

Diagnostic Accuracy of Scrape Cytology in Comparison to Histopathology in Neoplastic Breast Lesions: A Cross-sectional Study

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ABSTRACT

Introduction: Breast cancer is a predominant health issue among women, and has high morbidity and mortality rates. A diverse array of imaging techniques are available ranging from mammography and breast-specific gamma imaging to nanomedicine. Histopathological Examination (HPE) is the definitive standard for diagnosing breast lesions. The drawback of histopathology lies in its reliance on protracted processing methods, resulting in delayed reporting, rendering it unsuitable for intraoperative diagnosis where scrape cytology may serve as an option for early detection as well as treatment.

Aim: To study the accuracy of scrape cytology in comparison to histopathology in neoplastic breast lesions.

Materials and Methods: This cross-sectional study was conducted in the Department of Pathology, SGT Medical College Hospital and Research Institute, Gurugram, Haryana, India, for a period of two years from June 2022 to May 2024. This study included Fine Needle Aspiration Cytology (FNAC) confirmed 170 postoperative lumpectomy and mastectomy specimens for neoplastic lesions. All specimens were received in 10% neutral buffered formalin. Areas of growth were grossly identified and scraped with a scalpel. After cytological smear preparation the

formalin fixed specimens were prepared for HPE and stained with Haematoxylin and Eosin (H&E) stains. The diagnostic accuracy of scrape cytology in comparison to histopathological diagnosis was done by Chi-square test.

Results: Out of total 170 cases, 94 were found to be benign and 76 were found to be of malignant aetiology on scrape cytology, which was confirmed by HPE. In the study, 168 cases were diagnosed accurately with a diagnostic accuracy of 98.82%. Among the benign cases, fibroadenoma was the most common diagnosis, accounting for 74 cases. In the malignant group, Invasive Ductal Carcinoma (IDC) was the most frequent diagnosis, with 54 cases. Of 94 cases identified as benign in scrape cytology, 92 came out to be benign, and 02 cases were diagnosed as malignant on histopathology that included 01 case of malignant Phyllodes tumour and 01 case of lobular carcinoma.

Conclusion: Scrape cytology was compared to HPE, which is considered the gold standard for diagnosis. Scrape can be utilised in resource-limited locations with no special instruments or equipment required compared to histopathology. Scrape is also helpful in studies where FNAC yields non diagnostic results and can improve interpretation skills of FNAC.

Keywords: Benign, Histopathology, Malignant, Specimens

INTRODUCTION

Breast cancer is a predominant health issue among women, the reason being its high morbidity and mortality [1]. Globally, breast cancer accounts for one-third of all the malignancies in women, with a mortality rate of 15% among total cases diagnosed [2]. In developing nations, breast cancer is typically the second most common malignancy after cervical cancer. The rising incidence of breast cancer is associated with delayed marriage, advanced maternal age at childbirth, reduced breastfeeding duration, and nulliparity [3]. Certain benign breast conditions are associated with an increased risk for breast cancer [4]. The most common symptoms associated with breast cancer are nipple discharge, nipple abnormalities, breast pain, palpable tumours, and axillary lymphadenopathy. The highest incidence of breast cancer is observed in the age group of 41 to 60 years [5]. A palpable breast lump is the most prevalent health issue for clinicians, pathologists, and patients [6]. The accuracy of diagnosis can be enhanced with a combination of preoperative assessments involving mammography, FNAC, self-examination, as well as biopsy. These modalities are highly dependable, accurate, as well as acceptable in comparison to a singular diagnostic method, which possesses its technological restrictions [7].

Various imaging techniques have recently evolved, ranging from mammography and breast-specific gamma imaging to

nanomedicine. HPE remains the standard diagnosing modality for breast lesions. The drawback of histopathology lies in its reliance on protracted processing methods, resulting in delayed reporting, rendering it unsuitable for intraoperative diagnosis [8-10] where scrape cytology may serve as an option for early detection as well as treatment. Breast diseases encompass a wide spectrum of pathological entities. It is hypothesised that inflammatory as well as non proliferative breast lesions do not increase the risk of developing cancer. Proliferative breast disease without atypia and with atypia, respectively, carry a mild to moderate risk, while carcinoma in situ carries the highest risk of malignancy [11].

