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Comparative Evaluation of Fine Needle Aspiration Cytology and Core Needle Biopsy in the Diagnosis of Suspected Breast Carcinoma

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ABSTRACT

Background: Breast conditions are prevalent among women, with breast cancer being the most common type of cancer. FNAC is straightforward yet constrained by ambiguous outcomes, whereas CNB offers a more precise diagnosis but requires more resources. This research evaluates FNAC and CNB in comparison to excisional histopathology to determine diagnostic accuracy in suspected breast carcinoma. **Methods & Materials:** This prospective observational study lasting one year involved 70 patients with clinically suspected breast carcinoma who underwent FNAC, CNB, and excisional biopsy at Mymensingh Medical College. Data were examined with SPSS v28 to assess diagnostic performance in comparison to histopathology through sensitivity, specificity, accuracy, and Kappa statistics ($p < 0.05$). Ethical clearance and informed consent were secured, ensuring confidentiality was preserved. **Results:** The study involved 70 participants, primarily middle-aged females, with an average age of 46 years. Most breast lesions were cancerous (91.5%), typically found in the upper outer quadrant and ranging from 2 to 5 cm in size. CNB exhibited markedly superior diagnostic performance compared to FNAC, showing greater sensitivity (96.8% vs 65.6%) and accuracy (97.1% vs 68.5%). FNAC exhibited a greater false-negative rate, while CNB demonstrated strong consistency with the final histopathology (kappa = 0.75, $p < 0.05$). **Conclusion:** In this study group, breast lesions were predominantly malignancy. CNB demonstrated greater accuracy and sensitivity compared to FNAC and exhibited stronger concordance with the final histopathology. In general, CNB serves as a more dependable diagnostic method for breast lesions.

Keywords: *Fine Needle Aspiration Cytology, Core Needle Biopsy, Breast Carcinoma.*

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INTRODUCTION

The breast is a significant female organ linked to femininity and fertility. Breast conditions impact approximately 30% of women, often appearing as breast masses that can be benign fibroadenomas or malignant carcinomas [1,2]. Breast cancer is the most prevalent cancer among women and is rising worldwide. Differentiating between breast lumps clinically is challenging. The standard diagnostic method is the triple assessment approach, which includes clinical examination, imaging, and biopsy (FNAC or CNB) [3,4].

FNAC is frequently utilized for breast lesions but isn't a primary screening technique. It has drawbacks like unclear outcomes and challenges in differentiating in-situ from invasive carcinoma, leading to potential false positives in non-cancerous conditions [5,6]. In contrast, CNB is a very precise yet more time-intensive and expensive diagnostic approach. Its precision relies on the operator's expertise and proper sampling. It offers adequate tissue for a conclusive diagnosis, differentiates benign from malignant and in-situ from invasive lesions, and facilitates tumor grading and receptor analysis [7,8].

Global study of Kulkarni et al. (2022) and Verma et al. (2021) indicated that CNB surpasses FNAC in breast lesion diagnosis, showing greater sensitivity and reduced false-negative and inconclusive outcomes, which renders CNB more dependable for conclusive diagnosis [8,9].

Again, Sustova and Klijanienko (2020) discovered that the integration of FNAC and CNB enhances diagnostic precision in noticeable breast tumors, minimizing mistakes and boosting overall trustworthiness in comparison to using either technique separately [10].

Study in Bangladesh by Rahman et al. (2019) stated that CNB exhibits greater diagnostic precision than FNAC in breast lesions. FNAC proved beneficial for quick initial diagnosis but indicated increased levels of indeterminate and false-negative outcomes. CNB offered a more definitive histological diagnosis with enhanced sensitivity and overall diagnostic dependability, rendering it more effective than FNAC for precise evaluation of breast lesions [11].

Few studies in Bangladesh have evaluated FNAC and CNB against final histopathology as the definitive standard. The majority consist of small or single-method investigations. The aim of this study is to compare the results of FNAC and core needle biopsy with final excisional histopathology as the gold standard in the diagnosis of suspected breast carcinoma in our local context.

METHODS & MATERIALS

Study settings: This was an observational study planned in advance that took place over one year in the Pathology Department at Mymensingh Medical College, Mymensingh.

