Cytological Grading of Breast Carcinoma and its Correlation with Histological Grading

Dinesh Khadka*, Smriti Karki, Meenu Agrawal, and Rajat Agrawal

ABSTRACT

Background: Breast carcinoma is the most common malignant tumor and the leading cause of carcinoma death in women. Since the easiest way of diagnosing breast carcinoma is Fine Needle Aspiration Cytology (FNAC), it is important to perform grading of the malignancy on aspirates obtained as it will provide valuable information for further management.

Materials and Methods: It is a hospital-based prospective study conducted in the Department of Pathology (Cytopathology and Histopathology) at B.P. Koirala Institute of Health Sciences, Dharan, Nepal for one year, including forty-five (45) cases.

Results: Most patients were in the age group 41–50 years. The most common type of carcinoma detected was an Infiltrating ductal carcinoma followed by Infiltrating lobular carcinoma. The correlation between cytopathology and histopathology findings was evaluated by utilizing the Simplified Black grading Modified Black grading, Hunt's grading, and Nottingham Modification of Scarff-Bloom-Richardson grading system all of then showed more than 80% concordance rate.

Conclusion: Grading of breast malignancy obtained from Fine Needle Aspiration Cytology smears is easy to perform and has a high concordance rate with histological grading.

Keywords: Breast carcinoma, FNAC, Tumor grading system.

1. Introduction

Breast carcinoma is the most common malignant tumor and the leading cause of carcinoma death in women [1]. Evaluation of prognostic factors like tumor histological grade, cell proliferation index, hormone receptor status, and lymph node status is paramount.

The assignment of a histological grade has been recommended as a standard in all surgical pathology reports [2]. Fine Needle Aspiration Cytology is simple, easy, and rapid and permits reasonably definitive diagnosis in an Outpatient department setup.

Cytological tumor grading has shown a positive correlation with histological grade. Hence, it has been suggested that this fundamental cytological parameter should be included in the Fine Needle Aspiration Cytology report whenever possible [3].

The cytological grading of breast carcinoma is of mainly two types:

1. Architectural grading: Robinson, Mouriquand and Howell

2. Nuclear grading: Modified Black Simplified Black, Hunt, and Moroz

There have been a handful of research in the international arena correlating cytological grading of the malignant breast findings with that of final histological grading. However, there has not been a single study regarding the same among the Nepalese population. Since breast carcinoma has its own unique set of epidemiological characteristics the cytology and histology grading of breast carcinoma for its prognostic evaluation and management in the Nepalese population holds significant importance.

2. Materials and Methods

It is a hospital-based study conducted in the Department of Pathology (Cytopathology and Histopathology) B.P. Koirala Institute of Health Sciences, Dharan, Nepal for one year.
FNAC was performed on the suspected breast lump by the pathologist or interventional radiologist and alcohol-fixed and air-dried smears were prepared. The cases diagnosed based on cytomorphologic features (Fig. 1) as breast carcinoma were included in the study. The wet-fixed Papanicolaou stain was used for the assessment of nuclear features. Cytological grading of breast carcinoma was done according to the Modified Black grading system, Hunt’s cytological grading system, and Simplified Black grading system.

All the mastectomy specimens with prior cytological diagnosis of breast carcinoma received during this period were included in the study. Specimens were received in 10% formalin; gross findings were analyzed in detail for parameters like size, external surface, resected margins, and nature of the lump. Paraffin-embedded sections were prepared followed by routine Hematoxylin and Eosin (H & E) staining. Histology features were evaluated, and cases diagnosed as breast carcinoma (Fig. 2) and its subtypes were included in this study.

Relevant clinical information about the patient such as age, and clinical presentation, was obtained from case sheets.

Histological grading was done on corresponding mastectomy specimens using the Nottingham Modification of Scarff-Bloom-Richardson grading system. The obtained data was entered in Microsoft Excel and results were obtained. Ethical clearance was taken from the Review Committee of the Institute.

3. RESULTS

A total of 45 carcinoma breasts were included in the study. Patient age in the study population ranged from 27 to 67 years. Most of the patients were in the age group of 41–50 years with slight predominance on the right side (55%) in comparison to the left side (45%) of the breast.

