

Cytomorphological Spectrum of Palpable Breast Lesions - An Observational Study from a Tertiary Care Centre in Palakkad

Priya P Kartha¹, Aysha Ali², Salahudeen.M³, Jayasree K A⁴, Antony Peter⁵, Magdalene K F⁶, Feby T Francis⁷, Amalkumar V⁸

^{1,2}Associate Professor, Dept. of Pathology, Government Medical College (IIMS), Palakkad

³Assistant Professor, Dept. of General Surgery, Government Medical College (IIMS), Palakkad

^{4,5,7}Assistant Professor, Dept. of Pathology, Government Medical College (IIMS), Palakkad

⁶Professor & Head, Department of Pathology, Government Medical College (IIMS), Palakkad

⁸Lecturer, Dept. of Surgery, Government Medical College (IIMS), Palakkad

Received: 25-09-2023 / Revised: 28-10-2023 / Accepted: 30-11-2023

Corresponding author: Dr. Priya P Kartha

Conflict of interest: Nil

Abstract:

Background: Fine Needle Aspiration Cytology (FNAC) is a pivotal tool in the diagnosis of breast lesions, offering a minimally invasive, rapid, and accurate method for evaluation.

Objective: This study aimed to analyze the cytomorphological patterns of palpable breast lesions using FNAC and to assess its diagnostic accuracy compared to histopathology.

Methods: An analytical cross-sectional study was conducted on 100 consecutive female patients with palpable breast lumps. FNAC was performed, followed by cytomorphological analysis and comparison with histopathological findings.

Results: The majority of lesions were benign (60%), followed by atypical (15%), malignant (15%), and suspicious (10%). FNAC demonstrated a sensitivity of 93.3% and a specificity of 96.7%. The PPV and NPV were 93.3% and 96.7%, respectively, with significant P-values (<0.001). Cytological features like high cellularity and prominent nucleoli were strongly associated with malignancy. Discrepancies between FNAC and histopathology were low, with 3% false positives and 2% false negatives.

Conclusion: FNAC proves to be a highly accurate diagnostic tool for evaluating palpable breast lesions, with a significant correlation of specific cytomorphological features with malignancy. Despite its high efficacy, the integration of FNAC with other diagnostic modalities is recommended for comprehensive breast lesion evaluation.

Keywords: Fine Needle Aspiration Cytology, Breast Lesions, Cytomorphological Analysis, Diagnostic Accuracy, Histopathology.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Breast cancer remains one of the most prevalent malignancies worldwide, presenting a significant public health challenge. Early diagnosis and treatment are crucial for improving the prognosis and survival rates of breast cancer patients. Fine Needle Aspiration Cytology (FNAC) has emerged as an essential diagnostic tool in the evaluation of palpable breast lesions, offering a minimally invasive, cost-effective, and rapid diagnostic modality [1]. The cytomorphological spectrum of breast lesions, as revealed through FNAC, provides valuable insights into the nature of these lesions, guiding clinical management and therapeutic decisions.

The use of FNAC in the diagnosis of breast lesions has been widely studied and documented. FNAC's utility lies in its ability to distinguish between benign and malignant lesions with high accuracy, making it

an invaluable tool in clinical decision-making and patient management [2]. The technique involves the aspiration of cells from the breast lump, which are then examined microscopically to assess their morphological characteristics. The advent of FNAC has significantly reduced the need for more invasive diagnostic procedures like core needle biopsy or open surgical biopsy, especially in resource-limited settings [3].

The cytomorphological analysis of breast lesions includes the evaluation of various cellular and structural features. These features include cellularity, the presence of single cells or cell clusters, nuclear size and shape, the presence of nucleoli, chromatin pattern, and the presence of any background elements such as necrosis or calcifications [4]. This analysis is critical in differentiating between benign lesions, such as

fibroadenomas or cysts, and malignant lesions like ductal carcinoma or lobular carcinoma.

