Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 3
Open Access

Categorization of breast fine needle aspirates in a tertiary care centre in Bagalkot using International Academy of Cytology Yokohama System with Diagnostic Accuracy.

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Cite this paper as: Dr Uma Jamkhandi, Dr Pavan Kulkarni, Dr Viona Dcunha (2024) Categorization of breast fine needle aspirates in a tertiary care centre in Bagalkot using International Academy of Cytology Yokohama System with Diagnostic Accuracy. *Frontiers in Health Informatics, 13* (3), 7132-7140

Abstract:

Background: *Fine needle aspiration cytology (FNAC) has been a preoperative procedure for identifying neoplastic and non-neoplastic breast lesion. Using the International Academy of Cytology (IAC) Yokohama System, breast lesions can be categorized into 5 groups.*

Aim: *The main objectives of this study was to classify breast fine needle aspirates according to IAC Yokohama system and correlate with histopathological findings.*

Materials and methods: *All breast FNACs were done prospectively for one month in the department of Pathology. A total of 40 FNACs were examined and classified according to IAC Yokohama system for reporting Breast Cytopathology. Wherever possible, histopathological correlation was done with cytopathology.*

Results: *In the present study, a total of 4 smears of fine needle aspirations were included and categorized using the IAC system for reporting breast cytopathology. There were 0% cases in C1 category (insufficient), 60% cases in C2 category (benign), 10% cases in C3 category (atypical), 2.5% cases in C4 category (suspicious for malignancy) and 27.5% cases in the C5 category.*

Conclusion: *FNAC is a safe, rapid and economical out-patient procedure. Using IAC Yokohama system, it helps in diagnosing fine needle aspirates accurately.*

Key-words: *FNAC, Breast , Yokohama, Categorization*

Introduction

Breast carcinoma is the most common carcinoma among females worldwide. According to clinicopathological profile of cancers in India: A report of the Hospital Based Registries (HBR), 2021 diagnosis of breast cancer was done by microscopy in 99.7% of cases, by imaging techniques in 0.2% of cases and by clinical examination only in 0.1% of cases. 5.5% of cases were diagnosed by cytology of primary and 93.1% cases were diagnosed as histology of primary.

FNAC is a simple, rapid, minimally invasive and economical procedure. USG and rapid onset evaluation (ROSE) increases the efficacy of FNAC. ROSE helps to analyse whether the sample is adequate, thus decreasing the rates of insufficient samples.

The IAC System for Reporting Breast Fine Needle Aspiration Cytology was developed by a group of expert

cytopathologists working with clinical experts in breast diagnostics and management.

The IAC Yokohama System for Reporting Breast Cytopathology defines categories under the following:
C1- Insufficient
C2- Benign
C3- Atypical
C4- Suspicious for malignancy
C5- Malignant

This present study aims at classifying the breast FNA's according to IAC Yokohama system and diagnostic accuracy of various categories.

Material and methods

It is a prospective study in which all the breast FNAC done in September 2024 were taken after approval from institutional committee. Informed consent was taken from all the patients before FANC. FNAC of the breast lumps was performed by trained pathologist using a 22-23 gauge needle with 20ml disposable syringe under aseptic conditions. The smears prepared on the glass slides were fixed in 95% ethyl alcohol and stained in H&E stain and Pap stain. Slides prepared were examined by two cytopathologists and reported according to standardized criteria in the IAC Yokohama system for breast cytology.

The histopathological diagnosis was considered gold standard and was available in 37 cases.

Statistical analysis

The risk of malignancy was calculated for each category as the number of malignant cases confirmed on histopathology in the diagnostic category.

The histopathological diagnosis was labelled gold standard and the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy were calculated.

The cases with both cytological and histological diagnosis were divided into 3 groups for statistical analysis.
Group A- only the malignant category on cytology were considered positive.
Group B- only the malignant and suspicious for malignancy on cytology were considered positive.
Group C- All the cases in the malignant, suspicious for malignancy and atypical on cytology were considered positive.

Results

A total of 40 patients underwent 44 breast fine needle aspirates in the month of September 2024. The age group of patients ranged from 17 years to 73 years, majority of cases belonging to the age group between 31 and 40 years. Mean age of the patients was 38.50 +/- 14.713 years. Bilateral cases were seen in 4 cases whereas the remaining had unilateral lesions.