The carcinoma breast diagnosed based on histological types is grouped in Table I. The most common carcinoma breast was Infiltrating ductal carcinoma (n = 42; 93%) followed by Infiltrating lobular carcinoma (n = 2; 5%) and one case of Mixed carcinoma (n = 1; 2%).

In this study, Modified Black grading, Hunt’s grading, and Simplified Black grading were used as cytological grading systems and were compared with Nottingham’s Modification of the Scarff-Bloom-Richardson grading system.

In our study, this system of grading did reasonably well with an accuracy of 86%, (K = 0.722, p = 0.001; Table II), comparable to the results of Adriana [4], (K = 0.358, p = 0.003) and Zoppi et al., (70.37%) [5], Kalgeraki et al., (93.33%) [6]. A similar observation was also seen in the study by Adriana [4] where this system scored over other grading systems.

In correlation with the Nottingham Modification of Scarff-Bloom-Richardson grading system (2 Tier) (Table III), there was concordance of 24 (77.4%) cases in low grade and 14 (100%) cases in high grade. The total percentage of agreement was 84.44%. The correlation was statistically significant. (K = 0.681, p = 0.001).

We found the greatest correlation with the Simplified Black grading system (accuracy = 93%, K = 0.835, p = 0.001). These findings coincide with the study done by Vissa et al. [7].

4. DISCUSSION

Breast carcinoma is the most common malignant tumor and the leading cause of carcinoma death in women [1].

The value of histological grading of breast carcinoma is well established [8]. Since diagnosis of breast carcinoma is
Cytological Grading of Breast Carcinoma and its Correlation with Histological Grading

Khadka et al.

Fig. 2. Histology of carcinoma breast H&E section (400X).

TABLE I: THE CARCINOMA BREAST, DIAGNOSED BASED ON HISTOLOGICAL TYPES

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Number of cases</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infiltrating ductal carcinoma</td>
<td>42</td>
<td>93.33</td>
</tr>
<tr>
<td>Infiltrating lobular carcinoma</td>
<td>02</td>
<td>4.44</td>
</tr>
<tr>
<td>Mixed carcinoma</td>
<td>01</td>
<td>2.22</td>
</tr>
</tbody>
</table>

TABLE II: CORRELATION BETWEEN MODIFIED BLACK GRADING AND NOTTINGHAM MODIFICATION OF SCARFF-BLOOM-RICHARDSON GRADING SYSTEM

<table>
<thead>
<tr>
<th>Scarff bloom richardson grading</th>
<th>Modified black grading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade I</td>
<td>Grade II</td>
</tr>
<tr>
<td>Nuclear grade I</td>
<td>6 (100%)</td>
</tr>
<tr>
<td>Nuclear grade II</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Nuclear grade III</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Total</td>
<td>6 (100%)</td>
</tr>
</tbody>
</table>

Nottingham modification

<table>
<thead>
<tr>
<th>Measurement of agreement kappa</th>
<th>Asymp. Std errora</th>
<th>Approx. Tb</th>
<th>Approx. Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.722</td>
<td>0.015</td>
<td>6.582</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: a: Not assuming the null hypothesis; b: Using the asymptotic standard error assuming the null hypothesis; and Percentage of agreement: 86.66%.

TABLE III: CORRELATION BETWEEN HUNT’S CYTOLOGICAL GRADING AND NOTTINGHAM MODIFICATION OF SCARFF-BLOOM-RICHARDSON GRADING SYSTEM (2 Tier)

<table>
<thead>
<tr>
<th>Scarff bloom richardson grading (2Tier)</th>
<th>Hunt’s cytological grading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low grade</td>
<td>High grade</td>
</tr>
<tr>
<td>Low grade</td>
<td>24 (77.4%)</td>
</tr>
<tr>
<td>High grade</td>
<td>7 (22.6%)</td>
</tr>
<tr>
<td>Total</td>
<td>31(100%)</td>
</tr>
</tbody>
</table>

Nottingham modification

<table>
<thead>
<tr>
<th>Measurement of agreement kappa</th>
<th>Asymp. Std errora</th>
<th>Approx. Tb</th>
<th>Approx. Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.681</td>
<td>0.105</td>
<td>4.819</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: a: Not assuming the null hypothesis; b: Using the asymptotic standard error assuming the null hypothesis; Percentage of agreement: 84.44%.
often made by FNAC, it is important to perform grading on aspirates which will provide valuable information to the treating oncologist to plan the management [9]. Fine Needle Aspiration Cytology is a simple, cost-effective highly accurate procedure in the initial evaluation of breast lumps.

