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Diagnostic accuracy of core-needle and open surgical biopsies for palpable breast lesions in a Southern Nigerian teaching hospital: a retrospective study.

Tagar E[1,2], Kpolugbo J[1,2], Ehiagwina LA[1,2], Chukwu IM[3], Tagar AG[4]

1. Department of Surgery, Irrua Specialist Teaching Hospital, Edo State, Nigeria
2. Department of Surgery, Ambrose Alli University, Ekpoma, Edo State Nigeria
3. Department of Anaesthesia, Irrua Specialist Teaching Hospital, Edo State, Nigeria
4. Edo Specialist Hospital, Benin City, Edo State, Nigeria

Abstract

Background: Biopsy methods, including core needle and open surgical biopsy are commonly used for diagnosing suspicious breast lesions. This study aimed to analyse the biopsies performed for suspected breast cancers at our centre and assess their diagnostic accuracy. Methods: A retrospective review of all biopsies for suspected breast cancer conducted between January 2018 and December 2022 at the Irrua Specialist Teaching Hospital was carried out. Results: Among 117 patients, 43.6% underwent core needle biopsy, and 56.4% underwent open surgical biopsy, with mean ages of 47.8±13.5 and 47.0±11.6 years, respectively. In the core needle biopsy group, 13.7% of lesions were benign, 82.4% were malignant, one case was misdiagnosed as benign, and one was inconclusive. In the open surgical biopsy group, 7.6% of lesions were benign, and 92.4% were malignant. The diagnostic accuracies for core needle and open surgical biopsies were 96.1% and 100%, respectively, correlating well with postsurgical histological findings. Complications such as bleeding, hematoma formation, ulceration, and wound infection were observed with open surgical biopsy. Conclusion: Core needle and open surgical biopsies were effective in diagnosing suspicious breast lesions at our centre, with similar findings. Core needle biopsy was minimally invasive and had no observed complications in this study.

Keywords: *Breast cancer, core needle biopsy, open surgical biopsy, diagnostic accuracy*

Introduction

Breast cancer is a significant global health concern, being the most common malignancy among women worldwide.[1]It is the leading cause of cancer related deaths in African women[2]and the second leading cause in Caucasians following lung cancer.[3]

The discovery of a breast lump is a common concern for women of all ages, leading many to seek medical attention at surgical outpatient clinics due to increased awareness of breast cancer.[4] Clinical assessment may not always distinguish between benign and malignant lumps, necessitating biopsies for definitive diagnosis. Open surgical biopsies such as incisional and excisional biopsies, were historically performed to obtain a definitive diagnosis.[5] Core needle biopsy has now become the preferred method due to its accuracy and ability to provide enough tissue for histopathological analysis.[6] Image guidance further enhances the accuracy of core needle biopsy, making it a common choice for diagnosing breast lesions in many centres.

Core needle biopsy (CNB) is a faster, less traumatic, and more cost-effective alternative to open surgical biopsy with fewer complications and a shorter recovery time.[7] However, the accuracy of core needle biopsy results may be a concern without an interventional radiologist for image-guided biopsies, in which case open surgical biopsy may be preferred.

This study aimed to evaluate the accuracy of CNB and open surgical biopsy and to determine the extent to which CNB can be a reliable alternative to open surgical biopsy at our institution.

Corresponding author Dr. Esteem Tagar,
Department of Surgery,
Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria.
Email: tagestov2000@gmail.com
Tel: +2348030699256

Material and Methods

This retrospective review included all patients who underwent diagnostic evaluation for suspicious breast lumps through biopsies at the Department of Surgery, Irrua Specialist Teaching Hospital, Irrua, Nigeria, from January 2018 to December 2022. Approval was obtained from the hospital's Health Research and Ethics Committee (reference no: ISTH/HREC/20230810/500), and the study followed the principles of the Helsinki Declaration.