The 44 breast FNAs were categorized according to the IAC Yokohama System as follows:
C1- Insufficient: 0 cases (0%)
C2- Benign: 24 cases (60%)
C3- Atypical: 4 cases (10%)
C4- Suspicious for malignancy: 1 case (2.5%)
C5- Malignant: 11 cases (27.5%)

Histopathological correlation was available in 37 cases. The histopathological diagnosis was further categorised as benign and malignant breast lesions. Out of 37 cases, 51.35% of the cases were benign on histopathological examination, whereas 48.65% were malignant. The most common benign lesion on histopathology was fibroadenoma in 63% of the cases, whereas the most common malignant was invasive breast carcinoma of no special type in 69% of cases.

The risk of malignancy (ROM) for each category was calculated as the percentage of confirmed malignant cases in each of these categories to the total number of cases in that respective category. The risk of malignancy was maximum for C5 (100%) and C4 (100%), followed by C3 (25%), C2 (25%) and C1 (0%).

Table1: IAC Yokohama System category with cytohistological correlation and risk of malignancy

Cytohistological	C1	C2	C3	C4	C5	Total
Benign	00	17	03	00	00	20
Malignant	00	06	01	01	09	17
Total	00	24	04	01	09	37
ROM	00%	25%	25%	100%	100%	

The sensitivity, specificity, PPV, NPV and diagnostic accuracy of the three groups A, B , C were calculated summarised in Table2,3 &4.

Table2: Efficacy of IAC Yokohama System for Reporting Breast Cytopathology (Group A – C5 is considered positive)

Statistics	Value	95% CI
Sensitivity	60.00%	32.29 to 83.66%
Specificity	95.45%	77.16 to 99.88%
PPV	90.00%	55.93 to 98.46%
NPV	77.78%	65.16 to 86.75%
Accuracy	81.08%	64.84 to 92.04%

Table3: Efficacy of IAC Yokohama System for Reporting Breast Cytopathology (Group B – C4, C5 is considered positive)

Statistics	Value	95% CI
Sensitivity	66.67%	38.38 to 88.18%
Specificity	95.45%	77.16 to 99.88%
PPV	90.91%	58.77 to 98.59%
NPV	80.77%	67.12 to 89.63%
Accuracy	83.78%	67.99 to 93.81%

Table4: Efficacy of IAC Yokohama System for Reporting Breast Cytopathology (Group B – C3, C4, C5 is considered positive)

Statistics	Value	95% CI
Sensitivity	73.33%	44.90 to 92.21%
Specificity	95.45%	77.16 to 99.88%
PPV	91.67%	61.27 to 98.71%
NPV	84.00%	69.30 to 92.43%
Accuracy	86.49%	71.23 to 95.46%

Maximum sensitivity and diagnostic accuracy were achieved when malignant, suspicious for malignancy and atypical are considered positive for malignancy (73.33%).

Discussion

The IAC Yokohama System for reporting breast cytopathology provides definitions, descriptions and ROM for the standard five categories. This approach utilization of FNAB for breast lesions to maximise the benefits to patients as it is a cost-effective procedure.

FNAC proved as a good test for rapid onsite evaluation of breast lesions which decreases the overall turn-around and aids in rapid diagnosis of lesions.

In this present study 44 breast FNAC smears were studied. The results were categorized according to IAC Reporting System of Breast Cytopathology. Most of the cases belonged to benign category (C2-60%) on cytological examination. There were 27.5% cases in the malignant category (C5).

Similar results were obtained in the following studies (Kamatar P et al, Apuroopa P et al, Shankar M et al, Guru et al and Yadav et al).

