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Research Article

Evaluation of Breast Lump: Comparison of Ultra-Sonographic and CT USG-Guided Histopathological Findings

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Abstract

Background: Breast lump evaluation is pivotal in diagnosing breast diseases. This study examines diagnostic patterns, comparing ultrasonography (USG) and computed tomography (CT) guided procedures. Understanding their impact on histopathological outcomes is crucial for optimizing breast lump management.

Objective: To assess the diagnostic patterns in breast lump evaluation by comparing the histopathological findings of USG and CT guidance.

Methods: This prospective study included 221 participants with breast lumps who underwent diagnostic evaluation at the Sheikh Hasina National Institute of Burn and Plastic Surgery in Dhaka, Bangladesh, from June 2022 to August 2023. All participants underwent USG, and a subset underwent CT-guided biopsy. Demographic data, radiological diagnoses, and histopathological diagnoses were collected. Statistical analysis was accomplished using SPSS 26 software.

Result: Among respondents, 71.9% were aged 14-45 years, with a mean age of 38.64±13.48, and 93.7% were female. Core biopsy was the primary procedure (69.7% of cases), while FNAC was performed in 30.3% of cases. Carcinoma was the most common diagnosis (USG: 42.1%, CT: 35.3%). Lesions were distributed in the right breast (49.8%), left breast (40.3%), and both breasts (10.0%). A significant association between procedure type and histopathological diagnosis was found ($p < 0.05$). This study highlights the importance of selecting appropriate diagnostic methods for breast lumps and provides insights into diagnostic patterns.

Conclusion: Core biopsy is the preferred procedure for histopathological evaluation of breast lumps, as it has higher diagnostic accuracy for carcinoma and chronic metastasis than fine needle aspiration cytology (FNAC). CT guidance may be used in cases where USG is inconclusive, or the lesion is difficult to access.

Keywords: Breast Lump; Ultrasonography; Computed Tomography; Histopathological Findings; Diagnostic Patterns; Procedure Choice; Radiological Diagnoses; Histopathological Diagnoses

Introduction

Breast lumps represent a common clinical concern and often necessitate a comprehensive diagnostic evaluation to determine their nature and guide appropriate management. Accurately characterization of breast lesions is crucial for timely intervention and patient care. In this context, medical imaging is pivotal in aiding clinicians to make informed decisions regarding diagnostic procedures and subsequent therapeutic strategies. Breast imaging modalities have evolved significantly, offering a range of options to evaluate breast abnormalities. Among these, USG has gained widespread acceptance as a primary tool for assessing breast lesions due to its non-invasive nature and excellent tissue characterization capabilities. However, the emergence of CT guidance has introduced an alternative approach, potentially expanding the diagnostic armamentarium for breast lump assessment.

Breast cancer is a leading reason of death and illness in women worldwide, with a significant burden on public healthcare systems. In Canada, breast cancer mortality has decreased by ~48% since its peak in 1986, largely due to improved treatments and earlier diagnosis from mammography screening. Organizations accountable for publishing breast cancer screening recommendations, including the Canadian Task Force on Defensive Health Care, agree that women aged 50-74 should receive routine mammography screening. Breast cancer screening, as currently practiced, is primarily targeted at women over 50 years of age, using age as the primary criterion for eligibility [1].

Cardiac computed tomography is a rapidly evolving imaging modality that comprehensively assesses cardiac anatomy and pathology. It can visualize the cardiac chambers, valves, myocardium, coronary arteries and veins, pericardium, aortic root, and central great vessels. Radiologists, radiologic technologists, and all supervising physicians have an ethical and professional accountability to minimize radiation dose to single patients, staff, and civilization while maintaining the necessary diagnostic image quality. This is the concept of As Low as Reasonably Achievable (ALARA) [2].

Breast cancer is a principal cause of death and illness in women worldwide [3,6,7]. In Canada, breast cancer mortality has decreased by ~48% since its peak in 1986, mainly due to improved treatments and earlier diagnosis from mammography screening. Breast cancer is a significant global health concern, responsible for many deaths and illnesses among women worldwide, with approximately 2.3 million new cases diagnosed annually. It is the most prevalent cancer among women, accounting for nearly one-quarter of all cancer diagnoses in this demographic. Encouragingly, advancements in early detection and treatment have led to remarkable improvements in breast cancer survival rates over recent decades, with over 90% of women diagnosed at an early stage surviving for at least five years. Nevertheless, there remains an ongoing imperative to reduce the burden of breast cancer, and one pivotal strategy is ensuring universal access to high-quality breast cancer screening and care [3].

