

ORIGINAL ARTICLE

Diagnostic Accuracy of FNAC Compared with Histopathology in Patients with Palpable Breast Masses Attending a Tertiary Care Hospital

Aklima Parvin¹ , Sayem Al Monsur Faizi^{2*} 

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Gopalganj Medical College, Gopalganj, Bangladesh

*Corresponding Author

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ABSTRACT

Background: Breast masses are common, and accurate differentiation of benign and malignant lesions is essential. FNAC is a rapid, minimally invasive, and cost-effective diagnostic method, while histopathology remains the reference standard. However, recent Bangladeshi evidence on the diagnostic accuracy of FNAC is limited. This study aimed to evaluate the sensitivity, specificity, predictive values, and overall accuracy of FNAC compared with histopathology in diagnosing palpable breast masses. **Methods & Materials:** A hospital-based diagnostic accuracy study was conducted at Bangladesh Medical University, Dhaka, from January to December 2025, involving 94 patients with palpable breast masses. FNAC findings were compared with histopathology as the reference standard. Sensitivity, specificity, PPV, NPV, diagnostic accuracy, and Cohen's kappa were calculated using SPSS. Ethical approval and informed consent were obtained. **Results:** Among 94 patients, the mean age was 42.5 ± 11.6 years. Histopathology identified 39 (41.5%) malignant and 55 (58.5%) benign lesions, with fibroadenoma being the most common benign lesion and invasive ductal carcinoma/NST the predominant malignancy. FNAC correctly identified 34 malignant and 53 benign lesions, with 2 false-positive and 5 false-negative results. FNAC showed 87.2% sensitivity, 96.4% specificity, 94.4% PPV, 91.4% NPV, and 92.6% diagnostic accuracy. Agreement with histopathology was very good ($\kappa=0.845$, $p<0.001$). **Conclusion:** FNAC demonstrated high diagnostic accuracy, sensitivity, and specificity in differentiating benign from malignant palpable breast masses, with very good agreement with histopathology. It can therefore serve as a reliable, rapid, minimally invasive initial diagnostic tool, while histopathology remains essential for confirmation of difficult or suspicious lesions.

Keywords: FNAC, Histopathology, Accuracy, Palpable Breast Masses, Sensitivity, Specificity

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1. Assistant Professor, Department of Surgery, Officer on Special Duty (OSD), Directorate General of Health Services (DGHS), Dhaka, Bangladesh (ORCID: 0009-0001-2102-1586)
2. Associate Professor, Department of General Surgery, Bangladesh Medical University, Dhaka, Bangladesh (ORCID: 0009-0002-2861-3864)

INTRODUCTION

Breast masses are common among women and are mostly benign; however, accurate evaluation is essential to exclude malignancy. Breast cancer is the most commonly diagnosed cancer among women worldwide, emphasizing the need for accessible, reliable, and cost-effective diagnostic methods for evaluating breast masses. Lumps are common in all ages, but clinical diagnosis may be misleading^[1,2]. Clinical evaluation of a palpable breast mass includes history and physical examination, but clinical findings alone cannot reliably distinguish benign from malignant lesions. Therefore, accurate diagnosis requires triple assessment, combining clinical examination, imaging, and pathological evaluation, which provides greater diagnostic accuracy than any single modality^[3,4].

Fine-needle aspiration cytology (FNAC) is a quick, cost-effective, minimally invasive, and easily tolerated technique for assessing palpable breast lumps. It offers early cytological diagnosis and can assist in directing further treatment, especially in settings with limited resources. Research has demonstrated **high diagnostic effectiveness**, supporting FNAC as a reliable and dependable diagnostic method for evaluating breast lesions when properly performed,

interpreted, and correlated with clinical findings^[5,6]. FNAC is constrained by its lack of capability to evaluate tissue structure, rendering certain fibroepithelial, papillary, atypical, and low-grade malignant lesions hard to identify. Its precision also relies on appropriate sampling, method, and the skill of the cytopathologist^[7,8]. Histopathological examination evaluates both tissue architecture and cellular features, making it an important reference standard for definitive diagnosis. It assesses lesion architecture, invasion, tumor classification, and grading. Therefore, comparing FNAC findings with histopathology is essential for evaluating FNAC diagnostic accuracy^[9,10].

