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Cytological and Mammographic Evaluation of Palpable Breast Masses in Females of Reproductive Age Group: A Prospective Hospital-Based Cytopathological Study

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Abstract: ***Background: Palpable breast masses are a frequent clinical presentation in females of reproductive age, posing a diagnostic challenge due to overlapping features of benign and malignant lesions. Early and accurate differentiation is crucial for timely management. Mammography using BI-RADS classification provides structural imaging, while fine needle aspiration cytology (FNAC) with Modified Masood Scoring offers minimally invasive cellular diagnosis. Methods: A prospective hospital-based study was conducted over 18 months at FH Medical College and Hospital, Agra. One hundred females of reproductive age with palpable breast masses underwent both mammographic (BI-RADS) and cytological (Masood scoring) evaluation. Diagnostic parameters were computed with histopathology as the gold standard. Results: FNAC showed 94.29% sensitivity, 100% specificity, 100% PPV, 97.01% NPV, and 98% accuracy against histopathology. Mammography showed 100% sensitivity, 70.77% specificity, 64.81% PPV, 100% NPV, and 81% accuracy. Carcinoma was diagnosed in 33% by FNAC and 54% classified as malignant by BI-RADS IV/V. A strong correlation was observed between both modalities. Conclusion: Combined mammography and FNAC with Masood scoring provides a reliable, complementary diagnostic approach for palpable breast masses. FNAC is a highly accurate first-line investigation offering precise malignancy differentiation, while mammography serves as a sensitive screening adjunct.***

Keywords: Palpable breast mass; Mammography; FNAC; BI-RADS; Masood scoring; Breast carcinoma; Reproductive age group.

Ethical Approval: This study was approved by the Institutional Research Committee and Institutional Human Ethical Committee, FH Medical College and Hospital, Agra, U.P. Written informed consent was obtained from all participants prior to enrolment.

1. Introduction

Breast cancer is the most commonly diagnosed malignancy among women globally and is the second leading cause of cancer-related mortality in India. In 2016, approximately 118,000 new cases were recorded, with females accounting for 98.1% of all cases. The number of prevalent cases was estimated at 526,000 [1]. Although most palpable breast lumps are benign, a new palpable mass frequently serves as the first clinical sign of underlying malignancy and mandates thorough investigation [2].

Palpable breast masses encompass a broad differential diagnosis ranging from fibroadenoma and fibrocystic disease in younger women to invasive carcinoma in perimenopausal females. Imaging plays a pivotal complementary role: ultrasonography (USG) is preferred under the age of 30, while mammography is the primary imaging modality for women aged 40 and above, offering detailed characterization of lesion morphology [3,4]. The Breast Imaging Reporting and Data System (BI-RADS), standardized by the American College of Radiology (ACR), provides a structured risk-stratified reporting framework facilitating clinical decision-making [5]. Fine Needle Aspiration Cytology (FNAC) has long been established as a minimally invasive, rapid, cost-effective, and reliable technique for characterizing breast masses. The Modified Masood Scoring System (MMSS) provides a semi-quantitative cytological grading that enhances diagnostic reproducibility and differentiates benign from malignant lesions with high accuracy [6]. Triple assessment- combining clinical examination, imaging, and cytology- remains the gold standard. The present study was designed to correlate mammographic (BI-RADS) findings with FNAC (Masood scoring) and validate both against histopathological diagnosis in females of reproductive age presenting with palpable breast masses.

2. Materials and Methods

Study Design & Setting: This prospective hospital-based study was conducted over 18 months in the Department of Pathology, FH Medical College and Hospital, Agra, U.P.

(2023–2026). Institutional Ethics Committee approval was obtained before commencement, and written informed consent was secured from all participants.

Study Population: One hundred females of reproductive age (18–50 years) presenting with palpable breast masses were enrolled. Inclusion criteria comprised females attending surgical or gynaecological OPD with a palpable breast mass who underwent both mammography and FNAC. Postmenopausal women, previously diagnosed cases, and those refusing consent were excluded.

Mammographic Evaluation: Bilateral mammography was performed using the VISIMAM digital mammography unit, acquiring craniocaudal (CC) and mediolateral oblique (MLO) views. Findings were categorized according to the ACR BI-RADS classification (I–V).

Cytological Evaluation (FNAC): USG-guided FNAC was performed using a 23-gauge needle. Aspirated material was smeared on glass slides, air-dried, and stained with Giemsa and Papanicolaou stains. Cytological diagnosis was made using the Modified Masood Scoring System, classifying lesions as non-proliferative benign, proliferative benign, atypical/ suspicious, or malignant.

Statistical Analysis: Data were entered and analysed using SPSS version 20. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy were calculated with histopathology as the reference standard. Sample size was computed using the standard formula for sensitivity-based prospective studies.