Table5: Studies showing breast lesions according to categories of IAC Yokohama System

Studies	Insufficient (C1)	Benign (C2)	Atypical (C3)	Suspicious for malignancy (C4)	Malignant (C5)
Kamatar P et al (2019)	5%	71%	1%	2%	21%
Apuroopa P et al (2020)	3.6%	5.8%	17.7%	7.2%	12.8%
Shankar M et al (2023)	3.9%	78.6%	15.1%	1.1%	14.8%
Guru A et al (2023)	4%	69%	6%	8%	13%
Yadav et al (2024)	3.8%	71.6%	6.3%	3.1%	15.2%
Present study	0%	60%	10%	2.5%	27.5%

In the present study there were 10% cases in the atypical category which is lower when compared to Apuroopa et al and Shankar M et al. The breast lesion was diagnosed as atypical on cytology was diagnosed as ductal carcinoma in situ.

The risk of malignancy (ROM) for each category in the present study was 0%, 25%, 25%, 100% and 100% in categories C1, C2, C3, C4 and C5 respectively. The risk of malignancy was comparable to the studies by Mchugh et al, Wong et al and Kamatar et al.

Table6: Risk of malignancy in different categories

Studies	Insufficient (C1)	Benign (C2)	Atypical (C3)	Suspicious for malignancy (C4)	Malignant (C5)
Mchugh et al	0%	12%	25%	46%	91%
Wong et al	2.6%	1.7%	15.7%	84.6%	99.5%
Montezuma et al	4.8%	1.4%	13%	97.1%	100%
Kamatar P et al	0%	4%	66%	66%	99%
Apuroopa P et al	5%	1.2%	12.5%	83%	100%
Ahuja S et al	5%	1.5%	17.4%	93.65%	100%
Shankar M et al	10%	2.5%	44.4%	100%	100%
Present study	0%	25%	25%	25%	100%

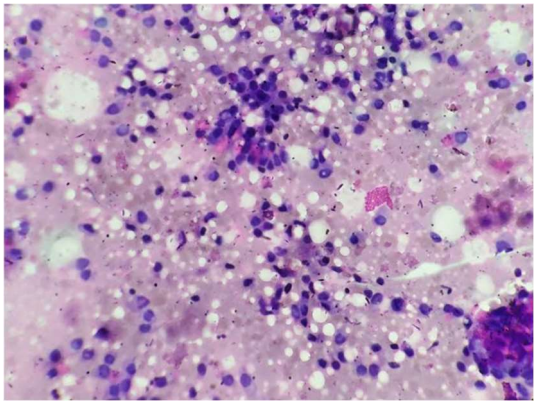
In the present study, the maximum sensitivity was achieved in Group C (73.33%). However, specificity remained unchanged in this study. Maximum diagnostic accuracy (86.49%) was also achieved in Group C.

Table7: Diagnostic accuracy of breast aspirates in diagnosis of malignancy using Yokohama System in various studies

CATEGORY		De Rosa et al	McHugh et al	Wong et al	Montezuma et al	Agarwal et al	Ahuja et al	Yadav et al	Present study
GROUP A	**No. of cases**	1616	199	536	755	299	224	321	40
	Sensitivity	82.2%	65.4%	75.4%	68.7%	86.7%	79.2%	82.1%	60.0%
	Specificity	97.8%	95.9%	100%	100%	100%	100%	100%	95.45%
	PPV	98.8%	91.1%	100%	100%	100%	100%	100%	90.0%
	NPV	71.0%	81.1%	80.7%	87.7%	71.2%	90.9%	93%	77.98%
	Accuracy	87.0%	83.9%	87.9%	90.3%	90.0%	93.2%	94.7%	81.08%
GROUP B	**Sensitivity**	93.7%	79.5%	92.0%	83.3%	96.0%	91.7%	91.5%	66.67%
	Specificity	90.8%	85.1%	97.8%	99.8%	91.9%	98.7%	98.7%	95.45%

	PPV	95.8%	77.5%	97.6%	99.5%	97.3%	97.1%	96.6%	90.91%
	NPV	86.6%	86.6%	92.7%	93.0%	88.3%	96.1%	96.5%	80.77%
	Accuracy	92.8%	82.9%	95.0%	94.7%	95.0%	96.4%	96.5%	83.78%
GROUP C	**Sensitivity**	98.9%	84.6%	98.9%	98.3%	98.2%	97.2%	95.7%	73.33%
	Specificity	46.3%	75.2%	62.1%	54.8%	59.5%	86.0%	90.2%	95.45%
	PPV	80.5%	68.8%	71.7%	49.2%	88.0%	77.0%	81.9%	91.67%
	NPV	95.1%	88.3%	98.3%	98.6%	91.7%	98.5%	97.9%	84.00%
	Accuracy	82.7%	78.9%	80.2%	68.2%	88.6%	89.6%	86.3%	86.49%

