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Redefining Prognosis in Oral Squamous Cell Carcinoma: A Descriptive study on the Clinical Application of the Brandwein - Gensler Risk Model

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Introduction

Oral squamous cell carcinoma (OSCC) is the most common malignancy of the oral cavity, accounting for nearly 80–90% of all oral cancers worldwide[1]. The incidence of oral cancer varies geographically and ranks among the most common cancers globally. OSCC predominantly affects middle-aged and elderly males due to higher exposure to risk factors such as tobacco, alcohol, and betel nut chewing[2, 3].

In developing countries like India, oral cancer is strongly associated with smokeless tobacco and betel quid use. These carcinogenic exposures can lead to potentially malignant disorders such as leukoplakia and oral submucous fibrosis, which may transform into carcinoma[4, 5].

Traditional prognostic evaluation relies on TNM staging and histological grading. However, these parameters may not fully predict tumor behavior. Histological risk models such as the Brandwein-Gensler risk assessment model evaluate tumor pattern of invasion, lymphocytic host response, and perineural invasion to improve prognostic accuracy[6, 7].

This study evaluates oral squamous cell carcinoma cases using the Brandwein-Gensler risk assessment model and categorizes them into low-, intermediate-, and high-risk groups.

Keywords: Alcohol, OSCC, Tobacco, Tumor.

Aims and Objectives

Aim

To categorize oral squamous cell carcinoma based on the Brandwein-Gensler histopathological risk assessment model

Objectives

1. To evaluate histopathological features of oral squamous cell carcinoma.
2. To assess pattern of invasion, lymphohistiocytic response, and perineural invasion.
3. To classify tumors into low-, intermediate-, and high-risk categories.
4. To compare findings with previously published studies.

Materials and Methods

This descriptive observational study was conducted in the Department of Pathology, SMS Medical College and Attached Hospitals, Jaipur.

Study sample included 100 histopathologically confirmed cases of oral squamous cell carcinoma.

Inclusion criteria:

- Histologically confirmed OSCC cases Adequate biopsy or resection specimens

Exclusion criteria

- Inadequate tissue samples
- Previously treated cases

Histopathological evaluation was performed using Hematoxylin and Eosin stained sections. Parameters assessed according to the Brandwein-Gensler risk model included pattern of invasion, perineural invasion, and lymphohistiocytic host response.

Based on cumulative scores, tumors were categorized into low-risk, intermediate-risk, and high-risk groups.

Results

A total of 100 cases of oral squamous cell carcinoma were analyzed.

- Male preponderance was found in our study.
- The most common age group in our study was 31-40 years, followed closely by the 51-60 and 41-50 years age groups. Mean age was 47.63 years for our study population.
- In the present study, most common procedure performed is mandibulectomy followed by glossectomy and excision biopsies. Miscellaneous procedures comprise of gingivobuccal sulcus resection and neck dissection with oral excisions.
- The most common site of biopsy was buccal mucosa followed by tongue, gingivobuccal sulcus, lip and palate.
- Lymphovascular invasion was seen in 23% of the cases.
- Perineural invasion was seen in 22% of the cases.
- 51% of the cases had Type 4 worst pattern of invasion with a score of +1.
- Non-aggressive worst pattern of invasion i.e. Type 1 to Type 3 was seen in 49% of the cases
- Type 1 lymphohistiocytic host response with complete dense rimming was seen in 61% of the cases.
- On applying the Brandwein–Gensler risk score model on individual cases, 52% of the cases fell in the intermediate risk category with a Brandwein–Gensler risk score of 1-2.
- 24% of the cases fell in low risk category with a score of 0.
- 24% of the cases fell in high risk category with a score of 3-9.

- Low risk category cases were characterized by non-aggressive worst pattern of invasion, no perineural invasion and complete dense lymphohistiocytic host response.
- High risk category cases were characterized by aggressive worst pattern of invasion, perineural invasion and little to no lymphohistiocytic host response.
- Intermediate risk category cases were characterized by Type 1 to 4 worst pattern of invasion/ Type 1 to 2 perineural invasion/ Type 1 to 2 lymphohistiocytic host response.
- We also concluded that this scoring system is an important model in enhancing reproducibility and objectivity in risk assessment and critical consideration in guiding the treatment protocol in cases of oral squamous cell carcinoma.

