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Correlation of Robinson's cytological grading with Elston-Ellis modification of Scarff-bloom-Richardson's histological grading in breast carcinoma

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Abstract
Breast cancer is often evaluated using fine-needle aspiration cytology (FNAC), which is a simple and minimally invasive first-line diagnostic procedure. Among the various cytological grading methods, Robinson's system is most commonly used because of its high reproducibility and strong prognostic significance.
Fifty confirmed cases of breast carcinoma were cytologically evaluated and correlated with histopathological findings in this retrospective study conducted in the Department of Pathology, B.J. Medical College and Civil Hospital, Ahmedabad. Cytological grading was performed on FNAC smears using Robinson's method, while histological grading of tissue sections was done according to the modified Bloom-Richardson system. Overall concordance between the two grading systems was 60%.
Cytological grading of breast carcinoma using the Robinson system is a straightforward and reliable method that demonstrates a good correlation with histopathological grading. It offers valuable prognostic insight and plays a supportive role in guiding appropriate neoadjuvant treatment decisions.

Keywords: Breast carcinoma, fine-needle aspiration cytology, Robinson's cytological grading, modified bloom-Richardson score

Introduction
Breast cancer has the highest incidence among Indian females [1]. Clinical examination, mammography, and FNAC together form an effective triple assessment for breast lesions. Fine-needle aspiration is a well-established, highly reliable diagnostic method characterised by high sensitivity and specificity, with minimal procedural complications [2].
With the increasing use of neoadjuvant therapy, preoperative grading of breast cancer helps in selecting the most appropriate medical treatment [3]. Multiple parameters, including histological grade, hormone receptor status, proliferative index, and oncogene expression, influence the prognosis of breast cancer [4]. Cytological grading provides insight into tumor aggressiveness and biological behaviour [5].
According to the National Cancer Institute, cytological tumour grading should be routinely included in FNAC reporting, as it contributes to better prognostication and aligns cytological evaluation with established histological grading systems like the Modified Bloom-Richardson method [6].
This study aims to evaluate Robinson cytology grading in breast cancer and correlate it with Nottingham modification of the Bloom-Richardson method.

Materials and Methods
This retrospective study was conducted on 50 cases of cytologically confirmed cases of breast carcinoma in the department of Pathology, B.J. Medical College, Ahmedabad. Patients presenting with complaints of a breast lump, who were diagnosed with carcinoma on FNAC and had histopathological confirmation, were included in the study. Cases diagnosed as benign breast lesions and where patients refused histopathological examination were excluded from the study.
FNAC smears were prepared using a 22-gauge needle and 10 ml syringes, followed by H & E, Pap and MGG staining. Cytology grading was done using Robinson's method, which assesses six parameters, namely cell dissociation, nuclear size, cell uniformity, nucleoli, nuclear margins and chromatin pattern.

Each parameter is given a score of 1 to 3, and based on the total score, the cytological grade is decided. A score of 6-11 is considered Grade I, 12-14 as Grade II and 15 -18 as Grade III in cytology. Histopathological examination is done after the lumpectomy and mastectomy specimens were subjected to routine histopathological processing and subsequently stained with H&E. stain. The grading is then done according to the modified Bloom-Richardson grading method in which tubule formation, nuclear pleomorphism and mitotic count are evaluated. Here, each parameter is given a score of 1 to 3, and based on the total score, the histological grade is decided. A score of 3-5 is considered Grade I, 6-7 as Grade II and 8-9 as Grade III in histology.

The cytological and histological grades were analysed, where correlation between them was determined using Spearman's rank correlation coefficient and association by the Pearson Chi-square test.

Results

Among the 50 cases, 25 (50%) cases, 23 (46%) cases and 2 (4%) cases were graded as Grade I, II and III, respectively, by Robinson's cytology grading method. In histopathological grading according to the modified Bloom-Richardson method, 15 (30%) cases, 26 (52%) cases and 9 (18%) cases were graded as Grade I, II and III, respectively. Cytological and histological grading showed an overall concordance of 60%. Grade I, Grade II and Grade III tumors had concordance of 52%, 50% and 69.5% respectively.

