

DIAGNOSTIC EFFICACY OF ASPIRATION CYTOLOGY VERSUS CELL BLOCK IN PALPABLE BREAST LESIONS

E. Tagar^{1,2}, CS. Okparaojiego¹, J. Kpolugbo^{1,2}, AE. Dongo^{1,2}, W. Akerele^{2,3}

1. General Surgery Unit, Department of Surgery, Irrua Specialist Teaching Hospital, Irrua, Nigeria
2. Department of Surgery, Ambrose Alli University, Ekpoma, Nigeria
3. Paediatric Surgery Unit, Department of Surgery, Irrua Specialist Teaching Hospital, Irrua, Nigeria

Corresponding:

Dr. E. Tagar

General Surgery Unit,
Department of Surgery,
Irrua Specialist Teaching Hospital,
Irrua, Edo State,
Nigeria.
Email: tagestov2000@gmail.com

Submission Date: 21st Oct., 2024

Date of Acceptance: 24th July, 2025

Publication Date: 31st Aug., 2025

Copyright Statement

The copyright of this manuscript is vested in this journal and in its publisher, the Association of Resident Doctors, University College Hospital, Ibadan.

This article is licensed under the Creative Commons Attribution-Non Commercial License 3.0 (CC BY-NC 3.0).

ABSTRACT

Background: Breast masses often cause anxiety in women due to concerns about cancer. Fine Needle Aspiration (FNA) is a common technique used to diagnose breast lumps before surgery. Cell blocks, created from the aspirates, are important for preserving cell structure and characteristics, as well as for further testing with immunohistochemistry. This study aimed to evaluate the efficacy of FNA and cell blocks in diagnosing breast lesions.

Methods: This one-year prospective study included 90 patients with palpable breast lesions who presented at Irrua Specialist Teaching Hospital from December 1, 2020, to November 30, 2021. FNA and cell block procedures were performed on each patient, with samples stained using haematoxylin and eosin (H&E). The breast lesions were classified as malignant or benign based on fine needle aspiration cytology (FNAC) and cell block results, which were then compared with the histological diagnosis of tissue biopsies.

Results: The study found that FNAC had a diagnostic accuracy of 82.5% for breast lesions, with a sensitivity of 76.0% and specificity of 98.5%. The positive predictive value (PPV) was 88.9% and the negative predictive value (NPV) was 82.7%. Cell blocks showed a higher diagnostic accuracy (94.0%), with a sensitivity of 95.0% and specificity of 98.5%. The PPV and NPV for cell block diagnosis were 94.1% and 91.8%, respectively.

Conclusion: The cell block method is a more accurate diagnostic tool for breast tumours than FNAC. It allows for the study of tissue architecture and may eliminate the need for invasive biopsies.

Keywords: Breast lumps, FNAC, Cell block, Diagnostic efficacy

INTRODUCTION

When a woman discovers a breast lump, her primary concern is to know whether it is cancerous or not.¹ This curiosity is completely understandable, as breast cancer is a serious and potentially life-threatening condition. It is imperative to conduct a thorough evaluation, including a physical examination, imaging studies, and possibly a biopsy, to determine the nature of the lump and provide appropriate management. Early detection and accurate diagnosis are key to ensuring timely treatment and better outcomes for patients with malignancies.

Pathological evaluation of breast malignancy involves fine needle aspiration cytology (FNAC), cell block (CB), core needle biopsy or open surgical biopsy. Each method has its unique merits and demerits, but tissue biopsy for histology is the definitive test for breast cancer diagnosis. FNAC is commonly used for the preoperative evaluation of breast lesions.² It is the most

useful initial test for distinguishing between benign and malignant lesions due to its cost-effectiveness and minimal invasiveness.^{2,3}

While FNAC is valuable, there are some issues associated with it, including false-negative results and suspicious lesions (C3 and C4) that may eventually need confirmation as benign or malignant through tissue biopsy and histology. Additionally, FNAC may not provide crucial information about the pathological types and intrinsic behaviours of tumours.⁴