Study population: The study group comprised patients with clinically and/or radiologically suspected breast carcinoma visiting the Pathology and Surgery Departments. The statistical calculation of the sample size indicated that 70 patients were incorporated in this study.

Selection criteria: Individuals with clinically suspected malignant breast lumps who were subjected to FNAC, CNB, and excisional biopsy were included. Patients lacking consent, with recurrent or metastatic breast cancer, receiving chemotherapy/radiotherapy or hormonal treatment, and those with diagnosed benign breast conditions were not included.

Data collection procedure: Data were gathered via in-person interviews, clinical assessments, and lab tests employing a semi-structured case record form. All patients enrolled participated in FNAC and CNB in the Pathology Department, subsequently undergoing surgical excision

(lumpectomy/mastectomy), and the histopathological analysis of the excised specimens was documented for comparison.
Statistical Analysis: Data were examined with SPSS version 28. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were computed for FNAC and CNB. Kappa statistics were utilized to evaluate the concordance among FNAC, CNB, and the final histopathology. A p-value less than 0.05 was deemed statistically significant.
Ethical considerations: Approval for ethical considerations was secured from the Institutional Review Board of Mymensingh Medical College, along with obtaining departmental consent. All participants provided informed written consent. Patient confidentiality, safety, and rights were upheld, and participants were guaranteed treatment for complications and their right to exit at any point.

RESULTS

A total of 70 patients with clinically suspected breast carcinoma were included in this study. All patients underwent FNAC, CNB, and subsequent excisional biopsy with final histopathological examination. The clinicodemographic characteristics, clinical findings, and diagnostic performances of FNAC and CNB were analyzed and compared with final histopathology as the gold standard. CNB showed superior diagnostic accuracy and sensitivity compared to FNAC.

Table I shows, the study participants with an average age of 46.0 ± 10.3 years, predominantly from the 41–50 years age category (44%). Most of them were women (97.14%) and in matrimony (88.57%). Merely 2.86% had a positive familial background of breast cancer. The use of oral contraceptive pills was noted in 64.29% of the patients. The majority of participants were from the average socioeconomic group (42.86%), with poor (35.71%) and good (21.43%) categories following. Among patients with suspected breast carcinoma, lesions were mostly found in middle-aged married women who had a low family history and a comparatively high usage of oral contraceptives.

Table I
Clinicodemographic Characteristics of Study Patients (*n* = 70).

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	20–30	3	4.0
	31–40	16	23.0
	41–50	31	44.0
	51–60	11	16.0
	≥61	9	13.0
Mean age ± SD	—	—	46.0 ± 10.3
Sex	Female	68	97.14
	Male	2	2.86
Marital status	Married	62	88.57
	Widow	5	7.14
	Unmarried	3	4.29
Family history of breast carcinoma	Positive	2	2.86
	Negative	68	97.14
Oral contraceptive pill use	Yes	45	64.29
	No	25	35.71
Socioeconomic status	Poor (<10,000 BDT/month)	25	35.71
	Average (10,000–20,000 BDT/month)	30	42.86
	Good (>20,000 BDT/month)	15	21.43

Table II shows, of all 70 cases, 6 patients (8.6%) presented with nipple retraction with peau d'orange appearance and 4 patients (5.7%) had surface ulceration on their skin. The final histopathological examination confirmed that 35 (54.6%) patients had metastatic lymph nodes whereas 10 cases were found positive for malignant cells in axillary lymph nodes by FNA.

Table II
Clinical examination findings (*n*=70).

