

ORIGINAL ARTICLE

DIAGNOSTIC ACCURACY OF FINE NEEDLE ASPIRATION CYTOLOGY (FNAC) IN PALPABLE BREAST LESION

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ABSTRACT:

Introduction: Fine needle aspiration cytology (FNAC) is a well-known and valued technique for estimation of palpable breast masses before any surgery because it is highly sensitive, accurate, specific, and cheap. However, many surgeons and oncologists prefer core needle biopsy in comparison to FNAC for diagnosis.

Objective: The present study aims to evaluate the diagnostic accuracy of preoperative FNAC in detecting malignancy in primary breast cancer.

Methods: A total of 219 cases were included based on inclusion and exclusion criteria. FNA was done using a 23-gauge needle and results were interpreted by pathologists for adequacy and cellularity. Final cytological diagnoses were categorized as per International Academy of Cytology (IAC) Yokohama Breast FNAC Reporting system. Comparison with histopathology was done. All the information collected was analyzed using SPSS version-24.

Results: Benign lesions (C2, C3) are most frequent in women aged 21–50 years. While malignant lesions (C4, C5) are heavily concentrated in the >50 age group, a significant number (48/87) were still seen in women's reproductive years (21–50), suggesting early-onset cancers. FNAC demonstrated a sensitivity of 87.8%, correctly identifying 86 out of 98 malignant cases, and a specificity of 100%, accurately classifying 120 out of 121 benign cases. These results underscore FNAC's high diagnostic reliability, particularly in ruling out benign lesions. On comparing the cyto categories with the histo categories, the chi-square test result statistically supports this association. With p-value < 0.0001, the results reflect a highly significant association between cytology and histological findings.

Conclusion: FNAC is a highly accurate and dependable first-line diagnostic tool for breast lesions.

Keywords: Cytopathology, Fine Needle Aspiration Cytology (FNAC), National Health Services Breast Screening Program

INTRODUCTION:

Among Asian countries, Pakistan bears the highest burden of breast cancer, with approximately one in nine women at risk of developing the disease during their lifetime. The incidence of breast cancer has been rising more rapidly among postmenopausal women, particularly in the 55–59-year age group, while a relatively stable increase has been observed in younger women aged 15–29 years. Incidence rates peak between 60 and 70 years of age, with a substantial disease burden affecting both urban and rural populations.^{1,2}

Clinically, breast cancer most commonly presents as a palpable breast lump. Such lumps may represent benign conditions, including fibroadenoma, fat necrosis, and acute or chronic breast abscesses, or may signify an underlying carcinoma of the breast, as described in standard surgical and pathological literature.³

Fine-needle aspiration cytology (FNAC) plays a pivotal role not only in the initial evaluation and staging of breast lesions but also in the assessment of suspected recurrence in breast malignancy. FNAC constitutes one of the three essential components of the triple assessment approach and is widely regarded as the first-line diagnostic investigation. Its utility in distinguishing primary breast malignancies from non-mammary metastatic lesions h-

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as been emphasized by Patel et al. Numerous studies have demonstrated that FNAC has a sensitivity ranging from 89% to 98% and a specificity approaching 98% to 100% in the evaluation of palpable breast lumps, underscoring its diagnostic reliability.⁴

From a procedural perspective, FNAC and core needle biopsy serve complementary roles in breast lesion assessment. FNAC provides cytological material for rapid evaluation, whereas core biopsy yields tissue samples suitable for histopathological examination. FNAC is widely favoured due to its simplicity, minimal invasiveness, cost-effectiveness, and suitability as an outpatient procedure. Additionally, it allows sampling from multiple areas of a lesion during a single sitting without additional cost and often provides same-day results, as emphasized by Verma et al. and De Cursi et al.^{5,6}

The present study aims to evaluate the diagnostic accuracy of preoperative ultrasound-guided FNAC in detecting malignancy in primary breast cancer. The findings of this study will help determine whether FNAC alone can serve as a reliable diagnostic criterion in selected cases and may contribute to reducing unnecessary surgical interventions for patients.

