# Original Article

# Comparative Evaluation of Cytomorphological Robinson's Grading with Elston and Ellis' Nottingham Modified Bloom-Richardson Histopathological Grading of Breast Carcinoma: A Hospital-Based Study of 52 Cases

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***DOI: 10.21276/APALM.3492***

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*Submitted: 24-Dec-2024*
*Final Revision: 09-Mar-2025*
*Acceptance: 07-Apr-2025*
*Publication: 31-May-2025*



## Abstract

**Background:** Breast carcinoma is one of the most common cancers in women. Fine needle aspiration cytology (FNAC) is routinely used as an initial investigation of choice in the rapid diagnosis of breast carcinoma. Among various cytological grading systems, Robinson's grading is most commonly used for breast carcinoma. It provides information about prognosis and also helps in selecting therapy. The aim of this study is to correlate Robinson's cytological grading with Bloom Richardson histological grading.

**Materials and Methods:** In the present study, 52 cases of FNAC smears of breast carcinoma were graded according to the Robinson's cytological grading system. Corresponding histology sections were graded according to the Elston and Ellis' Nottingham modification of the Bloom Richardson method. Correlation between cytological and histological grading was done.

**Results:** The maximum number of cases were in the age group of 41 to 50 years. Cytologically, 53.85% of cases were grade II, 38.46% were grade I, and 7.69% were grade III. Histologically, 50.00%, 44.23%, and 5.77% of cases were grade II, I, and III, respectively. The concordance rate between grade II tumors in cytology and histology was 71%; for grade I tumors, it was 70%; and for grade III tumors, it was 50%. The absolute concordance rate was 69.2%.

**Conclusion:** Cytological grading of breast carcinoma is simple, feasible, and provides valuable prognostic information. The cytological grading method is comparable with the histologic grading system. It might provide information about the aggressiveness of the tumor and is a useful parameter in selecting neoadjuvant chemotherapy for breast carcinoma.

***Keywords:***

*Fine Needle Aspiration Cytology, Breast carcinoma, Bloom Richardson's grading, Robinson's grading*

## Introduction

The incidence of breast cancer is rising in India and is now the second most common cancer diagnosed in women after cervical cancer [1]. In developing nations, it is the leading cause of cancer-related mortality among women [2]. After lung cancer, it is the

second leading cause of cancer-related fatalities in developed countries [2]. Numerous factors, such as tumor type, hormone receptor status, DNA ploidy, cell proliferation indicators, and the presence of distinct oncogenes, affect the prognosis of breast cancer [3]. These days, due to evolving treatment techniques for breast cancer, such as preoperative neoadjuvant chemotherapy, attempts are being made to grade breast cancer on fine needle aspiration material. The cytologic grade may reveal details about the tumor's biological behaviour and aggressiveness, as well as the likelihood of lymph node metastasis [4]. Cytological grading of breast cancer can be used to assess the tumor in situ prior to surgery, assisting clinicians in choosing the best course of action and preventing the morbidity that comes with overtreating low-grade tumors [5].

The Nottingham technique, also known as Elston and Ellis' modified Bloom and Richardson method, is a commonly used tumor grading system for breast cancer histologically. It has been shown to have strong prognostic connections [6]. For the initial assessment and diagnosis of palpable breast masses, FNAB is a trustworthy technique. Furthermore, it can provide the prognostic and predictive information that is required, especially for individuals who might get neoadjuvant therapy [7]. The grading of breast cancer on fine needle aspiration helps in understanding the biology of the disease, to predict the outcome, select the appropriate treatment modality, explain variations in treatment outcome, plan specific therapeutic interventions, and occasionally alleviate patient anxiety. Robinson’s cytological grading method shows a good correlation and substantial Kappa value of agreement with the histological grading due to the multifactorial nature of the system, objective set of criteria, and easy reproducibility [6].

The aim is to grade FNAC smears of breast carcinoma according to the Robinson’s cytological grading method and to correlate cytological grading with Nottingham’s Modified Bloom-Richardson’s histological grading.

