy, and malignant categories were considered malignant
Third scenario	Benign, atypical, and suspicious of malignancy categories were all classified as non-malignant, whereas only the malignant category was classified as malignant.

The overall specificity, sensitivity, negative predictive value, positive predictive value, and diagnostic accuracy were computed for all three cases.

Results

A total of 216 cases were included in this study, for which FNA was done in the pathology department, while 48 cases were correlated by histopathology. The median age of the patients in the present study was 44 years (15–85 years). Patients with benign breast lesions had 34 years as the median age, while malignant cases had a median age of 44.

Table 3 shows the risk of malignancy for each of the five IAC Yokohama groups.

Table 3
Risk of malignancy of IAC Yokohama system categories for all breast FNAC

	Inadequate	Benign	Atypical	Suspicious for malignancy	Malignancy
Malignant	02	0	01	02	11
Non-malignant	04	25	02	01	00
ROM	33.3%	00%	33.3%	66.7%	100%

Out of 216 cases, those 48 cases correlated by histopathology were categorized into five categories of the Yokohama system: C1 category included 6 cases, C2 had 25 cases, C3 and C4 included only 3 cases each. In comparison, C5 contains 11 cases in total.

The overall specificity, sensitivity, negative predictive value, positive predictive value, and diagnostic accuracy for each diagnostic scenario are given in Table 4.

Table 4
Specificity, Sensitivity, PPV, and NPV for breast FNAB using the IAC Yokohama system

	Atypical, considered positive	Suspicious for malignancy, considered positive	Malignant, considered positive
Specificity	100%	100%	100%
Sensitivity	87.5%	81.25%	68.75%
PPV	100%	100%	100%
NPV	93.5%	91.18%	86.49%
Diagnostic accuracy	95.56%	93.62%	89.58%

The high sensitivity and specificity for each situation were examined to show that the IAC Yokohama system provides excellent accuracy for breast FNAB.

It was seen that specificity, sensitivity, PPV, NPV, and accuracy were increased significantly when C3, C4, and C5 were considered positive compared to when only C5 was considered positive.

Discussion

Breast Fine needle aspiration cytology (FNAC) is among the most regularly done FNAs worldwide. It had a long history of success in palpable and impalpable lesions using ultrasound guidance [10]. In underdeveloped and developing nations, breast lesions are one of the most frequently sampled areas by FNAC [9]. There were analytical issues experienced in interpreting breast cytology, particularly with untrained pathologists, and hence cytopathology training is required to remove these errors [9]. In breast FNAC, the "grey zone" contains a wide range of conditions ranging from benign conditions such as

proliferative fibrocystic disease to sclerosing adenosis to malignant conditions like cancer [11]. A structured and uniform reporting system was required having cytological feature checklists for specific lesions based on an analytical approach that combines pattern recognition in low-power along with high-power cytological characteristics [12]. A "Breast Group" of cytopathologists, surgeons, surgical pathologists, radiologists, and oncologists were established by the "International Academy of Cytology Executive Council" in 2016 to promote the proper use of FNAC in breast lesions, improve the reporting system for breast FNAC, that increase communication between cytopathologist and clinical management team, and helps in further research into breast disease employing FNAC for the patient benefit [13].

The International Academy of Cytology (IAC) categorizes breast lesions into five categories, each with a clear definition and description, along with a specific risk of malignancy (ROM). The ROM is then linked with management recommendations. The system also emphasizes that breast FNAC relies on the expertise of those performing the biopsy, making slide smears, and interpreting material on the slides, and this requires good training and clear communication with clinicians for the management of patients with breast lesions [14].

Each of the five categories represents a distinct risk of malignancy was indicated for care by the breast group, and best-practice procedures were devised for each. The huge contrasts between developed and developing countries in terms of availability of imaging, core needle biopsy (CNB), surgical pathology, and management options were taken into consideration while doing this. The FNAC and CNB roles in the management algorithms will be included in these best-practice standards, which also consider the wide disparities in medical infrastructure [9].

According to the IAC Yokohama reporting system of breast cytology, 216 cases were included in the present study that underwent FNAC for breast lumps, and 48 of those who were confirmed by biopsy/histopathology were divided into the five categories of the Yokohama system.

Slides that are insufficient or inadequate for a cytomorphological diagnosis include those smears that are too sparsely cellular (do not fulfill the criteria of adequacy) or too badly smeared or badly fixed.

Out of 19 cases included in the present study, 6 exhibited a histological link, and two were later found to be malignant. The ROM in our study was 33.3%, which was higher than studies done by Montezuma et al. [15] which was 4.8%, Wang et al. [8] (2.6%) and Tejeswini et al. [14] (22.22%), but similar to Hoda *et al.* [16]. Technical problems or the nature of the lesion may be the cause of insufficient FNAC. It was impossible to establish ROM since the yield, if not representative, would raise the risk of cancer.

