

Histopathological Evaluation of Post-Operative Biopsies in Oral Squamous Cell Carcinoma

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Abstract

Introduction with Objective: The aim of the present study was to assess the Histopathological Evaluation of Post-Operative Biopsies in Oral Squamous Cell Carcinoma. **Materials and Methods:** This cross-sectional study was conducted from January 2020 to December 2021 in the oral and maxillofacial surgery department, DDCH. A total 85 cases were selected as study population as per inclusion and exclusion criteria. After data collection and processing, all statistical analysis were done by SPSS software windows version 29. **Result:** A large proportion of patients were diagnosed at an advanced stage, with 62.35% in Stage IV. Perineural invasion was present in 30.5% of cases, and lymphovascular invasion was seen in 31.8%. Histologically, the majority of cases were Grade I (76.4%), and Anneroth's Grade II (40%) was the most common. Adjacent bone involvement was found in 37.6% of cases, while 20% of patients exhibited tumor necrosis. Salivary gland involvement was noted in 17.6% of cases. Pathological TNM staging revealed the highest number of patients in the PT4aN0Mx group (19.10%) and the N0 group (48.23%). The study also examined the depth of invasion, with most cases falling between 1-9 mm (18.82%) and 10-19 mm (18.82%). Extranodal extension was present in 12 cases, and several statistically significant associations were found between histopathological features, such as the highly significant relationship between perineural invasion and bony involvement. **Conclusion:** In conclusion, this study identifies key socio-demographic and clinical traits of oral cancer patients, revealing frequent perineural, lymphovascular, and bone involvement that indicate the disease's aggressive nature.

Keywords: Squamous Cell Carcinoma, Perineural Invasion Lymphovascular Invasion.

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Introduction:

Oral squamous cell carcinoma (OSCC) is the most common malignant neoplasm affecting the oral cavity (96%)¹ & oral cancer is the sixth most common cancer in the world². In case of Head and neck cancer statistic 20% are SCC in Bangladesh³. Despite advances in diagnostic and therapeutic strategies, OSCC continues to pose a significant health burden due to its aggressive nature and high recurrence rates and annual incident rate of new cases exceeds 2,75,000⁴. Cancer in the oral cavity includes tumor of the buccal mucosa, alveolus, retro molar trigone, tongue, hard palate, floor of the mouth and lip⁵. Tobacco is

the main etiological factory in Bangladesh⁶. Buccal mucosa is the most common site in Asia whereas tongue in Europe⁷. Betel quid chewing is the main risk factor for development of oral cancer⁸. Surgical excision remains the primary mode of treatment, especially for resectable tumors. However, the success of surgical intervention is heavily dependent on the thorough histopathological evaluation of the excised tissue. Post-operative histopathological assessment provides essential insights beyond the initial diagnosis. It helps in evaluating surgical margins, depth of invasion, perineural and lymphovascular invasion, and nodal involvement—factors that are crucial for staging the disease and determining prognosis. Furthermore, it aids in identifying high-risk features that may necessitate additional treatments such as radiation or chemotherapy. In some cases, histopathology may also reveal unexpected findings, such as more aggressive subtypes or multicentric tumor origins. Therefore, the post-operative histopathological evaluation serves not only as a confirmation of clinical and radiological findings but also as a cornerstone for planning further management and predicting long-term outcomes in patients with OSCC.

Materials and Methods:

This retrospective study included 85 post-operative biopsy specimens from patients diagnosed with oral squamous cell carcinoma (OSCC). The study was conducted at Department of Dhaka Dental College Hospital, from January 2020 to December 2021. The following materials and methods were utilized: Patient Selection: The study included patients with a confirmed diagnosis of OSCC who underwent surgical resection of the primary tumor. Data on demographic characteristics, including age, sex, and tumor site, were obtained from medical records. Histopathological Examination: All biopsy specimens were reviewed by experienced pathologists. Tumors were classified and graded according to the World Health Organization (WHO) histological grading system (Grade 1 to Grade 4) and Anneroth's grading system. Tumor differentiation, invasion patterns, and other histopathological features were examined. Assessment of Tumor Features: Histological characteristics such as perineural invasion, lymphovascular invasion, adjacent bony involvement, tumor necrosis, and salivary gland involvement were recorded. Tumor necrosis was categorized as present or absent. TNM Staging: Tumors were staged according to the AJCC (American Joint Committee on Cancer) TNM classification system. The primary tumor (T), nodal involvement (N), and distant metastasis (M) were evaluated, and subcategories of N and T stages were noted. Statistical Analysis: Statistical analysis was performed using statistical package for the social sciences (SPSS) software version 29. Descriptive statistics were used to summarize the demographic data, histopathological features, and staging. Correlation between histopathological features and clinical outcomes was analyzed using [appropriate statistical tests, e.g., Chi-square, Fisher's exact test]. A p-value of <0.05 was considered statistically significant.