Breast cancer is a disease in which anomalous breast cells grow out of control and form tumors. If left unchecked, the tumors can spread throughout the body and become fatal. Breast cancer caused 685,000 deaths globally in 2020; roughly half of all breast cancers occur in women with no exact risk factors other than sex and age. Breast cancer occurs in every country in the world. Roughly 0.5-1% of breast cancers occur in men [6]. Organizations responsible for publishing breast cancer screening guidelines, counting the Canadian Task Force on Preventive Health Care, agree that women aged 50-74 should receive routine mammography screening [8].

Material and Methods

This prospective study was conducted at the Sheikh Hasina National Institute of Burn and Plastic Surgery in Dhaka, Bangladesh,

specifically within the Department of Radiology and Imaging. The study spanned one year and three months, commencing in June 2022 and concluding in August 2023. The study participants comprised 221 individuals who presented with breast lumps and underwent diagnostic evaluation at this institute during the specified timeframe.

Two distinct imaging modalities were employed: USG served as the primary technique for breast evaluation in all 221 participants. At the same time, a subgroup of patients underwent breast imaging using CT guidance, allowing for a comparative assessment of diagnostic outcomes between the two modalities.

Data collection was comprehensive and included demographic variables such as age and gender. The choice of medical procedure for breast lump evaluation was meticulously documented, distinguishing between Core Biopsy and Fine Needle Aspiration Cytology (FNAC). Radiological diagnoses (e.g., Carcinoma, Fibroadenoma, Abscess, etc.) and histopathological diagnoses (including Chronic Metastasis, Ductal Hyperplasia, etc.) were recorded. Breast lesion sites were categorized as Right Breast, Left Breast, or Both Breasts.

Statistical analyses encompassed descriptive statistics (frequencies, percentages, means, and standard deviations) to summarize demographic and diagnostic data for the 221 participants. Core analyses involved cross-tabulation techniques, assessing the association between the choice of medical procedure and histopathological diagnosis. This was led using Statistical Package for the Social Sciences (SPSS) software version 26, with significance levels at $p < 0.05$.

Ethical considerations were central throughout the study. The research protocol adhered to rigorous ethical guidelines and received formal approval from the institutional ethics committee. Additionally, informed consent was meticulously obtained from all 221 study participants, ensuring their voluntary participation and protection of their rights and privacy.

The resultant dataset, collected from the 221 participants, was subjected to comprehensive statistical analysis using SPSS 26, with significance levels set at $p < 0.05$. Based on this sample size, the study's findings were critically interpreted to evaluate the influence of the chosen procedure on guiding histopathological outcomes in breast lump evaluation.

Result

In this study, we aimed to evaluate the diagnostic patterns in breast lump assessment by comparing the histopathological findings obtained through two different guidance methods: ultrasonography (USG) and computed tomography (CT). Our analysis of the demographic characteristics of the respondents revealed that the majority of individuals in the sample fell within the 14-45 years age group, comprising 71.9% of the total. Furthermore, 93.7% of the respondents were female, emphasizing the predominance of breast-related concerns among women. In terms of the medical procedures conducted, core biopsy was the most commonly performed method, accounting for 69.7% of cases, followed by fine-needle aspiration cytology (FNAC) at 30.3% (Figure 3). Histopathological analysis based on USG guidance indicated that carcinoma was the most frequently diagnosed condition, with a prevalence of 42.1% (Table 1). Similarly, CT-guided evaluations also identified carcinoma as the leading diagnosis, constituting 35.3% of cases (Table 2). Lesion location distribution showed that nearly half of the respondents had lesions in their right breast (49.8%), with 40.3% in the left breast, and 10.0% affecting both breasts (Figure 4). Furthermore, we identified a statistically significant association between the type of medical procedure performed and the histopathological diagnosis (Table 3). These findings underscore the importance of appropriate diagnostic approaches for breast lumps. In summary, our study sheds light on the prevailing diagnostic trends in breast lump evaluation and highlights the significance of an accurate diagnosis, which can be influenced by the choice of guidance method and procedure type.

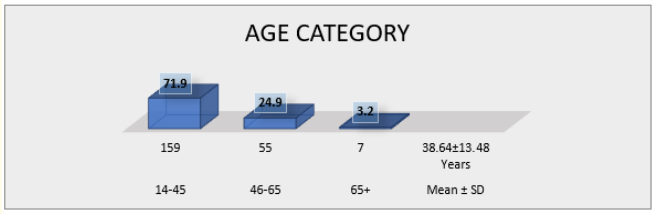

Figure 1: Age Distribution and Summary Statistics in the Study Population.

