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THE PREOPERATIVE DIAGNOSTIC SIGNIFICANCE OF FINE-NEEDLE ASPIRATION CYTOLOGY AND CORE BIOPSY IN THE CONTEXT OF SCREEN-DETECTED BREAST CARCINOMA

***[1]Noora M. Kareem, [2]Maab Moyaser Hameed and [3]Bashar A. Abdul Hassan**

[1]Al Nahrain University, College of Medicine, Baghdad, Iraq.
[2]Al Kadhymia Teaching Hospital, Breast Screening Unit, Baghdad, Iraq.
[3]Al Nahrain University, College of Medicine, Baghdad, Iraq.

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***Corresponding Author: Noora M. Kareem**
Al Nahrain University, College of Medicine, Baghdad, Iraq.

ABSTRACT

Background: Breast cancer is one of the top causes of cancer-related death in women globally, and early identification improves prognosis and survival. Screening mammography detects asymptomatic breast abnormalities. Not all screening mammogram lesions are cancerous, thus additional investigation is needed to establish their type. FNAC and CB are minimally invasive procedures for histopathological tissue sampling. The aim of study is to evaluate and compare the effectiveness of fine-needle aspiration cytology (FNAC) and core needle biopsy (CNB) as preoperative diagnostic tools for breast cancer identified through screening. **Method:** Cross-sectional study of 75 breast cancer patients from June 2023 till December 2023 in Al-Imamain Alkadhomain medical city. Age, core biopsy (B4a, B4b, B4c, B5), cytology diagnosis (Positive, Suspicious), and ultrasound diagnostic (carcinoma, duct ectasia, fibro adenomas) are obtained for all females. **Results:** In a study comparing diagnostic methods for breast cancer, 32% of females aged 50-59 and 26.7% aged 60+ were evaluated. Core biopsy revealed 29.3% at B4b stage and 18.1% at B4a, whereas cytology diagnosed 37.3% with carcinoma, and ultrasound detected 90.7% with breast cancer. Significant correlations were found between cytology and core biopsy diagnoses, with high concordance rates in B5 and B4a stages, but no significant association between ultrasound and core biopsy. Ultrasound showed a 41.2% sensitivity and 100% specificity when compared to cytology. Conclusion: In breast cancer diagnosis, cytology and core biopsy results are strongly correlated, demonstrating their complimentary roles in disease characterization. Although ultrasound diagnoses did not correlate with core biopsy findings, ultrasound had excellent specificity and moderate sensitivity for cytology outcomes. These findings highlight the necessity of merging cytology and core biopsy in breast cancer diagnosis to improve preoperative evaluations and influence treatment decisions.

KEYWORDS: The preoperative, diagnostic, fine-needle aspiration, cytology, core biopsy, screen-detected, breast carcinoma.

INTRODUCTION

Breast cancer remains one of the leading causes of cancer-related mortality among women worldwide, with early detection being a critical factor in improving prognosis and survival rates. Screening mammography has proven effective in identifying breast abnormalities at an asymptomatic stage. However, the detection of a lesion on screening mammography necessitates further evaluation to determine its nature, as not all detected lesions are malignant. This is where FNAC and CB come into play, serving as minimally invasive methods for obtaining tissue samples for histopathological analysis.[1,2] FNAC involves using a thin, hollow needle to extract cells from a breast lesion, which are then examined under a microscope by a cytopathologist. It is a quick, cost-effective procedure that causes minimal discomfort to the patient. FNAC is particularly valuable for distinguishing between cystic and solid lesions and can provide a rapid preliminary diagnosis. However, its utility is somewhat limited by a higher rate of non-diagnostic samples and an inability to assess the architecture of the lesion, which is crucial for diagnosing certain types of breast cancer.[3,4] On the other hand, CB involves the removal of a small core of tissue from the