METHODS:

Descriptive retrospective study in Shahida Islam Medical Complex, Lodhran & Meezan Lab, Faisalabad. 2.5 years from Jan 2023 to June 2025. The non-probability consecutive sampling. A total of 219 females were included. All females who presented with a palpable breast mass during the study period.

Patients who did not give consent were excluded.

After taking ethical approval via letter no SIMC/

ET.C/011/0015/02/25, the data from the software was retrieved. FNAC procedure was performed using 23G needle. Aspirated air-dried smears were stained with Diff-Quick and checked for cellularity & adequacy. Remaining smears were wet fixed in 95% methanol and stained with Hematoxylin & Eosin (H&E), and Papanicolaou stains.

The Final cytological diagnoses were then categorized into one of five diagnostic categories following the recommendations of the International Academy of Cytology (IAC) Yokohama Breast FNAC Reporting system.⁵

C1 - Insufficient cells for cytological analysis

C2 - Cells present all benign, no suspicious features

C3 - Cells suspicious but probably benign,

C4 - Cells suspicious but probably malignant

C5 - Definitely malignant.

For comparison purposes, we combined categories 2 and 3 of cyto category and regrouped as “Benign” and C4 and C5 as “malignant”, as practiced by some other studies.^{9, 11}

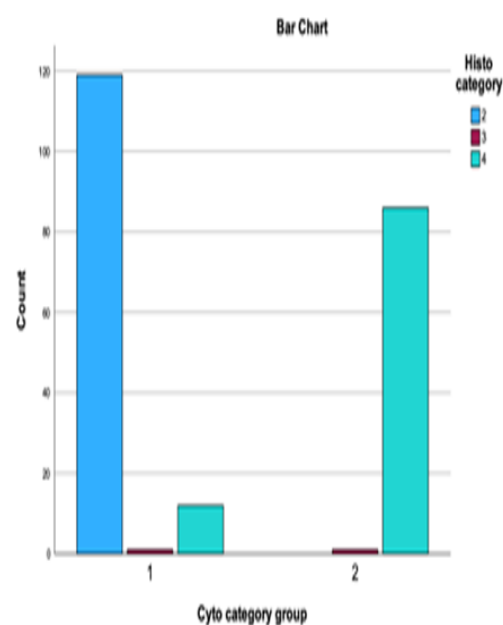
All the collected information was entered and analyzed using *SPSS version 30*. Frequency and percentages were measured for variables like FNAC categories and age. P values were also calculated and value <0.001 is taken as significant while correlation was seen by the Chi-square test.

RESULTS:

FNAC and Core Biopsy were performed of a total of 219 breast lesions for comparison. Out of 219 cases, 78 were C5 (malignant) and 105 were C2 benign For practical and treatment purposes, both C2 and C3(suspicious) were considered benign and we-

re compacted into a single cytological category group “Benign” and labelled as (1) which comprised of 132(60.3%) cases. The second category group malignant (2) compacted for analysis, collected cases from the cyto category, both C4 (highly suspicious) and C5 were taken as malignant,^{9,11} consisting of 87(39.7%) cases as shown in **Fig 1.1**. The crosstabulation **table 1.1** below shows that 119 out of 132 cases (90.2%) of cyto category group 1 (benign), corresponded with histology category 2 (benign). While 1 case (0.8%) was diagnosed as

Fig 1. Distribution of Cytological Categories



histology category 3 (borderline), and 12 cases (9.1%) as histology category 4 (malignant), representing false negative diagnosis. In contrast, for cyto category group 2 (malignant), none of the 87 cases (0%) matched with histology category 2(benign), only 1 case (1.1%) aligned with histology category 3 (borderline). The vast majority of 86 cases (98.9%) of cytro cate-

gory 2 (malignant) were proven to be histology category 4 (malignant).

