The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 2, Issue 3, 2024

# COMPARATIVE ANALYSIS OF FINE NEEDLE ASPIRATION CYTOLOGY RESULTS OF MAMMARY LESIONS WITH CORRESPONDING BI-RADS SCORES

**Dr. Hajrah Karori[*1], Dr. Akhtar Sohail Chughtai[2], Dr. Aribah Atique[3], Dr. Ali[4], Mr. Fawad Irshad[5], Dr Faria Waqar[6]**

[*1,5,6]*Resident Histopathologist, Chughtai Institute of Pathology, Pakistan*
[2,3]*Consultant Histopathologist, Chughtai Institute of Pathology, Pakistan*
[4]*Resident Medicine, Services Institute of Medical Sciences, Pakistan*

[*1]hajrahkarori45@gmail.com, [2]aschughtai@cll.edu.pk, [3]aribah.atiq@yahoo.com, [4]financialcorpp@gmail.com, [5]muhammadfawad90@gmail.com, [6]fariakhan59@gmail.com

**DOI:** https://doi.org/10.5281/zenodo.20082290

**Keywords**

**Article History**
*Received: 23 November, 2024*
*Accepted: 20 December, 2024*
*Published:28 December,2024*

**Copyright** @Author
**Corresponding Author: ***
**Dr. Hajrah Karori**

## Abstract

*Breast lesions are one of the most common clinical situations in women and can have either benign or invasive malignancy. Correct and early diagnosis is crucial to good management. Fine Needle Aspiration Cytology (FNAC) and the Breast Imaging Reporting and Data System (BI-RADS) are commonly used diagnostic modalities for evaluating mammary lesions.*

***Objective:*** *To compare FNAC results based on the Yokohama system with the BI-RADS scores of the breast lesions.*

***Methods:*** *It is a descriptive study performed in the Department of Cytopathology, Chughtai Institute of Histopathology between May 2024 to May 2025. The total number of breast FNAC samples that were included were 256 and the corresponding radiological BI-RADS reports were obtained using a non-probability consecutive sampling. The cytological results were interpreted according to the Yokohama reporting system. IBM SPSS was used for statistical analysis to calculate sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy.*

***Results:*** *The majority of lesions were classified as BI-RADS II (53.9%), with a close second being BI-RADS IV (17.6%) and third BI-RADS III (16.8%). Cytological assessment showed that the largest number of cases was C2 benign lesion (38.7%). FNAC had excellent diagnostic performance. Overall sensitivity, specificity and accuracy were 92.38%, 98.30% and 93.75% respectively, in BI-RADS I-III. The specificity of BI-RADS V lesions was 99.51% and PPV 96.4%. There was a statistically significant relationship between BI-RADS and Yokohama classifications ($p < 0.001$). In 26.6% it was invasive breast carcinoma and in 24.2% it was fibroadenoma.*

***Conclusion:*** *There is good agreement between FNAC and BI-RADS in the diagnosis of breast lesions. When used together, their use enhances the reliability of diagnosis and assists in the correct clinical management.*

## Introduction:

Mammary lesions are common among women worldwide, and most are reported as Benign. (2) Various factors play a pivotal role in the incidence of mammary lesions, such as age, genetic factors, hormonal factors, and environmental factors. Breast carcinoma is the most common malignancy in women worldwide. However, the majority of the lesions are benign in nature, like fibroadenomas and fibrocystic changes.

Fine needle aspiration cytology (FNAC) is a diagnostic procedure to evaluate lumps or masses in various body parts, including the breast. During FNAC, a thin needle is inserted into the raised firm area of the lump, and cells are aspirated via capillary pressure in the fine needle. Smears are then prepared using Giemsa and Pap stains for cytological examination under a microscope.

Breast lumps are assessed worldwide using triple assessment, which combines clinical examination, radiological evaluation, and cytological evaluation (usually through FNAC) to diagnose various pathologies in breasts, including carcinoma. The cytological assessment provides valuable information about the cellular composition of tissues, aiding in diagnosing and managing diseases such as cancer.