Inclusion criteria

All patients aged 18 years and above who underwent open surgical biopsies or freehand core needle biopsies for suspicious palpable breast lesions during the specified period were included in the study.

Exclusion criteria

Patients under 30 years of age with clinical and sonographic features suggestive of fibroadenoma, as well as those with incomplete medical records were excluded from the study.

Source of data

The general surgery unit records provided the hospital numbers of patients who underwent biopsies for suspicious breast lesions within the study period. The retrieved case notes from the hospital medical records were used to gather information about the demographic profile, duration of symptoms, size of the breast mass, histologic diagnosis from both biopsy methods, and complications following the procedures. The gold standard for confirming breast lesion diagnosis was the histology obtained from mastectomy specimens or excision biopsies in cases of benign lesions (postsurgical histology).

Data analysis

Deidentified data were collected in an Excel sheet and analysed using Statistical Product and Service Solutions (SPSS) software version 25. Frequencies, means, and standard deviations were calculated. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of histological results from core needle and open surgical biopsies were analysed. Statistical tests included Student's t-test and chi-square test, with significance set at $p < 0.05$ at a 95% confidence level.

Results

A total of 117 patients with complete data were included in the study out of 148 patients who underwent biopsy during the study period. Among them, 51 (43.6%) patients underwent CNB, and 66 (56.4%) underwent open surgical biopsy. The study included 111 (94.9%) females and 6 (5.1%) males, with a ratio of 18.5:1. The mean age for CNB patients was 47.8±13.5 years and for open biopsy patients was 47.0±11.6 years, with no significant difference ($p = 0.72$). The mean duration of symptoms was 14.1±23.2 months for CNB and 10.1±9.5 months for open biopsies, also not significant ($p = 0.21$). Other clinicopathologic characteristics are presented in Table 1, showing no significant differences between the two groups.

Table1: Clinicopathologic characteristics of patients

Variable	CNB (n = 51)	Open biopsy (n = 66)	χ^2	p-value
Age (years)				
≤ 39	15 (29.4)	19 (28.8)	5.631	0.228
40 – 49	15 (29.4)	22 (33.3)		
50 – 59	8 (15.7)	16 (24.2)		
60 – 69	12 (23.5)	6 (9.1)		
≥ 70	1 (2.0)	3 (4.5)		
Sex				
Male	3 (5.9)	3 (4.5)	0.106	0.75
Female	48 (94.1)	63 (95.5)		
Size of mass (cm)				
<2	0 (0.0)	0 (0.0)	4.390	0.036
2 – 5	17 (33.3)	11 (16.7)		
>5	34 (66.7)	55 (83.3)		
Axillary swelling				
Yes	33 (64.7)	51 (77.3)	2.224	0.134
No	18 (35.3)	15 (22.7)		
Histology type				
Benign	7 (13.7)	5 (7.6)	1.182	0.277
Malignant	44 (86.3)	61 (92.4)		
Stage				
IA	0 (0.0)	2 (3.3)	9.442	0.224
IIA	2 (4.5)	4 (6.6)		
IIB	6 (13.6)	2 (3.3)		
IIIA	3 (6.8)	8 (13.1)		
IIIB	19 (43.2)	31 (50.8)		
IIIC	0 (0.0)	1 (1.6)		
IV	14 (31.8)	13 (21.3)		
Immunohistochemistry				
Lumina A	4 (22.2)	8 (34.8)	4.865	0.433
Lumina B	0 (0.0)	3 (13.0)		
Triple Negative	8 (44.4)	9 (39.1)		
HER 2 Positive	6 (33.3)	3 (13.0)		

CNB: Core needle biopsy; HER 2: Human epidermal growth factor receptor 2

Pathologic evaluation revealed that 89.7% of the samples were malignant, while 10.3% were benign. Invasive carcinoma NSTs were the most common malignant lesions (74%), and fibroadenomas were the most common benign lesions (50%). All male patients had invasive carcinoma NSTs. Figures 1 and 2 illustrate the spectrum of pathologic lesions among the patients.