## Materials and Methods

This is a hospital-based cross-sectional study comprising a total of 52 cases from August 2023 to July 2024, conducted in the Department of Pathology, Gauhati Medical College and Hospital, Assam. Ethical approval was taken from the institutional ethical committee. Written informed consent was taken from all the patients. All female patients with a breast lump diagnosed as carcinoma on cytology were included in the study. Cases of carcinoma of the breast who had received chemotherapy or radiotherapy, patients who did not have histological confirmation, and patients who underwent lumpectomy alone were excluded from the study. Lumpectomy cases were excluded to ensure consistency in histological grading. Patients presenting with a breast lump suspected of having carcinoma were sent for fine needle aspiration cytology to the Department of Pathology. Under all aseptic measures, fine needle aspiration was done after explaining the procedure and obtaining written consent. FNA was performed using a 10 ml disposable syringe and a 22–23-gauge needle. FNA smears were stained with May Grunwald-Giemsa (MGG) stain and Papanicolaou (PAP) stain. FNA smears were evaluated for cytological grading according to Robinson’s grading system. Tissue sections of these patients obtained from mastectomy specimens were processed and stained with H&E stain and evaluated for grading according to Elston and Ellis’ Nottingham modified Bloom-Richardson histological grading. A comparison was done between these two grading systems.

Reporting of the Smears: Six parameters—cell dissociation, uniformity, size, nucleoli, nuclear boundary, and chromatin pattern—were taken into consideration while evaluating the smear using Robinson’s cytological grading scheme.

Statistical Analysis: A comparison was done between these two grading systems using kappa statistics to measure the strength of agreement between grades, and concordance rates were calculated between each grade separately.

***Table 1: Robinson's cytological grading system***

| Variables | Score 1 | Score 2 | Score 3 |
|---|---|---|---|
| **Cell dissociation** | Mostly in clusters | Single cells, with cell clusters | Mostly in singles |
| **Nuclear size** | 1-2 times the size | 3-4 times the size of RBCs | >5 times the size of RBCs |
| **Cell uniformity** | Monomorphic | Mildly pleomorphic | Highly pleomorphic |
| **Nucleoli** | Indistinct/small | Noticeable | Prominent/abnormal |
| **Nuclear margin** | Smooth | Slightly irregular/folds/groove | Buds and clefts |
| **Chromatin pattern** | Vesicular | Granular | Clumping and clearing |
| **Grade I: Score 6-11; Grade II: Score 12-14; Grade III: Score 15 -18** | | | |

***Table 2: Modified Bloom Richardson's histologic grading***

| Variables | Score 1 | Score 2 | Score 3 |
|---|---|---|---|
| **Tubule formation** | >75% of tumor shows tubule | 10-75% of tumor shows tubule | <10% of tumor shows tubule |
| **Nuclear pleomorphism** | Small regular nuclei; similar to normal ductal epithelium | Intermediate size;1.5 - 2 times size of normal ductal nuclei | High grade nuclei variation;>twice size of normal ductal nuclei |
| **Mitotic count** | 0-7 mitosis/10 HPF | 8-14 mitosis/HPF | >15 mitosis/HPF |
| **Total Score: Grade I: Score 3-5 (well differentiated); Grade II: Score 6-7(Moderately differentiated); Grade III: Score 8-9 (poorly differentiated)** | | | |

## Results

Total number of 52 cases were studied, where the maximum number of cases were in the age group (41–50) years [26.92%]. In this study, according to cytological Robinson's grading, the majority of the cases belonged to grade II with 28 (53.85%) cases, followed by grade I with 20 (38.46%) cases, and grade III with 4 (7.69%) cases. According to modified Bloom-Richardson histologic grading, the maximum cases were in grade II with 26 (50%) cases, followed by grade I with 23 (44.23%) cases, and grade III with 3 (5.77%) cases. Comparison between both grading systems was shown in Table 3.

In this study, the concordance rate between cytology and histology was highest in grade II tumors [71% (28 cases)]; grade I tumors had a rate of 70% (20 cases), and grade III tumors had a rate of 50% (4 cases). The absolute concordance rate was 69.2%.

Strength of agreement between cytological and histologic grades by statistical analysis was done using kappa statistics (Table 4). Grade I and II tumors had kappa values of 0.63 and 0.71, indicating substantial agreement between cytological and histological grading systems. Grade III tumors had a kappa value of 0.45, indicating moderate agreement between cytological and histological grading systems. A total of 46 (88.46%) cases showed concordance between cytology, and the remaining 6 (11.54%) cases showed discrepancy. The degree of concordance between the two grading schemes is therefore regarded as fair, and cytological grading can be used to assess tumor behaviour and prognosis.