A statistically significant association between the two grading systems was calculated by the Pearson Chi-square test ($\chi^2 = 12.53$, $p = 0.0138$). Spearman's rank correlation coefficient demonstrated a moderate positive correlation between cytological and histological grades ($\rho = 0.435$, $p = 0.0016$), indicating a significant relationship between the two methods.

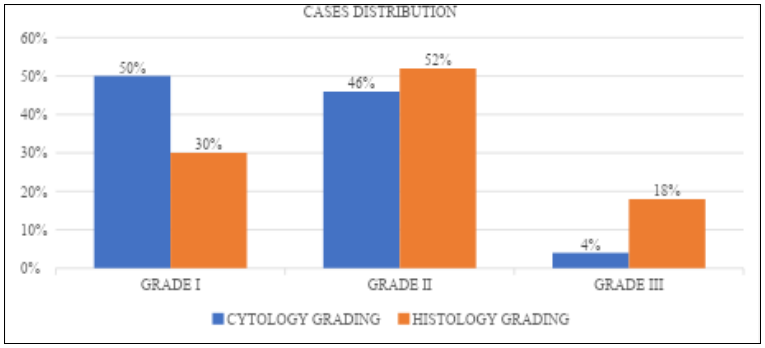

Fig 1: Case distribution in both the grading systems

Table 1: Correlation and concordance between cytological and histological grades

Cytology grade	Cytology Cases	Histology grade i	Histology grade ii	Histology grade iii	Concordance rate
I	25	13	9	3	52%
II	23	2	16	5	69.5%
III	2	0	1	1	50%
Total	50	15	26	9	Absolute concordance 60%

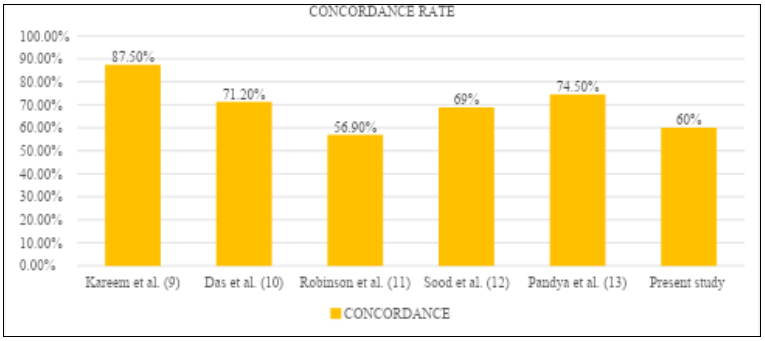

Fig 2: Concordance rate in different studies

Discussion

With the increasing use of neoadjuvant therapy, including preoperative chemotherapy and tamoxifen, in early breast cancer, preoperative tumor grading has become essential for selecting the most appropriate treatment. FNAC-based cytological grading allows assessment of tumor aggressiveness without surgery and enables serial monitoring of treatment response. Several cytological grading systems for breast carcinoma demonstrate good correlation with the Elston-Ellis (modified Bloom-Richardson) histological grading. Among these, Robinson's method is preferred for its higher sensitivity, simplicity, objective criteria, and reproducibility [7].

Histopathological grading using the Elston-Ellis modification of the SBR system is the gold standard for grading breast carcinoma [8]. Our study showed that 50% cases were categorised as grade I on cytology, which was similar to the observations of Kareem *et al.* [9]. In contrast, studies by Das *et al.* [10] and Robinson *et al.* [11] reported a predominance of Grade II tumors. The highest concordance was seen in Grade II tumors (69.5%). By comparison, Sood *et al.* [12] observed higher concordance for Grade I tumors.