Scrape cytology is a modified form of imprint cytology [12], that involves gently brushing or scraping cells from the freshly sliced surface of postoperative specimens to diagnose malignancies. It is a simple, straight forward, affordable method with growing diagnostic potential [13]. Scrape cytology can be utilised in the study of cases that are suspicious and non diagnostic on FNAC and as a possible replacement and adjunct to frozen section analysis, as scrape cytology doesn't require specialised equipment unlike frozen sections. Scrape smears do not show freezing artefacts that are produced during frozen sections. The objective of the study was to perform scrape cytology of postoperative neoplastic breast masses and evaluate its accuracy in relation to histopathological diagnosis.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Pathology, SGT Medical College Hospital and Research Institute, Gurugram, Haryana, India over a period of two years from June 2022 to May 2024. Ethical approval was obtained (No-IEC/FMHS/SGTU/N999).

Inclusion criteria: All preoperative FNAC confirmed cases of breast carcinoma who underwent lumpectomy or mastectomy, and patients who provided written consent were included in the study.

Exclusion criteria: Breast carcinoma cases that were not diagnosed by FNAC were excluded from the study.

Study Procedure

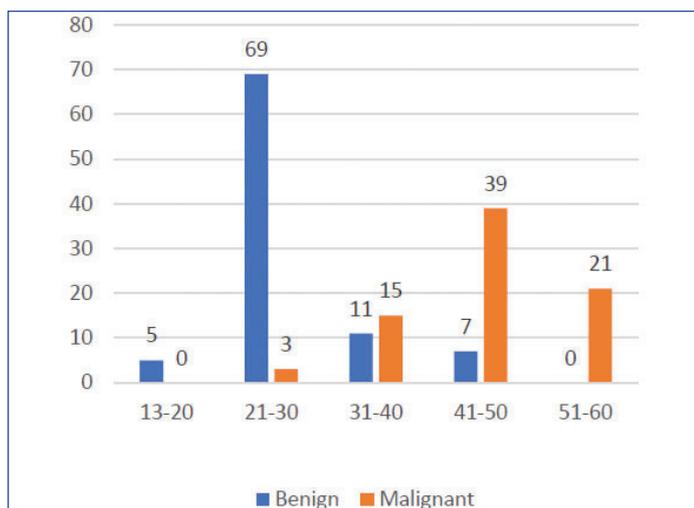
A total of 170 breast specimens were included in the study. All specimens were received in 10% buffered formalin. Gross examination was performed to identify areas of growth. Scrapings were obtained from growth by scalpel and uniformly smeared onto a glass slide by another glass slide. A minimum of four slides was prepared from each case. After cytological smear preparation, the formalin fixed specimens were prepared for HPE. Tissue sections were taken and stained with H&E stains, and evaluated. Scrape cytology slides were assessed using Robinson's Cytological Grading system [14] and the following parameters were evaluated: a) nuclear-cytoplasmic ratio; b) nuclear pleomorphism; c) nucleoli and d) nuclear membrane irregularity. The cytological diagnoses were then compared with the histopathological diagnosis.

STATISTICAL ANALYSIS

The Statistical Package for the Social Sciences (SPSS) software (version 23.0) was employed to perform the statistical analysis. Using histopathology as the gold standard, specificity, sensitivity, Positive Predictive Value, (PPV) Negative Predictive Value (NPV), and accuracy of scrape cytology were computed, exhibiting a p-value < 0.05 by Chi-square test.

RESULTS

Out of 170 cases studied, the majority were in the 21-30 years age group, comprising 72 cases (42.3%), followed by the 41-50 years age group with 46 cases (27.1%) [Table/Fig-1]. Based on scrape cytology findings, 94 cases were diagnosed as benign and 76 as malignant [Table/Fig-2]. All cases diagnosed by scrape cytology were confirmed by HPE. Histopathology revealed 92 benign and 78 malignant cases. Of the 94 cases diagnosed as benign on scrape cytology, 92 were confirmed as benign and 02 cases were found to be malignant on histopathology. These included 01 case each of malignant phyllodes tumour and lobular carcinoma. The comparison between cytological and histopathological diagnoses was found to be statistically significant [Table/Fig-3].