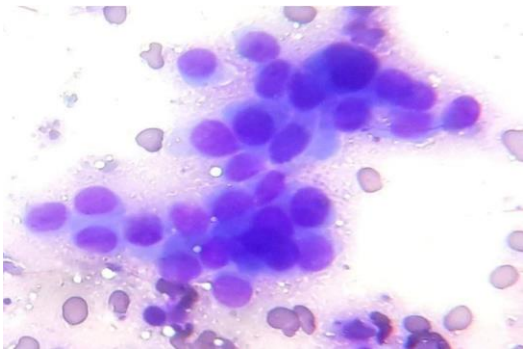

***Figure 1: Photomicrograph of Cytological Grade 1 Carcinoma: (a) Neoplastic cells arranged mostly in clusters and cell size is 1-2 x RBC size. Nucleoli are indisctinct. Nuclear membranes are mostly smooth; Pleomorphism is absent/minimal((MGG,40X)***

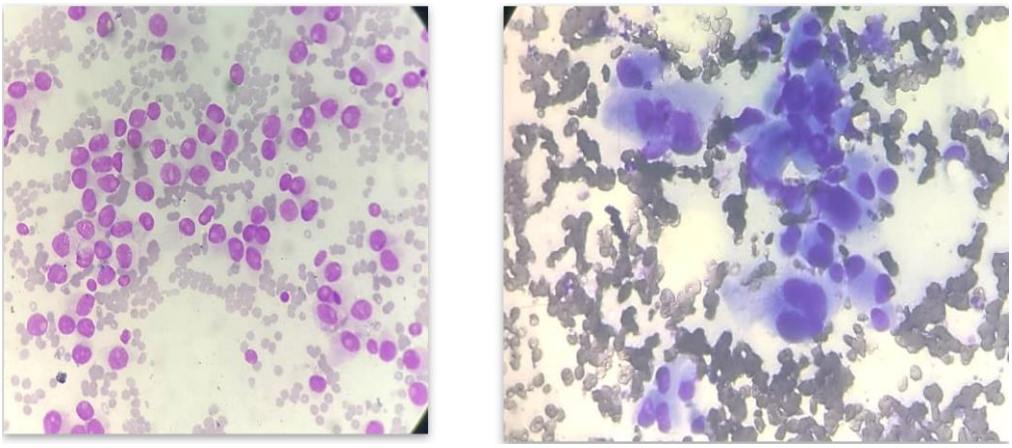

***Figure 2: Photomicrographs: Grade 3 Carcinoma (a) Predominantly dispersed pleomorphic cells with prominent nucleoli [MGG,4x]. (b) Large pleomorphic cells ≥5 xRBC size; hyperchromatic nuclei with irregular margins showing buds and clefts. [MGG, 40x]***

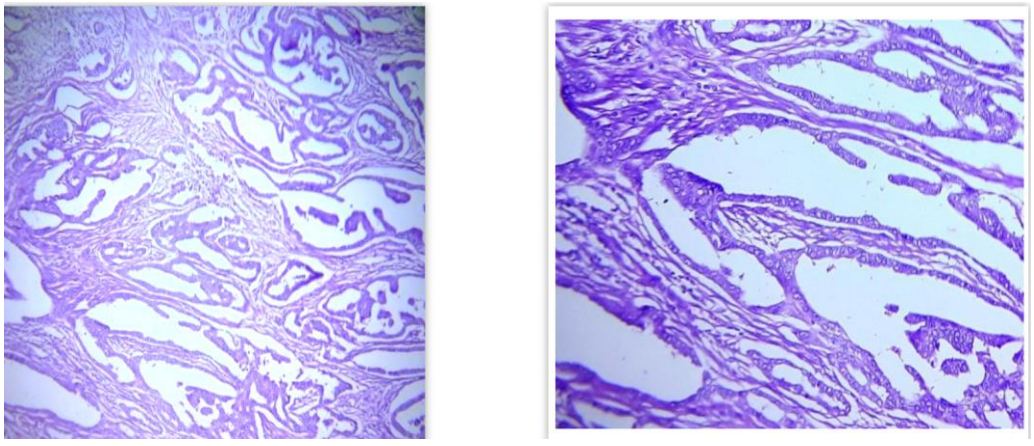

***Figure 3: Photomicrographs of Histological Grade 1 Breast Carcinoma (a) Neoplastic cells forming tubules in >75% of the tumour. [H&E, 4x] (b) Cells are small, with minimal nuclear pleomorphism. [H&E,40x]***

