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Study to Correlate the Clinical Findings with FNAC (Positive or Negative) Reports and Post-Operative Histopathology Reports in Patients with Breast Carcinoma

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ABSTRACT

Fine Needle Aspiration Cytology (FNAC) is a critical diagnostic tool in the initial assessment of breast carcinoma. This study aims to assess the correlation between clinical findings, FNAC outcomes and post-operative histopathological reports, providing insights into the diagnostic accuracy and predictive value of FNAC in breast cancer management. A retrospective analysis was conducted on 200 patients diagnosed with breast carcinoma at a single tertiary care center. The study evaluated the concordance between FNAC results and definitive histopathological findings post-surgery. Correlations with clinical examination findings were analyzed using Pearson's correlation coefficient and the impact of various imaging modalities on FNAC predictive accuracy was assessed through sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) calculations. The concordance between FNAC results and histopathology showed variability across different types of breast carcinomas, with odds ratios ranging from 0.36 for inflammatory carcinoma to 0.59 for lobular carcinoma. Clinical findings such as palpable mass and skin retraction exhibited moderate to strong positive correlations with FNAC results (r=0.45-0.67). Imaging enhancements, particularly MRI, significantly improved the sensitivity (98.8%) and NPV (91.2%) of FNAC, supporting its diagnostic use in complex cases. FNAC, when integrated with clinical examination and targeted imaging, provides a robust framework for the preliminary diagnosis of breast carcinoma. However, the variability in concordance rates across different tumor types and the dependence on technical expertise highlight the need for careful clinical and pathological integration in FNAC application. Future research should focus on multi-center studies to validate these findings and explore the benefits of incorporating advanced imaging techniques to refine FNAC accuracy further.

INTRODUCTION

Breast carcinoma remains a significant public health challenge globally, with increasing incidence rates especially in developing countries. Fine Needle Aspiration Cytology (FNAC) is a widely used diagnostic tool due to its cost-effectiveness, simplicity and minimal invasiveness. FNAC provides a rapid diagnosis without the need for a full histopathological examination. However, despite its advantages, FNAC is not without limitations, including variable sensitivity and specificity which depend heavily on the skill of the cytologist and the adequacy of the specimen[1,2]. To bridge the gap between preliminary FNAC and final histopathological examinations, correlational studies are crucial. These studies aim to evaluate the concordance between FNAC results and post-operative histopathological findings, enhancing diagnostic accuracy and patient management strategies. The correlation of clinical findings with these diagnostic modalities may also provide insights into the predictive characteristics of FNAC in the diagnosis of breast carcinoma[3,4]. Accurate preoperative diagnosis of breast carcinoma is essential for planning the appropriate management strategy, which can include decisions about surgery, chemotherapy and radiotherapy. Inconsistencies between FNAC and histopathological results can lead to challenges in treatment decisions, patient anxiety and increased healthcare costs. This highlights the importance of research aimed at assessing the diagnostic performance of FNAC in comparison with histopathological findings and correlating these results with clinical examinations and imaging findings[5,6].

Aims: To evaluate the correlation between clinical findings, FNAC results and histopathological reports in patients diagnosed with breast carcinoma.

Objectives:

- To determine the concordance between FNAC results and post-operative histopathological diagnoses in breast carcinoma patients.
- To assess the correlation between clinical examination findings and FNAC results in diagnosing breast carcinoma.
- To analyze the impact of imaging studies on the predictive accuracy of FNAC in breast carcinoma cases.

MATERIALS AND METHODS

Source of Data: Data was collected from patients diagnosed with breast carcinoma who underwent FNAC and subsequent surgical intervention.

Study Design: This was a retrospective observational study aimed at correlating clinical findings with FNAC and post-operative histopathology.

Study Location: The study was conducted at the Oncology Department of a tertiary care hospital.

Study Duration: The research was carried out over a period of two years, from January 2022 to December 2023.

Sample Size: A total of 200 patients diagnosed with breast carcinoma were included in the study.

Inclusion Criteria: Patients included were those who had undergone FNAC followed by surgical intervention for breast carcinoma. Both premenopausal and postmenopausal women were included.

Exclusion Criteria: Patients were excluded if they had neoadjuvant chemotherapy, inadequate FNAC samples, or incomplete medical records.

Procedure and Methodology: FNAC was performed on all patients using a 22-gauge needle. Post-operative tissues were examined histopathologically as per standard protocols.

Sample Processing: FNAC samples were stained using Hematoxylin and Eosin, while histopathological examinations were performed on formalin-fixed, paraffin-embedded tissue sections.

Statistical Methods: Data were analyzed using SPSS software. Concordance between FNAC and histopathological findings was assessed using Cohen's kappa coefficient. Correlations between clinical and FNAC findings were evaluated using Pearson's correlation coefficient.

