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Clinicopathological Characteristics and Recurrence Patterns in Advanced Lower Gingivobuccal Carcinoma: A Retrospective Institutional Study

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ABSTRACT

Objective: Carcinoma of the lower gingivobuccal complex is a common oral cancer subsite in India and is often treated at an advanced stage. This retrospective institutional study evaluated clinicopathological characteristics, treatment patterns, and recurrence in patients managed with primary surgery.

Materials and Methods: Records of 120 consecutive, previously untreated patients with squamous cell carcinoma of the lower gingivobuccal complex treated surgically at a tertiary care centre between June 2008 and June 2010 were reviewed. Clinical, radiological, treatment-related, and histopathological variables were recorded. Recurrence was assessed during follow-up and categorised as local, regional, locoregional, or distant. Fisher's exact test was used to examine associations between clinicopathological variables and recurrence. Patients with unavailable recurrence status or loss to follow-up before recurrence assessment were excluded from recurrence analysis.

Results: Most patients were male (85.8%) and younger than 60 years (74.2%). Tobacco use, areca nut chewing, or smoking was present in 90.8%. Stage IV disease was seen in 79.2%, and clinically positive cervical nodes were present in 45.0%. Histopathological bone invasion was identified in 54.2%, whereas confirmed skin invasion was uncommon (5.0%). Among 109 evaluable patients, recurrence occurred in 34 (31.2%). On univariate analysis, recurrence was not significantly associated with bone invasion, muscle involvement, skin invasion, paramandibular disease, depth of invasion, perineural invasion, nodal status, or surgical margin status. Lymphovascular invasion showed a statistically significant association with recurrence (p=0.019).

Conclusion: Advanced lower gingivobuccal carcinoma in this cohort was characterised by late-stage presentation and frequent adverse pathological features. Lymphovascular invasion was the only variable significantly associated with recurrence on univariate analysis. These findings support careful pathological assessment and structured follow-up after surgery.

Keywords: *Mouth Neoplasms; Carcinoma, Squamous Cell; Lymphatic Metastasis; Surgical Margins; Neoplasm Recurrence, Local; Neck Dissection.*

INTRODUCTION

Oral cavity cancer remains a major public health problem in India. According to the Global Cancer Observatory (GLOBOCAN 2022), cancers of the lip and oral cavity account for approximately 10% of newly diagnosed cancers and 8% of cancer-related deaths in the country.[1] Within the oral cavity, the lower gingivobuccal complex, which includes the buccal mucosa, gingivobuccal sulcus, lower alveolus and retromolar trigone, represents one of the most commonly affected

anatomical regions.[2] The high incidence of tumours at this site reflects the widespread use of smokeless tobacco, betel quid and areca nut, either alone or in combination, throughout the Indian subcontinent.[3] These exposures are recognised by the International Agency for Research on Cancer as Group 1 carcinogens and constitute the principal etiological factors for oral squamous cell carcinoma.[4]

Despite the accessibility of the oral cavity for clinical examination, a substantial proportion of patients continue to present with locally advanced disease. Delayed presentation is influenced by limited awareness of early symptoms, delayed referral and restricted access to specialised healthcare services.[5] Tumours involving the lower gingivobuccal complex commonly extend to adjacent structures, including the mandible, floor of the mouth, overlying skin and cervical lymph nodes, making surgical management technically demanding. Achieving an adequate oncological margin is particularly challenging because of the anatomical relationship to the mandible and the tendency for submucosal tumour spread.[2,6] Most locoregional recurrences after treatment for oral squamous cell carcinoma occur within the first two years and have been associated with adverse pathological features, particularly nodal metastasis and inadequate surgical margins.[7,8]

Although oral cavity cancer has been extensively studied, reports specifically evaluating the clinicopathological profile and recurrence patterns of advanced carcinoma of the lower gingivobuccal complex from Indian institutions remain limited.[9] The present retrospective institutional study was therefore undertaken to evaluate the clinicopathological characteristics, nodal burden, surgical margin status and early recurrence patterns in patients undergoing primary surgical treatment for advanced carcinoma of the lower gingivobuccal complex.

MATERIALS AND METHODS

Study Design and Patient Selection

A retrospective observational study was carried out at a tertiary referral centre in Mumbai to evaluate the clinicopathological profile, treatment characteristics and recurrence patterns of advanced carcinoma of the lower gingivobuccal complex. The records of 120 consecutive patients with previously untreated squamous cell carcinoma involving the lower alveolus, gingivobuccal sulcus, buccal mucosa or retromolar trigone were reviewed. All patients underwent primary surgical treatment between June 2008 and June 2010.