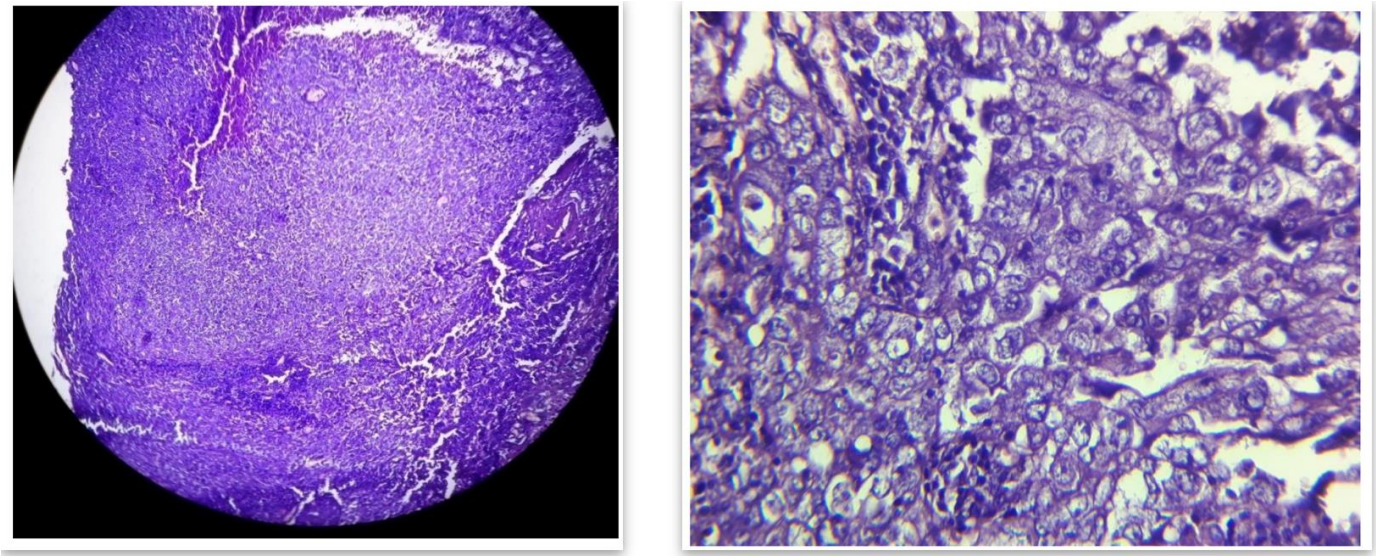

***Figure 4: Photomicrographs of Histological Grade 3 Breast Carcinoma (a) Closely packed neoplastic cells arranged in sheets. Tubular arrangement was seen in <10% of the tumour. [ H&E,4x] (b) Large neoplastic cells with marked nuclear pleomorphism [H&E, 40x]***

***Table 3: Comparison between Cytological and Histological grade***

| Cytological grade | Total cases | Histological grade | | | Concordance rate |
|---|---|---|---|---|---|
| | | Grade I | Grade II | Grade III | |
| I | 20 | 14 | 05 | 01 | 14/20*100= 70% |
| II | 28 | 08 | 20 | 00 | 20/28*100=71% |
| III | 04 | 01 | 01 | 02 | 02/4*100=50% |
| Total cases | 52 | 23 | 26 | 03 | Absolute concordance is 69.2% |

***Table 4: Agreement between cytological and histologic grades by statistical analysis (kappa statistics)***

| Grade | No. of case diagnosed in cytology | No. of case diagnosed in histology | Kappa value (95% CI) for concordance | Strength of agreement |
|---|---|---|---|---|
| **I** | 20 | 23 | 0.63 (0.4436 – 0.8206) | Substantial |
| **II** | 28 | 26 | 0.71 (0.5507 – 0.8746) | Substantial |
| **III** | 04 | 03 | 0.45 (0.0726 – 0.829) | Moderate |