The research results indicated that FNAC was an effective and trustworthy diagnostic technique for assessing palpable breast lesions, exhibiting a strong correlation with histopathological analysis. FNAC successfully distinguished benign lesions from malignant ones and offered a quick, minimally invasive diagnosis. Nonetheless, histopathology continued to be more effective for verifying challenging or borderline lesions, as it offers intricate tissue structure. In general, the research backed FNAC as a successful primary diagnostic method, while histopathology acted as the conclusive reference standard for confirming the final diagnosis^[1,11,12]. The studies in Bangladesh

found that FNAC effectively differentiated benign and malignant palpable breast lesions and showed good correlation with histopathology. FNAC was a rapid, minimally invasive, and useful initial diagnostic tool, while histopathology remained the definitive method for confirmation [13,14].

In Bangladesh, there is scant recent evidence regarding the diagnostic precision of FNAC for palpable breast lumps in comparison to histopathology. Consequently, this research intends to evaluate the sensitivity, specificity, predictive values, and overall accuracy of FNAC compared to histopathology in distinguishing between benign and malignant breast lesions.

METHODS & MATERIALS

Study design and setting

A hospital-based diagnostic accuracy study was conducted to evaluate the diagnostic performance of fine-needle aspiration cytology (FNAC) in comparison with histopathological examination among patients presenting with palpable breast masses. The study was carried out at Bangladesh Medical University (BMU), Dhaka, Bangladesh, over a 12-month period from January 2025 to December 2025.

Study population and participants

The study included patients presenting to BMU with a clinically palpable breast mass during the study period. Patients were recruited consecutively according to predefined eligibility criteria. A total of 94 patients were included in the final analysis.

Patients were eligible if they had a clinically palpable breast mass, were willing to undergo FNAC followed by histopathological examination, and provided informed consent. Patients with a previously diagnosed breast malignancy who were receiving treatment or follow-up, recurrent malignancy at a previously treated site, inadequate or unsatisfactory cytological material, absence of histopathological confirmation, or refusal to participate were excluded.

Data collection and diagnostic procedures

Demographic and clinical information was collected using a structured data collection form. Variables included age, duration of the breast lump, presence of breast pain, nipple discharge, and clinically palpable axillary lymphadenopathy. All eligible patients underwent FNAC of the palpable breast lesion under standard aseptic precautions. Cytological specimens were processed and examined by experienced pathologists, and the lesions were categorized as benign or malignant based on the cytological findings.

Patients subsequently underwent surgical excision or biopsy of the breast lesion according to the treating surgeon's clinical assessment and standard management practice. The obtained tissue specimens were processed and examined histopathologically by qualified pathologists. Histopathological examination was considered the reference standard for establishing the final diagnosis.

The FNAC findings were compared with the corresponding histopathological diagnoses. A malignant lesion correctly identified as malignant by FNAC was considered a true-positive result, whereas a benign lesion correctly identified as benign was considered a true-negative result. Malignant lesions reported as benign by FNAC were considered false-negative results, while benign lesions reported as malignant were considered false-positive results.

Study outcomes

The primary outcome was the diagnostic accuracy of FNAC for identifying malignant breast lesions using histopathology as the reference standard. Diagnostic performance was assessed by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), overall diagnostic accuracy, positive likelihood ratio (LR+), and negative likelihood ratio (LR-). Agreement between FNAC and histopathological diagnosis was additionally assessed using Cohen's kappa coefficient.

Statistical analysis

Data were entered, checked for completeness, and analyzed using IBM SPSS Statistics. Categorical variables were expressed as frequencies and percentages, whereas continuous variables were summarized using mean and standard deviation. A 2×2 contingency table was constructed to compare FNAC results with histopathological findings. Sensitivity, specificity, PPV, NPV, diagnostic accuracy, and likelihood ratios were calculated using standard diagnostic accuracy formulas.

The association between FNAC and histopathological diagnosis was assessed using the chi-square test, and the degree of agreement between the two diagnostic methods was evaluated using Cohen's kappa (κ). A two-sided p-value <0.05 was considered statistically significant.

Ethical considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was obtained from the appropriate institutional ethical review committee of Bangladesh Medical University before commencement of the study. Written informed consent was obtained from all participants. Confidentiality of participant information was maintained throughout the study, and data were used exclusively for research purposes.

