

Clinicopathological Spectrum of Breast Lumps: A Correlative Analysis of Fine-Needle Aspiration Cytology and Histopathological Findings

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Abstract

Background: Breast lumps constitute a frequent clinical presentation in women and encompass a broad spectrum of pathological entities, ranging from benign proliferative and non-neoplastic lesions to malignant neoplasms. Timely and accurate characterization of these lesions is essential for establishing an appropriate therapeutic strategy and optimizing clinical outcomes. Fine-Needle Aspiration Cytology (FNAC) and histopathological examination (HPE) represent important diagnostic modalities in the evaluation and characterization of breast lesions. **Aims:** To characterize the clinicopathological profile of patients presenting with palpable breast lumps and to assess the degree of correlation between FNAC findings and definitive histopathological diagnoses. **Subjects and Methods:** This study was conducted in the Department of General Surgery at Teerthanker Mahaveer Medical College & Research Centre, MORADABAD over a period of one year. The study population comprised patients presenting with clinically palpable breast lumps to the outpatient department, as well as admitted patients fulfilling the predefined eligibility criteria during the study period. A total of 100 patients were enrolled and constituted the study sample. **Results:** A total of 100 patients presenting with breast lumps were evaluated in the present study. Histopathological examination demonstrated that benign lesions constituted the predominant pathological category, accounting for 70 cases (70%). Malignant lesions were identified in 25 patients (25%), whereas inflammatory lesions constituted 5 cases (5%). **Conclusion:** FNAC represents a simple, rapid, minimally invasive, and cost-effective modality for the initial evaluation of palpable breast lesions. Nevertheless, histopathological examination continues to serve as the definitive diagnostic standard, particularly when precise pathological characterization is required. An integrated clinicopathological approach incorporating clinical assessment, FNAC, and histopathological evaluation can facilitate more accurate diagnosis and contribute to appropriate and timely patient management.

Keywords: Breast Lumps, Fine-Needle Aspiration Cytology.

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Introduction

Breast lumps represent one of the most frequently encountered clinical presentations in surgical and gynecological outpatient practice worldwide. The detection of a breast mass is often associated with considerable psychological distress, largely owing to the apprehension of an underlying malignancy. Nevertheless, a substantial proportion of breast lesions are benign. The pathological spectrum is broad, encompassing benign entities such as fibroadenoma and breast cysts, inflammatory conditions, proliferative disorders, and invasive malignant neoplasms. Consequently, systematic and accurate evaluation of a breast lump is fundamental to establishing an appropriate diagnosis and formulating an optimal management strategy.^[1]

The global burden of breast disease continues to increase, with a particularly significant impact in developing

countries, where limited awareness, inadequate access to healthcare facilities, and delayed presentation frequently contribute to advanced disease and poorer outcomes. Breast cancer has emerged as the most frequently diagnosed malignancy among women worldwide and continues to constitute a major contributor to cancer-related mortality.^[2] Early recognition and precise characterization of breast lesions are therefore of paramount importance, as timely diagnosis facilitates appropriate therapeutic intervention and has the potential to substantially improve survival and overall clinical outcomes.

The diagnostic assessment of a breast lump conventionally begins with a comprehensive clinical history and meticulous physical examination. Although clinical evaluation provides valuable information regarding the nature and characteristics of a lesion, it cannot reliably distinguish benign from malignant pathology in all cases, particularly when lesions

are small, deeply situated, or clinically equivocal.^[3] Consequently, imaging techniques, principally ultrasonography and mammography, are frequently employed as complementary diagnostic modalities. Despite substantial advances in breast imaging and lesion characterization, definitive tissue diagnosis remains essential for establishing the pathological nature of a suspicious lesion. Fine-Needle Aspiration Cytology (FNAC) has gained widespread acceptance as a minimally invasive, economical, rapid, and relatively simple diagnostic technique for the assessment of breast masses. The procedure enables cytological evaluation of cellular material obtained from a lesion with minimal patient discomfort and can frequently be performed in an outpatient setting, thereby facilitating an early preliminary diagnosis.^[4] FNAC is particularly valuable in differentiating cystic from solid lesions and in identifying cytological features suggestive of benign or malignant disease. However, despite its clinical utility, FNAC is subject to certain inherent limitations, including inadequate or unrepresentative sampling, equivocal cytological findings, and difficulty in reliably differentiating certain in-situ lesions from invasive carcinomas.^[5]