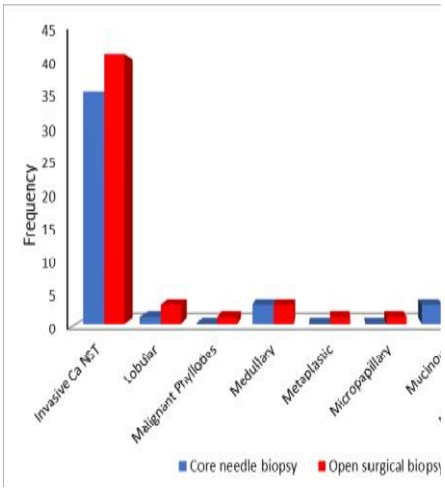

Fig. 1: Histology of malignant lesions

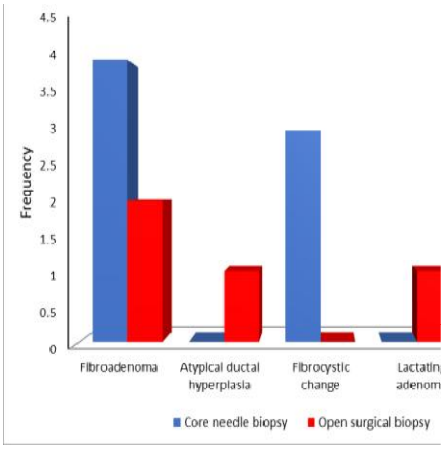

Fig. 2: Histology of benign lesions

Histology results from core needle biopsies showed 42 (82.4%) malignant lesions, 8 (15.7%) benign lesions, and 1 inconclusive result. Postsurgical specimen histology revealed 44 (86.3%) malignant and 7 (13.7%) benign lesions. Core needle biopsy had 82.4% true-positive cases, 0% false-positive cases, 3.9% false-negative cases, and 13.7% true-negative cases, as shown in Table 2. Open biopsy results were consistent with postsurgical histology for all cases (Table 3).

Table 2: Correlation of core needle biopsy with postsurgical histological findings

CNB	Postsurgical Histology			Pearson's rho	p-value
	Malignant (%)	Benign (%)	Total (%)		
Malignant	42 (95.4)	0 (0)	42 (82.3)	0.867	< .001
Benign	1 (2.3)	7 (100.0)	8 (15.7)		
Inconclusive	1 (2.3)	0 (0.0)	1 (2.0)		

CNB: core needle biopsy

Table 3: Correlation of open surgical biopsy with postsurgical histological findings

Open biopsy	Postsurgical Histology			Pearson's rho	p-value
	Malignant (%)	Benign (%)	Total (%)		
Malignant	61 (100.0)	0 (0.0)	61 (92.4)	1.000	<.001
Benign	0 (0.0)	5 (100.0)	5 (7.6)		

Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy are shown in Table 4 with open surgical biopsy slightly outperforming core needle biopsy.

Table 4: Diagnostic validities of core needle and open biopsies

Variable	CNB	Open biopsy
Sensitivity	100.0	100.0
Specificity	95.5	100.0
PPV	100.0	100.0
NPV	87.5	100.0
Diagnostic accuracy	96.1	100.0

CNB: Core needle biopsy; PPV: Positive predictive value; NPV: Negative predictive value

Complications were minimal, with one patient each experiencing bleeding, hematoma formation, ulceration, and wound infection after open biopsy,

while no complications were reported following core needle biopsy (Table 5).