Features O/E	Variables	Frequency(n=70)	Percentages
Laterality	Left	37	52.8
	Right	33	47.1
Quadrant	Central	2	2.8
	Upper outer quadrant	48	68.5
	Lower outer quadrant	2	2.8
	Upper inner quadrant	14	20
	Lower inner quadrant	3	4.2
	Axillary tail	1	1.4
Consistency	Firm	32	45.7
	Hard	30	42.8
	Soft	8	11.4
Size	≤ 2 cm	15	21.4
	>2 to 5 cm	45	64.3
	>5 cm	10	14.3
Skin Changes	Nipple retraction plus peau d' orange change	6	8.6
	Surface Ulceration	4	5.7
	No change	60	85.7

Table III presents FNAC and CNB results indicated that most lesions were malignant for both techniques, yet CNB displayed a higher detection rate. FNAC detected malignancy in 60% of instances, while CNB verified malignancy in 91.3% of instances. Benign lesions were identified more often by FNAC (12.8%) than by CNB (8.5%). FNAC additionally indicated 18.6% suspicious and 7.0% proliferative lesions, whereas these categories were absent in CNB. Inconclusive outcomes were low in FNAC (1.4%) and nonexistent in CNB.

Table III
Distribution of FNAC Cytological and CNB Histopathological Diagnostic Categories (*n* = 70).

Category	Diagnosis	FNAC n (%)	CNB n (%)
C1 / B1	Inconclusive / Inadequate	1 (1.4)	0 (0)
C2 / B2	Benign lesions (fibroadenoma, etc.)	9 (12.8)	6 (8.5)
C3	Proliferative disease	5 (7.0)	0
C4 / B3	Suspicious / Atypia	13 (18.6)	0
C5 / B4–B5	Malignant (DCIS + carcinoma)	42 (60.0)	64 (91.3)
Total	—	70	70

Table IV shows a statistically meaningful relationship existed between FNAC and CNB results ($p < 0.001$). All FNAC C5 cases were verified as cancerous on CNB. The majority of C4 cases were also found to be malignant or DCIS in CNB. Several C2 cases and one C1 case demonstrated malignancy on CNB. In general, elevated FNAC categories exhibited a strong positive correlation with malignant CNB outcomes, reflecting a solid diagnostic alignment between the two techniques

Table IV
Correlation between FNAC and CNB diagnosis.

FNAC category	CNB Diagnosis					P value & level of significance
	B1	B2	B3	B4	B5	
C1	0	0	0	0	1	**P value < 0.001****
C2	0	6	0	0	3	
C3	0	0	0	0	5	
C4	0	0	0	2	11	
C5	0	0	0	0	42	

Table V presents FNAC demonstrated a statistically significant correlation with lymph node biopsy ($\chi^2 < 0.001$) yet exhibited a high false-negative rate. CNB showed strong correlation with the final histopathology results (Kappa = 0.75, $p < 0.05$), yielding more true positives and fewer false negatives. In general, CNB demonstrated superior diagnostic performance compared to FNAC.

Table V
Diagnostic Performance and Agreement of FNAC and CNB Compared with Reference Standards (Lymph Node Biopsy and Final Histopathology) (*n* = 70).

Diagnostic Pathway	Method	True Positive	False Positive	False Negative	True Negative	Total	Statistical Result
Lymph Node Evaluation	FNAC vs Biopsy	10	0	25	35	70	$\chi^2 < 0.001$**
Primary Tumor Evaluation	CNB vs Final Histopathology	62	0	2	6	70	Kappa = 0.75 (Good agreement), $p < 0.05$

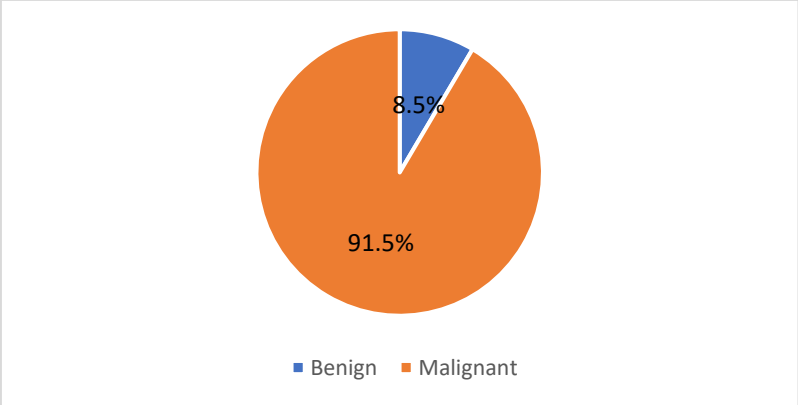

Figure 1 Final histopathological diagnosis of excised breast specimen.