Histopathological examination (HPE), in contrast, remains the definitive diagnostic standard for the characterization of breast lesions. Unlike cytological assessment, histopathology permits evaluation of tissue architecture in addition to individual cellular morphology, thereby enabling more precise classification of pathological entities and assessment of tumor grade and other prognostically relevant characteristics. Accordingly, HPE continues to serve as the reference standard against which cytological diagnoses are assessed.^[6] Although histopathological evaluation generally requires a more invasive tissue-acquisition procedure and entails greater processing time compared with FNAC, it provides a substantially more comprehensive assessment of the lesion and remains indispensable for definitive diagnosis. Clinicopathological correlation constitutes an integral component of the diagnostic evaluation of breast lumps. The systematic integration of clinical findings with cytological and histopathological observations can enhance diagnostic precision while minimizing the likelihood of false-positive and false-negative interpretations. Previous investigations have demonstrated substantial concordance between FNAC and histopathological diagnoses, particularly in lesions exhibiting unequivocal benign or malignant characteristics.^[7] Nevertheless, diagnostic discordance may occur in borderline and proliferative lesions, as well as in circumstances where cytological material is insufficient or fails to adequately represent the underlying pathology. Fibroadenoma represents the most prevalent benign breast neoplasm and is particularly common among women of reproductive age. Classically, it presents as a painless, freely mobile, well-defined, and circumscribed breast mass. Conversely, invasive ductal carcinoma constitutes the predominant histological type of breast malignancy and may characteristically manifest as a firm or hard, irregular, relatively immobile mass, occasionally accompanied by alterations of the overlying skin or nipple.^[8] Accurate differentiation between benign and malignant breast lesions

is therefore essential to ensure timely and appropriate therapeutic intervention.

The diagnostic performance of FNAC is influenced by several factors, including the experience and expertise of the cytopathologist, the anatomical and morphological characteristics of the lesion, adequacy of sampling, and the technique employed during specimen acquisition and interpretation. Published studies have reported sensitivities ranging from approximately 80% to 95%, with specificity generally exceeding 90% when FNAC is performed and interpreted by experienced personnel.^[9] Despite its favorable diagnostic performance, however, FNAC cannot completely replace histopathological examination, particularly when definitive pathological characterization is required for diagnosis and subsequent treatment planning.

In resource-constrained healthcare settings, FNAC assumes particular importance as an initial diagnostic modality because of its relative affordability, accessibility, rapid turnaround time, and minimally invasive nature. Its diagnostic utility is further enhanced when integrated with clinical assessment and appropriate imaging, constituting the widely recognized “triple assessment” approach. The combined interpretation of clinical examination, imaging findings, and tissue or cytological assessment substantially improves diagnostic confidence and can reduce the number of unnecessary open surgical biopsies.^[10] This integrated diagnostic strategy has consequently become an established approach in the systematic evaluation of patients presenting with breast lumps.

The present study was undertaken to characterize the clinicopathological profile of patients presenting with breast lumps and to evaluate the diagnostic performance of Fine-Needle Aspiration Cytology (FNAC) through correlation with histopathological examination (HPE), which serves as the definitive reference standard. The study further seeks to delineate the distribution of benign and malignant breast lesions, identify the predominant pathological patterns, and determine the sensitivity and specificity of FNAC in the diagnosis of breast lesions. In addition, the degree of concordance between FNAC and histopathological findings will be assessed to establish the clinical utility and reliability of FNAC as an initial diagnostic modality in the evaluation of breast lumps.

Subjects and Methods

Study Design

The present investigation was designed as a hospital-based observational study undertaken to evaluate the clinicopathological profile of patients presenting with clinically palpable breast lumps and to assess the correlation between Fine-Needle Aspiration Cytology (FNAC) and histopathological examination (HPE).

Study Setting

The study was conducted in the Department of General Surgery, Teerthanker Mahaveer Medical College & Research Centre, Moradabad.

Study Duration

The study was carried out over a period of one year.

Study Population

The study population comprised all patients presenting to the outpatient department with clinically palpable breast lumps, as well as admitted patients, who fulfilled the predefined eligibility criteria during the study period.

Sample Size

A total of 100 patients with clinically palpable breast lumps were enrolled in the study.

Study Variables

The following demographic, clinical, and pathological variables were recorded and analyzed:

- Age of the patient (in years)
- Sex
- Anatomical site of the breast lump
- Type of breast lesion
- FNAC findings
- Histopathological examination findings
- Correlation between FNAC and HPE results

Inclusion Criteria

Patients were eligible for inclusion if they fulfilled the following criteria:

- Patients of any age and sex presenting with a clinically palpable breast lump.
- Patients who underwent Fine-Needle Aspiration Cytology (FNAC) as part of the diagnostic evaluation.
- Patients who subsequently underwent surgical intervention with procurement of tissue for histopathological examination.
- Patients who provided informed consent for participation in the study.

