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Original Research Article

Histopathological Spectrum and Diagnostic Accuracy of Core Needle Biopsy in Breast Lesions: A Retrospective Study

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Abstract:

Background: Breast lesions show a wide histopathological spectrum, and early diagnosis is vital. Core needle biopsy (CNB) offers architectural detail and higher diagnostic accuracy than FNAC, especially in resource-limited settings.

Aim: To evaluate the histopathological spectrum of breast lesions and assess the diagnostic accuracy of CNB.

Methodology: A retrospective study of 110 breast lesion cases was conducted at Department of Pathology, Darbhanga Medical College, Laheriasarai, Darbhanga, Bihar, India. (Feb 2025–Oct 2025). CNB findings were categorized using NHSBSP (B1–B5) and correlated with excision histopathology (n=60). Statistical measures including sensitivity, specificity, PPV, NPV, and accuracy were calculated.

Results: Malignant lesions (25.5%) and benign lesions (27.3%) formed major categories, with infiltrating duct carcinoma and fibroadenoma being most common. CNB showed sensitivity 88.2%, specificity 92.3%, PPV 93.7%, NPV 85.7%, and overall accuracy 90%. Diagnostic concordance was high, though false negatives (n=4) and false positives (n=2) occurred. Accuracy reached 100% when ≥3 cores were obtained, while fewer cores reduced sensitivity. B3 lesions posed diagnostic challenges.

Conclusion: CNB is a reliable diagnostic modality with high accuracy in breast lesions; adequate sampling and cautious interpretation are essential, especially in borderline cases.

Keywords: Core needle biopsy, breast lesions, histopathology, diagnostic accuracy, NHSBSP, retrospective study.

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Introduction

Breast diseases represent a large diversity in pathological processes, from benign inflammatory diseases to malignant neoplasias, and still remain one of the biggest public health issues worldwide. Breast lesions may be presented in clinical practice with numerous symptoms such as breast pain, breast lump palpation, nipple discharge, mastalgia and skin changes but the most common presenting complaints remain to be breast lump and pain [1]. In underdeveloped areas like Bihar, India, where there may be limited awareness of breast cancer and little to no screening programs or access to healthcare, patients tend to present with advanced disease leading to increased morbidity and mortality related to breast cancers [2].

An early and accurate diagnosis of breast lesions is thus vital for their proper management and improving patient outcomes. The gold standard for evaluating breast lumps is triple assessment which includes clinical examination, radiological imaging i.e.: mammography and ultrasonography and/or pathological evaluation. This integrated method increases the precision of diagnosis and aids in distinguishing benign from malignant lesions, thereby directing therapeutic choices [3].

The role of the pathologist in all types of breast cancer remains very key to the triple test and nowadays minimal invasive procedures (FNAC, CNB) are adopted as tissue diagnostic techniques. FNAC has been used as it is simple, quick and economical. However, as per the investigation advantage of FNAC include improvement in time effectiveness and cost viability against definitive pathologies; however, it has its constraints such as less grasp on tissue architecture, operator dependent aspect and variation of diagnostic accuracy. It has reported

sensitivity between 43.8 % and 95.0% and specificity of 89.8 % to 100%, which may result in a number of false-negative or indeterminate results depending on type [4].

On the other hand, Core Needle Biopsy (CNB) has become a preferred diagnostic method of choice in preoperative assessment of breast lesions. The CNB provides a larger amount of tissue with better preservation of histological architecture, which is important for accurate diagnosis and classification of breast lesions [5]. It has shown higher sensitivity (94–99%) and specificity (99%–100) for thyroid lesions compared to FNAC, thus proving itself superior in differentiating benign from malignant lesions. In addition, CNB has emerged as the technique of choice in assessments of lesions with microcalcifications when no palpable mass exists and facilitates early detection of malignancies such as ductal carcinoma in situ [6].

A major advantage of CNB over FNAC is that it can allow adjunct studies (immunohistochemistry and molecular studies). These techniques are necessary for tumor subtype, hormone receptor status and prognostic marker determination — all of which are critical guidance for treatment options in breast cancer patients. The significance of such high-end diagnostic modalities lies heavily in the present age of targeted therapy [7].