3. Results and Discussion

3.1 Demographic Profile

The study included 100 females with palpable breast masses. The majority belonged to the 41–50-year age group (42%), followed by 31–40 years (39%) and 18–30 years (19%), indicating increasing prevalence with advancing age. Most patients were married (84%) and multiparous (76%). A positive family history of breast disease was present in 10% of cases (Table 1). These findings are consistent with Kolhar D et al. (2025) and Patro S et al. (2021), who reported the highest lesion burden in women during the late reproductive and perimenopausal phase [7,8].

Table 1: Distribution of Cases According to Demographic Parameters

Parameter	Category	No. of Cases	Percentage (%)
Age (years)	18–30	19	19.00%
	31–40	39	39.00%
	41–50	42	42.00%
Marital Status	Married	84	84.00%
	Unmarried	16	16.00%
Parity	Multiparous	76	76.00%
	Nulliparous	24	24.00%
Family History	Positive	10	10.00%
	Negative	90	90.00%

3.2 Mammographic (BI-RADS) Findings

The most common indication for mammography was a palpable lump (37%), followed by breast pain (24%), screening (21%), and nipple discharge (18%). The predominant breast density was fibro-fatty (42%). BI-RADS IV was the most frequent category (34%), followed by BI-RADS II (29%), BI-RADS V (20%), and BI-RADS III (17%). Mammography classified 54% of cases as malignant (BI-RADS IV/V) and 46% as benign (BI-RADS II/III).

3.3 Cytological (Masood Scoring) Findings

FNAC revealed carcinoma in 33% of cases, fibrocystic disease in 27%, fibroadenoma in 24%, breast abscess in 9%, and galactocele in 7% (Table 2). This distribution reflects the spectrum of breast pathology in the reproductive age group, with carcinoma constituting the most frequently diagnosed single entity. The higher proportion of malignant classification by mammography (54%) compared to cytology (33%) suggests that BI-RADS over-classifies lesions as suspicious relative to cytological diagnosis- an observation concordant with the known higher false-positive rate of mammography in dense breast tissue.

Table 2: Cytological Diagnoses (Masood Scoring)- Distribution of 100 Cases

Cytological Diagnosis	No. of Cases	Percentage (%)
Fibroadenoma	24	24.00%
Fibrocystic Disease	27	27.00%
Galactocele	7	7.00%
Breast Abscess	9	9.00%
Carcinoma	33	33.00%
Total	100	100.00%

3.4 Correlation and Diagnostic Performance

When both modalities were compared, cytology categorized 67 cases as benign and 33 as malignant, while mammography classified 46 as benign and 54 as malignant (Table 3). Histopathology- the gold standard- confirmed 65 benign and 35 malignant cases. On correlation with histopathology, FNAC with Masood scoring demonstrated a sensitivity of 94.29%, absolute specificity of 100%, PPV of 100%, NPV of 97.01%, and overall diagnostic accuracy of 98%. Mammography showed 100% sensitivity, 70.77% specificity, 64.81% PPV, 100% NPV, and 81% accuracy (Table 4).

These findings demonstrate that FNAC is a more specific and accurate diagnostic modality compared to mammography, while mammography excels in sensitivity and NPV- making it an ideal screening/triage tool. The complementary use of both techniques minimizes false negatives from cytology and false positives from mammography, thereby optimizing the diagnostic pathway. Narayanapuram H et al. (2025) and Mandal A et al. (2020) similarly reported superior accuracy of FNAC using cytological scoring systems in comparable prospective cohorts [9,10].

Table 3: Comparison of Modality Findings with Histopathology

Category	Cytology (Masood)	Mammography (BI-RADS)	Histopathology
Benign	67 (67%)	46 (46%)	65 (65%)
Malignant	33 (33%)	54 (54%)	35 (35%)
Total	100	100	100

Table 4: Diagnostic Performance- FNAC vs. Mammography (vs. Histopathology)

Parameter	FNAC (vs. Histopathology)	Mammography (vs. Histopathology)
Sensitivity	94.29%	100.00%
Specificity	100.00%	70.77%
PPV	100.00%	64.81%
NPV	97.01%	100.00%
Accuracy	98.00%	81.00%

4. Conclusion

FNAC using the Modified Masood Scoring System is an excellent first-line diagnostic modality for the evaluation of palpable breast masses in females of reproductive age, demonstrating near-perfect diagnostic accuracy (98%), absolute specificity (100%), and high sensitivity (94.29%) when validated against histopathology. Mammography, while providing high sensitivity and a 100% NPV, tends to overclassify lesions as malignant, resulting in moderate specificity (70.77%). The integrated use of both modalities offers a comprehensive, reliable, minimally invasive, and cost-effective triple-assessment approach that reduces unnecessary surgical biopsies, facilitates early cancer detection, and guides optimal clinical decision-making in resource-limited settings.

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