Exclusion Criteria

- Patients meeting any of the following criteria were excluded:
- Patients who declined or did not provide consent for participation in the study.
- Patients in whom the FNAC specimen was inadequate or non-diagnostic.
- Patients who did not undergo surgical excision or

otherwise lacked a definitive histopathological examination.

- Patients for whom adequate clinicopathological data were unavailable for analysis.

Statistical Analysis

The collected data were initially entered into a Microsoft Excel spreadsheet and subsequently subjected to statistical analysis using IBM SPSS Statistics, version 27.0 (SPSS Inc., Chicago, IL, USA) and GraphPad Prism, version 5.

Continuous numerical variables were summarized using the mean and standard deviation (SD), whereas categorical variables were expressed as frequencies and percentages.

For comparison of continuous variables between two independent groups, the independent-samples (unpaired) Student's t-test was employed where appropriate. For paired observations, the paired Student's t-test was used. The selection of the statistical test was based on the nature and distribution of the data.

Categorical variables and differences in proportions between groups were assessed using the Pearson chi-square (χ^2) test. Where the expected cell frequencies were insufficient for application of the chi-square test, Fisher's exact test was employed as appropriate.

For analyses involving the Student's t-test, the corresponding t statistic and degrees of freedom were determined according to the characteristics of the data and the specific comparison being undertaken. Both one-tailed and two-tailed tests may be applied depending upon the prespecified research hypothesis; however, statistical significance in the present study was assessed using a two-tailed approach.

The p-value was determined from the appropriate statistical distribution corresponding to the test applied. A p-value of ≤ 0.05 was considered indicative of statistical significance. Conversely, a p-value > 0.05 was considered statistically non-significant.

All statistical analyses were performed using the aforementioned statistical software packages, and the results were interpreted in accordance with standard statistical principles.

Results

Table 1: Age distribution of patients (n = 100)

Age group (years)	Number (n)	Percentage (%)
0-20	10	10%
21-30	35	35%
31-40	25	25%
41-50	20	20%
>50	10	10%
Total	100	100%

Table 2: Sex distribution of patients (n = 100)

Sex	Number (n)	Percentage (%)
Female	92	92%
Male	8	8%
Total	100	100%

Table 3: Distribution of breast lesions (HPE diagnosis) (n = 100)

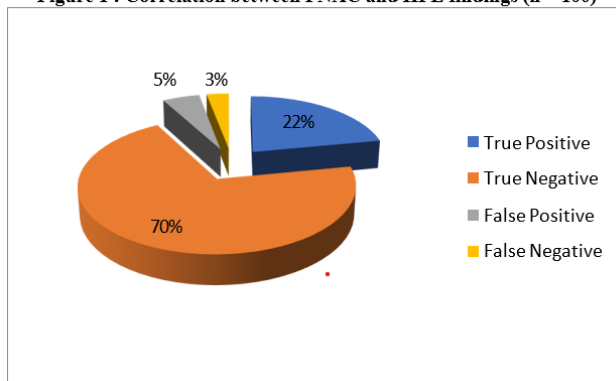
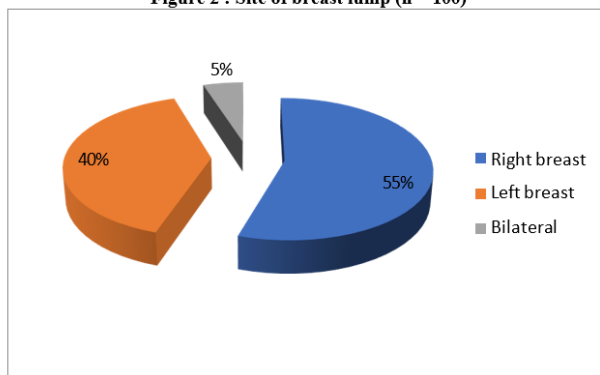
Type of lesion	Number (n)	Percentage (%)
Benign	70	70%
Malignant	25	25%
Inflammatory	5	5%
Total	100	100%

Table 4: Correlation between FNAC and HPE findings (n = 100)

FNAC vs HPE Result	Number (n)	Percentage (%)
True Positive	22	22%
True Negative	70	70%
False Positive	5	5%
False Negative	3	3%
Total	100	100%

Table 5: Site of breast lump (n = 100)

Site of lump	Number (n)	Percentage (%)
Right breast	55	55%
Left breast	40	40%
Bilateral	5	5%
Total	100	100%

Figure 1 : Correlation between FNAC and HPE findings (n = 100)**Figure 2 : Site of breast lump (n = 100)**

In the present study, 100 patients presenting with breast lumps were evaluated. The age-wise distribution demonstrated a predominance of patients in the 21–30-year age group, which comprised 35 cases (35%). This was followed by the 31–40-year age group, accounting for 25 patients (25%). The 41–50-year age group constituted 20 patients (20%), whereas the 0–20-year and >50-year age groups each comprised 10 patients (10%).