Result:

The study investigated the socio-demographic and clinical features of 85 oral cancer patients. The sample was fairly balanced in terms of gender, with 48.23% male and 51.77% female patients. The majority of patients were aged between 51-60 years (32.94%) and 61-70 years (28.24%), with a median age of 55.5 years. The most common site of the lesion was the buccal mucosa (18.40%), followed by the tongue (21.40%) and floor of the mouth (28.20%). A large proportion of patients were diagnosed at an advanced stage, with 62.35% in Stage IV. Perineural invasion was present in 30.5% of cases, and lymphovascular invasion was seen in 31.8%. Histologically, the majority of cases were Grade I (76.4%), and Anneroth's Grade II (40%) was the most common. Adjacent bone involvement was found in 37.6% of cases, while 20% of patients exhibited tumor necrosis. Salivary gland involvement was noted in 17.6% of cases. Pathological TNM staging revealed the highest number of patients in the PT4aN0Mx group (19.10%) and the N0 group (48.23%). The study also examined the depth of invasion, with most cases falling between 1-9 mm (18.82%) and 10-19 mm (18.82%). Extranodal extension was present in 12 cases, and several statistically significant associations were found between histopathological features, such as the highly significant relationship between perineural invasion and bony involvement. These findings highlight the clinical severity of oral cancer in the studied population and emphasize the need for early detection and targeted treatment strategies.

Table- I: Socio-demographic characteristics (gender, age, mean, median, and SD of age) of 85 oral cancer patients by number and percentage.

Gender	Number of patients (n = 85)	Percentage (%)
Male	41	48.23%
Female	44	51.77%
Age (in Years):	Number of patients	Age (in Years): Percentage (%)
21–30	3	3.53%
31–40	6	7.06%
41–50	17	20.00%
51–60	28	32.94%
61–70	24	28.24%
71–80	05	5.88%
81–90	02	2.35%
Median of age		Mean of age ± SD
55.5		55.74 ± 12.44

Table- II: Clinical features (site of lesion, stage of disease) of 85 oral cancer patients by number and percentage.

Site of Lesion	Number of patients (n = 85)	Percentage (%)
Buccal mucosa	16	18.40%
GBS	09	10.58%
Floor of the mouth	24	28.20%
Retromolar trigone	06	7.05%
Palate or maxilla	05	5.89%
Tongue	18	21.40%
Lip	02	2.35%
Mandible	05	5.89%
Stage of Disease	Number of patients	Percentage (%)
Stage I	05	5.80%
Stage II	12	14.11%
Stage III	15	17.64%
Stage IV	53	62.35%

Perineural Invasion and Lymphovascular Invasion

Table- III: Presence of Perineural Invasion and Lymphovascular Invasion by number and percentage.

Perineural Invasion		
Present	26	30.5%
Absent	59	69.5%
Lymphovascular Invasion		
Present	27	31.8%
Absent	58	68.2%

Borders Histological Grade and Anneroth’s Grade

Table-IV: Borders Histological Grade and Anneroth’s Grade by number and percentage.

Histological Grade		
Grade I	65	76.4%
Grade II	18	21.1%
Grade III	2	2.50%
Grade IV	0	0.00%
Anneroth’s Grade		
Grade I	29	34.00%
Grade II	34	40.00%
Grade III	20	23.50%
Grade IV	2	2.50%

Cancer Staging

Table- V: Pathological stage and disease by number and percentage.

Stage	Number of patients	Percentage (%)
Stage I	05	5.80%
Stage II	12	14.11%
Stage III	15	17.64%
Stage IV	53	62.35%

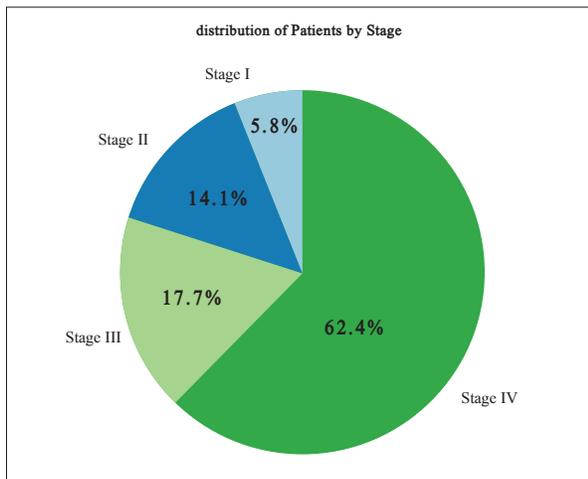


Figure-1: Distribution of Patients by Stage.

