



FINE NEEDLE ASPIRATION CYTOLOGY OF BREAST LUMPS WITH THEIR HISTOPATHOLOGICAL CORRELATION

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ABSTRACT

Breast cancer is a significant global health burden, affecting millions of women worldwide and contributing to a high number of cancer-related deaths[1]. According to the International Agency for Research on Cancer (IARC), an estimated 2.3 million new cases of breast cancer were diagnosed in 2020, accounting for 11.7% of all cancer cases worldwide[2]. Moreover, breast cancer caused approximately 685,000 deaths, making it the fifth leading cause of cancer-related mortality globally[2]. Recent studies indicate that breast cancer is the most common cancer among Indian women, accounting for 14% of all cancer cases[3–6]. The incidence rates have been rising steadily over the years, attributed to a combination of factors such as changing lifestyles, urbanization, delayed childbearing, hormonal factors, and limited awareness about breast health[7]. Several risk factors contribute to the development of breast cancer, including age, gender, family history, genetic mutations (e.g., BRCA1 and BRCA2), reproductive factors, hormonal influences, obesity, alcohol consumption, and exposure to ionizing radiation[7]. Early detection plays a critical role in reducing morbidity and mortality. Breast self-examination, clinical breast examination, mammography, and tissue biopsy are key tools for early detection, allowing for timely intervention and improved treatment outcomes[5,8]. Several conditions ranging from benign breast diseases (e.g., fibrocystic changes, fibroadenoma, intraductal papilloma's) Inflammatory Conditions (e.g. mastitis, abscess), hormonal changes, traumatic lesion, fat necrosis to rapidly spreading & fatal malignant cancers can initially present with only a lump in the breast without any associated symptoms[9]. Accurate evaluation of breast lumps involves a comprehensive approach, including thorough clinical assessment, focusing on the characteristics of the lump, associated symptoms, and presence of risk factors[10–13].

KEYWORDS : Breast Cancer, Global Health Burden, Cancer-related Deaths, Age, Gender, Incidence

INTRODUCTION

Fine Needle Aspiration Cytology is best understood as a method where a fine needle is used to remove a sample of cells from a suspicious mass for diagnostic purposes. The acquired material is processed into a cytological specimen that is appropriate for microscopic analysis. FNAC biopsy is considered a minimally invasive and cost-effective method that has a diagnosis accuracy ranging from 90% to 99%^[45,46].

The benefits of FNAC include its safety, quick reporting, high sensitivity and specificity for diagnosing malignancy, minimal equipment requirements, minimal patient discomfort, ability to be performed on an outpatient basis, reduced need for hospital beds, ability to provide preoperative diagnosis, avoidance of frozen sections, decreased need for exploratory procedures, ability to provide a definitive diagnosis for inoperable patients, absence of fibrosis (which could hinder future investigations), no requirement for wound healing, and ease of repetition and cost-effectiveness^[47]. FNAC has several drawbacks. Firstly, the aspiration technique necessitates proficiency and expertise. Additionally, a certain proportion of the aspirates obtained are deemed unsatisfactory. Moreover, accurate interpretation

of the results demands experience, and there is a limitation on the amount of diagnostic material available. The diagnostic precision of FNAC relies on various factors, such as the location and nature of the abnormality, the expertise of the person performing the procedure, the excellence of the specimen preparation, and the diagnostic proficiency of the cytopathologist. Multiple studies have indicated that diagnostic accuracy is improved when the same individual carries out the aspiration procedure, prepares the smears, and provides the interpretation^[48].

MATERIAL AND METHODS

This prospective study was conducted in the department of pathology, Amaltas institute of medical sciences bangar, dewas. Patients presenting with breast lumps underwent Fine Needle Aspiration Cytology (FNAC) as part of their diagnostic workup and patient breast tissue that were received from department of surgery after MRM surgery.

The study received ethical clearance from the Institutional Ethical Committee of Amaltas Institute of Medical Sciences, Dewas.

Approval was granted following a thorough review of the study's aims, methods, and the procedures for ensuring participant confidentiality and informed consent. This clearance affirmed the study's adherence to ethical guidelines for research involving human subjects, ensuring that the dignity, rights, safety, and well-being of the participants were protected throughout the research process.