The study population demonstrated a pronounced female

predominance. Of the 100 patients evaluated, 92 (92%) were female, whereas 8 (8%) were male, indicating a substantially higher occurrence of clinically palpable breast lumps among women in the study cohort.

Histopathological evaluation revealed that benign lesions constituted the predominant pathological category, accounting for 70 cases (70%). Malignant lesions were identified in 25 patients (25%), while inflammatory lesions constituted 5 cases (5%). Thus, benign breast pathology represented the largest proportion of lesions encountered in the study population.

The diagnostic concordance between Fine-Needle Aspiration Cytology (FNAC) and Histopathological Examination (HPE) was subsequently assessed. FNAC correctly identified 22 malignant cases (22%), which were subsequently confirmed by HPE, representing true-positive (TP) findings. Concordant benign results were observed in 70 patients (70%), constituting true-negative (TN) cases. False-positive (FP) results were documented in 5 patients (5%), wherein FNAC indicated malignancy but subsequent HPE demonstrated a benign lesion. Conversely, 3 patients (3%) were categorized as false-negative (FN) cases, in whom FNAC failed to identify malignancy that was subsequently confirmed on histopathological examination.

With regard to the anatomical distribution of breast lesions, the right breast was the most frequently involved site, accounting for 55 cases (55%). Lesions involving the left breast were observed in 40 patients (40%), whereas bilateral breast involvement was documented in 5 patients (5%). Thus, unilateral lesions predominated, with right-sided involvement being more frequent than left-sided disease.

The diagnostic concordance between Fine-Needle Aspiration Cytology (FNAC) and Histopathological Examination (HPE) was assessed among the 100 patients included in the study. FNAC correctly identified 22 malignant lesions (22%), which were subsequently corroborated by HPE, constituting the true-positive (TP) category. Conversely, 70 patients (70%) demonstrated concordant benign findings on

both FNAC and HPE, representing true-negative (TN) cases. False-positive (FP) results were observed in 5 patients (5%), wherein FNAC indicated malignant pathology, whereas subsequent histopathological assessment revealed benign disease. False-negative (FN) findings occurred in 3 patients (3%), in whom FNAC failed to identify malignancy that was subsequently established on HPE. These findings demonstrate a high degree of overall concordance between cytological and histopathological assessment, while also highlighting the occurrence of a small proportion of discordant cases.

Analysis of the anatomical distribution of breast lesions demonstrated a predominance of right-sided involvement. Of the 100 patients evaluated, 55 (55%) presented with lesions involving the right breast, making it the most frequently affected site. Lesions involving the left breast were documented in 40 patients (40%), whereas bilateral breast involvement was identified in 5 patients (5%). Thus, unilateral breast lesions accounted for the overwhelming majority of cases, with right-sided involvement occurring more frequently than left-sided disease.

Discussion

The present study demonstrated that breast lumps were encountered predominantly among younger women, with the 21–30-year age group accounting for the largest proportion of cases (35%), followed by patients aged 31–40 years (25%) and 41–50 years (20%). Patients aged 0–20 years and >50 years constituted 10% each of the study population. This age distribution indicates a greater representation of breast lumps among younger and reproductive-age individuals, a pattern that may largely reflect the substantial contribution of benign breast disorders within this demographic. Comparable observations have been documented by Ramala Jr SR et al,^[11] and Haldar C et al,^[12] who reported a greater incidence of breast lesions during the second and third decades of life, with benign entities such as fibroadenoma accounting for a considerable proportion of cases. Johansson A et al,^[13] similarly observed that benign breast disorders are more frequently encountered among younger women, whereas the probability of malignant breast pathology progressively increases with advancing age.

A pronounced female predominance was observed in the present study, with women constituting 92% of the study cohort, compared with only 8% male patients. This substantial sex disparity is consistent with the well-established biological, hormonal, and anatomical differences underlying the epidemiology of breast disease. Similar findings have been reported by Hassan MM et al,^[14] and Arnold M et al,^[15] both of whom documented that females accounted for more than 90% of patients presenting with breast lumps. Shi ZA et al,^[16] further emphasized the relative rarity of clinically significant breast lesions in males, with gynecomastia representing one of the predominant causes of male breast enlargement. The marked female predominance observed in the present cohort therefore corresponds closely with the established epidemiological profile of breast

pathology.