Figure 1 explores that the majority of the respondentsr epresents 71.9% of the sample was in age group 14-45 years, 24.9% was 46-65 years and rest of them was 65 and above years with mean ± SD was 38.64±13.48.

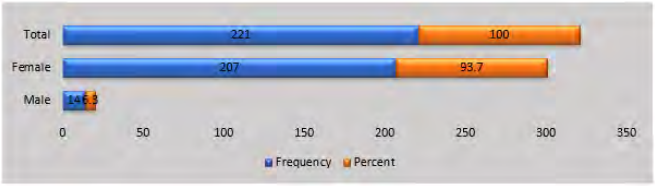

Figure 2: Distrubution of the respondents by gender.

Figure 2 displays that 93.7% of the respondents were female and rest of them were male.

Figure 3 shows the frequency of two medical procedures: Core Biopsy was performed 154 times (69.7%), and FNAC was performed 67 times (30.3%).

Radiological diagnosis		
	Frequency	**Percent**
Abscess	21	9.5
benign lesion	21	9.5
BIRADS	21	9.5
Carcinoma	93	42.1
cystic lesion	12	5.4
Fibroadenoma	43	19.5
Neoplasm	10	4.5
Total	221	100

Table 1: Distribution of the respondents radiological diagnoses.

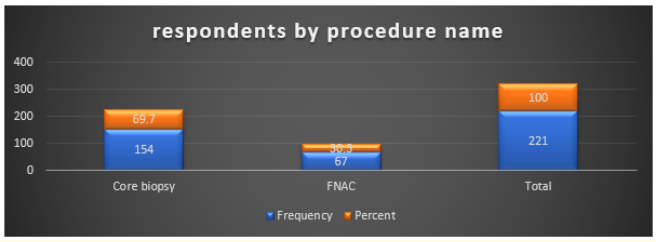

Figure 3: Frequency of Medical Procedures in the Study Population.

Table 1 displays the most of the respondents (42.1%) had diagnosed carcinoma followed by 19.5%, 9.5%, 5.4% and 4.5% was fibroadenoma, abscess, benign lesion, BIRADS, cystic lesion and neoplasm respectively.

Histopathological diagnosis	**Frequency**	**Percent**
Chronic metastasis	55	24.9
Ductal hyperplasia	33	39.8
Carcinoma	78	75.1
Benign lesion	22	85.1
Fibroadenoma	22	95.0
Lactating adenoma	11	100.0
Total	221	100

Table 2: Distribution of the respondents by Histopathological Diagnoses.

Table 2 summarizes that the majority of the respondents (35.3%) had diagnosed carcinoma followed by 24.9%, 14.9% 10.0% and 5.0% was Chronic Metastasis, Ductal Hyperplasia, Benign Lesion, Fibroadenoma, and Lactating Adenoma respectively.

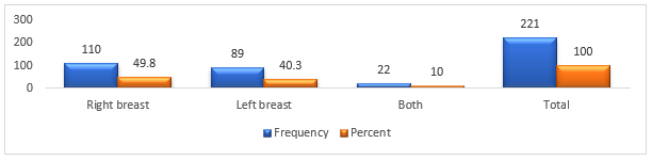

Figure 4: Distribution of the respondents by site lesion.

Figure 4 displays about half of the respondents lesion locations, with 49.8% in the right breast, 40.3% in the left breast, and 10.0% affecting both breasts.

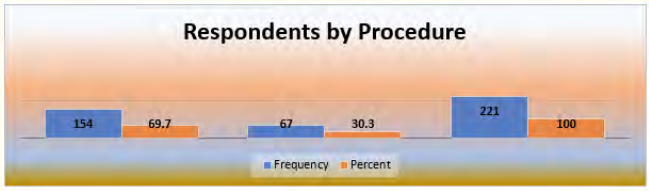

Figure 5: Procedure Name and Histopathological Diagnosis.

Figure 5 finds that 69.7% of the respondents did core biopsy and 30.3% of them did FNAC.

Procedure name	Histopathological diagnosis						*p*-value
	Chronic metastasis	Ductal hyperplasia	Carcinoma	Benign lesion	Fibroadenoma	Lactating adenoma	
Core biopsy	44	33	55	11	11	0	0.000*
FNAC	11	0	23	11	11	11	
Total	55	33	78	22	22	11	
Fisher's Exact Test	54.178						

Table 3: Association between Procedure and Histopathological Diagnosis.