RESULTS

Table 1 shows total of 94 patients with palpable breast masses were included in the study. The mean age of the participants was 42.5 ± 11.6 years, with an age range of 19–71 years. The largest proportion of patients belonged to the 41–50-year age group (31.9%), followed by those aged 31–40 years (26.6%). Most patients presented with a breast lump of ≤ 6 months' duration. Breast pain was reported by 31.9% of patients, while nipple discharge was present in 11.7%. Clinically palpable axillary lymphadenopathy was detected in 19.1% of the patients.

Table I: Demographic and clinical characteristics of the study participants (n=94)

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
≤30	14	14.9
31–40	25	26.6
41–50	30	31.9
51–60	17	18.1
>60	8	8.5
Mean age ± SD	42.5 ± 11.6	
Duration of breast lump		
≤3 months	34	36.2
>3–6 months	27	28.7
>6–12 months	19	20.2
>12 months	14	14.9
Breast pain		
Present	30	31.9
Absent	64	68.1
Nipple discharge		
Present	11	11.7
Absent	83	88.3
Clinically palpable axillary lymph nodes		
Present	18	19.1
Absent	76	80.9

Table II presents all 94 patients underwent FNAC followed by histopathological examination of the breast lesion. Histopathological examination was considered the reference standard for determining the final diagnosis. On FNAC, 36

(38.3%) lesions were classified as malignant and 58 (61.7%) as benign. In comparison, histopathological examination identified 39 (41.5%) malignant and 55 (58.5%) benign lesions.

Table II: Distribution of breast lesions according to FNAC and histopathological diagnosis (n=94)

Diagnosis	FNAC, n (%)	Histopathology, n (%)
Benign lesions	58 (61.7)	55 (58.5)
Malignant lesions	36 (38.3)	39 (41.5)

Table III shows histopathological examination showed that fibroadenoma was the most common benign lesion, accounting for 24.5% of all cases, followed by fibrocystic disease (11.7%) and benign proliferative disease (9.6%). Among malignant

lesions, invasive ductal carcinoma/no special type was the predominant histopathological diagnosis, accounting for 36.2% of all patients.

Table III: Histopathological diagnosis of breast lesions (n=94)

Histopathological diagnosis	Frequency (n)	Percentage (%)
Benign lesions		
Fibroadenoma	23	24.5
Fibrocystic disease	11	11.7
Benign proliferative disease	9	9.6
Intraductal papilloma	4	4.3
Benign phyllodes tumor	3	3.2
Other benign lesions	5	5.3
Total benign	55	58.5
Malignant lesions		
Invasive ductal carcinoma/NST	34	36.2
Invasive lobular carcinoma	3	3.2
Other malignant lesions	2	2.1
Total malignant	39	41.5
Total	94	100.0

Table IV presents comparison of FNAC findings with the histopathological reference standard demonstrated that 34 of the 39 histopathologically confirmed malignant lesions were correctly identified as malignant by FNAC, resulting in 34 true-positive cases. Five malignant lesions were incorrectly

classified as benign, representing false-negative results. Among the 55 histopathologically confirmed benign lesions, 53 were correctly identified as benign, while 2 were incorrectly reported as malignant. Thus, FNAC yielded 34 true-positive, 2 false-positive, 5 false-negative, and 53 true-negative results.

Table IV: Comparison of FNAC findings with histopathological diagnosis (n=94)

FNAC result	Histopathology malignant	Histopathology benign	Total
FNAC malignant	34 (True positive)	2 (False positive)	36
FNAC benign	5 (False negative)	53 (True negative)	58
Total	39	55	94

Table V shows FNAC demonstrated a sensitivity of 87.2% (95% CI: approximately 73.4–94.9%) and a specificity of 96.4% (95% CI: approximately 87.7–99.0%) for detecting malignant breast lesions. The positive predictive value was 94.4%, while the

negative predictive value was 91.4%. The overall diagnostic accuracy of FNAC was 92.6%. The positive likelihood ratio was approximately 24.0, whereas the negative likelihood ratio was approximately 0.13.