breast lesion using a larger, hollow needle. This technique allows for the examination of both the cellular details and the architectural arrangement of the tissue, making it highly effective for diagnosing invasive breast cancer and certain types of non-invasive cancer, such as ductal carcinoma in situ (DCIS). Core biopsy has a higher diagnostic accuracy compared to FNAC, with lower rates of non-diagnostic and indeterminate results. However, it is slightly more invasive than FNAC, with a higher risk of bleeding and discomfort.[5,6] The choice between FNAC and CB often depends on various factors, including the characteristics of the breast lesion, patient preferences, the availability of skilled practitioners, and institutional policies. In some cases, both techniques may be employed sequentially or concurrently to maximize diagnostic yield and accuracy.[7,8] The preoperative diagnostic significance of FNAC and CB in the context of screen-detected breast carcinoma cannot be overstated. Accurate differentiation between benign and malignant lesions is crucial for determining the appropriate management plan, whether it be active surveillance, surgical intervention, or other treatments. A correct preoperative diagnosis helps to avoid unnecessary surgeries for benign conditions and ensures timely and appropriate treatment for malignancies, ultimately improving patient outcomes.[9] To standardize breast imaging reporting, the American College of Radiology created the Breast Imaging-Reporting and Data System (BI-RADS). This application helps radiologists, doctors, and patients communicate and make breast cancer screening and treatment decisions. BI-RADS divides breast imaging studies into seven evaluation categories, from 0, indicating an incomplete assessment requiring more imaging, to 6, identifying biopsy-proven cancers. Negative and benign BI-RADS 1 and 2 results reassure clinicians and patients of a low cancer risk. BI-RADS 3 recommends short-term follow-up due to a low cancer risk of 2%. Based on a 2% to 94% cancer likelihood, categories 4A, 4B, and 4C demand biopsy. For discoveries with a 95% chance of malignancy that require prompt intervention, BI-RADS 5 is employed. This classification prioritizes patient care, identifying and managing high-risk patients immediately. The BI-RADS system shows breast imaging's dedication to precision, quality, and patient safety. The clear, standardized reporting vocabulary provided by BI-RADS improves breast cancer screening, diagnosis, and treatment planning, improving patient outcomes.[10] The aim of study is to evaluate and compare the effectiveness of fine-needle aspiration cytology (FNAC) and core needle biopsy (CNB) as preoperative diagnostic tools for breast cancer identified through screening.

METHOD

Cross sectional study of 75 patients with breast carcinoma, the data collected from June 2023 till December 2023 in Al-Imamain Alkadhomain medical city. All female's data collected are; Age groups, Core biopsy (B4a, B4b, B4c, B5), Cytology diagnosis (Positive, Suspicious), Ultrasound Diagnosis (Carcinoma, duct ectasia, Fibro adenomas). Mean, median, and standard deviation were applied to continuous data, while frequency and percentage were utilized for categorical data in SPSS 22. P-values equal to or less than 0.05 are deemed significant when utilizing the chi-square test to examine the relationship between variables.

RESULTS

as shown in table 1, 32% of females at age 50-59 years, 26.7% of them then at age 60 years and more. 29.3% of females diagnosed as B4b stage while 18.1% diagnosed at B4a stage under ultrasound. While by cytology 37.3% of females diagnosed carcinoma, and 90.7% also diagnosed breast cancer by core biopsy.

Table 1: distribution of females according to study variables.

Variables		Frequency	Percentage
Age groups (years)	20-29	4	5.3
	30-39	8	10.7
	40-49	19	25.3
	50-59	24	32.0
	≥60	20	26.7
BIRAD	B4a	21	28.1
	B4b	22	29.3
	B4c	19	25.3
	B5	13	17.3
Cytology finding	Malignant	28	37.3
	Benign	47	62.7
Core biopsy	Ca	68	90.7
	duct ectasia	2	2.7
	FA	5	6.6

As shown in table 2; no any significant association between diagnosis by ultrasound and diagnosis by core biopsy.

Table 2: association between diagnosis by ultrasound and diagnosis by core biopsy.

Variables		Core Biopsy			P-value
		ca	duct ectasia	FA	
US BIRAD	B4a	17	1	3	0.4
		81.0%	4.8%	14.3%	
	B4b	19	1	2	
		86.4%	4.5%	9.1%	
	B4c	19	0	0	
		100.0%	0.0%	0.0%	
	B5	13	0	0	
		100.0%	0.0%	0.0%	

There is significant association between diagnosis by cytology and diagnosis by US BIRAD. 84.6% of females diagnosed as B5 stage by US have malignancy results on cytology. And 81.8% of females diagnosed as B4a stage US BIRAD have Benign results on cytology. As shown in table 3.

Table 3: association between diagnosis by cytology and diagnosis by US BIRAD.

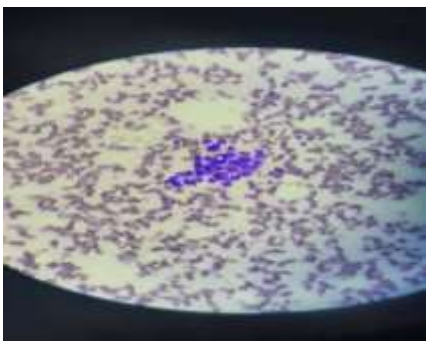
Variables		Cytology		P-value
		Carcinoma	Benign	
US BIRAD	B4a	4	17	**0.0001**
		19.0%	81.0%	
	B4b	4	18	
		18.2%	81.8%	
	B4c	9	10	
		47.4%	52.6%	
	B5	11	2	
		84.6%	15.4%	

There is significant association between diagnosis by **Core biopsy** and diagnosis by cytology, 100% of females diagnosed as benign lesion on **Core biopsy** have Benign results on cytology, and 58.8% females diagnosed as malignant lesion on **Core biopsy** have malignant results on cytology, sensitivity of **Core biopsy** to cytology is 41.2% while specificity is 100%. As shown in table 4.