Patients with locally advanced disease who were considered suitable for definitive surgery were included in the study. Those presenting with recurrent disease, distant metastasis, previous treatment for head and neck cancer or inadequate clinicopathological records were excluded. All patients had a minimum follow-up period of one year.

Clinical Assessment and Treatment

Preoperative evaluation consisted of a detailed examination of the oral cavity and neck, followed by contrast-enhanced computed tomography of the face and neck. Imaging was used to assess tumour extent, mandibular invasion, skin involvement, cervical nodal disease and paramandibular extension. Tumours were staged according to the American Joint Committee on Cancer (AJCC) 7th edition staging system.

Primary surgery was performed in every patient. Reconstruction was achieved using local or regional flaps whenever indicated, with the pectoralis major myocutaneous (PMMC) flap being the most frequently used reconstructive option. Postoperative radiotherapy or concurrent chemoradiotherapy was administered in accordance with institutional treatment protocols for patients demonstrating adverse pathological features.

Data Collection

Demographic characteristics including age, sex, tobacco-related habits and premalignant lesions were retrieved from hospital records. Clinical and radiological variables included tumour subsite, cervical nodal status, bone involvement, skin involvement and paramandibular disease. Histopathological assessment included tumour size, grade, depth of invasion, bone, muscle and skin infiltration, perineural invasion, lymphovascular invasion, surgical margin status, metastatic lymph nodes and perinodal extension.

Recurrence was categorised as local, regional, locoregional or distant. The diagnosis of recurrence was established on the basis of clinical examination, radiological findings and histopathological confirmation whenever available.

Ethical Considerations

The study was based entirely on anonymised clinical and pathological records obtained during routine patient care between June 2008 and June 2010. No additional investigations or interventions were undertaken for research purposes. Documentation relating to institutional ethics review could not be retrieved because the treating institution subsequently ceased functioning and archival records were no longer available. Patient confidentiality was maintained throughout the study by analysing only de-identified data. Because the study used anonymised retrospective records, informed consent was waived. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and is reported following the STROBE recommendations for observational studies.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows, Version .0 (IBM Corp., Armonk, NY, USA). Categorical variables are presented as frequencies and percentages. The association between clinicopathological variables and tumour recurrence was analysed using Fisher's exact test. Patients with unavailable recurrence status (NIL) and those lost to follow-up before recurrence assessment were excluded from recurrence analysis. Consequently, recurrence analysis was performed in 109 evaluable patients. A two-sided p value below 0.05 was considered statistically significant. Owing to the relatively small number of recurrence events, multivariable analysis was not undertaken.

RESULTS

Patient Demographics and Treatment Characteristics

The study included 120 patients with advanced carcinoma of the lower gingivobuccal complex. Most patients were younger than 60 years (74.2%), and males accounted for 85.8% of the cohort. A history of tobacco use, areca nut chewing or smoking was present in 90.8% of patients. Premalignant lesions were identified in 47 patients, with oral submucous fibrosis being the commonest lesion. Nearly four-fifths of the cohort presented with Stage IV disease, while clinically positive cervical lymph nodes were present in 45.0% of patients.

All patients underwent definitive surgical treatment. Arch-saving mandibulectomy was the most frequently performed procedure, followed by hemimandibulectomy and marginal mandibulectomy. Reconstruction was achieved predominantly with PMMC and tongue flaps. Neoadjuvant chemotherapy was administered in a minority of patients. Detailed demographic and treatment characteristics are presented in **Table 1**.

Table 1: Patient demographics and treatment characteristics (n=120)

Characteristic	Category	n (%)
Age group (years)	<60	89 (74.2)
	≥60	31 (25.8)
Sex	Male	103 (85.8)
	Female	17 (14.2)
Habits	Present	109 (90.8)
	Absent	11 (9.2)†
Premalignant lesions	Oral submucous fibrosis	39 (32.5)
	Leucoplakia	6 (5.0)
	Oral submucous fibrosis + leucoplakia	1 (0.8)
	Erythroplakia	1 (0.8)
	None	73 (60.8)
TNM stage	Stage III	25 (20.8)
	Stage IV	95 (79.2)
Clinical nodal status	N0	66 (55.0)
	N+	54 (45.0)
Primary surgical procedure	Arch-saving mandibulectomy	49 (40.8)