Table 1: Gender distribution of cases of OSCC in the present study

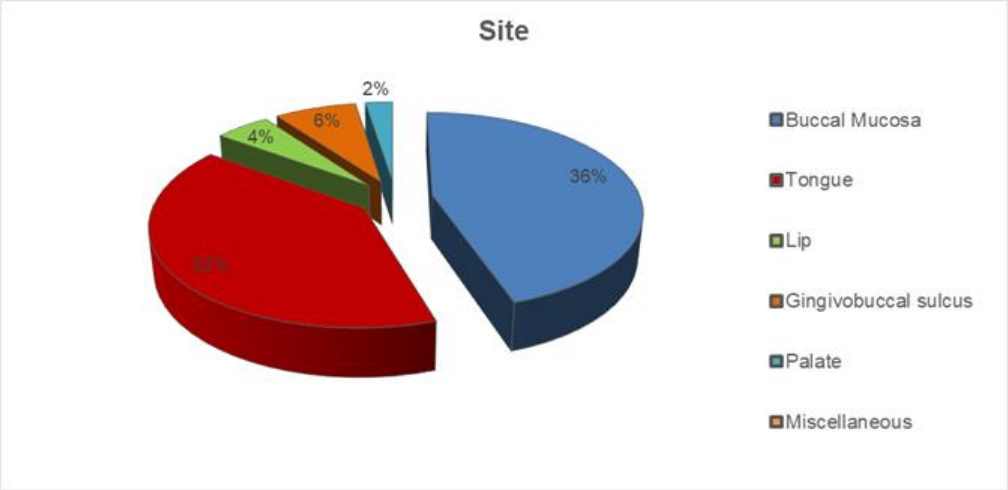
Sex	Number of Patients	Percentage
Male	87	87%
Female	13	13%

Table 2: Distribution according to age groups in the present study

Age Group	No. of Patients	Percentage
0-10	0	0%
11-20	0	0%
21-30	3	3%
31-40	36	36%
41-50	21	21%
51-60	25	25%
61-70	11	11%
71-80	4	4%
81-90	0	0%

Table 3: Site of tumors in the present study

Site	No. of patients	Percentage
Buccal Mucosa	36	36%
Tongue	32	32%
Lip	4	4%
Gingivobuccal sulcus	6	6%
Palate	2	2%
Miscellaneous	20	20%



Graph 1: Site of tumors in the present study

Table 4: Histologic grade of tumors in the present study

Histologic grade	No. of tumors	Percentage
Grade 1: Well differentiated	62	62%
Grade 2: Moderately differentiated	34	34%
Grade 3: Poorly differentiated	4	4%

Table 5: LVI in cases included in the present study

Lymphovascular invasion	No. of cases	Percentage
Identified	23	23%
Not identified	77	77%

Table 6: PNI in cases included in the present study

Perineural invasion	Score	No. of cases	Percentage
Type 1 - None	0	78	78%
Type 2 – Small nerves	+1	20	20%
Type 3 – Large nerves	+3	2	2%

Table 7: WPOI in cases included in the present study

WPOI	Score	No. of cases	Percentage
Type 1	0	15	15%
Type 2	0	14	14%
Type 3	0	20	20%
Type 4	+1	51	51%
Type 5	+3	14	14%

Table 8: LHR in cases included in the present study

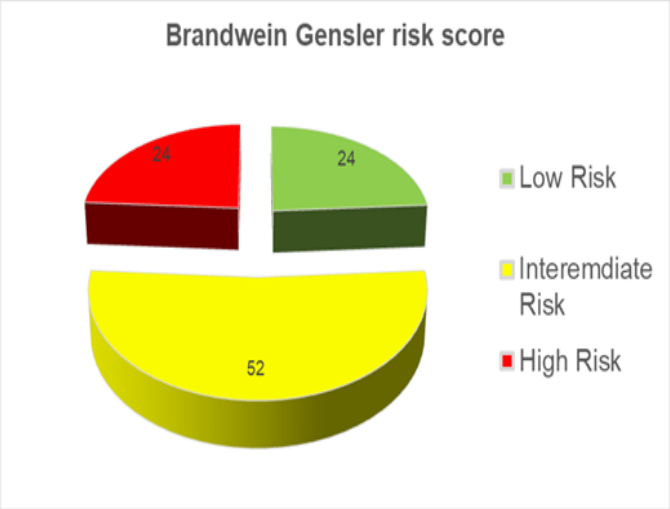
LHR	Score	No. of cases	Percentage
Type 1	0	61	61%
Type 2	+1	36	36%
Type 3	+3	3	3%