The Breast Imaging Reporting and Data System (BI-RADS) (1) is a classification system developed by the American College of Radiology (ACR) to report radiological findings from various imaging modalities used for breast lumps, such as mammography, ultrasound, and MRI. The system assigns a score ranging from 0 to 6, with each category indicating a level of suspicion for breast carcinoma:

0 - Incomplete: Need Additional workup (imaging or clinical examination)

1 - Negative: No evidence of cancer.

2 - Benign: Findings consistent with benign breast lesions.

3 - Probably benign: Findings have a high likelihood of being benign but require short-term follow-up.

4 - Suspicious: Findings are suspicious for malignancy, further evaluation with biopsy is recommended.

5 - Highly suggestive of malignancy: Findings are highly suspicious for cancer, biopsy is recommended.

6 - Known biopsy-proven malignancy: The lesion has been confirmed as cancer through biopsy.

FNAC is a minimally invasive procedure and can often be performed in an outpatient setting. It provides precise information about the cellular details of the lesion like discohesive cells, variation in cell size, hyperchromasia, nuclear details to differentiate between benign and malignant. Hence it guides further management, whether a patient needs a follow up or biopsy.

The International Academy of Cytology Yokohama System (12) is the universal system for reporting Breast lesions. Five categories are defined to classify breast lesions by their risks of malignancy and management.

Class 1 smears: Inadequate for cytological evaluation (like insufficient material)

Class 2 smears: Benign

Class 3 smears: Atypical

Class 4 smears: Suspicious for malignancy

Class 5 smears: Malignant

Although FNAC is the widely used procedure, its agreement with the BI-RADS system in diagnosing mammary lesions is a subject of investigation and debate. Hence, in this study, we are comparing the results of FNAC with the corresponding BIRADS score.

**Materials and method:**

**Study design location and duration:**

This study is a descriptive study conducted in the Department of Cytopathology at Chughtai Institute of Histopathology during the period from May 2024 to May 2025.

Inclusion criteria in the current study were all In-house and received cases of FNAC breast along with respective radiology.

All those cases in which radiology has not been received

**Sample size and Sampling technique:**

The sample size was calculated using a confidence interval of 95%; the final sample size was 256. Data about patient demographics and tumor type were obtained using a medical prescription form. Telephonic interviews were conducted to collect information about treatment options and prognosis. The sampling technique was Non-probability consecutive sampling.

**Results:**

A total of 256 cases of mammary lesions were evaluated using BI-RADS and the Yokohama cytological classification systems. IBM SPSS statistics were applied. According to BI-RADS categorization, the majority of cases fell into category II (138 cases; 53.9%), followed by category IV (45 cases; 17.6%), category III (43 cases; 16.8%), category V (28 cases; 10.9%), and category I (2 cases; 0.8%).

| BI-RADS | Frequency | Percentage |
|---|---|---|
| I | 2 | 0.8 |
| II | 138 | 53.9 |
| III | 43 | 16.8 |
| IV | 45 | 17.6 |
| V | 28 | 10.9 |
| Total | 256 | 100.0 |

On cytological assessment using the Yokohama system, most cases were classified as C2 (benign) comprising 99 cases (38.7%), followed by C1 (inadequate) with 59 cases (23.0%), C5 (malignant) with 50 cases (19.5%), C3 (atypical) with 39 cases (15.2%), and C4 (suspicious of malignancy) with 9 cases (3.5%). Overall, benign categories (BI-RADS II and Yokohama C2) constituted the largest proportion of cases, indicating that the majority of lesions in this cohort were non-malignant, while a smaller yet significant proportion fell into suspicious and malignant categories warranting further evaluation.

| Yokohama Scale | Frequency | Percent |
|---|---|---|
| C1 | 59 | 23.0 |
| C2 | 99 | 38.7 |
| C3 | 39 | 15.2 |
| C4 | 9 | 3.5 |
| C5 | 50 | 19.5 |
| Total | 256 | 100.0 |