Table V: Diagnostic accuracy of FNAC compared with histopathology (n=94)

Diagnostic parameter	Value
Sensitivity	87.2%
Specificity	96.4%
Positive predictive value	94.4%
Negative predictive value	91.4%
Diagnostic accuracy	92.6%
Positive likelihood ratio	24.0
Negative likelihood ratio	0.13

Table VI shows there was a high level of agreement between FNAC and histopathological diagnosis. The overall observed agreement was 92.6%, and the Cohen's kappa coefficient was 0.845, indicating very good agreement between the two

diagnostic methods. The association between FNAC findings and histopathological diagnosis was statistically significant ($\chi^2=68.0$, $p<0.001$).

Table VI: Agreement between FNAC and histopathological diagnosis

Parameter	Value
Observed agreement	92.6%
Cohen's kappa (κ)	0.845
Interpretation	Very good agreement
Chi-square (χ^2)	68.0
p-value	<0.001

Among the 39 histopathologically confirmed malignant lesions, FNAC correctly identified 34 (87.2%), while 5 (12.8%) were reported as benign. Conversely, among the 55 histopathologically confirmed benign lesions, 53 (96.4%) were correctly classified by FNAC and 2 (3.6%) were incorrectly classified as malignant. The false-negative cases were mainly observed in lesions with limited cytological material or atypical/proliferative features that were difficult to distinguish from malignancy on FNAC alone.

Overall, FNAC demonstrated high diagnostic performance in distinguishing malignant from benign palpable breast masses, with a sensitivity of 87.2%, specificity of 96.4%, and overall diagnostic accuracy of 92.6%. The high positive predictive value and very good agreement with histopathology indicate that FNAC was a reliable diagnostic modality for the evaluation of palpable breast masses in this study population.

DISCUSSION

Our study indicated that noticeable breast lumps were more prevalent in middle-aged women, with an average age of 42.5 ± 11.6 years and the largest percentage in the 41–50-year range. This discovery aligns with earlier Bangladeshi research indicating a prevalence of breast lesions in adult females. The majority of patients sought help within 6 months, whereas breast pain, nipple discharge, and axillary lymphadenopathy occurred less frequently. These results highlight the

importance of prompt and structured assessment of noticeable breast lumps [15,16].

This study indicated that the majority of breast lesions were benign, as determined by FNAC and histopathology, while malignant lesions represented 38.3% and 41.5%, respectively. This result aligns with earlier research, which indicated a prevalence of benign breast lesions in symptomatic individuals. The minor distinction between FNAC and histopathology emphasizes the necessity of histopathological validation [17].

The current study identified fibroadenoma as the most prevalent benign lesion, followed by fibrocystic disease, with invasive ductal carcinoma/NST being the leading malignant lesion. This result aligns with earlier research that indicated fibroadenoma as a common benign breast lesion and invasive ductal carcinoma as the leading malignant histopathological type. The results emphasize the broad range of breast lesions and the significance of histopathological analysis for a conclusive diagnosis [18].

The current study showed a significant relationship between FNAC and histopathology in distinguishing benign from malignant breast lesions. This observation aligns with earlier research, which indicated strong clinicopathological correlation and endorsed FNAC as an effective preliminary diagnostic approach, although histopathology is crucial for definitive validation [19].

The current research showed 87.2% sensitivity, 96.4% specificity, and 92.6% diagnostic accuracy for FNAC. This result aligns with previous research, which indicated that FNAC has

strong diagnostic effectiveness in comparison to histopathology. The findings endorse FNAC as a dependable, minimally invasive first approach for assessing palpable breast lesions [1,20].

The current research demonstrated a 92.6% observed agreement and a Cohen's kappa of 0.845, reflecting a strong correlation between FNAC and histopathology, with a statistically significant relationship. This result resembles earlier research, which indicated a strong relationship between FNAC and histopathological results in breast lesions. The strong consensus reinforces FNAC as a dependable initial diagnostic method, though false-negative instances can arise in atypical or poorly sampled lesions [12,20].

In summary, FNAC showed excellent diagnostic precision and strong correlation with histopathology, endorsing its role as a trustworthy, quick, and minimally invasive primary diagnostic approach for palpable breast lesions.

CONCLUSION

FNAC showed excellent diagnostic precision, sensitivity, and specificity in distinguishing between benign and malignant palpable breast lumps, with a strong correlation with histopathology. Its quick, minimally invasive, economical, and dependable characteristics advocate for its application as a primary diagnostic tool, especially in settings with limited resources. Histopathological analysis is still crucial for validating FNAC results, especially in cases that are suspicious, atypical, or difficult to diagnose.

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