Therefore, Wang et al. concluded that expertise with the aspirator, radiographic guided FNAC, instantaneous cytological assessment, and extra repeated aspirates via the Rapid On-Site Evaluation (ROSE) approach would all work together to reduce incorrect interpretation of insufficient samples [8].

Cases included in Category II have unmistakably benign cytological characteristics that may or may not indicate a particular benign lesion. Infections, inflammatory lesions, benign cysts, neoplasms, and

epithelial hyperplasia fall within this group. This is the most common group in the present study, consistent with Montezuma *et al.* [15] and Tejeswini *et al.* [14]. 142 cases were included in this group. Out of 142 cases, no cases were malignant on histopathology. The ROM was 0%, which is less than mentioned in studies by Montezuma *et al.* [15] (1.4%) and Wang *et al.* [8] (1.7%) and Hoda *et al.* [16] (4.7%) and Tejeswini *et al.* [14].

The atypical group consists of cases with cytological characteristics that suggest micropapillary or cribriform proliferation, such as a single cluster of intact cells dispersed widely inside the nucleus, pleomorphism, high cellularity, necrosis, and complicated architecture.

In the present study, only 4 cases were included as atypical, out of which three have histopathological correlation, from which 1 case was found malignant. The ROM for this category was 33.3% which is significantly higher than in the studies done by Montezuma *et al.* [15] (13%) and Wang *et al.* [8] (15.7%) and Tejeswini *et al.* [14] but lower than Hoda *et al.* [16] (51.5%). This can be explained by the fact that there were fewer atypical cases in this study.

Triple correlation testing is employed to handle this group. If clinical and imaging data are normal, a review after a few months, preferably 3–6 months with or without FNAC, is advised; if suspicious or inconclusive, a core needle biopsy or excisional biopsy is suggested.

The cytological features of cells of suspected malignancy, most likely an in situ or invasive carcinoma, exhibit some cytological characteristics typically found in malignant lesions, but not enough of them, either in quantity or quality, to render a conclusive diagnosis of malignancy. Hence included in the category of suspicious of malignancy. There were only 6 cases in this category, out of which three were confirmed by histopathology; two of them were malignant on histopathological examination with a ROM of 66.7%. ROM for this category in the present study was low as compared to the study done by Montezuma *et al.* [15] (97.1%), while the ROM of Wang *et al.* [8] (84.6%) and Hoda *et al.* [16] (85.4%) and Tejeswini *et al.* [14]. This can be due to the minimal number of instances in this group in the present study.

There are specific cellular characteristics of malignancy in the malignant group. All of the incidents in this category were cancerous based on histology. The ROM was 100%, which is comparable to another study by Tejeswini *et al.* [14] (100%), Montezuma *et al.* [15] (100%), Wang *et al.* [8] (99.5%), and Hoda *et al.* [16] (100%). (98.7 percent). The present study's overall sensitivity, specificity, positive predictive value, and negative predictive value were comparable to those of investigations by Hoda *et al.* [16] Tejeswini *et al.* [14] Wang *et al.* [8], Montezuma *et al.* [15].

Limitations

As a tertiary care center situated in the capital of the state, it covers the usual population surrounding, which is usually urban, suburban, and near the peripheral area, but there is a huge periphery that remains unscreened under this study. Also, this study had a relatively smaller sample size, and the results may

vary with a large study group. Lastly, the occurrence of the COVID-19 pandemic proved to be a hindrance as there was a limited inflow of patients during the study period. Ours is a small study group, resulting in a lack of statistical power; therefore, further studies with a large cohort, preferably multicentric, are needed along with proper follow-up to explore the role of the Yokohama system in reporting breast cytology.

Conclusions

In conclusion, the breast FNAC is a reliable test for diagnosing breast lesions. In particular for cancer cases. Sensitivity, Specificity, negative predictive value, positive predictive value, and diagnostic accuracy were all statistically significant in this investigation. Utilizing the IAC Yokohama breast cytology reporting system then aids in standardizing reporting across numerous institutes and giving doctors clear direction for follow-up management. Yokohama classification system may be far more helpful in reporting breast lesions because each diagnostic category sends specific cancer risk information, giving patients the information, they may utilize to determine their treatment strategy.

Abbreviations

FNAB

Fine needle aspiration biopsy

CNB

Core needle biopsy

ROSE

Rapid on-site evaluation

IAC

Academy of Cytology, ROM:risk of malignancy

NPV

negative predictive value

PPV

positive predictive value

DCIS

Ductal carcinoma in situ

ADH

atypical ductal hyperplasia.

Declarations

Ethics approval and consent to participate: This study was approved by the ethics committee of Gandhi Medical College, Bhopal, India (Ethics Code: #637/MC/IEC).

Consent for publication: Written informed consent was obtained from the patients for using the information. A copy of the written consent is available for review by the Editor of this journal.

Availability of data and materials: Not applicable.

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Authors' contributions: All authors have read and approved the manuscript.

DV: Involved in data collection

NK and MAM: Reviewed the manuscript.

VN and SB: Drafted and did background research.

RM and AK: Drafted, reviewed results and revised the manuscript

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