Original Article

Histopathological and Immunohistochemical Evaluation of Trucut Biopsies of Breast Lesions

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Abstract

Background: Trucut (core needle) biopsy is a minimally invasive and effective diagnostic tool for evaluating breast lesions. It not only facilitates histopathological classification but also enables immunohistochemical (IHC) analysis which is essential for therapeutic decision making in breast carcinoma. This study aimed to assess the histopathological spectrum of breast lesions diagnosed on trucut biopsy and correlate the findings with IHC profiles. The objective is to evaluate the histopathological features of breast lesions on trucut biopsy and to assess the immunohistochemical expression of ER, PR, HER2 in malignant tumors with clinicopathological correlation. **Material and Methods:** This cross-sectional study included 50 patients with breast lesions undergoing trucut biopsy. Histological classification was done using H&E stained sections. IHC staining for ER, PR and HER2 was performed on all malignant cases. Data were analysed for age distribution, lesion type and marker expression. **Results:** Of 50 cases, 15 (30%) were benign and 35 (70%) malignant. The most common benign lesion was fibroadenoma (60% of benign cases) while invasive ductal carcinoma was the predominant malignancy (94.3%). Benign lesions occurred most frequently in the age group of 30-40 years (mean age 36.2 years) while malignant lesions were more common in the age group of 50-60 years (mean age 55.6 years). Among malignant tumors ER was positive in 68.6%, PR in 57.1%, HER2 in 17.1%. Triple negative breast cancer were seen in 14.3% of malignant cases. **Conclusion:** Trucut biopsy proves to be a reliable diagnostic modality for breast lesions, allowing for early histopathological and immunohistochemical evaluation. The correlation of IHC markers with histological findings highlights its utility in subclassifying breast carcinomas and guiding treatment strategies. However, limitations such as sample size and tumor heterogeneity may affect diagnostic yield.

Keywords: Breast lesions, Trucut biopsy, Histopathology, Immunohistochemistry, ER, PR, HER2, Triple-negative breast cancer.

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Introduction

Breast cancer is regarded as the most prevalent of all the cancer types that are reported in women around the world and also a major cause of cancer related death.[1] Early detection and proper categorization of breast lesions is essential in managing the patient in the best way possible, prognosis and the treatment plan. In this respect, core needle (trucut) biopsy has become a minimally invasive, dependable and extensively adopted procedure of getting representative tissue samples of palpable and non-palpable lesions in the breast.[2]

Trucut biopsy does not only enable histopathological analysis, but also maintains tissue structure to the extent that such a test can subsequently be followed up by other tests like immunohistochemistry (IHC) that are important in sub classifying breast carcinomas to molecular subtypes.[3] The analysis of estrogen receptor (ER), progesterone receptor (PR) and human epidermal growth factor receptor2 (HER2) by the IHC technique is now regarded as one of the pillars of breast cancer testing since it can predict and prognosticate the efficacy of the systemic therapy decision.[4,5]

Histopathologically, the lesion spectrum of breast is very broad and it includes benign cases like fibroadenoma, fibrocystic disease and malignant lesions like invasive ductal carcinoma(IDC) and invasive lobular carcinoma. IDC is the cause of most breast cancers and is usually characterized by one of the variable expression of ER, PR and HER2.[6] Benign tumors although not as dangerous also need proper classification, given the characteristics they present during clinical/ radiological examination that resembles malignant cancers.[7]

The diagnostic validity of core needle biopsy has been proved many times, in differentiating benign and malignant breast lesions with reported sense and specificity of above 90%.[8,9] In addition the capacity to determine the hormone receptor and HER2 status on core biopsy specimens an early peep into biology is possible that helps shorten the diagnostic lag time and permits the commencement of targeted therapy in time.[10]

The above benefits are not disregarded, but small sizes and

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heterogeneity of tumors can influence diagnostic precision and biomarker determination in trucut biopsies, which underscores the need to correlate with the ultimate histopathy and IHC.[11] Thus, the consistency of the histopathological and immunohistochemical results of trucut biopsies is necessary to qualify its use in clinical practice.

