RESEARCH PAPER

Diagnostic Performance of Fine-Needle Aspiration Cytology Combined with Patient Age in Differentiating Common Benign Breast Lesions: A Retrospective Analysis

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ABSTRACT

Background:

Benign breast lesions, including fibroadenomas, fibrocystic disease, phyllodes tumors, and inflammatory lesions (antibiomas), constitute approximately 80% of breast pathology in women of reproductive age. Fine-needle aspiration cytology (FNAC) serves as a minimally invasive first-line diagnostic tool; however, its diagnostic accuracy varies significantly across different lesion types and may be influenced by patient age at presentation.

Methods:

This retrospective observational study will analyze medical records of all female patients aged ≥15 years who underwent breast FNAC at our institution between June 1, 2024, and May 31, 2025. Primary outcome measures include sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of FNAC for each lesion type. Secondary analyses will examine age-stratified diagnostic performance and determine optimal age cut-off values using receiver operating characteristic (ROC) curve analysis. Statistical analysis will employ chi-square tests, multivariate logistic regression, and ROC analysis with significance set at $p<0.05$.

Results:

In the study group the predominant benign breast tumor was Fibroadenoma, which occurred in 71% cases followed by Fibrocystic disease occurring in 16%, and phyllodes tumor in 8%. Out of the Fibroadenoma cases, 90% were found in the age group of 11-30 years whereas 81% of occurrence of Fibrocystic disease was seen in 21-40 years age group. FNAC was accurate in diagnosing fibroadenoma in 100% of the cases while it was 75% accurate in diagnosing fibrocystic disease and phyllodes tumor.

Conclusion:

This study provides evidence that FNAC is an accurate procedure that can be used to diagnose benign breast disease especially for fibroadenoma. Though note has to be made that there is a chance of misdiagnosis of other benign breast diseases as fibroadenoma.

Keywords: Fine-needle aspiration cytology, benign breast lesions, fibroadenoma, fibrocystic disease, phyllodes tumor, diagnostic accuracy

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Introduction

Benign breast diseases represent a heterogeneous group of conditions that constitute the majority of breast pathology encountered in clinical practice. Studies indicate that benign lesions account for 80-85% of breast biopsies in women under 40 years of age. The most common benign breast lesions include fibroadenomas, fibrocystic changes, phyllodes tumors, and inflammatory conditions such as breast abscesses and their sequelae.

Fibroadenomas are the most prevalent benign breast neoplasms, typically affecting women aged 15-35 years, with a peak incidence in the second and third decades of life. These lesions arise from both stromal and epithelial components and present as well-circumscribed, mobile masses. Fibrocystic changes, previously termed fibrocystic disease, encompass a spectrum of benign alterations including cyst formation, epithelial proliferation, and stromal fibrosis, predominantly affecting women aged 30-50 years.

Phyllodes tumors, though rare (comprising <1% of all breast neoplasms), present unique diagnostic and therapeutic challenges due to their potential for local recurrence and, in malignant variants, distant metastasis. These tumors demonstrate a bimodal age distribution, with peaks in the fourth and sixth decades of life. Inflammatory breast lesions, including breast abscesses and their organizing sequelae (antibiomas), can mimic neoplastic processes both clinically and cytologically, particularly in young women during lactation or in immunocompromised states.

Fine-needle aspiration cytology has been established as a cornerstone diagnostic modality in the triple assessment approach for breast lesions, alongside clinical examination and imaging. FNAC offers several advantages including minimal invasiveness, cost-effectiveness, rapid results, and high patient acceptability. Studies have reported variable diagnostic accuracy rates for FNAC in benign breast lesions, with sensitivity ranging from 85-95% and specificity from 90-98% .

However, diagnostic challenges persist, particularly in differentiating certain benign entities. The cytological distinction between fibroadenomas and phyllodes tumors remains problematic, with studies reporting misclassification rates of 15-30% . Similarly, inflammatory conditions may present cytological features that overlap with both benign and malignant processes, leading to diagnostic uncertainty.

Patient age represents a readily available clinical parameter that may enhance diagnostic accuracy when integrated with cytological findings. Age-related variations in breast tissue composition, hormonal influences, and disease prevalence patterns suggest potential utility in diagnostic algorithms. However, systematic evaluation of age-stratified cytological patterns in Indian populations remains limited, representing a significant gap in current literature.