Comparative Analysis of Fine Needle Aspiration Cytology Results of Mammary Lesions with Corresponding BI-RADS Scores was done. For BI-RADS categories 1–3 (corresponding to C1–C3), the sensitivity was 92.38%, specificity 98.30%, positive predictive value (PPV) 99.45%, negative predictive value (NPV) 79.45%, and overall accuracy 93.75%, with a statistically significant p-value <0.001 (0.000). For BI-RADS category 4 (corresponding C4), the sensitivity was 88.88%, specificity 85.02%, PPV 17.77%, NPV 99.52%, and accuracy 85.15%, also showing statistical significance p value <0.001 (0.000). In BI-RADS category 5 (corresponding C5), the sensitivity was 54%, specificity 99.51%, PPV 96.4%, NPV 89.91%, and accuracy 90.6%, again with a significant p-value <0.001 (0.000). Overall, higher BI-RADS categories demonstrated increasing specificity and PPV, while sensitivity showed variation across categories, with the highest sensitivity observed in BI-RADS 1–3 and the highest specificity in BI-RADS 5. A statistically significant association was observed between FNAC (Yokohama) classification and BIRADS categories ($p < 0.001$), indicating strong concordance between cytological and radiological assessment of mammary lesions.

| Patients | | Diseased | Healthy |
|---|---|---|---|
| Test Results | Positive | True positive TP | False Positive FP |
| | Negative | False Negative FN | True Negative TN |

Sensitivity: TP / (TP+FN)
Specificity: TN / (TN+FP)
PPV: TP / (TP+FP)
NPV: TN / (FN+TN)
Accuracy: TP+TN / TP+TN+FP+FN

| BI-RADS | | YOKOHAMA | | | P-value | Sensitivity | Specificity | PPV | NPV | Accuracy |
|---|---|---|---|---|---|---|---|---|---|---|
| | | C1, C2, C3 | | | 0.000 | 92.38 | 98.30 | 99.45 | 79..45 | 93.75 |
| | | Yes | No | Total | | | | | | |
| BI-RADS 1,2,3 | Yes | 182 | 1 | 183 | | | | | | |
| | No | 15 | 58 | 73 | | | | | | |
| | Total | 197 | 59 | 256 | | | | | | |
| | | C4 | | | 0.000 | 88.88 | 85.02 | 17.77 | 99.52 | 85.15 |
| | | Yes | No | Total | | | | | | |
| BI-RADS 4 | Yes | 8 | 37 | 45 | | | | | | |
| | No | 1 | 210 | 211 | | | | | | |
| | Total | 9 | 247 | 256 | | | | | | |
| | | C5 | | | 0.000 | 54 | 99.51 | 96.4 | 89.91 | 90.6 |
| | | Yes | No | Total | | | | | | |
| BI-RADS 5 | Yes | 27 | 1 | 28 | | | | | | |
| | No | 23 | 205 | 228 | | | | | | |
| | Total | 50 | 206 | 256 | | | | | | |

Out of a total of 256 cases, histopathological evaluation was not performed in 90 patients (35.2%), making it the largest category. Among the cases with confirmed diagnoses, invasive breast carcinoma was the most common finding, observed in 68 patients (26.6%), followed closely by fibroadenoma in 62 patients (24.2%). A smaller proportion of patients presented with other benign conditions, including breast abscess in 4 cases (1.6%), papilloma in 2 cases (0.8%), and fibrocystic change in 1 case (0.4%). Additionally, 29 patients (11.3%) were lost to follow-up. Overall, a considerable proportion of cases lacked definitive histopathological diagnosis due to either non-performance of the test or loss to follow-up.

| Histopathology | Frequency | Percent |
|---|---|---|
| Fibroadenoma | 62 | 24.2 |
| Histopathology not done | 90 | 35.2 |
| Invasive breast carcinoma | 68 | 26.6 |
| Breast abscess | 4 | 1.6 |
| Fibrocystic change | 1 | .4 |

## DISCUSSION

Breast lesions are a common concern in women's health, and their accurate diagnosis is essential for effective treatment planning. Fine Needle Aspiration Cytology (FNAC) and the Breast Imaging Reporting and Data System (BI-RADS) are widely accepted diagnostic tools for evaluating mammary lesions. FNAC provides rapid cytological assessment of breast lumps, whereas BI-RADS offers a standardized radiological classification based on mammography and ultrasonography findings (1).