The current research will discuss the histopathological range of breast lesions diagnosed on trucut biopsy, and determine the scenario of immunohistochemical phenotypes of malignant tumors with the help of ER, PR, and HER2. Additionally, the study evaluates the correlation between histological findings and IHC results while considering the limitations associated with sample size and tumor representation.

Materials and Methods

Study Design and Setting: This was a cross-sectional observational study conducted in the Department of Pathology at Gauhati Medical College, Assam over a period of one year. Ethical clearance for the study was obtained from the institutional ethical review board prior to commencement.

Sample Selection: A total of 50 patients with breast lesions who underwent trucut (core needle) biopsy were included in the study. Inclusion criteria comprised both palpable and radiologically suspicious breast lesions for which trucut biopsy was clinically indicated. Patients with inadequate biopsy samples or previously diagnosed and treated breast cancers were excluded.

Sample collection and processing: Trucut biopsies were obtained using an automated 14-gauge core needle biopsy device under palpation or ultrasound guidance, as appropriate (8). The specimens were fixed in 10% neutral buffered formalin for 6-12 hours and then processed using standard paraffin embedding protocols. Four-micron-thick sections were prepared and stained with Hematoxylin and Eosin (H&E) for histopathological evaluation.

Histopathological Classification: All cases were examined under light microscopy and classified into benign and malignant categories based on WHO classification criteria for breast tumors (12). Benign lesions included fibroadenoma, fibrocystic disease, intraductal papilloma, granulomatous mastitis, and ductal hyperplasia. Malignant lesions were categorized based on histological type and grade.

Immunohistochemistry: Immunohistochemistry staining was performed on malignanat cases using antibodies for estrogen receptors(ER), progesterone receptor(PR) and human epidermal growth factor receptor2 (HER2). Standard IHC procedures were followed using the avidin-biotin complex method. Appropriate positive and negative controls were included for each marker.[10-13] ER and PR expression was considered positive if >1% of tumor nuclei showed staining, as per ASCO/CAP guidelines.[4] HER2 status was scored from 0to 3+; a score of 3+ was considered positive, 2+ equivocal (requiring FISH confirmation) and 0-1+ negative.[14]

Data analysis: Patient demographics, histological diagnosis and IHC profiles were recorded and tabulated. Data were analysed using Microsoft Exel 2019. Descriptive statistics such as frequencies, percentages, and means were calculated. Chi square test of independence was used to measure the statistical significance. Concordance between histological findings and IHC expression was assessed qualitatively.

Limitations: The primary limitation of the study was the relatively small sample size (n=50) which may affect the generalisability of findings and restricts statistical subgroup analysis.

Results

A total of 50 patients with breast lesions were included in the study. Of these 15 (30%) were diagnosed with benign lesions and 35 (70%) with malignant lesions on trucut biopsy. The age of patients ranged from 18 to 85 years. Benign cases were seen predominantly in the 30-40 years age group, whereas malignant cases were more frequent in the 50-60 year age group.

The mean age of patients with benign lesions was 36.2 years while the mean age for malignant lesions was 55.6 years.

[Table 1] shows the age-wise distribution of cases.

Table 1: Age distribution of patients with breast lesions

Age Group	Benign Cases (n=15)	Malignant Cases (n=35)
18–29	2 (13.3%)	0 (0%)
30–39	7 (46.7%)	1 (2.9%)
40–49	3 (20%)	5 (14.3%)
50–59	2 (13.3%)	14 (40%)
60–69	1 (6.7%)	10 (28.6%)
70–79	0 (0%)	4 (11.4%)
80–89	0 (0%)	1 (2.9%)

Mean Age (Years) for benign cases – 36.21

For malignant cases – 55.6

Statistical Test applied: Chi-square test of independence

Chi-square value – 24.24, Degrees of Freedom =6

p- value- 0.0005 (statistically significant at p,0.05).

Histopathological examination revealed that fibroadenoma was the most common benign lesion, comprising 66.7% of benign cases. Among malignant lesions invasive ductal carcinoma (IDC) accounted for 94.3% of cases.

[Table 2] summerises the histological spectrum of breast lesions

Table 2: Histopathological classification of breast lesions.