The objective of this study is to analyze comprehensive the combined diagnostic utility of FNAC and patient age across the spectrum of common benign breast lesions in Indian populations. This study aims to contribute to developing evidence-based diagnostic protocols that optimize resource utilization while maintaining diagnostic accuracy.

Methodology

Study Design

Retrospective observational study with cross-sectional analysis.

Study Setting

Department of General Surgery, Chettinad Hospital & Research Institute, Kelambakkam, Chennai, Tamil Nadu, India.

Study Period

Data collection from medical records spanning June 1, 2024, to May 31, 2025 (12-month period).

Study Population

Female patients aged ≥15 years who underwent fine-needle aspiration cytology for palpable breast lesions during the study period.

Inclusion Criteria

1. Female patients aged ≥15 years
2. Underwent fine-needle aspiration cytology for palpable breast lesions during the study period
3. Available cytology report with adequate sample quality

4. Benign cytological diagnosis (fibroadenoma, fibrocystic changes, phyllodes tumor, or inflammatory lesion)
5. Available demographic and clinical data

Exclusion Criteria

1. Inadequate or unsatisfactory FNAC samples
2. Missing age or essential demographic data
3. Malignant or atypical/indeterminate cytological diagnoses
4. Male patients
5. Previous breast surgery or ongoing treatment for breast disease
6. Concurrent pregnancy or lactation (for specific sub-analyses)

Data Collection

Data Sources

Data was collected from the hospital medical records, pathology department archives and radiology reports when availabe

Data Variables

- **Age**
- **Presenting complaints**
- **FNAC**
- **Cytology**
- **HPE**

Statistical Analysis

Statistical analysis was performed using appropriate software. Continuous variables were analyzed using Mean ± standard deviation (SD) or median with interquartile range (IQR) based on distribution. Categorical variables were analyzed using Frequencies and percentages. Age distribution across lesion types was done using histograms and box plots.

Given the observational nature of the study and absence of comparison groups, primarily descriptive statistics were employed. Where appropriate, 95% confidence intervals were calculated for proportions. A p-value <0.05 was considered statistically significant for any comparative analyses performed.

Results and Analysis:

In the present study a total of 380 cases were included out of which the 270 cases (71%) were Fibroadenoma, 61 cases (16%) were fibrocystic disease, 30 cases (8%) were Phyllodes tumor and 19 cases (5%) were Antibiomas.

97% of the cases fall in the age group of 11-40 years. Out of these cases 29% cases fall under 11-20 years age group, 50% fall under 21-30 years age group with average age being 26.5 years.

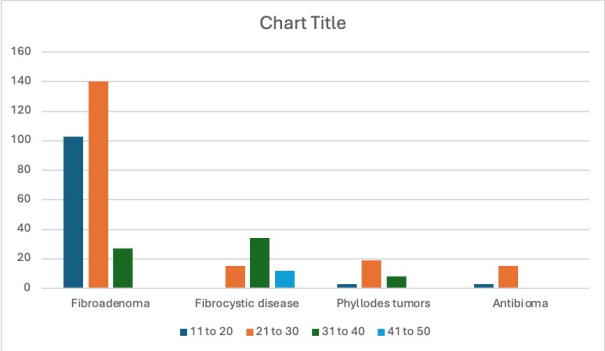
The mean age of the patients with with fibroadenoma is 25.4 years, with majority being in the age group of 11-30 years. The youngest patient with fibroadenoma in this study is 15 years and the oldest is 39 years of age.

In the study the cases of Fibrocystic disease were seen between the age group of 21-50 years out of which the majority of cases were seen in the age group of 31-50 years. 12 cases of benign breast disease were seen in the age group of 40-50 years, which were diagnosed to be fibrocystic disease. Youngest patient with fibro cystic disease was 27 years old and oldest patient was 50 year old.