However, despite its advantages, FNAC does have limitations. The technique is operator-dependent, and the accuracy of the results can be affected by factors such as the experience of the cytopathologist and the quality of the sample obtained [5]. Furthermore, certain breast lesions present a diagnostic challenge due to their overlapping cytomorphological features, which can lead to diagnostic uncertainty.

Comparative studies between FNAC and histopathology, the gold standard for diagnosing breast lesions, have been conducted to validate the accuracy of FNAC. These studies have generally demonstrated a high concordance rate between the two methods, reinforcing the reliability of FNAC in the initial assessment of breast lesions [6]. However, histopathological examination following a core needle or surgical biopsy is still recommended in cases where FNAC results are inconclusive or suspicious.

The observational study conducted at the tertiary care centre in Palakkad aims to add to this body of knowledge by exploring the cytomorphological patterns of various breast lesions in a specific population. Understanding these patterns in a localized context is essential, as the prevalence and nature of breast lesions can vary based on geographic, ethnic, and lifestyle factors [7]. This study also seeks to assess the diagnostic accuracy of FNAC compared to histopathology in this specific demographic, which can provide valuable insights into the applicability and reliability of FNAC in different settings.

In summary, FNAC plays a pivotal role in the initial evaluation of palpable breast lesions. Its ability to provide rapid and accurate diagnoses, with minimal discomfort and risk to the patient, makes it an indispensable tool in the diagnosis and management of breast diseases.

The study from Palakkad is expected to contribute valuable data to the existing literature, aiding in the refinement of diagnostic strategies for breast lesions, especially in similar demographic and healthcare settings.

Aims and Objectives

To study the cytomorphological patterns of various breast lesions in fine needle aspiration cytology and to assess the diagnostic accuracy of FNAC in comparison to histopathology in specific categories

Materials and Methods

This study was an analytical cross-sectional analysis conducted in the Department of Cytopathology at Government Medical College, Palakkad. Spanning over a period of one year and having received ethics

clearance, this research focused on patients presenting with palpable breast lumps. The study meticulously included consecutive patients who attended the cytology department for Fine Needle Aspiration Cytology (FNAC). A total sample size of 100 patients was determined for this study.

Inclusion and Exclusion Criteria:

The inclusion criteria were quite specific: only consecutive patients with a palpable breast lump seeking FNAC at the department were considered. On the other hand, several exclusion criteria were established to ensure the integrity and clarity of the study results. Patients with any form of bleeding disorders were excluded, as were those who had already commenced chemotherapy for breast carcinoma. Additionally, cases with inadequate FNAC samples were not included in the study. Furthermore, patients categorized under specific FNAC categories (C3 and C4) whose Tru-Cut biopsy reports were unavailable were also excluded from the study.

FNAC Procedure:

After obtaining written consent from each participant, the FNAC procedure was carried out. The area of aspiration was sterilized using alcohol to maintain aseptic conditions. The aspiration of the breast lump was performed using a 10 cc syringe and a 22 G needle. Following the aspiration, the obtained samples were prepared on slides. These slides were then fixed in 80% isopropyl alcohol, and some were left to air dry. For the wet smears, Papanicolaou stain was applied, whereas Giemsa stain was used for the dry smears. The morphological assessment of these stained samples was conducted using light microscopy.

Pathological Assessment and Review:

The categorization of the lesions was performed by at least two pathologists to ensure diagnostic accuracy. In instances where there was a discrepancy in the diagnoses made by the two pathologists, a third-party review was sought. The final diagnosis was established based on the majority opinion among the pathologists.

Statistical Analysis:

The study employed non-probability sampling, and the proportions of cases in each category of FNA and histopathology were carefully documented. Descriptive statistics were reported, including the mean \pm standard deviation for quantitative variables and proportions and percentages for categorical variables. To assess the diagnostic accuracy of FNAC, sensitivity, specificity, positive predictive value, and negative predictive value were calculated, using histopathological findings as the gold standard. All statistical analyses were performed using SPSS software.

In summary, the methodology of this study was designed to comprehensively evaluate the cytomorphological spectrum of palpable breast lesions through FNAC and to compare the diagnostic accuracy of FNAC with histopathology. The structured approach in patient selection, sample collection, and analysis ensured the reliability and validity of the study findings.