A



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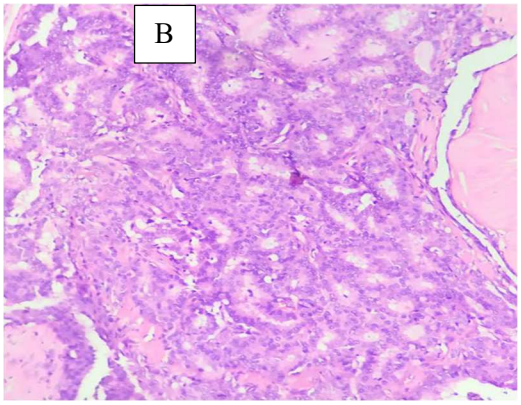

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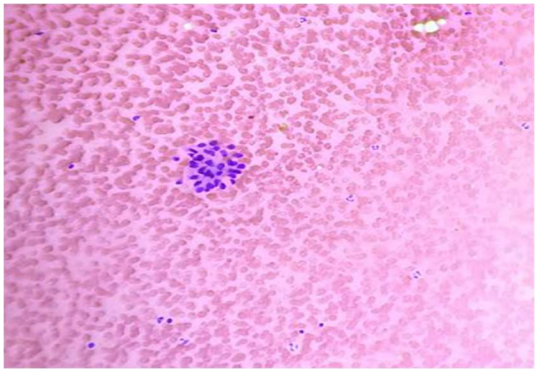

D

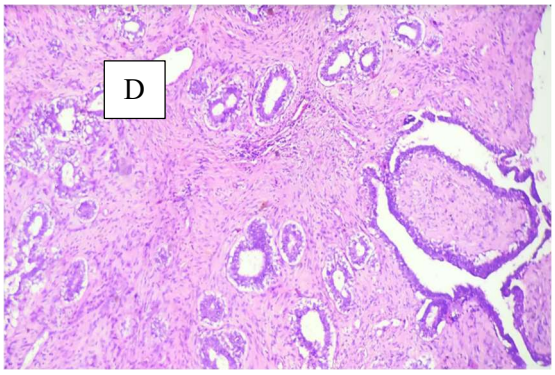

Figure A: Shows dyscohesive clusters with few myoepithelial cells. It was reported as Category 3 (200X magnification, H&E stain).

Figure B: On Histopathology the diagnosis was Ductal Carcinoma in-situ (100X magnification, H&E stain).

Figure C: Shows tight cohesive clusters of cells with benign bipolar nuclei reported as Benign Proliferative Breast Disease- Category 2 (100X magnification, H&E stain).

Figure D: On Histopathology was diagnosed as Fibroadenoma with adenosis (200X magnification, H&E stain).

In the present study, the sensitivity in Group A was 60% when only malignant cases were included in positive test results. The sensitivity further increased in Group C to 73.33% when atypical, suspicious and malignant cases were considered as positive test results. Similar results were achieved by De Rosa et al, McHugh et al, Wong et al, Montezuma et al, Agarwal et al, Ahuja et al and Yadav et al.

The specificity in Group A, Group B and Group C was 95.45%. This was in disagreement with the other studies which had varied specificities in each group. The PPV was 90% (Group A), 90.91% (Group B) and 91.67% (Group C). The present study found discordance with the other studies as it found an increasing trend of PPV.

The diagnostic accuracy in the present study was maximum in Group C (86.49%) when atypical, suspicious for malignancy and malignant cases were included in positive results. These results were in discordance with other studies where Group B had maximum diagnostic accuracy.

Conclusion

FNAC is a reliable test for diagnosing breast lumps – benign or malignant lesions. The sensitivity, specificity, PPV, NPV and diagnostic accuracy were statistically significant. Using the IAC Yokohama System for Reporting Breast Cytopathology helps in categorising the lesions, reporting and risk stratification.

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