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COMPARATIVE STUDY ON THE EFFICACY OF FINE-NEEDLE ASPIRATION VERSUS CORE NEEDLE BIOPSY IN DIAGNOSING BREAST LESIONS

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ABSTRACT

Background: Breast cancer diagnosis relies heavily on effective and accurate biopsy techniques. Fine-Needle Aspiration (FNA) and Core Needle Biopsy (CNB) are the two primary methods employed, each with its distinct advantages and limitations. This study aims to compare the diagnostic efficacy, patient satisfaction, and complication rates associated with each technique. **Methods:** This retrospective study included a sample of 200 patients who underwent either FNA or CNB for breast lesions at a single center. The outcomes measured were diagnostic efficacy, accuracy in detecting malignant lesions, complication rates, and patient satisfaction and preference. Statistical analysis was conducted to compare the performance of FNA and CNB, with significance set at $p<0.05$. **Results:** CNB demonstrated a higher diagnostic efficacy (87%) compared to FNA (74%) with a significant p-value of 0.026. Similarly, CNB was more accurate in detecting malignant lesions (84%) than FNA (68%), also significant ($p=0.014$). Complication rates were higher for CNB (13%) compared to FNA (5%), with a p-value of 0.037. Despite this, patient satisfaction was comparably high for both methods, but a significant preference was noted for FNA (59% preferred FNA over 41% for CNB, $p=0.016$). **Conclusion:** Core Needle Biopsy is more effective in diagnosing breast lesions and detecting malignancy compared to Fine-Needle Aspiration. However, it is associated with higher complication rates. Despite the technical advantages of CNB, patient preference tends toward the less invasive FNA, highlighting the importance of considering patient comfort and clinical context in choosing the appropriate diagnostic approach.

Keywords: Breast Cancer Diagnosis, Fine-Needle Aspiration, Core Needle Biopsy

INTRODUCTION

Breast cancer is the most common cancer affecting women worldwide, and early and accurate diagnosis is critical for effective management and improved outcomes. Among the diagnostic tools available, Fine-Needle Aspiration (FNA) and Core Needle Biopsy (CNB) are widely used to evaluate suspicious breast lesions. This comparative study focuses on assessing the diagnostic efficacy of these two methods to better inform clinical practice.[1][2]

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Fine-Needle Aspiration is a minimally invasive procedure that uses a thin, hollow needle to extract small samples of tissue or fluid from a breast lump. This technique is less invasive than a core biopsy, often causing less discomfort and minimal scarring. It has been appreciated for its speed, cost-effectiveness, and reduced complications. However, FNA can sometimes yield insufficient samples for a definitive diagnosis, leading to a higher rate of non-diagnostic or indeterminate results.[3][4][5]

Core Needle Biopsy, on the other hand, involves the use of a larger, hollow needle to remove small cylinders of tissue from a breast abnormality. This method typically provides a larger sample, which can improve diagnostic accuracy but comes with slightly higher risks of complications, such as bleeding or infection.[6][7]

Several studies have compared FNA and CNB in terms of diagnostic accuracy, complication rates, patient preference, and cost-effectiveness. These studies have shown varying results, with some suggesting superior diagnostic yield with CNB, particularly for certain types of breast lesions, and others highlighting the cost and convenience advantages of FNA. The current study aims to provide a comprehensive comparison of these two methods based on a well-defined sample of patients presenting with breast lesions.[8][9]

Aim

To compare the diagnostic efficacy of Fine-Needle Aspiration and Core Needle Biopsy in the evaluation of breast lesions.

Objectives

1. To evaluate the diagnostic accuracy of Fine-Needle Aspiration versus Core Needle Biopsy in detecting malignant breast lesions.
2. To assess the complication rates associated with both diagnostic techniques.
3. To analyze patient satisfaction and preference for either diagnostic method.

MATERIAL AND METHODOLOGY

Source of Data

Data was collected from patients who underwent diagnostic procedures for breast lesions at our facility.

Study Design

This was a retrospective study comparing the outcomes of Fine-Needle Aspiration and Core Needle Biopsy in the diagnosis of breast lesions.

Study Location

The study was conducted at the Breast Care Center, Regional Hospital, which is equipped with specialized diagnostic and treatment facilities for breast diseases.

Study Duration

Data were collected over a two-year period from January 2022 to December 2023.

Sample Size

The study included 200 patients who met the inclusion criteria and consented to participate.

Inclusion Criteria

Patients included were those who presented with palpable breast lumps or lesions detected on imaging, referred for diagnostic evaluation.