Table 9: Brandwein Gensler risk scoring of the cases included in the present study

Brandwein Gensler Risk Score	No. of cases
0	24
1-2	52
3-9	24

Table 10: Risk stratification of the cases according to the Brandwein Gensler Risk Scoring in the present study

Brandwein Gensler Risk Score	Risk category	No. of cases	percentage
0	Low risk	24	24%
1-2	Intermediate risk	52	52%
3-9	High risk	24	24%



Graph 2: Risk stratification of the cases according to the Brandwein Gensler Risk Scoring in the present study

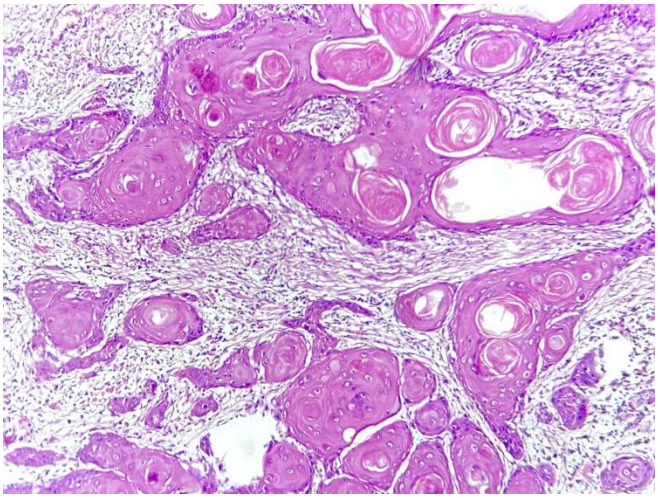


Figure 1: Photomicrograph showing malignant squamous epithelial cells forming keratin pearls (H&E stain).

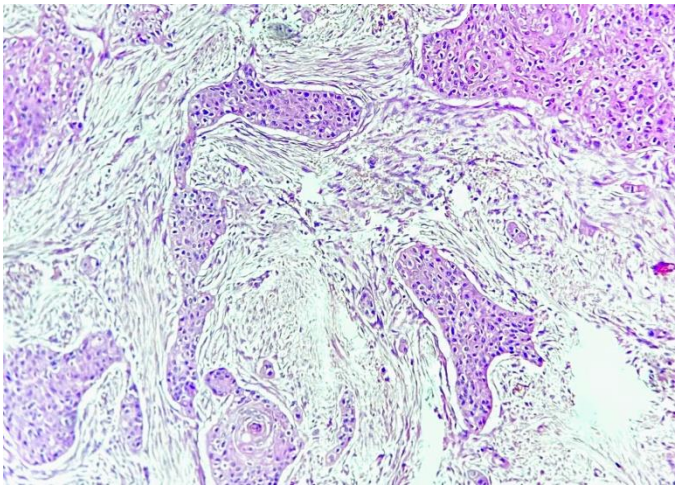


Figure 2: Pattern of invasion showing irregular tumor islands infiltrating connective tissue.

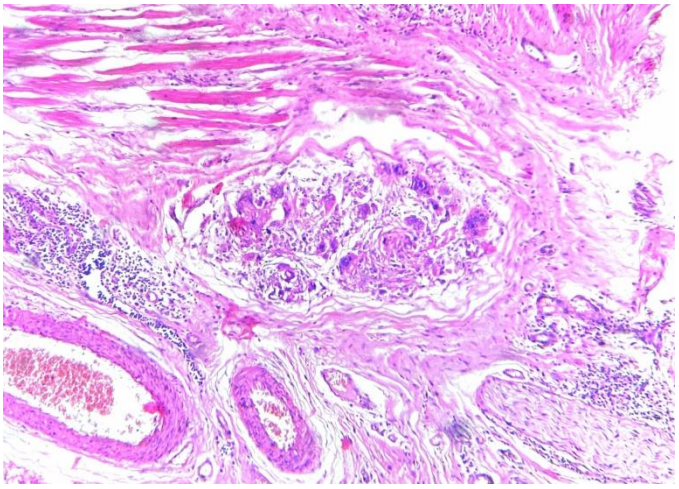


Figure 3: Perineural invasion with tumor cells surrounding nerve fibers.