Cell blocks created from aspirated material have become a valuable technique to enhance diagnostic accuracy and assess immune markers. They have the potential to eliminate the need for invasive breast biopsies.³ Cell blocks allow for the appreciation of architectural features not visible with fine needle aspiration cytology, preserve nuclear architecture,

characterize ductal proliferation, and detect malignant cell invasion into adjacent tissue. They enhance the diagnostic capabilities of breast fine needle aspiration by diagnosing invasion in ductal carcinoma, bridging the gap between cytology and histopathology, and complementing fine needle aspiration smears. Additionally, cell blocks enable immunohistochemistry (IHC) to detect hormone receptor status or human epidermal growth factor receptor 2 (HER2) overexpression, improving diagnostic accuracy, subtyping tumours, and identifying primary sites in metastasis.⁵

Despite their simplicity and affordability, many centers in developing countries lack awareness of cell block preparation and its usefulness. The current study aimed to evaluate the diagnostic efficacy of fine needle aspiration cytology and cell block in the management of breast lesions in a tertiary hospital in Southern Nigeria.

MATERIALS AND METHODS

Study design and duration

This study prospectively evaluated patients with palpable breast lumps who underwent FNAC, CB, and tissue biopsy histology at Irrua Specialist Teaching Hospital (ISTH) from December 2020 to November 2021.

Study location

This research was conducted at Irrua Specialist Teaching Hospital, a federal tertiary institution located in Irrua, Edo State, in the south-south region of Nigeria. The hospital offers tertiary healthcare services to residents of Edo Central and Northern senatorial districts, as well as parts of Edo south district, and receives referral from neighbouring Delta, Ondo, and Kogi states. Additionally, ISTH serves as the teaching hospital for Ambrose Alli University in Ekpoma, Edo state. The study involved various departments of the hospital, including the general surgery histopathology, and cytology clinic.

Study population

All patients with palpable breast lumps who agreed to participate and met the inclusion criteria were included in the study. They were enrolled when they presented at the general surgery clinics, emergency department or on the wards after receiving appropriate counselling.

Inclusion and exclusion criteria

All patients aged 18 years and older who presented to ISTH, Irrua with a palpable breast lump during the study period were included. Patients who had previously been diagnosed or received breast chemotherapy or radiotherapy, those with ulcerated

or fungating breast masses, and those with cystic lesions confirmed on ultrasound were excluded.

Sample size determination

The sample size was calculated using formula for determining the minimum sample size in a diagnostic study.⁶ A minimum sample size of 84 samples was calculated.

Sampling method

Patients who met the inclusion criteria were recruited consecutively for the study from either the general surgery clinics or the emergency unit of ISTH. Each patient was assigned a serial number upon presentation until the sample size was reached.

Fine-needle aspiration and cell block techniques

The patient was placed in a supine position with the ipsilateral hand positioned behind the head. The skin was cleaned using chlorhexidine and 70% alcohol solutions and then draped with sterile surgical towels. A size 23G needle connected to a 10 ml syringe was inserted into the lesion. Negative pressure was created by pulling back the syringe plunger, and the needle was moved back and forth to aspirate the mass, with cellular material collected using suction. Sterile gauze dressing was applied to the puncture sites to control bleeding. The aspirate was spread on labelled glass slides, fixed in methanol, and stained with haematoxylin and eosin. The remaining aspirate was collected for cell block preparation, fixed in formalin, and processed in a Leica® TP 1020A automatic tissue processor. The cell block was embedded in paraffin, sectioned and stained with haematoxylin and eosin. The stained sections were examined under the microscope by a consultant cytopathologist. The patients' vital signs were monitored after the procedure, and they were observed for three hours before being discharged home on paracetamol. The turnaround time for FNAC was 24 hours, while for the cell block, it was 5 to 7 days.

Data collection

Data was collected using a structured proforma from the time the patient presented until after histopathology analysis. We documented the demographic details and clinical information of the patients including age, clinical characteristics of the tumour, cytology findings, cell block findings, and histological diagnosis.

Data analysis

The data was analysed using the International Business Machine for Statistical Package for Social Sciences (IBM SPSS) version 22 software. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as medians, ranges,

and in tabular forms. The diagnostic accuracy of FNAC and CB was determined using the histology of tissue biopsy as the gold standard. The diagnostic accuracy measures included sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and the area under the Receiver Operating Characteristic (ROC) curve.

The values were calculated using the following formulas⁷

- (1). Sensitivity = $TP / (TP + FN) \times 100$
 - (2). Specificity = $TN / (TN + FP) \times 100$
 - (3). Positive Predictive Value (PPV) = $TP / (TP + FP) \times 100$
 - (4). Negative Predictive Value (NPV) = $TN / (TN + FN) \times 100$
 - (5). Accuracy = $(TP + TN) / \text{Total participant} \times 100$
- Where TP = True Positive, TN = True Negative, FP = False Positive and FN = False Negative
- (6). Receiver Operating Characteristic curve- The ROC curve is a tool used to compare different tests by calculating the area under the curve for each test.