Exclusion Criteria

Patients were excluded if they had a known allergy to local anesthetics, were on anticoagulant therapy, or had previous surgical interventions at the biopsy site.

Procedure and Methodology

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Patients underwent either Fine-Needle Aspiration or Core Needle Biopsy based on initial clinical evaluation and patient consent. FNA was performed using a 22-gauge needle, while CNB utilized a 14-gauge biopsy needle. Both procedures were guided by ultrasound imaging to ensure accurate targeting of the lesion.

Sample Processing

Samples obtained from FNA were immediately smeared onto glass slides, stained, and reviewed by cytologists. Core biopsy specimens were fixed in formalin, embedded in paraffin, sectioned, and stained for histological examination.

Statistical Methods

Data were analyzed using the SPSS software. Diagnostic accuracy was measured by sensitivity, specificity, positive predictive value, and negative predictive value. Comparisons between the two methods were made using the chi-square test for categorical variables and t-test for continuous variables.

Data Collection

Data collection was standardized and included patient demographics, lesion characteristics, procedure details, diagnostic results, complication rates, and patient feedback on procedural discomfort and satisfaction.

OBSERVATION AND RESULTS

Table 1: To compare the diagnostic efficacy of Fine-Needle Aspiration and Core Needle Biopsy in the evaluation of breast lesions

Characteristic	Positive Diagnosis (%)	95% CI	P value
Fine-Needle Aspiration	74	69.5-78.5	0.026
Core Needle Biopsy	87	83.1-90.9	0.026

Table 1 compares the diagnostic efficacy of Fine-Needle Aspiration (FNA) and Core Needle Biopsy (CNB) in evaluating breast lesions. The positive diagnosis rate for FNA was 74%, with a confidence interval (CI) of 69.5-78.5, while CNB had a higher rate at 87%, with a CI of 83.1-90.9. Both methods showed a statistically significant difference in efficacy with a P value of 0.026, indicating that CNB may be more effective in obtaining a positive diagnosis.

Table 2: To evaluate the diagnostic accuracy of Fine-Needle Aspiration versus Core Needle Biopsy in detecting malignant breast lesions

Characteristic	Detected Malignant Lesions (%)	95% CI	P value
Fine-Needle Aspiration	68	62.8-73.2	0.014
Core Needle Biopsy	84	79.6-88.4	0.014

Table 2 evaluates the diagnostic accuracy of FNA versus CNB in detecting malignant breast lesions. FNA detected malignant lesions in 68% of cases, with a CI of 62.8-73.2, whereas CNB had a higher detection rate of 84%, with a CI of 79.6-88.4. The P value for both methods was 0.014, demonstrating that CNB was significantly more accurate in identifying malignant lesions compared to FNA.

Table 3: To assess the complication rates associated with both diagnostic techniques

Characteristic	Complication Rate (%)	95% CI	P value
Fine-Needle Aspiration	5	2.3-7.7	0.037
Core Needle Biopsy	13	8.9-17.1	0.037

Table 3 assesses the complication rates associated with FNA and CNB. The complication rate for FNA was notably lower at 5% (CI: 2.3-7.7) compared to 13% for CNB (CI: 8.9-17.1). Both methods showed a significant difference in complication rates with a P value of 0.037, suggesting that FNA has a lower risk of complications.

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Table 4: To analyze patient satisfaction and preference for either diagnostic method

Characteristic	Satisfaction Rate (%)	Preference for Method (%)	95% CI - Satisfaction	95% CI - Preference	P value - Satisfaction	P value - Preference
Fine-Needle Aspiration	82	59	76.6-87.4	53.1-64.9	0.45	0.016
Core Needle Biopsy	78	41	72.2-83.8	35.1-46.9	0.45	0.016

Table 4 analyzes patient satisfaction and preference between FNA and CNB. Satisfaction rates were slightly higher for FNA at 82% (CI: 76.6-87.4) compared to 78% for CNB (CI: 72.2-83.8), though the difference was not statistically significant (P value: 0.45). However, patient preference showed a significant difference; 59% of patients preferred FNA (CI: 53.1-64.9), while only 41% preferred CNB (CI: 35.1-46.9), with a significant P value of 0.016, indicating a clear preference for FNA over CNB among patients.

DISCUSSION

Table 1 shows that CNB has a higher positive diagnosis rate (87%) compared to FNA (74%). These findings are supported by previous studies, such as those by Parker and colleagues, who noted that CNB tends to provide a more definitive histological diagnosis due to the larger tissue samples obtained, which reduces the incidence of inconclusive results Tripathi K et al.(2022)[10]. The statistical significance (P value = 0.026) underscores the consistent performance of CNB over FNA in terms of diagnostic yield.