Figure 1 show the final histopathological analysis of the removed breast specimens indicated that most cases were cancerous. Among 70 patients, 64 (91.5%) were found to have malignant conditions, while 6 (8.5%) had benign conditions. This shows a significant occurrence of breast carcinoma within the study group.

Table VI presents FNAC demonstrated decreased sensitivity (65.6%) and accuracy (68.5%) with 22 false negatives, whereas CNB exhibited significantly higher sensitivity (96.8%) and accuracy (97.1%) with just 2 false negatives. Both techniques demonstrated 100% specificity and positive predictive value. In general, CNB proved to be more precise and dependable than FNAC in identifying breast carcinoma.

Table VI
Diagnostic Validity of FNAC and CNB Compared with Final Histopathological Diagnosis (n = 70).

Test	TP	FP	FN	TN	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
FNAC	42	0	22	6	65.6%	100%	100%	78.5%	68.5%	<0.001
CNB	62	0	2	6	96.8%	100%	100%	75%	97.1%	<0.001

DISCUSSION

In our study, the majority of patients were women in midlife, with the highest frequency in the 41–50 years category. The majority consisted of females and were married, showing a low rate of family history positivity and a comparatively high usage of oral contraceptives. These results align with the study by Ban and Godellas (2014), which indicated that breast cancer predominantly impacts middle-aged women and is associated with hormonal and reproductive influences. Aljarrah and Miller (2014) similarly highlighted a changing and rising burden of breast cancer among middle-aged groups over time, corroborating the demographic trend noted in our study [12,13].

In this study, the majority of lesions were located in the upper outer quadrant, measured 2–5 cm in size, and were firm to hard in texture, with 8.6% presenting nipple retraction and 5.7% exhibiting ulceration; 54.6% had lymph nodes that were metastatic. These results correspond with Rajbongshi et al. (2018), who noted comparable morphological traits in suspected breast carcinoma cases, and Barra et al., (2008) who indicated that tumor dimensions and features greatly affect diagnostic and nodal involvement trends [14,15].

CNB demonstrated greater malignancy detection compared to FNAC with fewer indeterminate results, whereas FNAC revealed a higher number of benign, suspicious, and proliferative findings. In general, CNB offered a clearer diagnosis compared to FNAC [16,17].

In this study, FNAC demonstrated a strong association with CNB, with all C5 and the majority of C4 instances verified as cancerous. Several C1–C2 cases were reclassified as malignant on CNB, reflecting an underestimation by FNAC. In general, there was strong diagnostic agreement between FNAC and CNB [16,17].

FNAC demonstrated a strong correlation with lymph node biopsy but exhibited a considerable false-negative rate. Conversely, CNB showed strong concordance with final histopathology, exhibiting more true positives and reduced false negatives. In general, CNB demonstrated greater accuracy and reliability compared to FNAC [3,8].

Our findings demonstrate that a majority of the excised breast specimens were malignant, while just 8.5% were benign, highlighting a significant prevalence of breast carcinoma among the study population. Comparable hospital-centered research has likewise indicated a prevalence of malignant tumors in surgically removed breast samples [18].

CNB demonstrated greater sensitivity and accuracy compared to FNAC, along with a reduced number of false negatives. Both techniques exhibited 100% specificity and PPV. These results indicate that CNB is more dependable than FNAC for diagnosing breast cancer [17,19].

Overall, CNB exhibited considerably greater sensitivity, accuracy, and diagnostic reliability compared to FNAC, rendering it a more efficient technique for breast carcinoma diagnosis. As the study included predominantly clinically suspected malignant lesions, the proportion of benign cases was relatively low, which may have influenced specificity and predictive value estimates.

CONCLUSION

In this study, breast lesions were mainly malignant and primarily affected middle-aged married women, with the majority of tumors situated in the upper outer quadrant. FNAC exhibited reduced sensitivity and an increased false-negative rate, whereas CNB revealed notably greater sensitivity, accuracy, and superior concordance with the final histopathology. In general, CNB is a more dependable diagnostic technique compared to FNAC for evaluating suspected breast carcinoma.

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