Ethical Considerations

This study was approved by the Research Ethics Committee of Irrua Specialist Teaching Hospital (approval no.: ISTH/HREC/20200510/097). Participation was voluntary, and written informed consent was obtained from all patients. Data were

analysed anonymously, and privacy was strictly respected.

RESULTS

In this study, a total of 90 patients who met the specified criteria were included, and their data were analysed. The median age of the patients was 29 years, with an interquartile range of 21 to 43. Patients under the age of 39 had a higher prevalence of benign breast lumps, while those aged 40 and above had a higher incidence of malignant breast lumps (Table 1). The study primarily included female participants (97.8%), and all patients presented with breast lesions on one side, with the majority (54.4%) on the left side.

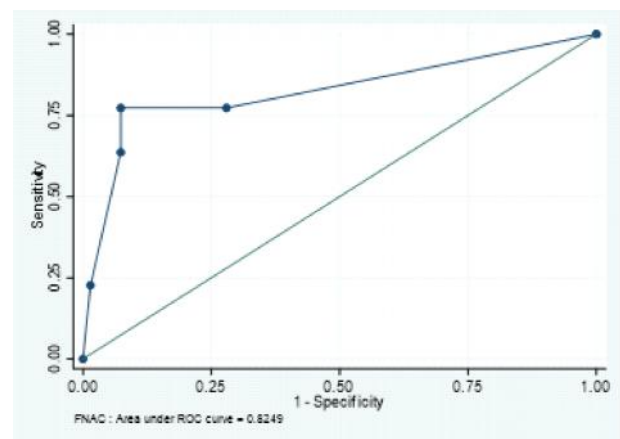


Figure 1: Receiver operating characteristic curve for FNAC

Table 1: Age and sex distribution of patients

Variables	Malignant breast lumps	Benign breast lumps
Age		
≤ 20	0 (0.0)	12 (100.0)
20-29	1 (2.9)	34 (97.1)
30-39	2 (13.3)	13 (86.7)
40-49	9 (56.2)	7 (43.8)
50-59	6 (75.0)	2 (25.0)
≥60	4 (100.0)	0 (0.0)
Sex		
Female	21 (23.9)	67 (76.1)
Male	1(50.0)	1 (50.0)

Table 2: Diagnostic performance of FNAC and cell block

Variables	FNAC	Cell Block
Sensitivity (%)	76.0	95.0
Specificity (%)	98.5	98.5
PPV (%)	88.9	94.1
NPV (%)	82.7	91.8
Accuracy (%)	82.5	94.0

FNAC- Fine-Needle Aspiration Cytology; PPV- Positive Predictive Value; NPV- Negative Predictive Value

Histology was used as the reference standard for diagnosing breast lumps. The majority of patients (75.6%) had benign lesions, while 24.4% had malignant lumps. Fibroadenoma was the most common lesion accounting for 56.7% of cases, while 22.2% of the patients had carcinoma.

The diagnostic efficacy of FNAC and Cell Block for breast lesion diagnosis is outlined in Table 2. FNAC had an inadequacy rate of 15.6%, while Cell Block

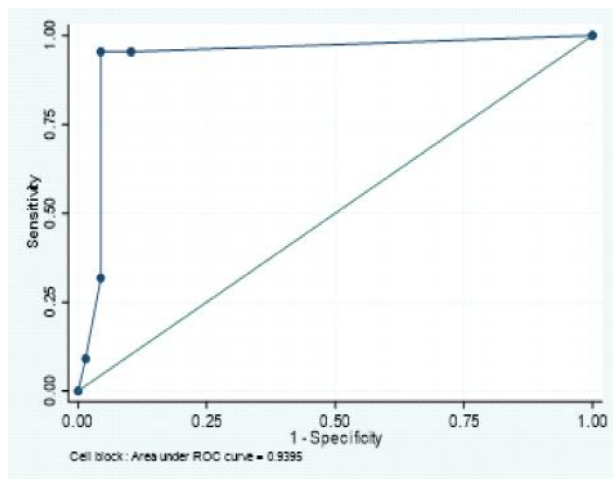


Figure 2: Receiver operating characteristic curve for cell block

had a rate of 4.4%. The receiver operating curve demonstrated the predictive capacity of the diagnostic tools. In this study, FNAC and Cell Block showed predictive accuracies of 82.5% and 94.0%, respectively (Figs 1 and 2).