Table 2 further underscores the superiority of CNB in detecting malignant lesions, with an accuracy of 84% compared to 68% for FNA. This aligns with the research by Hoda RS et al.(2019)[11], who demonstrated that CNB's larger samples provide a more accurate assessment of cellular architecture and thus better malignancy detection. The lower confidence intervals for FNA reflect its variability and the occasional need for repeat procedures due to inadequate sampling.

Table 3 contrasts the complication rates, showing that FNA has a significantly lower rate (5%) compared to CNB (13%). This is consistent with the findings of Lee and colleagues, who noted that the less invasive nature of FNA results in fewer complications such as bleeding or infection, making it a safer option particularly for patients on anticoagulation therapy or with other contraindications to more invasive procedures Bhandari A et al.(2018)[12].

Table 4 highlights differences in patient satisfaction and preference, with FNA being preferred by 59% of patients compared to 41% for CNB. Despite similar satisfaction rates, the preference for FNA could be attributed to its less invasive nature and quicker recovery time, aspects favored in patient-centered care models as noted by Ly A et al.(2016)[13]. The significance of these preferences (P value = 0.016) indicates a notable difference in how patients perceive and choose between these diagnostic methods.

Conclusion

This comparative study has critically evaluated the efficacy of Fine-Needle Aspiration (FNA) and Core Needle Biopsy (CNB) in diagnosing breast lesions, revealing distinct advantages and limitations associated with each method. Core Needle Biopsy demonstrated superior diagnostic efficacy and accuracy, evidenced by higher rates of positive diagnoses and better detection of malignant lesions compared to Fine-Needle Aspiration. This underscores CNB's value in

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providing more definitive and reliable histopathological evaluations, which are crucial for the accurate diagnosis and subsequent management of breast cancer.

However, this enhanced diagnostic capability comes with an increased incidence of complications. Core Needle Biopsy was associated with a higher complication rate than FNA, highlighting the need for careful patient selection and consideration of individual patient circumstances, such as coagulation status and personal preferences.

Patient satisfaction and preference metrics revealed that despite the invasiveness and slightly higher complication rates of CNB, patient satisfaction levels were comparably high for both techniques. Notably, a significant number of patients preferred FNA, likely due to its less invasive nature and quicker recovery process, which align with the growing emphasis on patient-centered care in medical practice.

In conclusion, both Fine-Needle Aspiration and Core Needle Biopsy hold valuable places in the diagnostic pathway for breast lesions. The choice between these two methods should be guided by a combination of clinical indications, patient health status, and personal preferences. Moving forward, enhancing patient education about the benefits and risks of each method will be crucial in aligning diagnostic strategies with patient expectations and improving overall care outcomes in breast disease management.

LIMITATIONS OF STUDY

1. **Retrospective Design**: Being a retrospective analysis, this study is subject to the inherent biases associated with historical data, including selection bias and information bias. Future studies could benefit from a prospective design to more actively control for confounding variables and ensure a more representative sample selection.
2. **Sample Size**: Although a sample size of 200 is adequate for initial comparisons, larger sample sizes would improve the statistical power of the study and enable more detailed subgroup analyses. This would be particularly valuable in stratifying results by lesion type, patient demographics, or previous medical history.
3. **Single-Center Data**: The data were collected from a single institution, which may limit the generalizability of the findings to other settings with different patient populations or different levels of expertise in performing these biopsies.
4. **Subjective Elements**: Patient satisfaction and preference were assessed through surveys, which can introduce response biases and may not fully capture the nuances of patient experiences. Additionally, the subjective nature of interpreting FNA and CNB samples can vary significantly between pathologists, which could affect diagnostic outcomes.
5. **Lack of Longitudinal Follow-up**: The study did not include follow-up data to assess long-term outcomes based on the initial diagnostic method used. Long-term follow-up would provide insights into the impact of diagnostic accuracy on treatment effectiveness and patient prognosis.
6. **Exclusion of Non-palpable Lesions**: The study focused on palpable breast lesions, which may not accurately represent the performance of FNA and CNB in diagnosing non-palpable lesions detected via imaging techniques. Including non-palpable lesions could change the diagnostic efficacy results.
7. **Variability in Technique**: There is potential variability in how FNA and CNB are performed, including the gauge of needles used and the experience of the clinician. These variations can influence diagnostic outcomes but were not controlled for in this study.

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ISSN: 0975-3583,0976-2833 VOL15, ISSUE 12, 2024

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