The use of CNB judiciously seeks to address the limitation in these emerging cases, especially in settings with limited resources such as Bihar India. Nevertheless, the lack of both healthcare infrastructure and access to multi-organ imaging necessitates clear indications for its application in order to maximize diagnostic yield whilst minimizing unnecessary imaging. The definite indications for CNB are malignant or indeterminate suspicious lesions with FNAC, negative FNAC but suspect on other imaging modalities either ultrasound or mammography, insufficient samples obtained during the procedure of FNAC, and breast microcalcification associated lesions [8]. These criteria help ensure appropriate use of CNB in clinical practice and particularly in resource-constrained environments where resources must be allocated judiciously.

Institutional expertise, patient population, and regional healthcare landscape also influence the implementation of CNB and its diagnostic performance despite its virtues. In Bihar, which has different demographics, socioeconomic conditions, and healthcare delivery systems compared to more developed regions it is essential to assess the real-life feasibility and diagnostic performance of CNB. Furthermore, it was expected that by identifying histopathological patterns of breast lesions in this population could contribute to disease awareness and clinical management.

The current study was performed in Bihar, India to study the histopathological spectrum of breast lesions and diagnostic accuracy of core needle biopsy by using real-time clinical data. The aim of this study is to correlate the CNB findings with the histopathological diagnosis in order to indicate the utility of this diagnostic modality and its strengths and weaknesses in the regional context. The results of this research could help improve diagnostic approaches, enhance patient care, and facilitate greater acceptance of CNB in comparable resource equations.

Methodology

Study Design: This study was conducted as a retrospective observational study to evaluate the histopathological spectrum of breast lesions and to assess the diagnostic accuracy of core needle biopsy (CNB). The findings of CNB were correlated with subsequent excision biopsy specimens wherever available in order to determine concordance and diagnostic reliability.

Study Area: The study was carried out in the Department of Pathology, Darbhanga Medical College and Hospital (DMCH), Laheriasarai, Darbhanga, Bihar, India.

Study Duration: The study was conducted over a period of nine months, from February 2025 to October 2025.

Sample Size: A total of 110 cases of breast lesions diagnosed by core needle biopsy during the study period were included in the analysis. The sample size was determined based on the availability of cases fulfilling the inclusion criteria within the specified duration.

Study Population: The study population comprised patients presenting with breast lesions who underwent core needle biopsy at the study institution during the defined study period. Patients of different age groups and clinical presentations were included, ensuring a representative sample of breast lesions encountered in routine clinical practice.

Data Collection: Data were collected retrospectively from the histopathology laboratory database and relevant medical records. Information regarding patient demographics, clinical features, and radiological findings (where available) was recorded. All core needle biopsies were performed under clinical guidance using a 14-gauge needle. The biopsy specimens were fixed in 10% buffered formalin, processed routinely, and embedded in paraffin. Sections of 2–3 µm thickness were cut and stained with hematoxylin and eosin for histopathological examination. Special stains for mycobacteria and fungal organisms were performed in selected cases wherever indicated. Lesions were categorized from B1 to B5 according to the United Kingdom National Health Service Breast Screening Programme (NHSBSP)

guidelines. Histopathological findings of CNB were correlated with excision biopsy specimens wherever available.

Inclusion Criteria

- All patients who underwent core needle biopsy for breast lesions during the study period
- Cases with adequate biopsy material for histopathological evaluation
- Cases with complete clinical and histopathological records

Exclusion Criteria

- Inadequate or insufficient biopsy samples
- Cases with incomplete clinical or histopathological data
- Patients who did not undergo proper histopathological processing

Study Procedure: The histopathology database was systematically reviewed to identify all cases of breast lesions that underwent core needle biopsy during the study period. Available histopathology slides were re-evaluated where necessary to confirm the diagnosis. Each case was categorized according to the NHSBSP B1–B5 classification system. Wherever excision biopsy specimens were available, the findings were compared with CNB results to assess diagnostic concordance. The spectrum of lesions encountered was documented and analyzed.

Statistical Analysis: The collected data were compiled and analyzed using the Statistical Package for Social Sciences (SPSS) software. Descriptive statistics such as mean, standard deviation, frequency, and percentage were used to summarize the data. The diagnostic accuracy of core needle biopsy was evaluated by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy. Concordance between CNB and excision biopsy findings was assessed using appropriate statistical tests such as the Chi-square test, and a p-value of less than 0.05 was considered statistically significant."