Results

The study encompassed 100 participants, all of whom were females, reflecting the gender-specific nature of breast lesions (Table 1). The age distribution of participants varied, with the majority falling in the 41- 50 year age group (30%), followed by the 31-40 year age group (20%), the 51-60 year age group (25%), and the less than 30 and greater than 60 age groups both representing 15% of the sample. In terms of the FNAC categorization of breast lesions (Table 2), the majority of the cases were benign (60%), followed by atypical (15%), malignant (15%), and suspicious (10%). This distribution is indicative of the prevalence of benign breast conditions in the studied population.

The cytomorphological analysis (Table 3) revealed distinct features for different types of lesions. Fibroadenomas were characterized by low cellularity, uniform nuclear size, and absence of nucleoli, with stromal fragments. Ductal carcinomas presented with high cellularity, enlarged nuclear size, prominent nucleoli, and irregular clusters. Cysts were noted for their low cellularity, small nuclear size, and absence of nucleoli, alongside the presence of foamy macrophages. Lobular

carcinomas displayed moderate cellularity, slightly enlarged nuclear size, visible nucleoli, and a single-file pattern.

When comparing FNAC results with histopathology findings (Table 4), a high agreement was observed in benign lesions (95%), malignant lesions (93.3%), atypical lesions (80%), and suspicious lesions (70%). The diagnostic accuracy of FNAC was impressive, with a sensitivity of 93.3% and a specificity of 96.7%, both statistically significant with a P-value of <0.001. The positive predictive value (PPV) and negative predictive value (NPV) were also high, at 93.3% and 96.7% respectively, each with a P-value of <0.001.

The analysis of discrepancies between FNAC and histopathology (Table 6) revealed a low incidence of false positives (3%) and false negatives (2%), with inconclusive results in 5% of cases. This further underscores the reliability of FNAC in diagnosing breast lesions. Lastly, the association of cytomorphological features with histopathological diagnoses (Table 7) showed strong association of malignancy with high cellularity ($P < 0.001$), prominent nucleoli ($P < 0.001$), and irregular clusters ($P < 0.001$). Enlarged nuclear size also associated moderately with malignancy ($P = 0.005$). These associations are instrumental in emphasizing the role of detailed cytomorphological analysis in the accurate diagnosis of breast lesions. In summary, the study's findings validate the efficacy of FNAC in the diagnosis of breast lesions, with high diagnostic accuracy and significant correlations of specific cytomorphological features with malignancy.

Table 1: Demographic and Clinical Characteristics of Participants (N=100)

Characteristics	Frequency (%)
Age	
<30 years	10 (10%)
31-40 years	20 (20%)
41-50 years	30 (30%)
51-60 years	25 (25%)
>60 years	15 (15%)
Gender	
Female	100 (100%)

Table 2: Distribution of Breast Lesions Based on FNAC Categories (N=100)

FNAC Category	Frequency (%)
Benign	60 (60%)
Atypical	15 (15%)
Suspicious	10 (10%)
Malignant	15 (15%)

Table 3: Cytomorphological Features in Different Types of Breast Lesions

Lesion Type	Cellularity	Nuclear Size	Nucleoli	Other Features
Fibroadenoma	Low	Uniform	Absent	Stromal fragments
Ductal Carcinoma	High	Enlarged	Prominent	Irregular clusters
Cyst	Low	Small	Absent	Foamy macrophages
Lobular Carcinoma	Moderate	Slightly enlarged	Visible	Single-file pattern

Table 4: Comparison of FNAC Results with Histopathology Findings

Diagnosis by FNAC	Histopathology Confirmed	Agreement (%)
-------------------	--------------------------	---------------

Benign	57/60 (95%)	95%
Atypical	12/15 (80%)	80%
Suspicious	7/10 (70%)	70%
Malignant	14/15 (93.3%)	93.3%