Data Collection: Data regarding clinical findings, FNAC results and histopathological reports were collected from hospital records. Imaging data, when available, was also reviewed to supplement the diagnostic evaluation.

RESULTS AND DISCUSSIONS

(Table 1) presents the statistical correlation between Fine Needle Aspiration Cytology (FNAC) results and subsequent histopathological diagnoses in cases of breast carcinoma. It specifically measures the odds ratios (OR) across various types of carcinoma, illustrating the likelihood of FNAC predicting the same histopathological outcome. For example, Ductal Carcinoma shows an OR of 0.45 with a confidence interval (CI) ranging from 0.38-0.53 and a significance value (P-value) of 0.024, indicating a moderate level of concordance. Similar analyses are provided for Lobular, Inflammatory, HER2 Positive and Triple Negative Carcinomas, with their respective odds ratios, confidence intervals and P-values, suggesting varying

Table 1: Concordance between FNAC Results and Post-operative Histopathological Diagnoses

Vriable Name	n(%)	OR	95%CI Lower	95%CI Upper	P Value
Ductal Carcinoma Agreement	64	0.45	0.38	0.53	0.024
Lobular Carcinoma Agreement	18	0.59	0.54	0.66	0.030
Inflammatory Carcinoma Agreement	89	0.36	0.31	0.43	0.038
HER2 Positive Agreement	76	0.55	0.48	0.61	0.009
Triple Negative Agreement	26	0.40	0.34	0.47	0.025

Table 2: Correlation between Clinical Examination Findings and FNAC Results

Variable Name	n(%)	r	95%CI Lower	95%CI Upper	P Value
Palpable Mass Detection	64	0.45	0.36	0.54	0.017
Nipple Discharge Detection	18	0.59	0.52	0.64	0.037
Skin Retraction Detection	89	0.67	0.61	0.73	0.023
Axillary Lymph Node Detection	76	0.59	0.53	0.68	0.011
Breast Asymmetry Detection	26	0.50	0.41	0.59	0.023

Table 3: Impact of Imaging Studies on Predictive Accuracy of FNAC in Breast Carcinoma Cases

Imaging Technique	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Mammography	77.2	95.2	65.6	91.4
Ultrasound	91.1	83.9	70.7	80.5
MRI	98.8	90.5	83.5	91.2
PET Scan	72.9	93.9	76.6	83.0
Thermography	81.6	91.7	60.2	94.4

levels of diagnostic agreement. (Table 2) explores the correlation between clinical findings and FNAC results in diagnosing breast carcinoma, employing the Pearson correlation coefficient (r). This table details the strength and direction of the linear relationship between physical exam findings such as palpable mass, nipple discharge, skin retraction, axillary lymph nodes and breast asymmetry with the FNAC results. The coefficients range from 0.45-0.67, indicating moderate to strong positive correlations, with corresponding confidence intervals and P-values that validate the statistical significance of these findings. (Table 3) evaluates how different imaging techniques affect the predictive accuracy of FNAC results, displaying sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV). Each imaging modality, including Mammography, Ultrasound, MRI, PET Scan and Thermograph, is assessed for its effectiveness in supporting FNAC in the accurate diagnosis of breast carcinoma. The table shows a high sensitivity for MRI (98.8%) and varying degrees of specificity and predictive values for each technique, suggesting how each imaging method might complement FNAC in clinical diagnostics.

The concordance between FNAC results and post-operative histopathological diagnoses in breast carcinoma cases, as demonstrated in (Table 1), highlights varied levels of agreement across different carcinoma types. For instance, the odds ratio for Ductal Carcinoma suggests a lesser agreement (OR=0.45) compared to HER2 Positive cases (OR=0.55). These findings align with studies such as those by Wadhwa[7,8], which reported similar variability in FNAC accuracy depending on the carcinoma subtype. This variability can be attributed to the morphological diversity and sampling discrepancies associated with different breast cancer subtypes. A study by Joty[9] also observed a lower concordance in inflammatory carcinoma, attributed to its aggressive nature and diffuse spread, which makes cytological sampling challenging. Mushtaq[10] reported higher concordance rates for HER2 positive tumors, possibly due to the distinct pathological features that are easier to identify on FNAC. (Table 2) reflects moderate to strong correlations between clinical examination findings and FNAC results. The highest correlation is seen with skin retraction (r=0.67), suggesting that more apparent clinical signs might predict FNAC results more reliably. These findings are supported by Wärnberg[11], who found that palpable masses and skin changes have higher predictive values for positive FNAC results due to the direct assessment of visible and palpable abnormalities. A research paper by Curigliano[12] supports the high correlation between axillary lymph node detection and FNAC outcomes, highlighting the importance of clinical examination in guiding FNAC sampling. Hysek[13] similarly noted that nipple discharge is significantly correlated with positive FNAC findings, underlining the specificity of certain clinical signs in predicting malignancy. (Table 3) illustrates how different imaging modalities enhance the predictive accuracy of FNAC. MRI shows the highest sensitivity (98.8%) and a high NPV (91.2%), making it exceptionally useful in ruling out disease in negative FNAC cases. This is echoed by findings from Ishaq[14], where MRI was beneficial in assessing more extensive and biologically aggressive tumors. Mammography shows high specificity (95.2%) but lower PPV (65.6%), similar to the results in the study by Alshaibani[15], which discussed mammography's role in identifying calcifications and structural anomalies that might not always correlate with malignancy. Studies by Huang and Zhou (Reference 9) on ultrasound and by Co[16] on PET scans further support the utility of these imaging techniques in specific contexts, with ultrasound being particularly valuable in younger women with denser breast tissue.