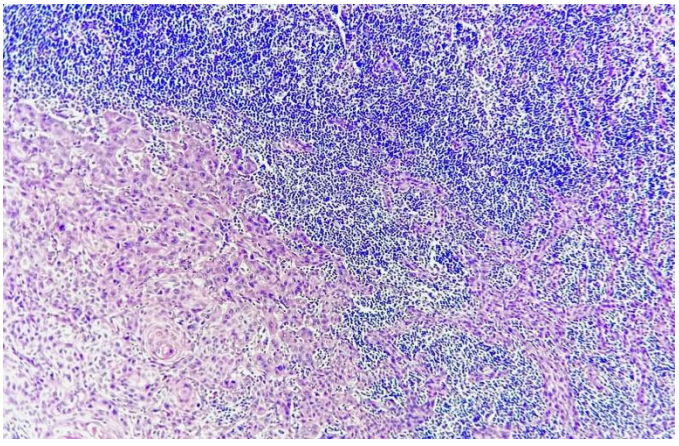


Figure 4: Dense lymphohistiocytic host response around tumor nests.

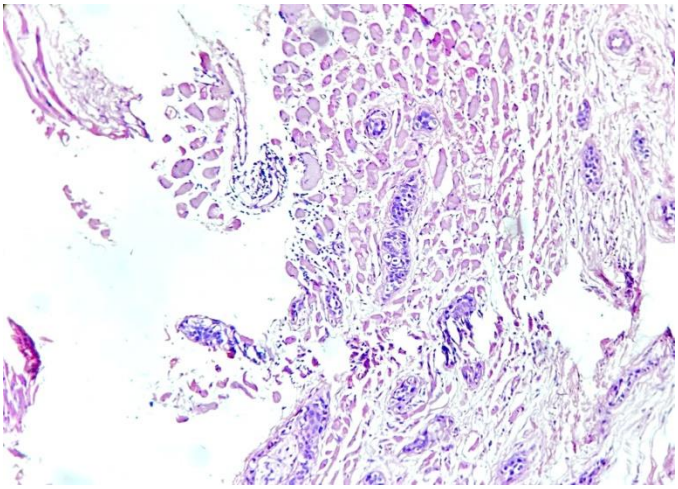


Figure 5: High-risk invasive pattern with single-cell infiltration at the tumor front.

Discussion

Oral squamous cell carcinoma remains a major health burden worldwide, especially in regions with high tobacco consumption[8,9].

The age and gender distribution in this study were similar to previous epidemiological studies, which reported higher incidence among males and individuals in the fifth to sixth decades of life[10].

Perineural invasion is considered an important adverse prognostic indicator in head and neck malignancies[11]. The lymphohistiocytic host response represents the immune reaction of the host against tumor cells and may influence tumor progression.

The Brandwein-Gensler risk model integrates these histological parameters to improve prognostic prediction compared with conventional grading systems[12,13].

Recent studies on the Brandwein–Gensler risk score model have reinforced its utility in stratifying patients with oral squamous cell carcinoma (OSCC) based on histopathological criteria. Research findings consistently highlight the model's effectiveness in predicting patient outcomes, with a significant correlation between higher risk scores and increased rates of recurrence and

metastasis. For instance, several studies report that patients classified as high risk experience notably poorer survival rates compared to those in the low-risk category.

Moreover, the model's reliance on measurable histopathological features—such as depth of invasion and lymphovascular invasion—has been validated across diverse populations, underscoring its applicability in different clinical settings. However, variations in reported percentages of risk categorization across studies suggest that further standardization may be necessary. Some research indicates that integrating additional biomarkers or molecular profiles could enhance the model's predictive accuracy.

Overall, the findings highlight the Brandwein–Gensler model's role in informing treatment strategies and follow-up protocols for OSCC patients. As the body of research grows, ongoing validation and refinement of the model will be critical to optimize its clinical application and improve patient outcomes in oral cancer management.

Conclusion

The Brandwein-Gensler risk assessment model is a useful histopathological tool for prognostic evaluation of oral squamous cell carcinoma.

The study demonstrated that most cases fall into the intermediate-risk category.

Perineural invasion and invasion patterns are important indicators of tumor aggressiveness.

Routine application of this model can aid in better prognostication and management planning for patients with oral squamous cell carcinoma.

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