Table 1. Cross-tabulation of Cytological Category and Histopathological Category

Cyto category group & Histo category Crosstabulation					
Cyto category group		Histo category			Total
		2	3	4	
1	Count	119	1	12	132
	% of Total	54.3%	0.5%	5.5%	60.3%
2	Count	0	1	86	87
	% of Total	0.0%	0.5%	39.3%	39.7%
Total	Count	119	2	98	219
	% of Total	54.3%	0.9%	44.7%	100.0%

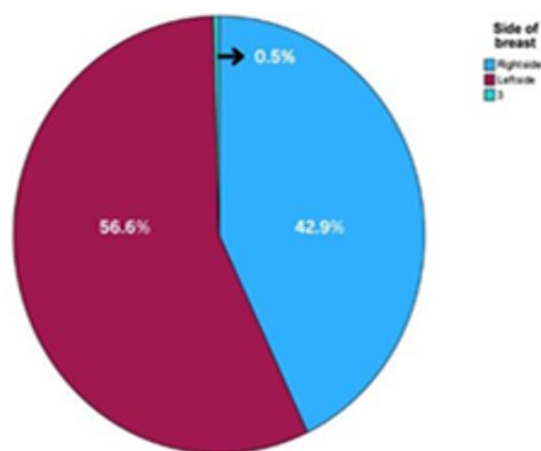
Based on the cross-tabulation data, FNAC demonstrated a sensitivity of 87.8%, correctly identifying 86 out of 98 malignant cases, and a specificity of 100%, accurately classifying 120 out of 121 benign cases. These results underscore FNAC’s high diagnostic reliability, particularly in ruling out benign lesions. On comparing the cyto categories with the histo categories, the chi-square test result statistically supports this association. With p-value < 0.001, the results reflect a highly significant association between cytology and histological findings. In conclusion, the results suggest that the FNAC findings are a reliable predictor of biopsy outcomes.

Not only that but our data interpretation also revealed that 54.3% of the majority of breast lesions diagnosed by histopathology were benign, highlighting fibro adenomas and fibrocystic changes as the most common benign breast conditions as shown in the bar chart in **Fig 1.1**.

Benign lesions (C2, C3) are most frequent in women aged 21–50 years. While malignant

lesions (C4, C5) are heavily concentrated in the >50 age group, a significant number (48/87) were still seen in women's reproductive years (21–50), suggesting early-onset cancers. So overall, all the majority of cases peaked in the reproductive age group as shown below by the line graph **Fig. 1.2**

Figure 1.2 Pie chart affected breast



Furthermore, in terms of laterality the left breast was more frequently affected (56.6%) as presented by the pie chart **Fig 1.4**. This finding is consistent with global data possibly due to anatomical or hormonal factors.

Thus, these findings highlight FNAC as a highly reliable and efficient first-line diagnostic tool for

evaluating breast lesions and aiding in timely and accurate clinical decision-making.

DISCUSSION:

Fine-needle aspiration cytology (FNAC) is a fundamental, minimally invasive, and cost-effective diagnostic technique for the evaluation of breast lesions, particularly in resource-limited settings. Several studies, including those by Verma et al. and Risaldar et al., have emphasized FNAC as an essential first-line investigation in the diagnostic workup of breast lumps due to its simplicity, rapid turnaround time, and high diagnostic yield.^{5,7} The present study assessed the diagnostic accuracy of ultrasound-guided FNAC in detecting malignancy in primary breast cancer and evaluated its role as a reliable first-line diagnostic modality.

In this study, FNAC correctly identified 87.8% of malignant lesions (86 out of 98 cases), demonstrating high sensitivity. The 12 false-negative cases (9.1%) occurred within cytology group 1 (C2 + C3) and were most likely attributable to sampling error, pauci-cellular aspirates, or overlapping cytological features.

Similar causes of false-negative FNAC results have been described by De Cursi et al. and Saadaat et al., particularly in low-grade carcinomas and lesions mimicking benign entities such as fibroadenomas.^{6,8} In contrast, FNAC accurately classified 119 of 120 benign cases (99.2%), with only one false-positive case, later categorized as borderline on histology, indicating a minimal risk of overdiagnosis.