## Discussion

One of the leading causes of death for middle-aged women in many developed nations is breast cancer, which is also growing more common in developing countries. After cervical cancer, breast cancer is the second most common malignancy among women in India [8]. It is feasible and reproducible to do cytological grading on breast cancer. Before surgery, its use in conjunction with mammography can yield crucial information on the type, grade, and size of the tumor, allowing the best possible treatment plan to be chosen [9]. When evaluating the prognosis of breast cancer aspirates, cytological grading is a valuable tool. Accurately identifying benign and malignant breast tumors is crucial for future treatment plans and for directing surgeons in the kind of

operation they should perform [9]. The three primary goals of research on breast cancer are to accurately diagnose and stage the disease, identify breast cancer at an early stage, and predict the prognosis [6]. Unless there is a discrepancy between cytology and clinical and/or mammographic evaluation, definitive treatment is frequently predicated on cytological diagnosis without histological confirmation [10].

In the present study, the maximum number of cases were in the age group (41–50) years, comprising 26.92%, which was consistent with Ahuja S et al. [2], Khadka et al. [11], Jivani et al. [12], Devi PU et al. [13], and Sood et al. [14].

In the present study, the majority of the cases belonged to grade II (53.85%) with 28 cases, followed by grade I (38.46%) with 20 cases, and grade III (7.69%) with 4 cases, which was similar to studies by Jivani T et al. [12] (2024), Pandya A et al. [6] (2012), Wani et al. [15], Dash et al. [16], and Robles et al. [17].

In terms of CG and HG concordance, the current study found that grade II had the highest concordance with 71%, grade I had 70% concordance, and grade III had 50% concordance. The absolute concordance rate was 69.2%, and a predominance of grade II tumors was observed. The original study by Robinson et al. found only 57% concordance, but previous studies were consistent with our study: 74.57% by Pandya et al. [6], 64% by Lingegowda et al. [18], 80.76% by Das et al. [19], 65% by Chhabra et al. [20], 77.19% by Saha et al. [21], Rekha TS et al. [22], and Wani et al. [15]. However, Sood et al., in his study, found that the highest concordance was in grade I tumors (75%) and the lowest in grade III tumors [14]. An additional benefit of this approach, according to Dalton et al. [23], is that the analysis of the other components lessens the impact of individual variation in the evaluation of a single component of Robinson's grade.

Highest discordance was observed in grade III, followed by grade I and grade II tumors, between cytology and histology—similar to the study by Pandya et al. [6]. Discordance may be due to subjectivity when assessing cytological features that are not included in histological grading, such as difficulty in detection of mitosis and tubule formation in cytology of breast carcinoma, while nuclear feature has contributed more to cytologic grade. The key components of histological grading systems are the degree of nuclear pleomorphism, the number of mitotic figures, and the extent of tubule formation; however, some characteristics that are included in cytological grading, such as nuclear margin, chromatin pattern, and nucleoli, are not very significant in histopathological grading. Because preoperative neoadjuvant chemotherapy is increasingly being used to treat breast cancer, cytological grading prior to surgery is crucial as it aids in the selection of the best treatment plan [14].

The kappa statistics was done to measure the strength of agreement between grades. Kappa value of grade I, grade II, and grade III tumors was 0.63, 0.71, and 0.45 respectively, which indicate substantial agreement between grade I and II—similar to studies by Pandya et al. [6] and Landis et al. [24].

Limitation: The study was conducted in a single tertiary centre with a small sample size of 52 cases. More studies with larger sample sizes would have been beneficial for more specific results.

## Conclusion

Carcinoma of the breast is a major entity of the global cancer burden. One of its most preliminary investigations, FNAC, is a reliable, cost-effective, quick, and minimally invasive method of diagnosing breast carcinoma. Cytological grading of breast carcinoma is simple, feasible, and provides valuable prognostic information [1]. The study shows a significant correlation between the cytologic grade and histologic grade. Cytological grade can predict tumor aggressiveness, identifying fast-growing tumors (grade III), which are more likely to respond to chemotherapy than the lower grades. It was concluded that cytological grading

should be included in all FNAC reports, so that appropriate decisions regarding preoperative neoadjuvant chemotherapy can be made and overtreatment of low-grade cancers can be avoided.

***Acknowledgements: We would like to extend our sincere gratitude to Dr. Manjula Choudhury, Head of Department, and the technical staff of the sections of Cytology and Histopathology, Department of Pathology, Gauhati Medical College and Hospital, without whom the study would not have been possible.***

***Funding: None***

***Competing Interests: None***

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