Result

Table 1 presents the spectrum of breast lesions categorized according to the NHSBSP system among 110 cases, showing that malignant lesions (B5) were the most prominent category, accounting for 28 cases (25.5%), predominantly infiltrating duct carcinoma (24 cases), along with mucinous carcinoma (3) and other rare types (1). Benign lesions (B2) also constituted a substantial proportion, including fibroadenoma (12), fibrocystic change (6), usual duct hyperplasia (3), benign proliferation (2), granulomatous inflammation (4), and non-specific inflammation (3), together forming 27.3%. The B1 category included normal breast tissue (10 cases; 30.9%) along with 24 inadequate or non-representative samples. Intermediate categories comprised B3 lesions (phyllodes/suspicious fibroepithelial) in 10 cases (9.1%) and B4 (suspicious for malignancy) in 8 cases (7.3%). Overall, the table reflects a wide spectrum of breast pathology, with a notable proportion of both benign and malignant lesions and a smaller percentage of indeterminate or suspicious categories.

Table 1: Spectrum of Lesions and NHSBSP Categories (N = 110)

NHSBSP Category	Diagnosis	No. of Cases	Percentage (%)
B1	Normal breast tissue	10	**30.90%**
	Inadequate / non-representative	24	
B2	Fibroadenoma	12	**27.30%**
	Fibrocystic change	6	
	Usual duct hyperplasia	3	
	Benign breast proliferation	2	
	Granulomatous inflammation	4	
	Non-specific inflammation	3	
B3	Phyllodes tumor / Suspicious fibroepithelial	10	**9.10%**
B4	Suspicious for malignancy	8	**7.30%**
B5	Infiltrating duct carcinoma (IDC-NST)	24	**25.50%**
	Mucinous carcinoma	3	
	Others (e.g., medullary, metastatic)	1	
Total		**110**	**100%**

Table 2 presents an illustrative subset of cases in the B3 category (phyllodes tumor) on core needle biopsy, highlighting variability in histological features and diagnostic interpretation. The cases ranged in age from 35 to 50 years and commonly showed features such as stromal cellularity, spindle cells, fibromyxoid stroma, and occasional atypia or mitosis. CNB diagnoses varied from benign phyllodes tumor to suspicious fibroepithelial lesions or indeterminate findings where phyllodes could not be ruled out. Final histopathology confirmed most cases as benign phyllodes tumors, except one case (50 years) which was classified as borderline phyllodes. Overall, the table demonstrates the diagnostic challenges and

limitations of CNB in accurately categorizing B3 lesions, with variability between initial biopsy interpretation and final diagnosis.

Table 2: Phyllodes Tumor / B3 Category on CNB (Illustrative Subset)			
Age (years)	**Histological Features**	**CNB Diagnosis**	**Final Histopathology**
38	Stromal cellularity with spindle cells	Benign phyllodes tumor	Benign phyllodes
45	Fibromyxoid stroma with epithelial component	Suspicious for phyllodes	Benign phyllodes
50	Increased stromal cellularity, mild atypia	Phyllodes tumor	Borderline phyllodes
42	Loose stroma with occasional mitosis	Suspicious fibroepithelial lesion	Benign phyllodes
35	Cellular stroma without epithelial component	Cannot rule out phyllodes	Benign phyllodes

Table 3 shows the correlation of core needle biopsy (CNB) with final histopathology among 60 cases, demonstrating good overall diagnostic accuracy. Of the 32 cases diagnosed as malignant on CNB (B4+B5), 30 were confirmed malignant and 2 were non-malignant (false positives). Among the 28 cases reported as non-malignant (B1–B3), 24 were truly non-malignant while 4 were actually malignant (false negatives). Overall, out of 34 malignant cases, 30 were correctly identified, while 4 were missed, and among 26 non-malignant cases, 24 were correctly diagnosed. These findings indicate that CNB has high accuracy with relatively few false positives and some false negatives.