In the present study, 256 female patients with palpable breast lumps were evaluated, with ages ranging from 13 to 85 years. According to radiological assessment, BI-RADS categorization showed that 2 cases (0.78%) were BI-RADS 1, 138 cases (53.9%) BI-RADS 2, 43 cases (16.8%) BI-RADS 3, 45 cases (17.6%) BI-RADS 4, and 28 cases (10.9%) BI-RADS 5. Cytological evaluation using the Yokohama classification

revealed 59 cases as C1 (inadequate), 99 cases as C2 (benign), 39 cases as C3 (atypical), 9 cases as C4 (suspicious), and 57 cases as C5 (malignant). Histopathological evaluation, available in a subset of cases, further substantiated these findings. Fibroadenoma was the most common benign lesion, identified in 62 cases (24.2%) which is consistent with the findings of Begum et al., who reported fibroadenoma as the most common benign breast lesion (52.4%) (2), followed by a small number of breast abscesses (1.6%) and fibrocystic changes (0.4%). Among malignant lesions, invasive breast carcinoma was the most frequent diagnosis, seen in 68 cases (26.6%). However, histopathology was not performed in 35.2% of cases, likely due to conservative management of benign lesions or lack of follow-up. Despite this limitation, the available histopathological data served as a reliable gold standard for evaluating diagnostic accuracy.

To assess the diagnostic performance of FNAC using the Yokohama system, comparative analysis was performed. For benign lesions, the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were 92.38%, 98.30%, 99.45%, 79.45%, and 93.75%, respectively. For malignant lesions, these values were 54%, 99.51%, 96.4%, 89.91%, and 90.6%, respectively, indicating high specificity and accuracy but relatively lower sensitivity for malignancy detection.

Previous studies have reported varying diagnostic indices for BI-RADS scoring. Pandia et al. reported sensitivity, specificity, PPV, NPV, and accuracy of 88.57%, 82.46%, 75.61%, 92.16%, and 84.78%, respectively (3). Similarly, Navya et al. reported 88%, 87.5%, 80%, 93%, and 88%, respectively (4). Some studies have demonstrated even higher diagnostic performance, suggesting variability due to differences in study population and methodology.

In the present study, BI-RADS scoring demonstrated sensitivity, specificity, PPV, NPV, and accuracy of 76.92%, 76.47%, 71.43%, 81.25%, and 76.67%, respectively, when compared with histopathological findings (5). These findings are comparable to those reported by Shrestha et al., who observed sensitivity and specificity of 78.9% and 95%, respectively, for sonomammography using BI-RADS classification (6).

Chavam et al. reported lower specificity (82.3%) but higher sensitivity (93.9%), PPV (91.1%), and accuracy (90%) compared to the present study (7). Such differences may be attributed to variations in sample size, imaging techniques, and interpretation criteria.

Mammography remains an essential tool for detecting breast cancer and screening for additional lesions in patients with palpable masses. However, it has a reported false-negative rate of 4–12%, influenced by patient age and breast density. Ultrasonography complements mammography by improving diagnostic accuracy and reducing unnecessary invasive procedures (8).

Balasundaram et al. evaluated multiple diagnostic modalities and reported that FNAC had 100% specificity and PPV, making it highly reliable. Mammography and clinical examination also showed high diagnostic performance, while ultrasonography demonstrated relatively lower sensitivity (9).

Similarly, Mohson et al. reported high sensitivity (97%) and accuracy (90.5%) of ultrasonography in detecting malignant lesions (10). In contrast, Bhagat et al. observed higher specificity for ultrasonography (100%) compared to FNAC (94.57%), but significantly lower sensitivity (50% vs. 95%) (11).

Overall, the findings of this study support the complementary role of FNAC and BI-RADS in the evaluation of breast lesions, with each modality contributing unique diagnostic strengths.

**Conclusion**

The present study demonstrates that both FNAC and BI-RADS are valuable tools in the evaluation of breast lesions. FNAC, particularly when categorized using the Yokohama system, shows high specificity and diagnostic accuracy, making it highly reliable for confirming benign and malignant lesions. However, its relatively lower sensitivity for malignant lesions suggests the need for cautious interpretation in suspicious cases.