Characteristic	Category	n (%)
	Hemimandibulectomy	32 (26.7)
	Marginal mandibulectomy	13 (10.8)
	Segmental mandibulectomy	9 (7.5)
	Bite resection	7 (5.8)
	Wide local excision	4 (3.3)
	Ascending ramus mandibulectomy	3 (2.5)
	Full-thickness cheek excision	2 (1.7)
	Extended hemimandibulectomy	1 (0.8)
Reconstruction	PMMC flap	61 (50.8)
	Tongue flap	45 (37.5)
	Split skin graft	8 (6.7)
	Primary closure	3 (2.5)
	Tongue flap + nasolabial flap	1 (0.8)
	Local flap	1 (0.8)
	Free flap	1 (0.8)
Neoadjuvant chemotherapy	Yes	17 (14.2)
	No	103 (85.8)

Note: Habits included tobacco use, areca nut chewing, or smoking. Lower gingivobuccal complex subsites included the lower alveolus, gingivobuccal sulcus, buccal mucosa, and retromolar trigone. PMMC = pectoralis major myocutaneous; TNM = tumour-node-metastasis. Values are presented as n (%).

Clinicopathological Findings

The clinicopathological features of the study population are summarised in **Table 2**. Clinical evidence of skin involvement was observed in one-third of patients, whereas histopathological confirmation of skin invasion was identified in only a small proportion. Clinical bone involvement was documented in 38.3% of patients, while histopathological examination demonstrated bone invasion in 54.2%.

Most tumours were moderately differentiated squamous cell carcinomas. More than half of the patients had a depth of invasion exceeding 1 cm, and muscle infiltration was present in nearly three-quarters of specimens. Perineural invasion was identified in 53.3% of patients, whereas lymphovascular invasion was present in 28.3%. Surgical margins greater than 5 mm were achieved in 84.2% of resections.

Table 2: Clinicopathological characteristics (n=120)

Variable	Category	n (%)

Clinical skin involvement	Present	40 (33.3)
	Absent	80 (66.7)
Clinical bone involvement	Present	46 (38.3)
	Absent	74 (61.7)
Histopathological bone invasion	Present	65 (54.2)
	Absent	55 (45.8)
Paramandibular disease	Present	52 (43.3)
	Absent	68 (56.7)
Tumour size	≤2 cm	17 (14.2)
	Absent	68 (56.7)
	Absent	68 (56.7)
Histological grade	Well differentiated	18 (15.0)
	Moderately differentiated	78 (65.0)
	Poorly differentiated	17 (14.2)
	Others	7 (5.8)
Depth of invasion	≤0.3 cm	5 (4.2)
	0.4–1.0 cm	46 (38.3)‡
	>1 cm	69 (57.5)‡
Muscle involvement	Present	87 (72.5)
	Absent	33 (27.5)
Histopathological skin invasion	Present	6 (5.0)
	Absent	114 (95.0)
Perineural invasion	Present	64 (53.3)
	Absent	56 (46.7)
Lymphovascular invasion	Present	34 (28.3)
	Absent	86 (71.7)
Surgical margin	>5 mm	101 (84.2)

	<5 mm	19 (15.8)

Note: Values are expressed as number (%)

Recurrence Analysis

Recurrence status was available for 109 patients after excluding six patients with unavailable recurrence data and five patients who were lost to follow-up before recurrence assessment. During follow-up, recurrence developed in 34 patients (31.2%), whereas 75 patients (68.8%) remained free of recurrence.

Univariate analysis showed no significant association between recurrence and histopathological bone invasion (p=0.836), muscle involvement (p=0.483), histopathological skin invasion (p=1.000), paramandibular disease (p=0.836), depth of invasion (p=0.533), perineural invasion (p=0.837), nodal status (p=0.837) or surgical margin status (p=0.789). Lymphovascular invasion demonstrated a statistically significant association with recurrence (p=0.019). The results of the univariate analysis are summarised in **Table 3**.