Type of Lesion	Number of Cases	Percentage (%)
Benign Lesions (n=15)		
Fibroadenoma	10	20%
Fibrocystic disease	2	4%
Granulomatous mastitis	1	2%
Intraductal papilloma	1	2%
Ductal Hyperplasia	1	2%
Malignant Lesions (n=35)		
Invasive Ductal carcinoma	33	66%
Invasive Lobular carcinoma	1	2%
Ductal Carcinoma in situ	1	2%

Immunohistochemical (IHC) analysis was performed on all 35 malignant cases using ER, PR and HER2. ER positivity was observed in 24 (68.6%) cases, PR positivity in 20 (57.1%) cases, HER2 positivity in 6 (17.1%) cases. Triple negative breast cancer (ER-, PR-, HER2-) was found in 5 (14.3%) cases.

[Table 3] shows the IHC profile of malignant lesions.

Table 3: IHC profile of malignant breast lesions (n=35)

IHC Marker Status	Number of Cases	Percentage
ER positive	24	68.6%
PR positive	20	57.1%
HER2 positive (3+)	6	17.1%
Triple Negative (ER-/PR-/HER2-)	5	14.3%

Concordance was observed between histopathological subtype and receptor expression patterns, particularly with IDC cases showing promiment hormone receptor positivity.

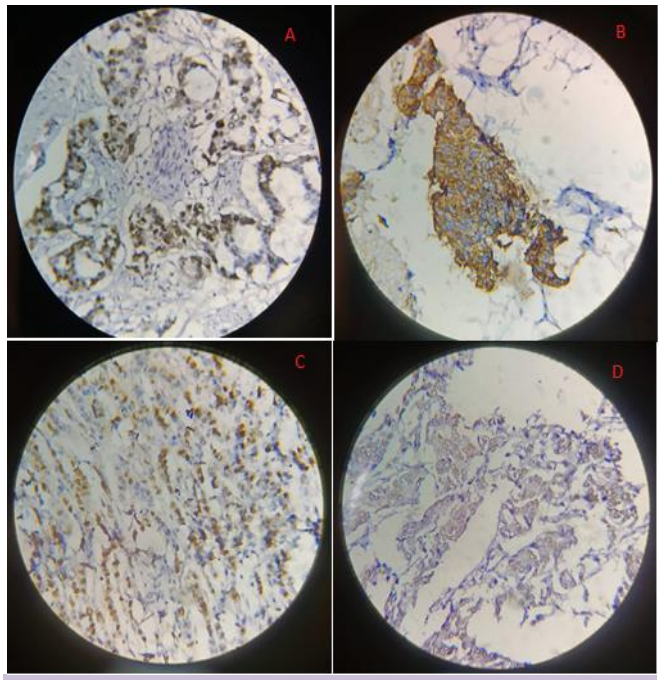
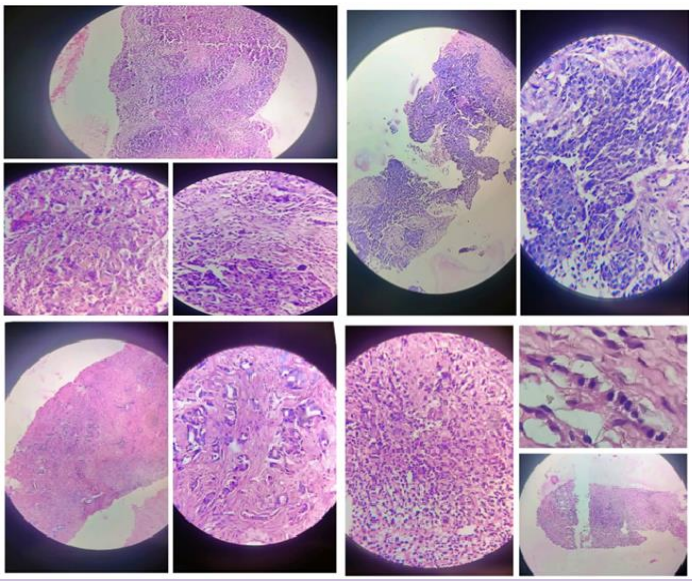


Figure 1: Representative photomicrographs of immunohistochemical staining in trucut biopsy specimens of breast carcinomas.
A. Positive nuclear staining for PR antibody (IHC staining) for Invasive Ductal Carcinoma.
B. Positive membrane staining for Her2 antibody (IHC staining) for Invasive Ductal Carcinoma
C. Positive nuclear staining for ER antibody (IHC staining) for Invasive Lobular Carcinoma.
D. Positive nuclear staining for ER antibody (IHC staining) for Invasive Ductal Carcinoma.