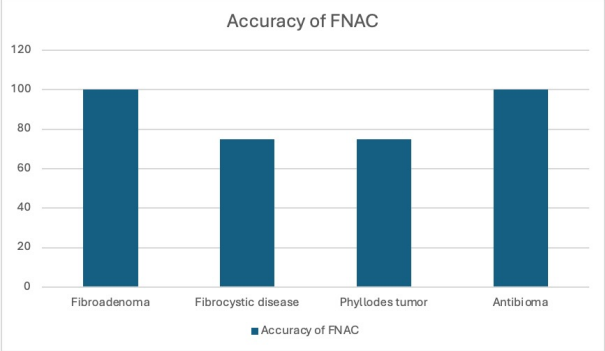
30 cases of phyllodes tumor were seen in the study in which the youngest patient being 20 years and oldest being 37 years of age. Among these patients, in 8 patients, FNAC diagnosed them to have Fibroadenoma but HPE diagnosed them to have Phyllodes tumor.

In this study out of 380 cases, 16 cases which were diagnosed to be fibrocystic disease later on HPE diagnosed as fibroadenoma in 12 cases and Lipoma in 4 cases. And in 8 patients diagnosed as Phyllodes tumor later on HPE diagnosed as Fibroadenoma

Age specific distribution of benign breast lump					
Age incidence					
Diagnosis	Age in groups				
	11-20	21-30	31-40	41-50	>50
Fibroadenoma	103	140	27	0	0
Fibrocystic disease	0	15	34	12	0
Phyllodes tumors	3	19	8	0	0
Antibioma	3	15	0	0	0
Total	106	189	69	12	
Percentage	28	50	18	3	0



Accuracy of FNAC against HPE					
Diagnosis	No. of cases	FNAC			
		Consistent		Inconsistent	
		No. of cases	Percentage	No. of cases	Percentage
Fibroadenoma	270	270	100%	-	-
Fibrocystic disease	61	46	75%	16	15%
Phyllodes tumor	30	23	75%	7	15%
Antibioma	19	19	100%	0	0



Discussion:

Fibroadenoma was seen in 71% of the cases in the present study which is consistent with Oluwole who reported 70.5%. Similar studies by Malik MAN et al [1] reported 77%, Rosen PP et al [2] reported 45% and Greenberget et al [3] reported 50%. In all the above mentioned studies, the benign breast disease with the highest incidence is Fibroadenoma.

In the present study Fibrocystic disease was seen in 16% of the cases which is consistent with Malik MAN et al who reported 13%. In a similar study by RangabhashyamN, Gnanaprakashan D et al [4] reported 14.2%. Phyllode tumor was seen in 8% in the present study where as it was reported to be 2.3% in Oluwole [5] and 0.4% in Malik MAN et al [6]. The discrepancy may be due to the study center being a tertiary care center.

Reports show that in India there is a wide variation in the incidence of phyllodes tumor ranging from 0.63% to 13.8% of the benign breast lesions.

In the present study the youngest patient is 15 year old and eldest was 39 years old. The present study shows majority of the cases accounting to 50% of the cases in the age group of 21-30 years which was similar to the results shown in study by Shukla S hari [7]. The mean age of cases with fibroadenoma is 25.4 , with majority (90%) within the age group of 11-30 years. All the cases of Fibrocystic disease accounting to 16% are seen under the age group of 21-50 years. While Phyllodes tumour accounted to 8% of cases and Antibioma accounted to 1% of the cases.

In our study, all the cases of fibroadenoma were accurately diagnosed by FNAC. While it was 75% accurate for Fibrocystic disease. The rest of the 25% of the false positive cases were later diagnosed to be Fibroadenoma and Lipoma in HPE. And similarly it was 75% accurate in Phyllodes tumor and the 25% of the false positive cases were diagnosed to be Fibroadenoma.

According to our study the sensitivity and Specificity of FNAC to Fibroadenoma are 93% and 100% respectively. While FNAC had 100% sensitivity and 95% specificity to Fibrocystic disease and sensitivity was 74.2% and Specificity was 98% to Phyllodes tumor.

Conclusion:

In patients with benign breast disease, 71% of the cases were Fibroadenomas, 16% were Fibrocystic disease and phyllodes tumor accounted to 8%. The majority of Fibroadenoma (90%) were found in age group of 15-30 years, while majority of Fibrocystic disease (80%) was seen in 21-40 years age group with the majority being in 31-40 years age group. FNAC was 100% accurate in diagnosing Fibroadenoma while it was 75% accurate in diagnosing Fibrocystic disease and Phyllodes tumor. Statistical study showed high sensiticity and specificity of FNAC with respect to Benign breast disease but lower sensitivity to Phyllodes tumor has to be noted.

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