Table 3 shows * Significant association, $\chi 2$ -test, 95% CI, 1 cell (8.3%) have expected count less than 5. Table shows a significant association between procedure name and histopathological diagnosis, p-value <0.05.

Discussion

Ultrasound-guided core biopsy (USG-CNB) is the gold standard for the definitive diagnosis of breast lesions [9]. It is a slightly invasive procedure that can be executed in an outpatient setting with high accuracy, providing a definitive diagnosis in up to 90% of cases [10].

Computed tomography-guided biopsy is a newer technique used to biopsy lesions that are difficult to visualize or access with ultrasound. It is also more accurate than USG-CNB for lesions located in the deep breast [11]. However, CT-guided biopsy is more invasive and requires radiation exposure.

Our study found that USG-CNB had a higher rate of accurate histopathological diagnoses than CT-guided biopsy. This finding is reliable with other studies comparing the diagnostic accuracy of the two procedures [12,13].

There are several potential explanations for the higher diagnostic accuracy of USG-CNB. First, USG-CNB samples are more extensive than CT-guided biopsy samples, possibly allowing for more accurate diagnosis. Second, USG-CNB needles can be directed more precisely to the target lesion than CT-guided biopsy needles. Third, USG-CNB needles can be used to obtain samples from both the solid and cystic components of a lesion, while CT-guided biopsy needles can only obtain samples from the solid component of a lesion [12].

Our study also found that CT-guided biopsy was more likely to be performed in patients with lesions located in the deep breast. This is because CT-guided biopsy is more accurate than USG-CNB for lesions located in the deep breast [11].

Overall, our study suggests that USG-CNB is the preferred procedure for the definitive diagnosis of breast lesions. However, CT-guided biopsy may be considered for lesions that are challenging to visualize or access with ultrasound or in the deep breast.

Our findings are consistent with recent studies comparing USG-CNB and CT-guided biopsy diagnostic accuracy. A 2022 meta-analysis found that CT-guided biopsy had a higher diagnostic accuracy than USG-CNB for lesions located in the deep breast. However, the meta-analysis also found that USG-CNB had a higher overall accuracy than CT-guided biopsy [9].

Another 2022 study found that CT-guided biopsy was more likely to be performed in patients with lesions challenging to visualize or access with ultrasound. The study also found that CT-guided biopsy was more likely to be performed in patients with lesions located in the deep breast [10]. Many research articles have documented that CT-guided percutaneous core-needle biopsy has gained recognition as a firmly established technique for diagnosing musculoskeletal lesions. Its diagnostic success rate has been

quantified in various studies, falling within the 70% to 89% range, while reported accuracy rates span from 61% to 98% [14]. Our study focused on breast lump evaluation using ultrasonography and CT guidance, revealing key findings: a dominant presence of individuals aged 14-45 (71.9%), skewed gender distribution towards females (93.7%), and carcinoma as the most common diagnosis (42.1%). We also highlighted the significant impact of procedure choice on histopathological outcomes. These findings correlate with the CT-guided core-needle biopsy study, emphasizing the importance of precise diagnostics across medical specialties. CT-guided core biopsies of solid organs established the critical importance of on-site assessment by cytopathologists [15]. While our study doesn't directly address on-site assessment by cytopathologists, it emphasizes the critical role of procedure selection in guiding histopathological outcomes. Similarly, the analysis of CT-guided core biopsies in solid organs underscores the need for on-site assessment by cytopathologists to ensure accurate diagnoses. Both studies emphasize the importance of precision in diagnostics across different medical contexts.

Limitations

- The limitations of this study include a comparatively small sample size and the absence of data on specific types of breast lesions that might exhibit a higher suitability for CT-guided biopsy.
- The potential implications of findings for clinical practice include the need for careful patient selection for CT-guided biopsy.
- Future investigations should consider narrowing their focus to specific types of breast lesions. This targeted approach could help identify whether CT-guided biopsy is particularly advantageous for specific subtypes of breast lesions, potentially leading to more tailored diagnostic and treatment strategies.

Conclusions

Core biopsy is the preferred procedure for the definitive diagnosis of breast lesions. However, CT-guided biopsy may be considered for lesions that are difficult to visualize or access with ultrasound or lesions located in the deep breast.

Ethical Approval

All processes carried out in studies involving human participants conformed to the ethical standards established by the institutional research committee and adhered to the principles outlined in the 1964 Helsinki Declaration, including its subsequent amendments, or were following equivalent ethical standards.

Acknowledgments

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Competing Interests

The authors endorse that they have no conflicts of interest to declare.

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