Table 5: Complications of biopsies

Variable	CNB	Open biopsy
Bleeding	0	1
Hematoma	0	1
Infection	0	1
Ulceration	0	1

CNB: Core needle biopsy

Discussion

A suspicious breast lesion detected on breast self-examination, clinical breast examination or imaging needs pathological examination and confirmation before treatment. There are three main types of diagnostic procedures: fine needle aspiration cytology (FNAC), core needle biopsy (CNB) and open surgical biopsy. Each method has its benefits and limitations. Open surgical biopsy is reliable and used to be the most preferred method because it provides a larger specimen for examination. It was shown to be highly accurate in a previous systematic review.[7] This was also evident in this study, with a sensitivity, specificity, PPV, NPV, and diagnostic accuracy of 100%. However, percutaneous breast biopsies are now commonly used for diagnostic purposes instead of open surgical procedures.[8]

This method is considered cost-effective and helps in better preoperative planning by reducing the need for multiple surgeries. Fine needle aspiration cytology is a quicker and cheaper option but has limitations in confirming invasive disease and providing tissue for immunohistochemistry (IHC). In cases where malignancy is suspected, a follow-up core needle biopsy may be necessary. This is especially important for women who choose to have a mastectomy right away or are planning to undergo neoadjuvant chemotherapy. Core needle biopsy can distinguish between invasive disease and ductal carcinoma in situ (DCIS) and allows for immunohistochemical assessment of estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER-2) status. These factors are crucial for treatment decisions and rely on the presence of invasion.[8] Similar concerns with FNAC were also noted in a previous study conducted at this centre.[9]

Although breast cancer assessment by either FNA or CNB is now considered the standard of care, particularly image-guided or stereotactic, it is still not a routine procedure in many developing countries[10]. This may be due to the paucity of interventional radiologists or experience of surgeons in the use of ultrasound-guidance. Open biopsy was still the most commonly used technique for the diagnosis of breast lesions in 56.4% of the patients in this study. We therefore decided to test the utility of freehand core biopsy and open surgical biopsy for clinically suspicious breast lumps. The CNB group and open surgical biopsy group had comparable clinicopathological characteristics. The open biopsy findings in this study correlated with their postsurgical histology in all of the benign and malignant cases, which had always been the case from historical data.[5] Core needle biopsy findings correlated with their postsurgical histological findings in 49 of 51 patients (96.1%), which included 42 of 44 (95.1%) malignant lesions and all benign lesions. There were no false-positive results. Mehta et al. reported similar findings in their study of 106 patients with palpable breast lumps.[11]

Other studies have shown that CNB is highly effective in diagnosing breast lesions, with a sensitivity ranging from 88.9% to 98.1% and specificity between 91.3% to 100%.[11-13] This retrospective study in a tropical low-income setting supports the accuracy and reliability of CNB for diagnosing cancer in individuals with breast lesions. Our study achieved a high sensitivity of 95.5%, and a specificity of 100%, with a positive predictive value, negative predictive value, and diagnostic accuracy of 100%, 77.8% and 96.1%, respectively, even when using freehand technique. These results align with the findings reported by Dimitrov et al.[14] Most authors have reported results for sensitivity, specificity, PPV and diagnostic accuracy that are very similar to ours.[11,12,14-16] The negative predictive value in our study may have been affected by the limited number of patients with benign conditions. A meta-analysis of CNB accuracy showed a low risk of breast cancer despite benign results, with less than 1% in the US and 4-6% in Europe.[17]

The study results, in conjunction with previous research, support the reliable use of CNB as the initial diagnostic step for palpable breast lesions due to its high sensitivity, specificity, and accuracy in detecting

both malignant and benign cases. The 3.9% false negative rate in our study was slightly higher than reported by Fattahi et al.[16], possibly due to sampling error or needle size. Larger needles are preferred for breast mass biopsies to capture more tissue and reduce false negatives. Using a 14G needle may improve diagnostic accuracy without increasing risk.[18]Taking multiple core samples and using image guidance can further reduce sampling errors.

