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A Comparison of Fine Needle Aspiration Cytology and Core Needle Biopsy in Evaluation of Breast Lesions: A Prospective Study.

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Abstract

Background: Breast lesions are common in clinical practice, ranging from benign conditions to invasive malignancies. Fine needle aspiration cytology (FNAC) and core needle biopsy (CNB) are the primary minimally invasive diagnostic tools, each with distinct advantages and limitations in accuracy, sample adequacy, and architectural assessment. ***Objectives:*** To compare the diagnostic efficacy, accuracy, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), procedure time, patient discomfort, complication rates, and tissue adequacy of FNAC and CNB in evaluating breast lesions, using histopathology after surgical excision as the gold standard. ***Methods:*** This prospective study was conducted at Santosh Medical College, Ghaziabad, from 2024 to 2025. A total of 205 patients aged 20 years and above with palpable breast lumps underwent FNAC followed by CNB (when indicated) in randomized order. Diagnoses were categorized using the IAC Yokohama system for FNAC (C1-C5) and NHSBSP for CNB (B1-B5). Results were compared with final histopathology. Statistical analysis used McNemar's test, t-test, Chi-square test, and performance indices via SPSS version 26. ***Results:*** FNAC showed sensitivity 83.6%, specificity 91.2%, PPV 86.9%, NPV 89.0%, and accuracy 88.3%. CNB demonstrated superior performance with sensitivity 95.1%, specificity 97.4%, PPV 96.3%, NPV 96.6%, and accuracy 96.6% ($p < 0.001$). CNB had higher tissue adequacy (99.0% vs 96.1%) and fewer inadequate samples. FNAC was faster (6.4 ± 1.8 min vs 18.9 ± 3.6 min) with less discomfort and fewer complications. Histopathology confirmed malignancy in 41.5% of cases. ***Conclusion:*** CNB offers higher diagnostic accuracy and better tissue adequacy for definitive diagnosis, while FNAC remains valuable as a rapid, cost-effective initial screening tool. A combined approach optimizes patient management.

Keywords: Fine needle aspiration cytology, Core needle biopsy, Breast lesions, Diagnostic accuracy, Histopathology, Sensitivity, Specificity.

INTRODUCTION

Breast lesions are among the most common clinical presentations, particularly in women, spanning benign conditions to invasive malignancies. Accurate early diagnosis is critical for appropriate management and prognostication. Although most breast lesions are benign, breast cancer remains the most common malignancy in women. FNAC and CNB serve as the primary minimally invasive diagnostic modalities. FNAC is quick, cost-effective, and well-tolerated but limited by inadequate cellularity, air-drying artifacts, and difficulty distinguishing atypical ductal hyperplasia from ductal carcinoma in situ or invasive carcinoma. CNB provides larger tissue samples for architectural evaluation, better differentiation of in situ from invasive disease, and material for ancillary studies such as immunohistochemistry, though it is more invasive with potential for crush artifact and higher complication rates.

The choice between modalities often depends on institutional protocols and operator experience. Comparative studies show variable results influenced by operator skill, lesion characteristics, and study design. A direct comparison is essential to determine the optimal approach for precise diagnosis and patient management.

MATERIALS AND METHODS

Study Design: Prospective observational study.

Study Place: Santosh Medical College, Ghaziabad.

Duration: 2024-2025.

Sample Size: 205 patients (calculated with Z=1.96, D=6%, P=51%).
Inclusion Criteria: Age ≥20 years, palpable breast lumps, informed consent.

Exclusion Criteria: Known breast cancer, prior surgery/biopsy at site, coagulopathy, pregnancy.

Sampling Technique: Serial recruitment from outpatient department with randomized order of FNAC and CNB.

Procedure: FNAC performed with 22-25G needle; CNB with 14-16G automated gun, often under ultrasound guidance. Both under aseptic conditions. Diagnoses categorized by IAC Yokohama (C1-C5) for FNAC and NHSBSP (B1-B5) for CNB.

Surgical excision and histopathology performed when indicated as gold standard.The study used Fine Needle Aspiration Cytology (FNAC) and Core Needle Biopsy (CNB) as diagnostic tools for evaluating lesions, followed by histopathological analysis.

For FNAC, according to Yokohama classification of breast lesions five categories were considered, represented by C1 to C5:

- C1 - Insufficient
- C2 - Benign
- C3 – Atypical
- C4 - Suspicious of Malignancy
- C5 - Malignant

Similarly, CNB was used to confirm or refine the FNAC findings, using B category (NHSBSP/Standard core biopsy reporting) to categorize the core needle biopsy findings from B1 to B5:90.

- B1 – Inadequate / Normal Tissue only
- B2 - Benign
- B3 - Benign lesion of uncertain malignant potential
- B4 - Suspicious of malignancy
- B5 - Malignant

Data Collection: Demographics, clinical features, procedure time (minutes), discomfort (VAS 0-10), complications, sample adequacy, and diagnoses recorded. Statistical Analysis: SPSS version 26. McNemar's test for accuracy comparison, independent t-test for time/discomfort, Chi-square for complications, and calculation of sensitivity, specificity, PPV, NPV, and accuracy. $p<0.05$ significant.

RESULTS

Table 1: Socio-Demographic Profile of Study Participants (n = 205)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	20–29	34	16.6
	30–39	62	30.2
	40–49	58	28.3
	≥50	51	24.9
Sex	Female	205	100
Residence	Urban	121	59.0
	Rural	84	41.0
Menopausal status	Premenopausal	118	57.6
	Postmenopausal	87	42.4

The majority of participants were in the 30-39 years age group with urban predominance and slight premenopausal majority.