In this study, we have used Modified Black grading, Hunt's grading, and Simplified Black grading as cytological grading systems [10].

These three different cytological grading systems were compared with the Nottingham Modification of the Scarff-Bloom-Richardson grading system.

4.1. Simple Black System of Grading

Ohri et al. [10] found the agreement between Simplified Black grading and Nottingham Modification of Scarff-Bloom-Richardson grading system as 95% and 78% respectively.

Dabbs [11] found the concurrence of nuclear grade assignment as 95% when he used the Simplified Black grading system for both aspirates and tissue specimens whereas Cajulis et al. [12] found agreement as 80%–90% when they used the Simplified Black grading system for cytological grading and compared to the original histological grading.

We found the greatest correlation with the Simplified Black grading System (Table IV) which coincides with the study done by Vissa et al. [7] whose study found a greater degree of correlation between the Simplified Black Grading system and Nottingham Modification of Scarff-Bloom-Richardson grading system.

There is a well-defined set of criteria within this system namely nuclear uniformity versus anisonucleosis, fine versus clumped chromatin, absence or presence of prominent nucleoli, specified amount of mitosis per 10 HPF, and nuclear size (x size of RBC or lymphocyte) which is responsible for its objectivity.

4.2. Modified Black System of Grading

In our study, this system of grading did reasonably well with an accuracy of 86%, (K = 0.722, p = 0.001; Table I), comparable to the results of Adriana [4] (K = 0.358, p = 0.003) and Zoppi et al. [3] (70.37%). Kalgeraki et al. [6] obtained better agreement (93.33%) in their study.

Mitosis is an important parameter considered in this system of high-grade tumors which correlates with the Nottingham Modification of the Scarff-Bloom-Richardson system. This observation was also seen in the study by Adriana [4] where this system scored over other systems of grading.

In a study by Cajulis et al. comparing the Modified Black and Simplified Black systems, the three-tier system of grading had lesser reproducibility than the Simplified Black System. In our study, we found it easier, to assign grading in two-tier than three-tier as the middle zone and not clearly described. As ours is a different study design we could not prove this statistically.

There has been a variation of 86% in the association between Modified Black grading and Nottingham Modification of Scarff-Bloom-Richardson grading system in our study.

Mossler et al. [13] found the correlation between the Modified Black grading system and the Nottingham Modification of Scarff-Bloom-Richardson grading as 87% which very much coincides with our observation of 86%.

While grading by the Modified Black system the judgment of mitotic activity is impaired by several problems e.g., poor quality of the slides with fixation artifacts, properties of the tumor such as necrosis, or severe inflammation.

4.3. Hunt System of Grading

In our study, The Hunt System of Grading had an accuracy of 84%. This grading system depends on limited criteria i.e., The characteristics of nucleoli are neglected and only the presence or absence of nucleoli is taken for scoring.

Hunt et al. [14] found the association between Hunt’s cytological grading and Nottingham Modification of Scarff-Bloom-Richardson grading system as 66% and de Graaf et al. [15] found the correlation between these two grading systems as 67% with a higher concordance than our observation of 84% (Table III).

5. Conclusion

Grading of Fine Needle Aspiration Cytology smears is easily performed and has a high concordance rate with histological grading. The correlation was found to be statistically highly significant (p < 0.001). The correlation
was found as Simplified Black grading (93%) followed by Modified Black grading (86%) and Hunt’s grading (84%) when compared with Nottingham Modification of Scarff-Bloom-Richardson grading system. This study found the Simplified Black grading system as a simple grading tool with a greater degree of correlation than the three grading systems.

ACKNOWLEDGMENT

We would like to thank the staff of the Department of Pathology, Record section, and the Management Committee of BPKIHS, Dharan, Nepal.

CONFLICT OF INTERESTS

There are no conflicts of interest.

REFERENCES