BI-RADS scoring provides a standardized and non-invasive radiological assessment, with

moderate sensitivity and specificity. When combined with FNAC, it enhances overall diagnostic accuracy and reduces the likelihood of misdiagnosis.

Therefore, a multimodal approach combining clinical examination, imaging (BI-RADS), and cytology (FNAC) is recommended for optimal evaluation and management of breast lesions. Histopathological confirmation remains the gold standard in ambiguous or high-risk cases.

**Ethical Considerations**

The present study was conducted in accordance with established ethical standards for research involving human participants. Ethical approval was obtained from the **Institutional Review Board (IRB)/Ethics Committee** of the respective institution prior to the commencement of the study.

**REFERENCES**

BN, Navya & Thomas, Shalu & Hiremath, Rudresh & Alva, Sathyavathi. (2017). Comparison Of Diagnostic Accuracy Of BIRADS Score With Pathologic Findings In Breast Lumps. Annals of Pathology and Laboratory Medicine. 4. A236-A242. 10.21276/APALM.1124.

Begum, Zeenath & Risaldar, Aaisha & Alvi, Uzma. (2020). Correlation of FNAC with Histopathology of breast lesions. IP Journal of Diagnostic Pathology and Oncology. 5. 375-380. 10.18231/j.jdpo.2020.073.

Pandia A, Samantaray S, Mohapatara JS, Dash S. A comparative analysis of mammography breast imaging reporting and data system score and fine needle aspiration cytology in the evaluation of palpable breast lump. Int J Res Med Sci 2019;7:2644-9.

BN, Navya & Thomas, Shalu & Hiremath, Rudresh & Alva, Sathyavathi. (2017). Comparison Of Diagnostic Accuracy Of BIRADS Score With Pathologic Findings In Breast Lumps. Annals of Pathology and Laboratory Medicine. 4. A236-A242. 10.21276/APALM.1124.

Das, S., Raju, K., Tunuguntla, A., Sakalecha, A., & Nadipanna, S. (2022). Association of the International Academy of Cytology category with the Breast Imaging Reporting and Data System score in relation to the diagnostic accuracy for breast lumps. Biomedical Research and Therapy, 9(10), 5332-5340. https://doi.org/10.15419/bmrat.v9i10.771

Shrestha MK, Ghartimagar D, Ghosh A, Shrestha E, Bolar P. Significance of quadruple assessment of breast lump – A Hospital based study. Journal of Pathology of Nepal. 2014;4:630-4.

Chavan, Shahaji & B., Sree & Vemuri, Nandan. (2019). Diagnosis of breast lumps based on breast imaging reporting and data system score and histopathological examination: a comparative study. International Surgery Journal. 7. 144. 10.18203/2349-2902.isj20195960.

Sheikh Burgees Ismail, Jigyasa Puri, Rounaq Mishra, Rajesh Sharma. Mammogram and ultrasound evaluation of breast lesion with FNAC correlation. International Journal of Contemporary Medical Research 2022;9(6):F7-F12.

Balasundaram, A. Nilavazhagan. A comparative study with clinico-pathological correlation between ultrasonography, mammography and fine needle aspiration cytology in evaluation of breast lumps in coastal population of Karaikal. IAIM, 2019; 6(9): 21-27.

Mohson, Khaleel. (2022). Correlating Fine Needle Aspiration Cytology Results of Mammary Malignancy with Corresponding Ultrasound BIRADS Score. Asian Pacific Journal of Cancer Care. 7. 37-40. 10.31557/apjcc.2022.7.1.37-40.

Swani Bhagat, Sheema sheikh, Atul Choudhary. Comparative evaluation of FNAC and USG breast with core needle biopsy in the diagnosis of malignant breast lesions: a prospective observational study. International Journal of Research and Review. 2023; 10(1): 25-31. DOI: https://doi.org/10.52403/ijrr.20230104

Yu W, Gan Q, Gong Y. The Yokohama System for Reporting Breast Cytopathology. J Clin Transl Pathol. 2023;3(2):99-105. doi: 10.14218/JCTP.2023.00006.

IEER