[Table/Fig-1]: Bar graph of distribution of neoplastic breast lesions according to age.

	Diagnosis	Number of cases
Benign	Fibroadenoma	74
	Fibrocystic disease	15
	Benign phyllodes tumour	05
Malignant	Malignant phyllodes tumour	02
	Lobular carcinoma	17
	Invasive ductal carcinoma	54
	Medullary carcinoma	01
	Mucinous carcinoma	01
	Malignant spindle cell lesion	01
Total		170

[Table/Fig-2]: Distribution of breast lesions into benign and malignant on scrape cytology.

Cyto score	Histo		Total	p-value
	Benign	Malignant		
Benign	92	02	94	<0.05
Malignant	00	76	76	
Total	92	78	170	Statistically significant

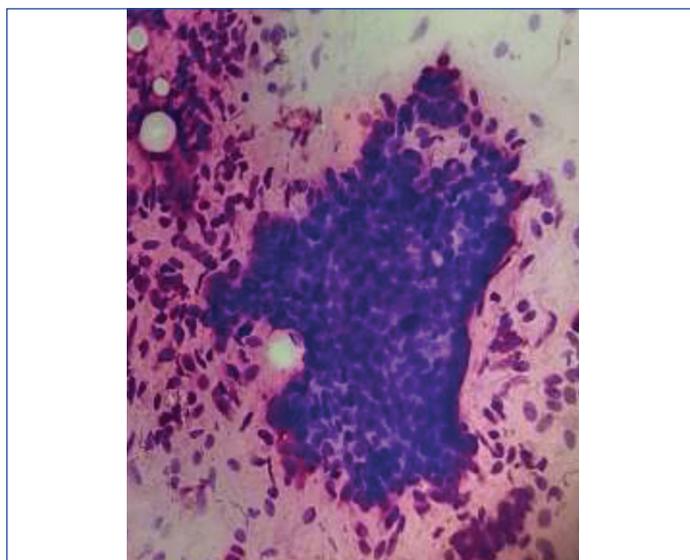
[Table/Fig-3]: Distribution of cases reported on histopathology and scrape cytology.

Cytological grading of scrape smears was performed using Robinson's Cytological Grading system; based on this, cases were categorised into grade 1 (26.3% of cases), grade 2 (39.4% of cases), and grade 3 (34.2% of cases) [Table/Fig-4]. The PPV and NPV were 100% and 97.87%, respectively. Of the 170 cases examined, 168 cases were diagnosed accurately with an overall diagnostic accuracy of 98.82% and sensitivity and specificity of 97.44% and 100%, respectively.

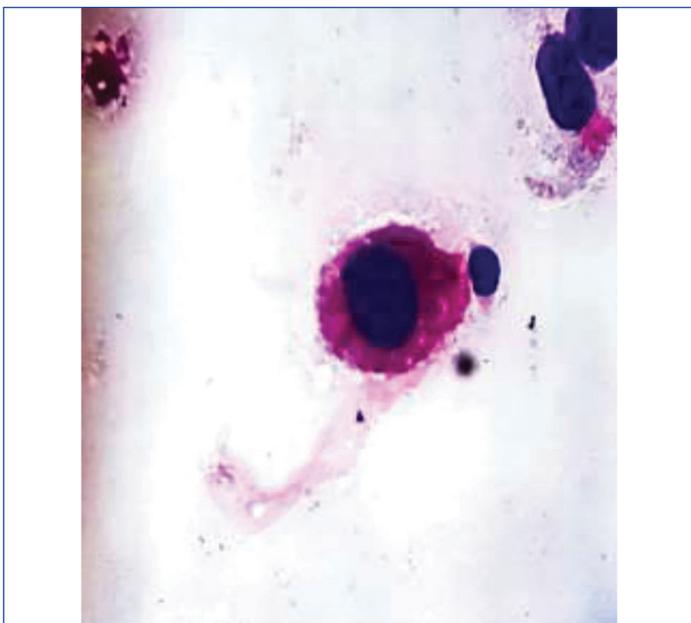
Cyto score	Number of cases (%)
Score (<5)	94 (55.2)
Score (>5)	76 (44.7)

[Table/Fig-4]: Distribution of cases with regard to Robinson cytological grading system.