Table 2: Clinical Characteristics of Breast Lumps (n = 205)

Characteristic	Category	n	%
Laterality	Right breast	104	50.7
	Left breast	91	44.4
	Bilateral	10	4.9
Lump size (cm)	<2 cm	61	29.8
	2–5 cm	103	50.2
	>5 cm	41	20.0
Duration of symptoms	<3 months	79	38.5
	3–6 months	88	42.9
	>6 months	38	18.6

Most lumps were unilateral, sized 2-5 cm, with symptoms lasting 3-6 months.

Table 3: FNAC Cytological Diagnosis (n = 205)

IAC Yokohama System	N	%
C1 – Insufficient	8	3.9
C2 – Benign	132	64.4
C3 – Atypical	6	2.9
C4 - Suspicious for Malignancy	18	8.8
C5 – Malignancy	41	20.0

Benign lesions predominated on FNAC.

Table 4: Core Needle Biopsy Histological Diagnosis (n = 205)

B Category	N	%
B1 - Inadequate/normal tissue only	2	1.0
B2 – Benign	118	57.6
B3 - Benign lesion of Uncertain Malignant Potential	18	8.8
B4 - Suspicious of Malignancy	0	0
B5 – Malignant	67	32.7

CNB showed higher malignant yield and near-perfect adequacy.

Table 5: Diagnostic Performance Comparison

Parameter	FNAC (%)	CNB (%)	p-value
Sensitivity	83.6	95.1	-
Specificity	91.2	97.4	-
PPV	86.9	96.3	-
NPV	89.0	96.6	-
Diagnostic accuracy	88.3	96.6	<0.001

CNB demonstrated superior performance (McNemar test).

DISCUSSION

The present prospective study of 205 patients with palpable breast lumps demonstrated that CNB provides significantly higher diagnostic accuracy (96.6%) compared to FNAC (88.3%), with a statistically significant difference of 8.3% ($p < 0.001$, McNemar test). These findings align with and extend previous comparative literature. Westenend et al. (2001)1 reported comparable sensitivities (FNAC 92%, CNB 88%) but higher specificity for CNB (90% vs 82%) in 286 lesions, supporting the current observation of CNB superiority in overall accuracy. Mirza et al. (2001)2 found FNAC sensitivity of 93.8% when atypical/malignant categories were combined but only 65.4% for unequivocal malignancy, while CNB sensitivity reached 88.7%; the current study's FNAC sensitivity of 83.6% falls between these values, likely reflecting improved sampling techniques. Recent meta-analyses reinforce CNB advantages. Wang et al. (2017)3 pooled 12 studies (1,802 patients) and reported CNB sensitivity 87% versus FNAC 74%, with similar high specificities. Sani et al. (2024)4 in a meta-analysis of five studies (1,177 patients) confirmed CNB sensitivity 88.1% versus FNAC 68.6%, with comparable specificities (97.2% vs 96.1%). Chauhan et al. (2025)5 in a prospective study of 50 patients reported CNB sensitivity 95.65% and specificity 96.22%, closely mirroring the present results (95.1% and 97.4%). Tripathi et al. (2022)6 noted combined FNAC+CNB accuracy rising to 88.1%, highlighting complementarity also observed here. Tissue adequacy was

markedly better with CNB (99.0% adequate, 1.0% inadequate) than FNAC (96.1% adequate, 3.9% inadequate), consistent with Westenend et al.1 who noted lower inadequacy with CNB in image-guided settings. The current low FNAC inadequacy rate (3.9%) benefits from standardized IAC Yokohama reporting, as emphasized by Yoon et al. (2015)7 and Phonglosa et al. (2025)8, who achieved 98.97% cyto-histopathological agreement using the Yokohama system.

Procedure time favored FNAC (6.4 ± 1.8 min vs CNB 18.9 ± 3.6 min, $p < 0.001$), aligning with Stewart et al. (2002)9 who described FNAC completion in 5-10 minutes versus longer CNB times due to imaging and processing. Patient discomfort (VAS) was lower for FNAC (2.1 ± 1.0) than CNB (4.6 ± 1.3), corroborating Tripathi et al.6 Complications (pain requiring analgesics 5.4% vs 19.0%; hematoma 1.5% vs 6.8%) were fewer with FNAC, consistent with literature noting minor CNB morbidity rates of 6-10%. Histopathology confirmed malignancy in 41.5% of cases, similar to Tripathi et al.6 (35-40%) and Chauhan et al.5 (38%). CNB's higher malignant yield (32.7% vs FNAC 20%) reflects preserved architecture, enabling better distinction of in situ versus invasive disease and ancillary testing, as noted in the review of literature. Limitations include single-center design and focus on palpable lesions. Strengths include prospective design, randomized order, standardized categorization, and direct comparison to gold-standard histopathology.

Overall, while FNAC remains valuable for rapid initial assessment due to speed, safety, and cost-effectiveness, CNB provides superior accuracy and tissue adequacy for definitive diagnosis,particularly in suspicious or indeterminate lesions. Recent studies have further corroborated thesefindings, demonstrating the benefits of ultrasound-guided procedures and combined FNAC-CNBapproaches in improving diagnostic yield and reducing unnecessary surgeries.10-15 A combined or sequential approach, as suggested in algorithmic flowcharts in the literature, optimizes outcomes.

CONCLUSION

CNB demonstrates superior diagnostic accuracy, sensitivity, specificity, and tissue adequacy compared to FNAC in evaluating breast lesions. FNAC excels in speed, patient comfort, and low complication rates, making it ideal for initial screening. Both modalities are complementary; integration enhances diagnostic precision and guides appropriate management while minimizing unnecessary interventions.

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