DISCUSSION

Cytology has evolved significantly since its inception in the 18th century, with advancements aimed at improving accuracy.⁸ One notable development is the introduction of cell block technology which has enhanced the diagnostic capabilities in the field. This study focused on evaluating the accuracy of fine needle aspiration and cell block in diagnosing breast lesions. The study included 90 patients with palpable breast lesions, all of whom had unilateral breast lumps. The highest number of breast lumps was observed in the 20 to 29 age group, accounting for 39% of all cases. Benign lumps were more common in the 21-30 age group, while malignant lumps were predominant in the 40-49 age group, consistent with findings from previous research in Nigeria.^{9,10,11}

Prompt diagnosis of breast lumps is important as they can cause anxiety, especially in younger women, who may worry about cancer and possible cosmetic changes after surgery. Fine needle aspiration cytology is a minimally invasive, cost-effective, and a quick method for assessing breast lumps.⁵ FNAC in this study had a sensitivity of 76.0%, specificity of 98.5%, positive predictive value of 88.9%, negative predictive value of 82.7%, and a diagnostic accuracy of 82.5%. The diagnostic accuracy is similar to the 80% reported in a study by Patel *et al.*,¹² higher than the 69.2% reported by Kawatra *et al.*,³ but lower than the 96.5% reported by Desai *et al.*¹³ The variations in diagnostic accuracy could be attributed to the varying levels of expertise

among the cytopathologists at the different institutions where the studies were conducted.

Despite its benefits, fine needle aspiration cytology has limitations, including inadequate sample distribution and the potential for false-negative or inconclusive results.⁴ To overcome these challenges, the cell block technique has been implemented to optimize material utilization and enhance diagnostic accuracy.^{3,4}

Over the past decade, there has been a decline in the use of breast FNAC in favour of more aggressive core biopsy techniques. Some pathologists favour core biopsies for histologic assessment, as they allow for the identification of additional predictive and prognostic markers.^{14,15} Cell blocks combine the advantages of both methods in a single procedure. It was even recommended that the cell block technique be used in conjunction with FNAC for accurate diagnosis of breast lesions.³ Cell blocks offer a less invasive alternative to traditional breast biopsy techniques, and the sections of the cell block can be used for special stains and IHC.³ This study reported a cell block sensitivity of 95.0%, specificity of 98.5%, positive predictive value of 94.1%, negative predictive value of 91.8%, and diagnostic accuracy of 94.0%. Our results were consistent with those of Raafat *et al.*, who found a sensitivity of 94%, specificity of 98%, PPV of 94%, NPV of 98%, and accuracy of 98%.¹⁶ Our figures are slightly higher than the findings of Prakash *et al.*, who reported a sensitivity of 77.77%, specificity of 82.85%, PPV of 70%, NPV of 87.87%, and accuracy of 81.13%.⁵ This may be possibly due to the limited number of cases with a histopathological correlation, and, in some instances, their cell block material was inadequate for assessment.

Cell block analysis, in this study, has demonstrated superior histocytological agreement and higher diagnostic value in comparison to FNAC, with predictive accuracies of 94% and 82% respectively for determining outcomes of breast lumps using the receiver operating characteristic curve (Figs 1 and 2). Keyhani-Rofaga *et al.* and Kern *et al.* further corroborated these findings, showing in their works, that cell block improved the initial smear diagnosis by 55% and 26%, respectively.^{17,18} Moreover, false positive results on FNAC were identified in this study, later confirmed as benign on histology, underscoring the importance of accurate diagnosis in distinguishing between benign and malignant lesions. Cell block analysis was particularly useful in resolving challenging cases, such as differentiating between typical and atypical hyperplasia in fibrocystic disease. Additionally, the study revealed a significant decrease in the inadequate rate from 16% with FNAC to 4% with cell

block, reducing the need for repeat procedures and alleviating patient distress related to breast lumps.

Limitation of the study

The absence of laboratory facilities and financial constraints for patients restricted the number of IHCs that could be performed at centers where they are accessible.