Histopathological evaluation in the present study revealed a clear predominance of benign lesions, which constituted 70% of all cases, whereas malignant lesions accounted for 25% and inflammatory lesions for 5%. The predominance of benign pathology is consistent with the clinical observation that most palpable breast masses do not represent malignancy, particularly among younger patients. These findings are in agreement with those reported by Lerwill MF et al,^[17] who likewise demonstrated a predominance of benign breast lesions, with fibroadenoma representing one of the most frequently encountered pathological entities. The relatively high proportion of benign lesions in the present study further emphasizes the importance of accurate diagnostic differentiation to prevent unnecessary surgical intervention while ensuring timely identification of malignant disease.

The comparison between Fine-Needle Aspiration Cytology (FNAC) and Histopathological Examination (HPE) demonstrated 22% true-positive, 70% true-negative, 5% false-positive, and 3% false-negative results. The predominance of concordant results suggests a substantial degree of agreement between FNAC and definitive histopathological assessment. The relatively small proportion of discordant cases further supports the utility of FNAC as an initial diagnostic modality in the evaluation of palpable breast lesions. Similar observations have been reported by Roheen T et al,^[18] who demonstrated favorable diagnostic performance of FNAC, particularly with respect to its sensitivity and specificity in the evaluation of breast lesions. Cheruku S et al,^[19] likewise reported a high level of concordance between cytological and histopathological diagnoses, while recognizing that diagnostic discrepancies may arise in borderline lesions, heterogeneous tumors, and cases in which cytological sampling is inadequate or unrepresentative. These limitations reinforce the importance of interpreting FNAC findings within the broader clinical and radiological context and, where indicated, confirming the diagnosis through histopathological examination.

With respect to the anatomical distribution of breast lesions, the present study demonstrated a modest predominance of right-sided involvement (55%), followed by left-sided lesions (40%), while bilateral involvement was observed in 5% of cases. Thus, unilateral disease constituted the overwhelming majority of presentations, with a slight predominance of right-sided lesions. Comparable findings have been described by Abdou Y et al,^[20] who also observed a relatively greater frequency of right-sided breast involvement. However, the reported difference between right- and left-sided lesions was not statistically significant, suggesting that the apparent laterality predominance may represent a variation within the study population rather than a definitive biological predisposition.

Overall, the findings of the present study indicate that benign breast lesions constitute the predominant pathological spectrum among patients presenting with palpable breast lumps, particularly within younger age groups. At the same time, the identification of a substantial proportion of malignant lesions underscores the importance of systematic

evaluation of every clinically significant breast mass. The favorable concordance observed between FNAC and HPE supports the role of FNAC as a rapid and minimally invasive diagnostic modality; however, histopathological examination remains indispensable for definitive diagnosis, particularly in cytologically equivocal, discordant, or clinically suspicious cases. An integrated approach incorporating clinical examination, imaging, FNAC, and histopathological assessment therefore remains essential for achieving diagnostic accuracy and guiding appropriate patient management.

Conclusion

The findings of the present study indicate that palpable breast lumps are encountered predominantly among younger patients, with the third decade of life representing the most frequently affected age group and a pronounced female predominance. The majority of breast lesions were benign in nature, with fibroadenoma constituting the predominant benign pathology, whereas invasive ductal carcinoma emerged as the most frequently identified malignant lesion. Fine-Needle Aspiration Cytology (FNAC) demonstrated a substantial degree of diagnostic concordance with histopathological examination (HPE), supporting its clinical utility as an initial investigative modality for the assessment of palpable breast lesions. Nevertheless, the occurrence of a limited number of false-positive and false-negative results emphasizes the inherent limitations of cytological assessment, particularly in lesions with borderline or equivocal characteristics and in specimens affected by inadequate or non-representative sampling.

Histopathological examination continues to represent the definitive diagnostic reference standard, owing to its ability to provide comprehensive architectural and cellular characterization of breast lesions and facilitate accurate pathological classification. The findings of this study further reinforce the value of integrating clinical assessment with FNAC and histopathology to enhance diagnostic precision and facilitate appropriate therapeutic decision-making.

In conclusion, FNAC represents a rapid, economical, minimally invasive, and clinically valuable first-line investigation for patients presenting with breast lumps. However, it should be regarded as a complementary rather than definitive diagnostic modality, with histopathological confirmation remaining essential whenever definitive tissue characterization is required, particularly in suspicious, discordant, or diagnostically challenging lesions.

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