- **Study Duration:** The total duration of the present study was 18 months: from august 2022 to January 2024 divided into the following three phases—
- i. **Planning (3 months):** During this initial phase, the research team developed the study design, including defining the objectives, selecting the methodology, and determining the criteria for participant inclusion and exclusion. The necessary materials, equipment, and protocols for FNAC and histopathological examination were prepared and standardized.

Participant Recruitment & Data Collection (12 months): This phase involved identifying and enrolling participants according to the predetermined inclusion and exclusion criteria. Informed consent was obtained from all participants. FNAC procedures were performed on participants presenting with breast lumps, followed by the collection of histopathological data through surgical biopsies. Detailed records were maintained for each participant, including demographic information, clinical findings, and the results of FNAC and histopathology.

- ii. **Data Analysis & Report Writing (3 months):** The collected data were systematically analyzed to compare the diagnostic accuracy of FNAC with that of histopathological examinations. Statistical tests were employed to evaluate sensitivity, specificity, and predictive values. Findings were compiled and interpreted, culminating in the drafting of the final report.

- **Primary Outcome:** The primary outcome of the study was the diagnostic accuracy of Fine Needle Aspiration Cytology (FNAC) in identifying malignant versus benign breast lumps, compared to the gold standard of histopathological diagnosis obtained from surgical biopsies. Diagnostic accuracy was assessed through sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy. These metrics were calculated based on the comparison of FNAC results with histopathological findings.
- **Secondary Outcomes:** Secondary outcomes included the assessment of the impact of various factors on the diagnostic accuracy of FNAC, such as the size of the breast lump, the age of the patient, and the experience of the cytopathologist. The influence of lump size and patient age on FNAC's diagnostic accuracy was evaluated through subgroup analyses, comparing accuracy metrics across different categories of lump size and age groups

RESULTS

Among the 139 patients who underwent FNAC, only 104 patients were further recommended for Histopathological Examination. Those who did not underwent histopathological examination included participant included those with inadequate FNAC (n=7), those with acute inflammatory conditions (n=15), those with chronic lesions (n=6) and patient who refused or lost to follow up (n= 11).

The histopathology grading of the cases reveals a variety of lesions. The most common finding is fibroadenoma, accounting for 31.73% (33 cases). Invasive breast carcinoma, no special type(NST), is the second most frequent at 21.15% (22 cases). Gynecomastia represents 14.42% (15 cases). Less common findings include acute suppurative lesions and fibroadenoma with cystic change, each comprising 3.85% (4 cases) of the total. Other lesions such as benign fibroepithelial lesions, fibroadenoma with secondary changes, fibrocystic breast lesions, and proliferative breast disease each account for 1.92% (2 cases).

Single cases (0.96%) are noted for various other histopathological categories, including acute inflammatory lesions, adenosis with ADH, atypical ductal hyperplasia, benign Phyllodes, borderline Phyllodes, chronic mastitis, complex fibroadenoma, fibroadenoma with apocrine changes, invasive breast carcinoma with medullary features, and mucinous breast carcinoma. In total, 104 cases were evaluated.

These findings highlight that the most common diagnosis was

fibroadenoma followed by invasive breast carcinoma NST and gynecomastia, while several diagnoses were equally rare, each representing only a small fraction of the cases.