Depth of Invasion

Table- VI: Depth of Invasion by number and percentage.

Depth Range (mm)	Number of Cases	Percentage (%)
1–9	24	28.24%
10–19	37	43.53%
20–29	14	16.47%
30–39	08	9.41%
40–49	02	2.35%
Minimum Depth	4 mm	
Maximum Depth	48 mm	

Extranodal Extension

Table- VII: Presence of Extranodal Extension.

Extranodal Extension	Number of Cases
Yes	12
No	22

Table-VIII: Association between Histopathological Features in Post-operative OSCC Specimens.

Comparison	p-Value	Significance
Perineural Invasion vs Bony Involvement	2.38×10^{-6}	Very Highly Significant
Lymphovascular Invasion vs Tumor Necrosis	0.00038	Highly Significant
Salivary Gland Involvement vs Bony Involvement	0.0237	Statistically Significant

Discussion:

The findings from this study provide a comprehensive view of the socio-demographic and clinical characteristics of oral cancer patients, contributing to the understanding of the disease's epidemiology, progression, and challenges in early diagnosis and management. A total of 85 patients were included in the analysis, with a gender distribution of 48.23% male and 51.77% female. Zhang et al. and Sugarman et al. in another study showed the different scenario^{9,11}. DS Aruna et al. in another study showed higher studies in males¹⁰. This near-equal gender distribution suggests that oral cancer affects both genders with relatively equal frequency in the studied cohort. While previous studies have shown a slightly higher incidence in males, this result could indicate that other factors, such as lifestyle, dietary habits, or access to healthcare, may play a role in this distribution. The slightly higher number of female patients in this study may reflect changes in risk factor patterns or evolving disease trends. Further research into gender-based differences in the pathogenesis of oral cancer would help in understanding this observed disparity. Age-wise, the data reveals that the majority of patients were in the older age groups, particularly between 51-60 years (32.94%) and 61-70 years (28.24%), with the median age of 55.5 years. This finding is in line with global trends, where oral cancer is more common in individuals over the age of 50, likely due to prolonged exposure to carcinogenic substances such as tobacco and alcohol, both of which are major risk factors for oral cancer. The observed median age of 55.5 years suggests that the disease predominantly affects the aging population, where immune function may decline, and the cumulative effect of environmental carcinogens increases the risk of malignancy. The fact that a significant proportion of patients were above 50 years old highlights the importance of early screening, particularly in older populations who may be more susceptible to oral cancer. It also suggests that health education campaigns aimed at older adults may help improve early detection and prevent late-stage diagnoses. However, the study also reveals a small number of patients in the younger age groups (21-40 years), which points to the need for greater awareness regarding oral cancer in younger populations, especially those with risk factors like smoking or

alcohol consumption. Early detection in younger patients could improve survival rates and reduce morbidity. Whereas, Tandon et al. reported that above 50 years (39.5%) was most commonly affected¹¹. The distribution of disease stage at diagnosis showed a significant proportion of patients diagnosed at advanced stages, with 62.35% of cases in Stage IV, and 5.8% in Stage I. This finding underscores a major challenge in oral cancer treatment: the disease is often diagnosed at a late stage, where the prognosis is much poorer, and treatment options become more complex. Oral cancer in its early stages may not exhibit obvious symptoms, leading to delays in diagnosis. Additionally, some patients may avoid seeking medical attention due to fear, lack of awareness, or financial constraints. The advanced-stage diagnosis in the majority of patients calls for stronger screening programs, especially for high-risk populations, to enable earlier diagnosis and better outcomes. It also highlights the importance of public education about the symptoms of oral cancer, which can include persistent sores, difficulty swallowing, and unexplained pain, all of which may be overlooked as benign conditions. Whereas a study conducted by Rajesh Shah showed highest number of patients had stage III (40.70%)¹². In terms of histological features, the majority of cases were classified as Grade I (76.4%), indicating that most tumors were well-differentiated. This suggests that the cancer cells in these cases were similar to normal cells, and the tumors may have been less aggressive. Adhikari et al. showed grade I was 60.30%¹³. However, there were also cases classified as Grade II (21.1%) and Grade III (2.5%), indicating that a small proportion of tumors were moderately or poorly differentiated, respectively. Poorly differentiated tumors are generally more aggressive, with a higher likelihood of spreading to other parts of the body. The finding that a minority of tumors were Grade III further emphasizes the variability in the aggressiveness of oral cancers and the need for individualized treatment approaches based on tumor grade and differentiation. It also highlights the importance of early diagnosis, as higher-grade tumors tend to have worse outcomes and a lower response to treatment. When analyzing the site of the lesion, the study found that the most common site was the buccal mucosa (18.4%), followed by the tongue (21.4%) and the floor of the mouth (28.2%). A study in India (Hyderabad) showed the most involved site was buccal mucosa followed by tongue¹⁴. Whereas in Allahabad the most common site is tongue (37.80%) followed by buccal mucosa¹⁵. This aligns with the results from several previous studies, where the buccal mucosa, tongue, and floor of the mouth are frequently affected in oral cancer patients. The buccal mucosa, in particular, is often exposed to tobacco and other carcinogenic substances, especially in populations with a high prevalence of smoking or chewing tobacco. The tongue is another common site of involvement due to its direct exposure to irritants, and the floor of the mouth has a high rate of cancer occurrence, likely due to its anatomical location and frequent contact with harmful substances. The findings from this study highlight the need for targeted awareness programs and