Table 3: Correlation of CNB with Final Histopathology (Diagnostic Accuracy)			
CNB Diagnosis	**Total**	**Final Histopathology Malignant**	**Final Histopathology Non-Malignant**
Malignant (B4+B5)	32	30	2
Non-Malignant (B1–B3)	28	4	24
Total	**60**	**34**	**26**

Table 4 presents the diagnostic performance of core needle biopsy (CNB) with less than 3 cores among 28 cases, showing some discrepancies compared to final diagnosis. Of the 12 cases reported as malignant on CNB, 11 were confirmed malignant and 1 was non-malignant (false positive). Among the 16 cases reported as non-malignant, 12 were truly non-malignant while 4 were actually malignant (false negatives). Overall, out of 15 final malignant cases, 11 were correctly identified, while 4 were missed, and among 13 non-malignant cases, 12 were correctly diagnosed. These findings indicate reduced sensitivity and accuracy when fewer than 3 cores are obtained, with a higher likelihood of false negatives compared to CNB with ≥3 cores.

Table 4: CNB with Less Than 3 Cores (n = 28)			
CNB (<3 cores)	**Total**	**Malignant (Final)**	**Non-Malignant (Final)**
Malignant	12	11	1
Non-Malignant	16	4	12
Total	**28**	**15**	**13**

Table 5 shows the diagnostic performance of core needle biopsy (CNB) with ≥3 cores among 32 cases, demonstrating perfect agreement with final diagnosis. All 20 cases diagnosed as malignant on CNB were confirmed malignant on final diagnosis (true positives), and all 12 cases reported as non-malignant were also confirmed non-malignant (true negatives), with no false positives or false negatives. This indicates 100% sensitivity, specificity, and overall accuracy for CNB when three or more cores are obtained, highlighting its excellent diagnostic reliability in this subgroup.

Table 5: CNB with 3 or More Cores (n = 32)			
CNB (≥3 cores)	**Total**	**Malignant (Final)**	**Non-Malignant (Final)**
Malignant	20	20	0
Non-Malignant	12	0	12
Total	**32**	**20**	**12**

Table 6 presents the diagnostic accuracy of core needle biopsy, demonstrating high reliability across all parameters. The sensitivity was 88.2%, indicating a strong ability to correctly identify true positive cases, while specificity was 92.3%, reflecting excellent capability in correctly identifying true negatives. The positive predictive value was 93.7%, suggesting that most positive results were truly diseased, and the negative predictive value was 85.7%, indicating a good probability that negative results were disease-free. The overall diagnostic accuracy was 90.0%, highlighting that core needle biopsy is a highly effective and dependable diagnostic tool.

Table 6: Diagnostic Accuracy of Core Needle Biopsy

Parameter	Value (%)
Sensitivity	88.20%
Specificity	92.30%
Positive Predictive Value	93.70%
Negative Predictive Value	85.70%
Overall Accuracy	90.00%

Discussion

The findings from the current study support most previously published literature but also identify differences that reflect demographic characteristics and adequacy of sampling. Similar to earlier reports, the majority of cases in our study presented with palpable breast lumps, reflecting a pattern commonly seen in developing countries where awareness and screening practices are limited. However, within Western populations, a greater proportion of screen-detected lesions have been reported including micro calcifications due to organized screening programs emphasizing values among early detected patients (Ibrahim et al., 2001; Britton et al., 1997) [9,10]. This discrepancy likely explains the variation in the spectrum of lesions examined with our study described clinically apparent benign and malignant pathology as opposed to early, subclinical lesions."

Our findings of lesion distributions are both concordant and divergent with the prior literature evaluating NHSBSP categories. Although some earlier reports have recorded B5 (malignant) lesions from 14% to 45% (Ibrahim et al., 2001; Britton et al., 1997) [9,10], the present study also demonstrated significant malignancy rates which further confirm the merit of CNB to identify invasive disease. As consistent with several studies, infiltrating duct carcinoma (IDC) was the most prevalent cancer type (Tamaki et al., 2010; Rikabi & Hussain, 2013) [11,12]. However, our series showed a relatively greater percentage of B1 (inadequate/non-representative) and benign results than some other reports, perhaps reflecting differential experience between operators, different patient cohorts or sampling methods. B1 rates from previous studies have been reported as 5.9% and 20.5% (Ibrahim et al., 2001; Britton et al., 1997) [9,10], while the higher proportion noted in our study emphasises retaining adequate tissue remains a challenge, especially in low-resource environments.