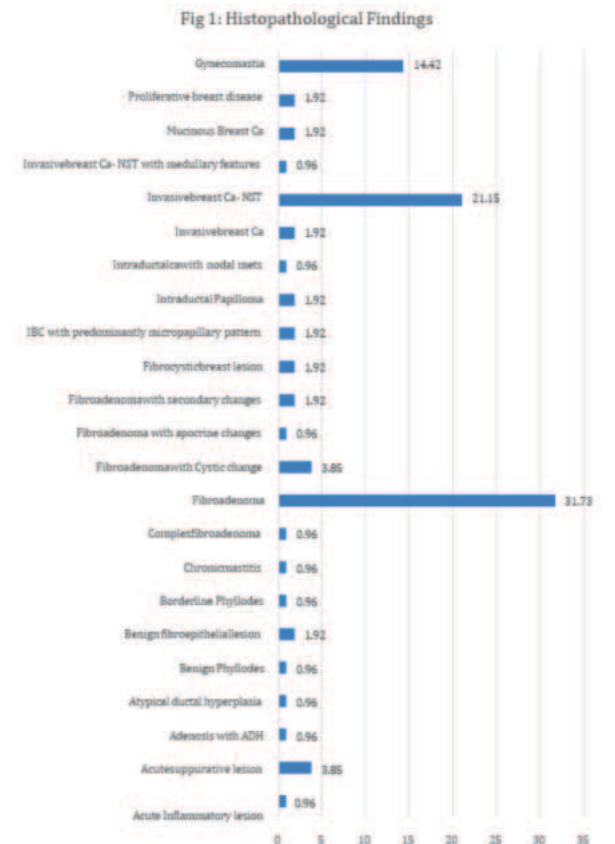


Figure 1 : Bar Graph Showing Different Histological Finding in the Study

Table 1: Diagnostic Accuracy of FNAC

Diagnostic accuracy of FNAC			
Outcome	Value	95% confidence interval(CI)	
Sensitivity	93%	86.80%	96%
Specificity	92.70%	80.10%	98.50%
ROC area	0.963	0.923	1
Positive predictive value	93.50%	82.10%	98.60%
Negative predictive value	100%	90.70%	100%

The diagnostic accuracy of fine needle aspiration cytology (FNAC) for breast lumps, evaluated in 139 participants, demonstrated high levels of effectiveness. The sensitivity of FNAC was 93%, with a 95% confidence interval (CI) ranging from 86.80% to 96%. The specificity was 92.70%, with a 95% CI of 80.10% to 98.50%. The area under the receiver operating characteristic (ROC) curve was 0.963, indicating excellent diagnostic performance, with a 95% CI from 0.923 to 1. The positive predictive value (PPV) was 93.50%, with a 95% CI of 82.10% to 98.60%, and the negative predictive value (NPV) was 100%, with a 95% CI from 90.70% to 100%. These results underline the high accuracy and reliability of FNAC in diagnosing breast lumps.

DISCUSSION

The primary objective of this study conducted at Department of Pathology, Amaltas Institute of Medical Sciences, Dewas by enrolling a total of 139 participants was to evaluate the diagnostic accuracy of fine needle aspiration cytology (FNAC) in the assessment of breast lumps by comparing cytological findings with histopathological results. The study aimed to determine the sensitivity, specificity, positive predictive value, and negative predictive value of FNAC, as well as to identify the distribution and characteristics of various breast lesions in a diverse patient population. By establishing the efficacy of FNAC, this research sought to reinforce its utility as a minimally invasive diagnostic tool in clinical practice.

Conducting this study holds significant importance due to the high prevalence of breast lumps and the crucial role of early and accurate

diagnosis in breast cancer management. Breast cancer remains one of the leading causes of cancer-related mortality among women worldwide. Early detection and appropriate intervention are critical for improving patient outcomes. FNAC, being a less invasive and cost-effective method, offers a rapid diagnostic alternative to more invasive procedures like core needle biopsy or surgical excision. This study's findings can enhance the diagnostic pathway for patients presenting with breast lumps, ultimately contributing to better clinical decision-making and patient care. The significance of researching FNAC in breast lumps lies in its potential to streamline the diagnostic process. By accurately distinguishing between benign and malignant lesions, FNAC can prevent unnecessary surgeries and allow for timely therapeutic interventions. The comparison groups in this study—based on histopathological correlation—provide a robust framework for assessing FNAC's diagnostic performance. This comparative analysis not only validates the FNAC findings but also highlights the technique's strengths and limitations in different clinical scenarios.

The findings of this study underscore the high diagnostic accuracy of fine needle aspiration cytology (FNAC) in the evaluation of breast lumps. With a sensitivity of 93% (95% CI: 86.80% to 96%) and specificity of 92.70% (95% CI: 80.10% to 98.50%), FNAC proves to be a reliable diagnostic tool in distinguishing between malignant and benign breast lesions.

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