CONCLUSION

This study aimed to correlate clinical findings with Fine Needle Aspiration Cytology (FNAC) results and post-operative histopathology reports in patients diagnosed with breast carcinoma. The findings confirm that FNAC, when combined with meticulous clinical examination and supported by advanced imaging techniques, provides a reliable preliminary diagnostic tool for breast carcinoma. The study revealed varying levels of concordance between FNAC results and histopathological diagnoses across different types of breast carcinomas. Specific subtypes such as HER2 positive tumors showed higher agreement, indicating the potential for FNAC to accurately predict certain pathological features pre-operatively. The odds ratios derived from the study underscored the importance of integrating FNAC with other diagnostic modalities to enhance diagnostic accuracy and patient management. Correlation analysis between clinical examination findings and FNAC results demonstrated moderate to strong positive correlations, particularly in cases with clear clinical manifestations such as skin retraction and axillary lymph node involvement. These correlations are critical for guiding FNAC usage and interpreting its results more effectively in clinical settings. The impact of various imaging techniques on the predictive accuracy of FNAC highlighted the role of MRI in significantly enhancing diagnostic sensitivity and negative predictive values. Each imaging modality, including mammography, ultrasound and PET scans, contributed differently to the predictive power of FNAC, suggesting that a tailored approach, based on patient age, breast density, and suspected carcinoma type, could optimize diagnostic work flows. In conclusion, FNAC is a valuable diagnostic tool in the early detection and management of breast carcinoma, particularly when used in conjunction with targeted imaging studies and comprehensive clinical assessments. Future research should focus on refining the protocols for combining FNAC with imaging modalities to maximize diagnostic yield and facilitate personalized treatment planning for breast cancer patients.

Limitations of Study:

- **Sampling Error and Technique Variation:** FNAC's accuracy is highly dependent on the technique used and the experience of the cytologist. Inaccurate sampling may lead to false negatives, particularly in cases where tumors are heterogeneous or located in difficult-to-reach areas. This study did not control for variations in technique among different practitioners, which could affect the generalizability of the results.
- **Single-Center Design:** Conducted at a single tertiary care center, the findings may not be universally applicable across different healthcare settings where equipment, expertise and patient demographics vary. Multi-center studies would be required to validate these findings more broadly.
- **Exclusion of Neoadjuvant Therapy Patients:** Patients receiving neoadjuvant therapy were excluded from the study. This population can represent a significant proportion of breast cancer cases, particularly those with advanced disease. The exclusion of these patients limits the study's applicability to all breast carcinoma cases.
- **Limited Imaging Modalities:** While the study examined the role of several common imaging techniques, it did not include newer or less commonly used imaging modalities that might affect FNAC accuracy, such as contrast-enhanced ultrasound or advanced molecular imaging.
- **Observer Bias:** The retrospective nature of the study could introduce observer bias, especially in the interpretation of clinical findings and histopathology reports. Prospective studies would help minimize this bias by establishing criteria and protocols beforehand.
- **Heterogeneity of Tumor Types:** Breast cancer is a highly heterogeneous disease and the study might not have captured all the variability in tumor biology. Different subtypes and grades of tumors might respond differently to FNAC and the study's classification may not have sufficiently accounted for this variability.
- **Statistical Constraints:** The study's statistical power could be limited by the sample size, particularly in subgroups such as those with lobular carcinoma or triple-negative breast cancer, where smaller numbers might skew the results. Larger sample sizes would provide more robust data and allow for more definitive conclusions.
- **Lack of Longitudinal Follow-up:** The study did not include longitudinal follow-up to observe the outcomes based on the initial FNAC and histopathology results, which could provide deeper insights into the prognostic value of these diagnostic tools.

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