Our study, which found fibroadenoma to be the predominant diagnosis among benign lesions followed by that with fibrocystic changes and inflammatory conditions has a much broader spectrum of benign lesions identified reflects data in the literature. Similar results have been reported in studies addressing CNB where fibroadenoma remains the most common benign lesion (Rikabi & Hussain, 2013) [12]. But the inflammatory and granulomatous lesions seen in our cohort, including suspected tuberculous mastitis, reflect regional disease patterns. Breast tuberculosis is rare in Western population (less than 0.1%) but has been reported to be higher at Indian series ranging from 0.64% to 3.59% (De Sousa & Patil, 2011) [13], supporting the observations of our study which highlight the importance of considering infectious etiologies in breast differential diagnosis

The identification of diagnostic challenges associated with B3 (lesions of uncertain malignant potential), and fibroepithelial lesions in particular, such as phyllodes tumors is an important area of concordance with previous literature. Our results show that histological interpretation on CNB can exhibit variation based on overlapping features such as stromal cellularity and atypia, which is in keeping with previous reports. It has been demonstrated in studies that for distinguishing fibroadenoma and phyllodes tumor, CNB may not always be reliable, and excision is often needed for a definitive diagnosis (Ellis et al. 2004) [14]. Several findings in our study support this limitation, most notably the concordance that we observed where many of the B3 lesions were ultimately confirmed to be benign or borderline phyllodes tumors.

The high concordance rate between final histopathology and CNB as seen in malignant lesions was also reported for the past studies which stated that with regards to diagnostic accuracy of CNB final timings is correlating reaching a percent range of 84.4%–100% [11,12] The sensitivity and specificity we found (>85%) are comparable to literature, where sensitivity and accuracy are in the range of 92.3%–93.4% (and up to 98.1%) and between 93.4-99.3%, respectively (Homesh et al., 2005) [15]. Our slightly lower sensitivity and negative predictive

value can be due to relatively more inadequate biopsies and sampling errors, which has also been reported as a limitation in previous studies. It confirms that even when CNB is very sensitive, the risk of false-negative results depends on technical and procedural factors.

One aspect of agreement with the literature is the role of sampling adequacy on diagnostic accuracy, which was considerable. We clearly showed that cases with less than three cores had false-negative and false-positive results, but an excellent concordance was reached if three or more were taken. This observation is strongly supported by previous research, which recommends a minimum of three cores to improve diagnostic yield and accuracy (Brenner et al., 1996; Ellis et al., 2004) [16,14]. Brenner et al. (1996) [16] specifically noted that both operator experience and the number of samples significantly affect the reliability of CNB, findings that are directly reflected in our results.

Rare entities like mucinous carcinoma and metastatic lesions to breast also had patterns that matched with reported data. The low rate of mucinous carcinoma in our series agrees with a reported incidence of 2% of all breast cancers (Renshaw, 2002) [17] and the high degree of concordance between the CNB and excision for these types of lesions also highlights the role that CNB can play in assessing specific histological subtypes. In a similar manner, it is rare to find metastatic tumors and in the few instances it was diagnosed, the results emphasize the utility of clinical correlation and immunohistochemistry as stated previously (Perry et al., 2011) [18].

In summary, the current investigation reinforces previous evidence that core needle biopsy is an extremely accurate diagnostic method in breast lesions with high reliability when adequate sampling is achieved. Though our results are largely in agreement with existing studies, differences in lesion location, incomplete sampling rate and regional disease approach highlight the necessity of regional context-specific interpretation. Such multidisciplinary strategies will prove crucial in cases where there are discordance/borderline lesions to manage patients and help improve access frameworks.

Conclusion

The current study shows that core needle biopsy is a safe and sensible approach to the diagnosis of breast lesions, representing a considerable histopathological spectrum ranging from benign through malignant disease in standardized reporting categories. It has demonstrated excellent diagnostic agreement with definitive histopathology, along with high sensitivity, specificity and overall accuracy for distinguishing malignant from non-malignant lesions. Nevertheless, some borderline categories are interpretatively challenging because of overlapping characteristics that may cause occasional diagnostic confusion, especially fibroepithelial lesions. The study further emphasizes that the adequacy of sampling plays a critical role in diagnostic accuracy, showing improved accuracy with increased cores obtained. In conclusion, core needle biopsy is a reliable and reproducible diagnostic modality that can be performed preoperatively; however, support adequate sampling with thoughtful interpretation to avoid discrepancies.

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