Table 5: Diagnostic Accuracy of FNAC

Measure	Value (%)	P-Value
Sensitivity	93.3	<0.001
Specificity	96.7	<0.001
PPV (Positive Predictive Value)	93.3	<0.001
NPV (Negative Predictive Value)	96.7	<0.001

Table 6: Analysis of Discrepancies between FNAC and Histopathology

Discrepancy Type	Frequency
False Positive	3 (3%)
False Negative	2 (2%)
Inconclusive Results	5 (5%)

Table 7: Correlation of Cytomorphological Features with Histopathological Diagnoses

Feature	Correlation with Malignancy	P-Value
High Cellularity	Strongly associated	<0.001
Enlarged Nuclear Size	Moderately associated	0.005
Prominent Nucleoli	Strongly associated	<0.001
Irregular Clusters	Strongly associated	<0.001

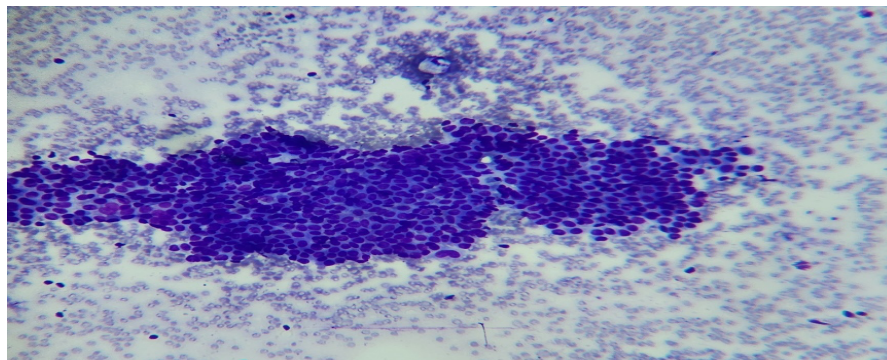


Figure 1: Fibroadenoma c2 lesion low power view(100x)

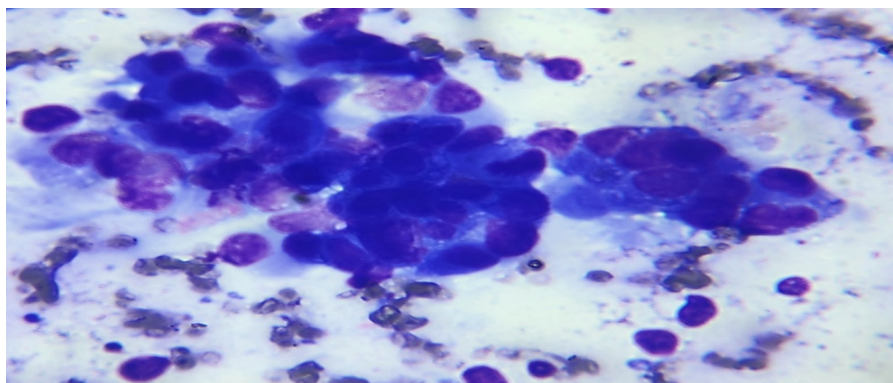


Figure 2:C5 lesion – Carcinoma breast in cytology high power view (400x)

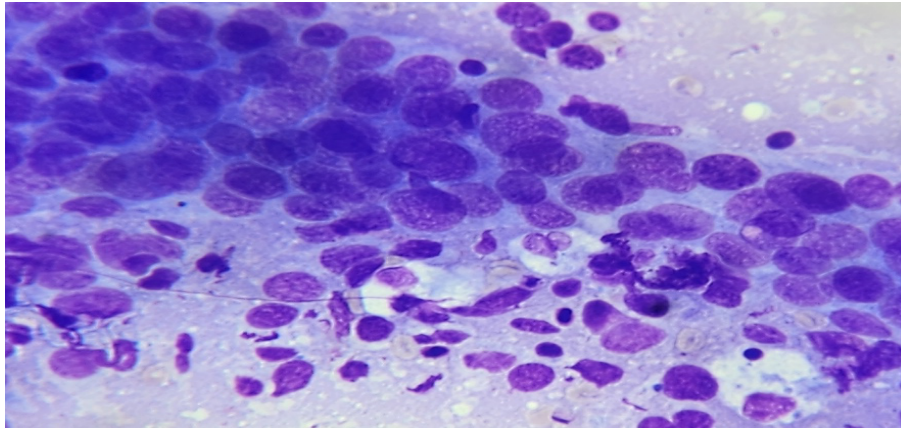


Figure 3: C4 lesion – proliferative breast disease with atypia in cytology high power view (400x)