public health initiatives that focus on these specific regions of the oral cavity, particularly in populations with a high risk of developing oral cancer due to lifestyle choices. Perineural invasion, present in 30.5% of cases, and lymphovascular invasion, found in 31.8% of cases, are both important prognostic factors in cancer progression. Perineural invasion refers to the cancer's ability to invade surrounding nerves, while lymphovascular invasion indicates the spread of cancer cells through the lymphatic or blood vessels. Both of these invasions are associated with a higher risk of metastasis and recurrence. The statistically significant association between lymphovascular invasion and tumor necrosis (p-value = 0.00038) suggests that these features may be indicative of more aggressive disease. The finding that perineural invasion is significantly associated with bony involvement (p-value = 2.38×10^{-6}) further supports the aggressive nature of oral cancers that invade surrounding tissues. The presence of these features in a significant proportion of patients points to the need for careful staging, monitoring, and the consideration of aggressive treatment strategies, including surgery, radiation, and chemotherapy, to address these high-risk factors. Whereas Alkhadar et al. showed perineural invasion was present in 17.40% of oral SCC¹⁶. Adjacent bone involvement was observed in 37.6% of cases, which is a concerning finding, as bone invasion can lead to severe functional impairment and poor prognosis. The ability of oral cancers to invade bone tissue reflects their aggressive nature and highlights the need for early detection and timely intervention to prevent the spread of the disease to adjacent tissues. Tumor necrosis, present in 20% of cases, is another important indicator of aggressive disease. Tumor necrosis often occurs in rapidly growing tumors and is linked to a poor response to treatment and increased risk of metastasis. These findings stress the importance of advanced imaging techniques in assessing tumor extent and guiding treatment decisions. Salivary gland involvement was noted in 17.6% of patients, which can complicate treatment due to the proximity of critical structures in the head and neck. In cases with salivary gland involvement, surgical resection may be challenging, and radiation therapy may carry risks of long-term complications such as xerostomia (dry mouth). Therefore, treatment plans for these patients should be tailored to minimize functional impairment while effectively managing the tumor. The pathological TNM staging, particularly the high proportion of patients in the advanced T4 and N0 categories, reveals the severity of the disease at diagnosis. A significant proportion of patients also presented with nodal metastasis, especially in the N0 and N1 groups, indicating that the cancer had spread to the lymph nodes in some cases. This finding emphasizes the importance of lymph node evaluation and the role of lymphadenectomy in the management of oral cancer. Additionally, the presence of extranodal extension in some cases (12 patients) further indicates a more aggressive form of the disease with a higher risk of recurrence. The depth of invasion, which ranged from 4 mm to 48 mm, highlights the variability in tumor growth. Deeper tumors tend to be more aggressive and have a higher

chance of metastasis. Extranodal extension, present in 12 cases, further suggests that the cancer may have spread beyond the primary site, necessitating more aggressive management strategies.

Conclusion:

In conclusion, this study highlights key socio-demographic and clinical features of oral cancer patients. It shows that the disease primarily affects older individuals, with many diagnosed at advanced stages. The findings also reveal high rates of perineural and lymphovascular invasion, along with bone involvement, pointing to the aggressive nature of the disease. The presence of tumor necrosis and salivary gland involvement suggests the need for personalized treatment strategies. Overall, the study emphasizes the importance of early detection, improved screening, and awareness to enhance treatment outcomes and survival rates for oral cancer patients.

Conflict of Interest: None.

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