The overall concordance between cytological and histological grading in our study was 60%. These findings are similar to previously reported concordance rates, as shown in Figure 2.

The maximum discordance in our study was observed in Grade III tumors, consistent with the findings of Pandya *et al*. [13] Rakha *et al*. noted that even on histological assessment, Grade II tumors are frequently reassigned to either Grade I or Grade III due to overlapping morphological features. As Grade II represents an intermediate biological category, inherent difficulty in its accurate classification is expected [14].

Differences between cytological and histological grading may arise from variation in atypia across different tumour regions and subjective interpretation of nuclear features such as margins and chromatin clumping. The two grading methods rely on distinct parameters: cytology emphasises nuclear morphology and cell dissociation, whereas histology assesses tubule formation, mitotic rate, and nuclear pleomorphism. Because tubule formation and mitotic activity cannot be reliably evaluated on cytology, a certain degree of discordance is expected. The greater emphasis placed on nuclear features in cytological grading further contributes to this disparity [15]. This disparity is therefore expected, as the cytological grading system is unable to objectively assess tubule formation and mitotic index, both of which are essential components of histopathological grading [16].

Technical limitations may also lead to misgrading. Smear preparation can cause peripheral accumulation of cell clusters, affecting interpretation. Accurate evaluation of chromatin and nuclear margin irregularities is challenging, and bare nuclei may show artifactual irregularity. Additionally, inadequate sampling in large, heterogeneous tumors increases the likelihood of discordance [17].

Despite these limitations, Robinson's method is a reliable grading method and it plays a significant role in preoperative planning, guides neoadjuvant therapy decisions, and allows assessment of treatment response through repeat aspiration [18].

The statistically significant association observed in our study by Chi-square analysis, along with the moderate positive Spearman correlation, is consistent with the observations of Nagaraju *et al*. [15], who also demonstrated significant cyto-histological correlation using similar statistical methods. These findings further reinforce the reliability of Robinson's cytological grading as a useful preoperative indicator of tumor grade.

Images

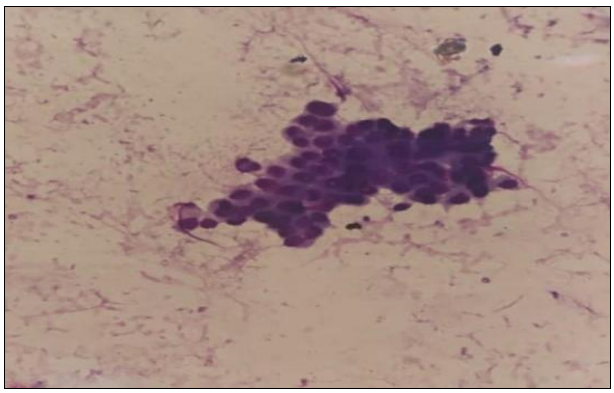

Fig 3: Cell cluster with mild nuclear pleomorphism and granular chromatin, Robinson grade 1 (40X, MGG).

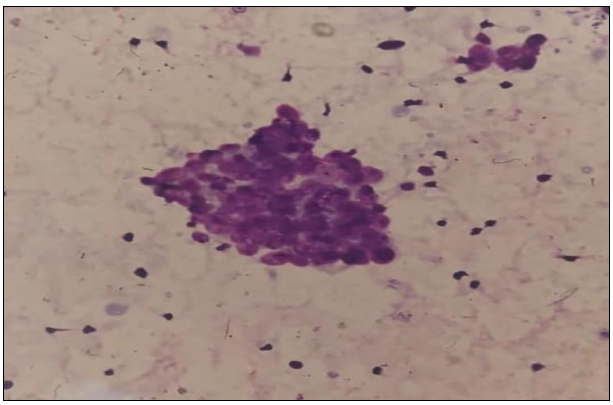

Fig 4: Cell cluster with nuclear pleomorphism, indistinct nucleoli and granular chromatin, Robinson grade 2 (40X, MGG)