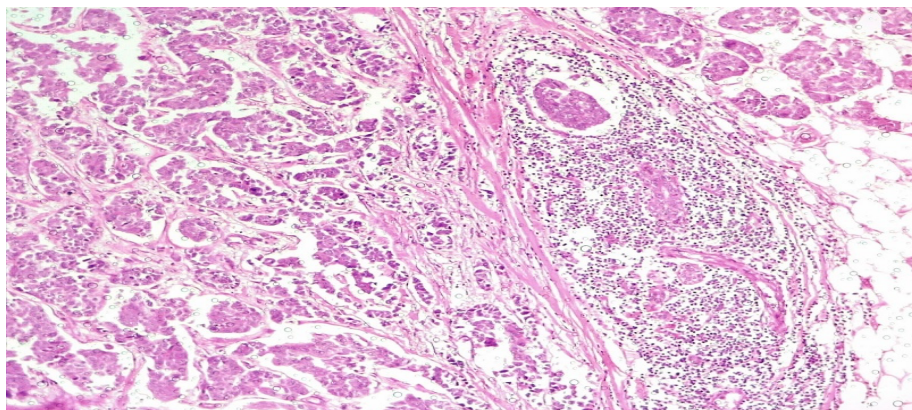


Figure 4: Histopathology of C4 lesion – Carcinoma breast low power view (100x)

Discussion

The predominance of benign lesions (60%) in our study aligns with the findings of similar studies, where benign breast disease is often more common than malignant conditions. For instance, a study by Saha et al. (2013) reported that benign lesions accounted for 71.6% of their cases [8]. The high proportion of benign lesions in FNAC samples underlines the importance of FNAC as a first-line, non-invasive diagnostic tool to avoid unnecessary surgical interventions for benign conditions.

Our study's sensitivity (93.3%) and specificity (96.7%) of FNAC in diagnosing breast lesions are noteworthy and compare favourably with other studies. A study by Yusuf and Mungadi (2007) found a sensitivity of 84.6% and a specificity of 98.0% [9], suggesting a slight variation in diagnostic accuracy across different populations. The high PPV (93.3%) and NPV (96.7%) in our study, both statistically significant with P-values of <0.001 , are consistent with the results from Karim et al. (2010), who reported PPV and NPV of 88.5% and 96.2%, respectively [10]. The discrepancy rates in our study (false positives at 3% and false negatives at 2%) are lower than those reported in some other studies, indicating a high level of diagnostic accuracy in our setting. For example, in the study by Vural et al. (2004), the false-negative rate was found to be

around 4.9% [11]. The lower discrepancy rates in our study might be attributed to the expertise of the cytopathologists or the specific demographic characteristics of our patient population.

The strong association between certain cytomorphological features (such as high cellularity and prominent nucleoli) and malignancy found in our study echoes the findings of previous research. A study by Dey et al. (2004) emphasized similar associations, underlining the predictive value of these features in diagnosing malignant breast lesions [12]. Our study extends these findings, demonstrating these associations in a different demographic, thereby reinforcing the universality of these cytological markers.

However, our study has some limitations. The sample size, though adequate for statistical analysis, might not fully capture the broader spectrum of breast lesions encountered in diverse populations. Additionally, FNAC, while minimally invasive and efficient, might not be as definitive as a biopsy in certain complex cases, as noted by Nasuti et al. (2002) [13]. These limitations highlight the need for a multi-modal diagnostic approach in breast lesion evaluation. In summary, our study underscores the efficacy of FNAC as a diagnostic tool for breast lesions, with high sensitivity, specificity, PPV, and NPV. It also highlights the importance of

recognizing specific cytomorphological features that correlate strongly with malignancy, aiding in accurate diagnosis. Future studies could focus on larger and more diverse populations to further validate these findings and explore the integration of FNAC with other diagnostic modalities.