Among the benign cases with cytological scoring of <5, fibroadenoma was the most common diagnosis, accounting for 74 cases [Table/Fig-5]. In the malignant group, invasive ductal carcinoma was the most frequent diagnosis, with 54 cases of cytological grading >5 [Table/Fig-6].



[Table/Fig-5]: Benign lesion on scrape cytology displaying sheet of tightly cohesive ductal epithelial cells and singly scattered bare nuclei (H&E,40x).



[Table/Fig-6]: High power view of Malignant lesion displaying nucleus covering 1/3rd to 2/3 the area of cell (H&E,100x).

DISCUSSION

Breast lesions can be rapidly diagnosed using FNAC, frozen sections, and HPE. However, the utility of scrape cytology in the detection of neoplastic lesions is scarce. In present study, maximum number of neoplastic breast lesions was observed in the 21-30 years age group. This was similar to the findings of Rahman MZ and Islam S et al., who reported 38.13% and Mosarrat SS, who reported 31.7% cases [15,16]. These findings were consistent with those of present study with 69 cases (40.58%).

In the present study, a higher number of benign cases were found compared to malignant cases. This finding was consistent with Chaithra H and Geetha JP, who reported 39 benign cases out of a total of 78 cases and Khudier HH et al., who reported 89 benign cases out of 110 [17,18]. Among benign cases, fibroadenoma was the most common lesion in the present study, similar to the findings of Ferguson CM and Powell RW [19]. The most common malignant neoplasm of breast was invasive ductal carcinoma, also aligning with the study by Singh A et al., [20].

In the present study, discrepancies were encountered in two cases. One was misdiagnosed as benign phyllodes tumour on scrape cytology but was later confirmed as malignant phyllodes tumour on HPE. The other case involved lobular carcinoma, which was misdiagnosed due to inadequate scraping, leading to a false negative result. Jayaram G and Gupta M, reported a case of sclerosing adenosis which was misdiagnosed as invasive lobular carcinoma [21]. Kolte SS and Satarkar RN, reported one case as a cellular smear due to dense sclerosis, with histopathology later confirming sclerosing adenosis [22]. Jackin RK et al., also reported one case which was diagnosed as benign granulomatous mastitis which subsequently confirmed histopathologically as lobular carcinoma [23]. In the present study study, no false positive cases were found, consistent with the findings of Hiregoudar AD et al., [24].

Statistical analysis in the present study showed sensitivity, specificity, PPV, NPV and diagnostic accuracy of 97.44%, 100%, 100%, 97.87% and 98.82%, respectively. These findings were comparable to results reported in various other studies [Table/Fig-7] [25-27].

Study	Sensitivity	Specificity	Accuracy	PPV	NPV	No. of cases
Mahmood Z et al., [25]	100%	100%	100%	100%	100%	40
Bukhari MH et al., [26] (2009)	91.3%	100%	95%	100%	89%	105

Ansari MA et al., [27]	91.7%	94.7%	97%	97.1%	85.7%	55
Present study, 2026	97.44%	100.00%	98.82%	100%	97.87%	170

[Table/Fig-7]: Comparison of different parameters between scrape cytology and histopathology [25-27].

Limitation(s)

Limitations of scrape cytology include cases with inadequate samples or those containing only a few atypical cells, which may lead to exclusion from a present study. This can affect the overall diagnostic accuracy and generalisability of findings.

CONCLUSION(S)

In this study, scrape cytology was compared to HPE. Scrape cytology can be effectively utilised in resource-limited settings, as it does not require any special instruments or equipment, unlike histopathology. In the present study, scraping was performed on postoperative specimens. This technique provides cellular smears for diagnostic evaluation without compromising the tissue required for subsequent histopathological analysis. It can also serve as an alternative to frozen section analysis for assessing surgical margin status, as it does not produce freezing artifacts and does not require specialised instruments. Additionally, scrape is also valuable in cases where FNAC yields non diagnostic results.

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