Our observations show that CNB can accurately be used in diagnosing both benign and malignant breast lesions. Benign lesions like fibroadenoma and fibrocystic changes were diagnosed with precision, similar to open surgical biopsy. Malignant lesions such as medullary, mucinous, lobular, and papillary carcinomas were also accurately identified on CNB sections, consistent with previous study by Samantaray et al.[13] We even successfully diagnosed a case of papillary carcinoma with CNB, a diagnosis that might easily be missed with needle biopsies as noted by Mehta et al.[11] Differentiating between benign and malignant papillary lesions can be challenging on both FNAC and CNB as they target the centre of the lesion while invasion typically occurs at the periphery.[19]

In this study, 41 patients (39.0%) underwent immunohistochemistry. Of these, 18 (43.9%) were from the CNB group, and 23 (56.1%) were from the open surgical biopsy group. A comparison of the IHC results between the two groups using Pearson's chi-square test ($p = 0.433$) showed no significant difference in the reported cases. Due to the retrospective nature of the study, we could not determine the concordance rate between CNB and open surgical biopsy as each patient had only one IHC test from either procedure. However, previous studies have demonstrated good agreement in IHC results between CNB and open surgical biopsy, indicating that CNB can confidently be used for the analysis of ER, PR, and HER-2/neu status in malignant breast lesions.[20,21] Hormone receptors play a crucial role in predicting response to endocrine therapy and prognosis. Therefore, early assessment of hormone receptor status through CNB can enable surgical oncologists to make informed treatment decisions promptly for patients diagnosed with breast cancer.

The absence of complications in the patients who underwent CNB in this study is consistent with findings from previous study by Gana et al.[22] In our study, we observed complications such as bleeding (1.5%), hematoma formation (1.5%), ulceration (1.5%), and wound infection (1.5%) with open biopsy. These complication rates were lower than those reported in the study by Gana et al., where open surgical biopsy was associated with higher rates of bleeding (5.6%), hematoma (1.9%), and wound infection (7.4%). A systematic review by Dahabreh et al. found that 2-10% of open surgical biopsies resulted in hematoma formation and 3.8-6.3% were complicated by infection.[23] However, the incidence of complications with CNB was less than 1% in their review.

Limitations

The retrospective nature of this review did not allow for an objective comparison between the diagnostic accuracy of core needle biopsy and open surgical biopsy. This can only be achieved with a randomized controlled trial.

Conclusion

Core needle biopsy is a viable method for diagnosing benign or malignant breast lesions, especially in resource-limited settings like ours. This study demonstrates that core needle biopsy is safe and accurate, similar to open surgical biopsy, in providing the correct diagnosis. Based on the evidence presented, core needle biopsy can be considered a reliable alternative to open surgical biopsy, with similar sensitivity, specificity, and diagnostic accuracy. Given the advantages and drawbacks of both techniques, we believe that core needle biopsy could be a valuable option for diagnosing palpable breast lesions in our institution.

References

1. Ghoncheh M, Pournamdar Z, Salehiniya H. Incidence and Mortality and Epidemiology of Breast cancer in the World. Asian Pac J Cancer Prev 2016; 17: 43–46.
2. Akinde OR, Phillips AA, Oguntunde OA, Afolayam OM. Cancer Mortality Pattern in Lagos University Teaching Hospital, Lagos, Nigeria. J Cancer Epidemiol 2015; 2015: e842032.
3. Kumar V, Abbas A, Aster J. The breast: In Robbins and Cotran pathologic basis of diseases 9th ed. ElseviewSaunder 2015; 1043–1071.
4. Breast lumps in adolescent girls. Br Med J 1978; 1: 260–261.
5. Zimmermann CJ, Sheffield KM, Duncan CB, Han Y, Cooksley CD, Townsend CM, et al. Time Trends and Geographic