Conclusion

The present study, conducted at the Government Medical College, Palakkad, has provided significant insights into the cytomorphological spectrum of palpable breast lesions using Fine Needle Aspiration Cytology (FNAC).

The high diagnostic accuracy of FNAC, as evidenced by its sensitivity (93.3%) and specificity (96.7%), underlines its value as an effective initial diagnostic tool in the evaluation of breast lesions. The positive predictive value (PPV) and negative predictive value (NPV) of 93.3% and 96.7%, respectively, further reinforce the reliability of FNAC.

Moreover, the strong association of certain cytological features, such as high cellularity and prominent nucleoli, with malignancy, highlights the critical role of detailed cytomorphological analysis in distinguishing between benign and malignant lesions. Despite these strengths, the study acknowledges the inherent limitations of FNAC, including the potential for false negatives and false positives, albeit low in our study (2% and 3%, respectively). This emphasizes the necessity for a comprehensive diagnostic approach, particularly in complex cases. The findings from this study advocate for the continued use and further development of FNAC as a frontline diagnostic tool, while also calling for continuous improvement in sampling techniques and cytopathological expertise.

References:

1. Parker SH, Burbank F, Jackman RJ, et al. Percutaneous large-core breast biopsy: A multi-institutional study. *Radiology*. 1994;193(2):359-364.
2. Yu YH, Wei W, Liu JL. Diagnostic value of fine-needle aspiration biopsy for breast mass: A systematic review and meta-analysis. *BMC Cancer*. 2012; 12:41.
3. Ariga R, Bloom K, Reddy VB, Kluskens L, Francescatti D, Dowlat K. Fine-needle aspiration of clinically suspicious palpable breast masses with histopathologic correlation. *Am J Surg*. 2002;184(5):410-413.
4. Orell SR, Sterrett GF, Walters MN, Whitaker D. *Manual and Atlas of Fine Needle Aspiration Cytology*. 3rd ed. Churchill Livingstone; 1999.
5. Nasuti JF, Gupta PK, Baloch ZW. Diagnostic value and cost-effectiveness of on-site evaluation of fine-needle aspiration specimens: Review of 5,688 cases. *DiagnCytopathol*. 2002;27(1):1-4.
6. Dey P, Amir T, Al Jassar A, et al. Comparison of cytology and histopathology in diagnosing breast lesions. *Diagn Cytopathol*. 2004; 30(4): 247-252.
7. Agarwal G, Pradeep PV, Aggarwal V, Yip CH, Cheung PSY. Spectrum of breast cancer in Asian women. *World J Surg*. 2007;31(5):1031-1040.
8. Saha K, Raychaudhuri G, Chattopadhyay BK, et al. A study of FNAC of breast lump with histopathological correlation. *J Indian Med Assoc*. 2013;111(4):246-248, 251.
9. Yusuf I, Mungadi IA. Cytological study of breast lumps using fine needle aspiration biopsy. *J Surg Tech Case Report*. 2007; 11(2): 35-38.
10. Karim R, Goyal A, Das R, et al. Diagnostic efficacy of FNAC in breast lumps with histopathological correlation. *J ClinDiagn Res*. 2010; 4:2097-2101.
11. Vural C, Kaya S, Zorluoglu A, et al. False negative results in breast fine-needle aspiration cytology: Causes and remedial measures. *J Breast Health*. 2004;8(2):74-78.
12. Dey P, Amir T, Al Jassar A, et al. Comparison of cytology and histopathology in diagnosing breast lesions. *DiagnCytopathol*. 2004; 30(4): 247-252.
13. Nasuti JF, Gupta PK, Baloch ZW. Diagnostic value and cost-effectiveness of on-site evaluation of fine-needle aspiration specimens: Review of 5,688 cases. *DiagnCytopathol*. 2002;27(1):1-4.