CONCLUSION

Accurately diagnosing and treating breast lumps with lower cost and less discomfort is crucial. Precise diagnosis is essential to avoid serious consequences. FNAC is a cost-effective and less invasive option, but cell block technology has shown superior diagnostic accuracy. As cell block technology advances, traditional tissue samples may become less necessary, promising a bright future for cytology.

REFERENCES

1. **Gana SG**, Yusufu L, Abur PP, *et al*. Comparative Accuracy and Complications of Palpation-Guided Versus Ultrasound-Guided Core Needle Biopsy of Palpable Breast Lumps in Ahmadu Bello University Teaching Hospital, Zaria. *J West Afr Coll Surg*. 2023 ;13:28-36.
2. **Obiajulu FJ**, Daramola AO, Anunobi CC, *et al*. The diagnostic utility of cell block in fine needle aspiration cytology of palpable breast lesions in a Nigerian tertiary health institution. *Diagn Cytopathol*. 2020, 48:1300–1306.
3. **Kawatra S**, Sudhamani S, Kumar SH, Roplekar P. Cell block versus fine needle aspiration cytology in the diagnosis of breast lesions. *J Sci Soc*. 2020, 47:23-27.
4. **Tagar E**, Kpolugbo J, Tagar AG, *et al*. Fine needle aspiration in the evaluation of patients with suspected breast cancer in a suburban Nigerian teaching hospital: A five-year review. *J Breast Cancer Res*. 2024, 4:11-16.
5. **Prakash D**, Puvvala OR, Nuguri VK, Venkatapathappa P. Advantages of the cell block technique over the FNAC and correlation with histopathology of most prevalent breast lesions in the community at the tertiary care center. *Indian J Pathol Oncol*. 2022, 9:312-317.
6. **Zadi SM**, Waseem HF, Fahim M, *et al* Sample Size Estimation of Diagnostic Studies. *Proc 14th Int Conf Stat Sci: Pakistan: ISOSS*. 2016, 29:239-246.
7. **Šimundiæ AM**. Measures of Diagnostic Accuracy: Basic Definitions. *EJIFCC*. 2009, 19:203-211.
8. **Frable WJ**. Integration of surgical and cytopathology: a historical perspective. *Diagn Cytopathol*. 1995, 13:375-378.
9. **Nuhu A**, Aliyu S, Musa AB. Management of breast lumps in Maiduguri, Nigeria. *Sahel Med J*. 2014, 17:50-53.
10. **Ogbuanya AU**, Anyanwu SN, Nwigwe CG, Iyare FE. Clinicopathologic study of breast lumps in Abakaliki, Southeastern Nigeria. *Asian J Med Sci*. 2016, 7:58-64.
11. **Tagar E**, Kpolugbo J, Okomayin AA, Tagar AG. A Review of Breast Cancer Surgeries in a Suburban Nigerian Tertiary Hospital and the Limitations of Breast-Conserving Surgery. *Breast Cancer (Auckl)*. 2025, 19:11782234251323774.
12. **Patel MJ**, Patel SC. Fine needle aspiration cytology and cell block study of various breast lumps. *J Cytol Histol*. 2018, 9:514.
13. **Desai PB**, Desai KN, Panchal NS. Utility of the United Kingdom National Health Services Breast Screening Program diagnostic protocol in fine needle aspiration cytology with cell block
14. **Pagni P**, Spunticchia F, Barberi S, *et al*. Use of Core Needle biopsy rather than Fine-Needle Aspiration Cytology in the Diagnostic Approach of Breast Cancer. *Case Rep Oncol*. 2014, 7: 452-458.
15. **Tagar E**, Kpolugbo J, Ehiagwina LA, *et al*. Diagnostic accuracy of core-needle and open surgical biopsies for palpable breast lesions in a Southern Nigerian tertiary hospital. *Arch Clin Res*. 2024, 8:8-13.
16. **Raafat AH**, Abdelmonem AH, Fathy AF, Samir I. Fine needle aspiration cytology and cell block study of various breast lumps. *Am J Biomed Life Sci*. 2013, 2:8 17.
17. **Keyhani-Rofaga S**, Toole RV, Leming MF. Role of Cell block in fine needle aspiration. *Acta Cytol*. 1984, 28:630–636.
18. **Kern WH**, Haber H. Fine needle aspiration mini biopsies. *Acta Cytol*. 1986, 30:403-408.