Variation in Use of Minimally Invasive Breast Biopsy. J Am CollSurg 2013; 216: 814–824.
6. Parikh B, Shah V, Parikh S, Shah J. Usefulness of Tru-Cut biopsy in the diagnosis of breast lesions. Natl J Integr Res Med; 9.
7. Bruening W, Fontanarosa J, Tipton K, Treadwell JR, Launders J, Schoelles K. Systematic Review: Comparative Effectiveness of Core-Needle and Open Surgical Biopsy to Diagnose Breast Lesions. Ann Intern Med 2010; 152: 238–246.
8. Silva E, Meschter S, Tan MP. Breast biopsy techniques in a global setting-clinical practice review. Trans Breast Cancer Res 2023; 4: 14.
9. Tagar E, Kpolugbo J, Tagar AG, Ozah E, Ehiagwina LA, Enegbuya O. 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.
10. Perry NM; EUSOMA working party. Quality assurance in the diagnosis of breast disease. EUSOMA working party. Eur J Cancer 2001; 37: 159-72.
11. Mehta M, Jagtap SV, Aggarwal D, Aggarwal P. Diagnostic usefulness of trucut biopsy in diagnosis of palpable breast lesions. J Med SciClin Res 2018; 6: 182-188.
12. Rikabi A, Hussain S. Diagnostic usefulness of tru-cut biopsy in the diagnosis of breast lesions. Oman Med J 2013; 28: 125-7.
13. Samantaray S, Panda N, Besra K, Pattanayak L, Samantara S, Dash S. Utility of Tru-cut Biopsy of Breast Lesions-An Experience in a Regional Cancer Center in Developing Country. J ClinDiagn Res 2017; 11: EC36-EC39.
14. Dimitrov DD, Karamanliev MP, Deliyski TS, Gabarski AV, Vatov PP, Gencheva RO, et al. Diagnostic value of tru-cut biopsy in diagnosing breast lesions. J Biomed Clin Res 2016; 9: 126-129.
15. Krishna MC, Narendra MC, Mutheeswaraiah Y, Prakash VG, Nagamuneiah S, Rao SB, et al. Evaluation of role of Tru-Cut biopsy in diagnosis of clinically palpable breast lumps. J Evolution Med Dent Sci 2020; 9: 1281-1285.
16. Fattahi AS, Tavassoli A, Kalantari MR, Noorshafiee S, Rahmani M. Evaluation of the value of core needle biopsy in the diagnosis of a breast mass. Arch Breast Cancer 2016; 3: 56-61.
17. Verkooijen HM, Peeters PH, Buskens E, Koot VC, BorelRinkes IH, Mali WP, et al. Diagnostic accuracy of large-core needle biopsy for nonpalpable breast disease: a meta-analysis. Br J Cancer 2000; 82: 1017-21.
18. Parker SK, Lovin JD, Jobe WE, Luethke JM, Hopper KD, Yakes WF, et al. Stereotactic breast bopsy with a bopsy gun. Radiology 1990; 176: 741-7.
19. Deshmukh SP, Mane AD, Hardas VS, Karnik SV. Papillary carcinoma of the breast- case reports and review of literature regarding management guidelines. Indian J Surg 2012; 74: 510-2.
20. Gupta MK, Gupta B, Kumar K. Comparative study of core needle biopsy with excisional biopsy: To determine diagnostic accuracy & concordance with er/pr/her-2/neu status. Indian J PatholOncol 2016; 3: 576-581.
21. You K, Park S, Ryu JM, Kim I, Lee SK, Yu J, et al. Comparison of Core Needle Biopsy and Surgical Specimens in Determining Intrinsic Biological Subtypes of Breast Cancer with Immunohistochemistry. J Breast Cancer 2017; 20: 297-303.
22. Gana SG, Yusufu L, Abur PP, Olarinoye-Akorede SA, Bello N. Comparative accuracy and complications of palpation-guided versus ultrasound-guided core needle biopsy of palpable breast lumps in Ahnadu Bello University Teaching Hospital, Zaria. J West AfrCollSurg 2023; 13: 28-36
23. Dahabreh IJ, Wieland LS, Adam GP, Halladay C, Lau J, Trikalinos TA. Core needle and open surgical biopsy for diagnosis of breast lesions: An update to the 2009 report. Effective Health Care Program. 2009; 139: 1-20.