A & B. Invasive Ductal Carcinoma gradeIII (low and high power views, H&E).
C.Invasive Ductal Carcinoma Tubular type (low and high power views,H&E).
D.Invasive Lobular Carcinoma (low and high power views, H&E).

Discussion

Trucut biopsy is a widely accepted, minimally invasive procedure used in the preoperative diagnosis of breast lesions. It offers a high degree of diagnostic accuracy while preserving tissue architecture suitable for histopathological and immunological evaluation.[12,15] In the present study comprising 50 cases of breast lesions, histopathological analysis was supplemented with immunohistochemical profiling using estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2), providing a comprehensive evaluation of both benign and malignant tumors.

Our study subjects were of the expected age of occurrence when it comes to breast disease. The lesions were benign and a mean age of 36.2 years was noted although a higher percentage of the lesions was observed to inflict those between the age 30-40 years, mainly in women. Conversely, malignant lesions affected ages of 55.6 years on average and were highest in women aged between 50-60 years. These results are also comparable to epidemiological research that showed higher occurrence of benign tumors in younger and reproductively aged women and malignant tumors in postmenopausal women.[16,17]

Among the benign lesions (n=15), a subtype of fibroadenoma with an incidence density of 60 percent was the leading lesion, next came fibrocystic disease, then granulomatous mastitis, intraductal papilloma and ductal hyperplasia. The results are consistent with the past literature that showed fibroadenoma to be the most common benign tumor of the breast in young women based on hormonal effects.[18,19]

The most common histological subgroup in the malignant group (n=35) was invasive ductal carcinoma (IDC) (94.3 percent), and only one patient with invasive lobular carcinoma and ductal carcinoma in situ (DCIS). The observed prevalence of IDC is similar to that of the world and other regional reports that indicate that about 70-80% of invasive cases of breast cancer are IDC-related.[6,20]

Detection of immunomedicinal reactions by the ER,PR and HER2 markers generate key molecular data which are used in therapy planning. The presence of hormone receptor (ER/PR) is linked to a better prognosis and sensitivity to endocrine treatments (tamoxifen or aromatase inhibitors) (4). HER2 positivity but aggressive tumor behavior means that targeted therapy can be administered using agent trastuzumab which substantially improves the results of such patients.[14] Generally, in our study, IHC finding were corroborated with histopathological findings and displayed the anticipated expression patterns of receptors in correlation to IDC and ILC subtypes.

Various researchers have confirmed the applicability of trucut biopsy in the accurate categorization of breast tumors and prediction of receptor status.[21,22] In addition, the capability to conduct IHC on a core biopsy sample is that it does not demand any waiting on the excisional samples and, therefore, the rapid execution of targeted therapies. All trucut specimens in our cohort were sufficient to undergo histopathological and IHC interpretation, and the validity of this technique was supported.

The small sample size is one of the limitations of this study because it does not allow the analysis of subgroups and its application in the generalization of our findings. Moreover, the cross-sectional design did not allow evaluating the long-term follow up and association with clinical outcome. Smaller cohorts should be further studies and more prognostic variables (such as Ki-67 and p53) should be included.

Conclusion

Finally, immunohistochemistry coupled with trucut biopsy provides an effective and informative method in the process of assessing the breast lesions. It makes it possible to diagnose promptly and correctly and assist in choosing specific treatment approaches, particularly in cancerous ones. We find that the combination of histopathology and IHC is extremely important in the standard diagnostic procedure of a breast pathologist.

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Conflicts of interest

There are no conflicts of interest.

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