Cytology–histology correlation further reinforced the diagnostic reliability of FNAC. Among 132 cases in cytology group 1, 90.2% were histologically

confirmed as benign, while 9.1% were malignant on biopsy. This finding highlights the importance of histopathological confirmation in cytologically benign but clinically or radiologically suspicious cases, as also emphasized by Risaldar et al., Chowdhury et al., and Khan et al.^{7,10} In cytology group 2 (C4 + C5), 98.9% of cases were confirmed malignant, underscoring the high predictive value of FNAC in suspicious and malignant categories. Comparable results were reported by Verma et al. and Nigam et al., who observed a high risk of malignancy in C4 and C5 categories using standardized reporting systems.^{5,18}

Overall, FNAC in the present study demonstrated high sensitivity (87.8%) and specificity (99.2%), findings consistent with large-scale meta-analyses. Yu et al., in a systematic review and meta-analysis, reported pooled sensitivity and specificity of 92.7% and 98.3%, respectively, for FNAC in breast lesion evaluation [11]. Similarly, De Cursi et al. documented diagnostic accuracy exceeding 98% for small breast lesions (≤ 1 cm), further validating the robustness of FNAC across different lesion sizes.⁶

Regarding lesion laterality, left-sided breast involvement (56.6%) was more common than right-sided involvement. This left-sided predominance has also been reported by Saadaat et al. in an Afghan cohort and by Tagar et al. in regional studies, suggesting possible anatomical or hormonal influences.^{8,12}

Age-wise distribution showed that most breast lesions occurred in women aged 26–50 years, with benign lesions predominating in this group. Although malignant lesions were more frequent in women above 50 years, a substantial proportion of malignancies were also observed in women of re-

productive age, highlighting the burden of early-onset breast cancer. Similar age patterns have been described by Saadaat et al., Tagar et al., and Sharif et al., though variations in peak age and laterality may reflect regional or ethnic differences.^{8,13}

Histologically, infiltrating ductal carcinoma (IDC) was the most common malignant tumor identified, accounting for all C5 cases, predominantly of grades II and III. This observation is consistent with international data indicating that IDC constitutes approximately 80–85% of invasive breast carcinomas, as reported by Shetty and Kusuma.^{1,5} Papillary carcinoma, medullary carcinoma, and malignant phyllodes tumor were encountered infrequently in the present study, with proportions aligning well with global prevalence ranges reported by Bagga et al., Dutta et al., and Li et al., respectively.^{15,17}

Importantly, none of the C4 or C5 cases were histologically benign, emphasizing the strong predictive accuracy of FNAC in higher cytological categories. A small number of cases showed no residual tumor on histology, most likely reflecting the effects of successful neoadjuvant therapy rather than cytological misinterpretation. This observation supports the findings of Nigam et al., who highlighted the limitations of post-treatment cytology due to tumor necrosis and fibrosis and stressed the importance of histopathological confirmation in such scenarios.¹⁸

While core needle biopsy may offer slightly higher sensitivity, FNAC remains a valuable pre-screening tool, especially where immediate access to core biopsy is limited. Verma et al. and Agarwal et al. demonstrated that the triple assessment approach yields near-perfect diagnostic accuracy; however, FANC alone provides a rapid, reliable, and cost-effective preliminary diagnosis that facilitates time-

ly clinical decision-making.^{5,19}

CONCLUSION:

In summary, the findings of this study confirm that FNAC is a highly accurate and dependable first-line diagnostic tool for breast lesions. Nevertheless, in cases with discordance between cytological, clinical, and radiological findings—particularly within C3 and C4 categories—close follow-up and histopathological confirmation remain essential to avoid missed malignancies.

DECLARATION OF INTEREST: The authors declare no conflict of interest.

AUTHORS CONTRIBUTIONS:

G.F: Conceptualization, literature review, data collection, data analysis, write up, proofreading and final editing of manuscript.

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