Table 4: association between diagnosis by core biopsy and diagnosis by cytology.

Variables		Core biopsy		P-value
		Malignant	Benign	
Cytology	Malignant	28	0	**0.041**
		41.2%	0.0%	
	Benign	40	7	
		58.8%	100.0%	

Sensitive = 41.2%
Specific = 100%



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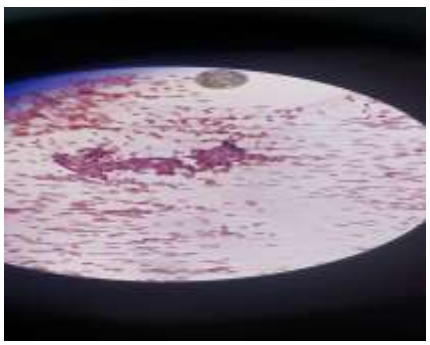

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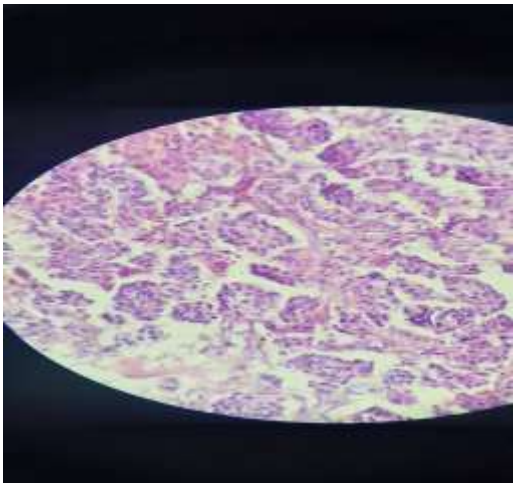

C

Fig 1: A: FNA: cluster of atypical epithelial cells, proved to be invasive ductal carcinoma on core biopsy, giemsa stain, power 40x. B: FNA: fibro adenoma, power40x. C: Micro papillary carcinoma in core biopsy, power40x.

DISCUSSION

Discussing the results provided requires an integration of the statistical findings with current literature on the diagnostic approaches for breast cancer, particularly focusing on the roles of core biopsy, cytology, and ultrasound. The data reflects diagnostic outcomes across different age groups, and diagnostic techniques, showing variability in sensitivity, specificity, and the association between different diagnostic modalities. The data indicates a decrease in diagnosis rates from 32% in females aged 50-59 to 26.7% in females aged 60 years and older. This could suggest that while breast cancer risk increases with age, the detection rate through screening might plateau or decrease possibly due to reduced participation in screening programs among older women, or the differential performance of diagnostic tests in different age groups. Similar age-related trends have been observed in previous studies, suggesting that targeted screening strategies might be beneficial (Lauby-Secretan et al., 2015).[11] The significant association between diagnosis by cytology and core biopsy, with a notably high concordance for B5 stage diagnoses on core biopsy showing positive results on cytology, highlights the complementary nature of these tests. Core biopsy's lower diagnostic rates for B4a and B4b stages compared to cytology's higher positive carcinoma diagnosis rate (37.3%) could indicate cytology's sensitivity in detecting carcinoma, which aligns with findings from Lin LLY et al. (2019)[12], who highlighted cytology's role in diagnosing and grading breast lesions. The reported high diagnostic rate (90.7%) of breast cancer by ultrasound contrasts with the lack of significant association between ultrasound diagnosis and core biopsy results. This discrepancy could point towards ultrasound's high sensitivity but potentially lower specificity in certain contexts, as indicated by the specificity of 100% but sensitivity of 41.2% when compared to cytology. The literature supports ultrasound's utility in breast cancer detection, especially in dense breasts, but also notes its limitations in specificity, which can lead to false positives (Berg et al., 2012, Cho N et al. 2017).[13,14] The significant association between cytology and core biopsy, and between ultrasound and cytology, but not between ultrasound and core biopsy, is intriguing. This may reflect the different diagnostic pathways and the nature of the lesions detected by each modality. For example, ultrasound may be more effective in identifying lesions warranting further investigation, whereas cytology and core biopsy provide cytological and histological confirmation, respectively. The findings that 100% of benign lesions on ultrasound have suspicious results on cytology suggest a potential for over-diagnosis or the cautious interpretation of cytology results in the context of benign ultrasound findings.

CONCLUSION

The data reveals a significant correlation between cytology and core biopsy findings in the diagnosis of breast cancer, highlighting their complementary roles in accurate disease characterization. Although no significant association was found between ultrasound diagnoses and core biopsy results, ultrasound demonstrated high specificity and moderate sensitivity in correlation with cytology outcomes. These findings underscore the importance of integrating cytology and core biopsy in the diagnostic pathway for breast cancer, enhancing the precision of preoperative assessments and informing tailored treatment strategies.

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