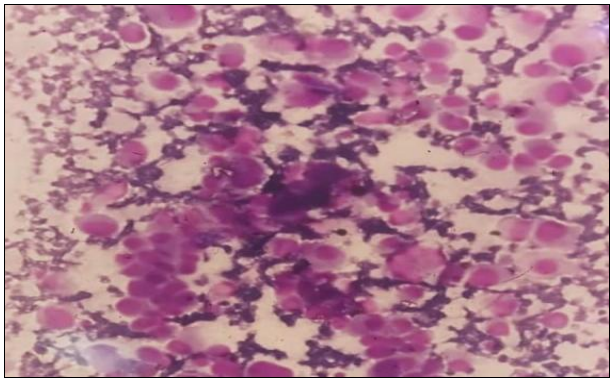

Fig 5: Cells with severe nuclear enlargement and marked pleomorphism, Robinson grade 3 (40X, MGG)

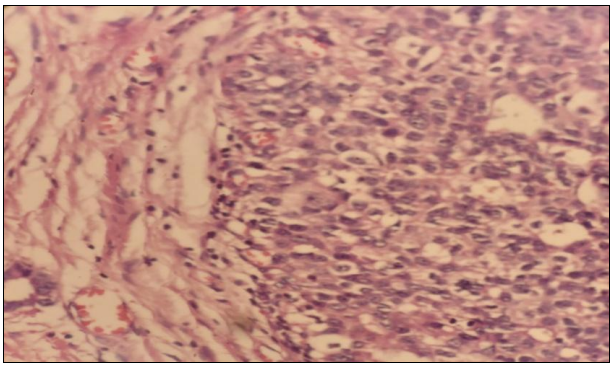

Fig 6: Tubular differentiation and nuclear pleomorphism, Nottingham grade 1 (40X, H&E)

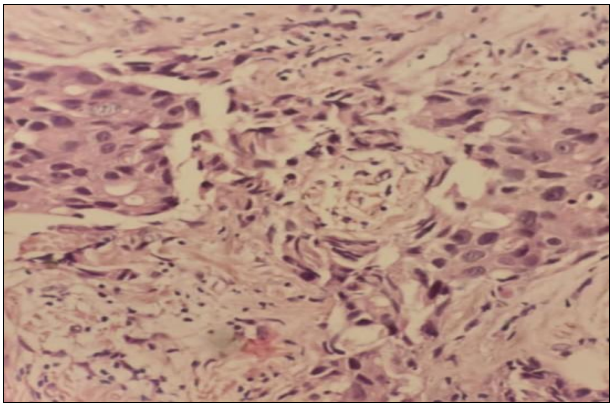

Fig 7: Tubular differentiation, nuclear pleomorphism and mitosis, Nottingham grade 2 (40X, H&E)

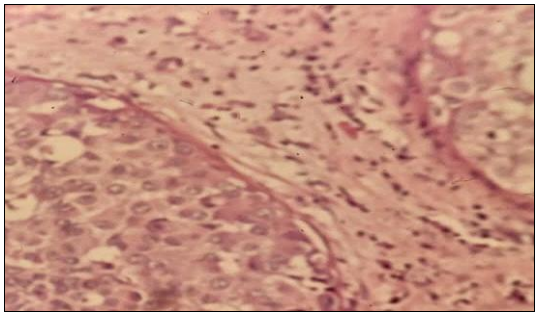

Fig 8: Nuclear pleomorphism and mitosis, Nottingham grade 3 (40X, H&E)

Conclusion

Our study confirms that FNAC combined with cytological grading is a reliable preoperative method for assessing tumour aggressiveness in breast carcinoma. The significant correlation between cytological and histopathological grades highlights its usefulness as a prognostic tool. Routine inclusion of cytological grading in FNAC reports is therefore recommended to guide appropriate neoadjuvant therapeutic decision-making.

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Conflict of interest: There are no conflicts of interest.

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