Table 3: Univariate recurrence analysis (n=109)

Histopathological bone invasion	Present	19/58 (32.8)	39/58 (67.2)	0.836
	Absent	15/51 (29.4)	36/51 (70.6)	
Muscle involvement	Present	27/80 (33.8)	53/80 (66.2)	0.483
	Absent	7/29 (24.1)	22/29 (75.9)	
Histopathological skin invasion	Present	1/5 (20.0)	4/5 (80.0)	1.000
	Absent	33/104 (31.7)	71/104 (68.3)	
Paramandibular disease	Present	15/46 (32.6)	31/46 (67.4)	0.836
	Absent	19/63 (30.2)	44/63 (69.8)	
Depth of invasion	>1 cm	21/61 (34.4)	40/61 (65.6)	0.533
	≤1 cm	13/47 (27.7)	34/47 (72.3)	
Perineural invasion	Present	16/54 (29.6)	38/54 (70.4)	0.837
	Absent	18/55 (32.7)	37/55 (67.3)	
Lymphovascular invasion	Present	4/30 (13.3)	26/30 (86.7)	**0.019**
	Absent	30/79 (38.0)	49/79 (62.0)	
Nodal status	N+	14/47 (29.8)	33/47 (70.2)	0.837
	N0	20/62 (32.3)	42/62 (67.7)	
Surgical margin status	Close/positive (<5 mm)	6/18 (33.3)	12/18 (66.7)	0.789
	Clear (≥5 mm)	28/91 (30.8)	63/91 (69.2)	

Note: Fisher's exact test was used. Statistical significance was defined as p<0.05. Patients with no recurrence records available or loss to follow-up were excluded.

DISCUSSION

Lower gingivobuccal complex carcinoma remains one of the most frequently encountered oral malignancies in India, largely because of the continued use of smokeless tobacco, areca nut and related products.[3,10,11] Although the oral cavity is easily accessible for examination, many patients continue to seek medical attention only after the disease has reached an advanced stage. The present study reflects this clinical reality, with most patients presenting with Stage IV disease and requiring extensive surgical resection. These findings underline the persistent need for community awareness, early diagnosis and timely referral, particularly in populations with a high prevalence of tobacco-related habits.

The demographic characteristics observed in this cohort were comparable with those reported from other Indian centres managing oral cavity cancer.[7,9] The predominance of males and the high frequency of tobacco-related habits are consistent with the recognised epidemiology of lower gingivobuccal carcinoma in the Indian subcontinent. Oral submucous fibrosis was the most frequent premalignant lesion encountered, further emphasising the close association between areca nut consumption and malignant transformation.

Assessment of mandibular involvement remains an important component of preoperative planning because the extent of bone invasion influences the type of mandibulectomy and subsequent reconstruction. In the present series, histopathological examination identified bone invasion more frequently than clinical or radiological assessment. Similar observations have been reported previously, suggesting that microscopic cortical or medullary invasion may escape preoperative detection despite modern imaging techniques.[6,12] However, bone invasion alone was not associated with recurrence in the present analysis, indicating that tumour behaviour is influenced by several pathological factors acting together rather than by mandibular involvement alone.

A similar discrepancy was observed between clinical assessment and histopathological confirmation of skin involvement. While clinical examination frequently suggested skin infiltration, only a small proportion of patients demonstrated true dermal invasion on histopathological evaluation. Previous studies have shown that inflammatory changes, fibrosis and tumour fixation may mimic skin invasion clinically, resulting in overestimation of disease extent.[13] Histopathological assessment therefore remains essential for accurate pathological staging and treatment planning.

Most tumours in this study exhibited features generally associated with advanced disease, including deep tumour infiltration, muscle invasion, perineural invasion and histopathological bone involvement. Nevertheless, none of these variables demonstrated a statistically significant association with recurrence on univariate analysis. Similar observations have occasionally been reported in retrospective series with relatively small sample sizes, where limited statistical power may reduce the ability to detect modest differences between patient subgroups. Consequently, the absence of statistical significance should not be interpreted as evidence that these pathological features lack clinical importance.

Lymphovascular invasion was the only variable that demonstrated a statistically significant association with recurrence in the present analysis. However, this finding differed from the pattern described in most published studies, where lymphovascular invasion is generally considered an adverse prognostic feature associated with increased locoregional failure and poorer survival.[14] [15]The unexpected direction of the association observed in the present study should therefore be interpreted cautiously. Factors such as retrospective data collection, missing follow-up information, limited sample size or variation in pathological reporting may have influenced the observed result. Larger prospective studies are required before any definitive conclusions can be drawn.

Recurrence occurred in approximately one-third of evaluable patients, highlighting the aggressive nature of advanced lower gingivobuccal carcinoma despite definitive surgical treatment. Although recurrence was numerically more frequent in patients with greater tumour depth, nodal disease and paramandibular involvement, these differences were not statistically significant. This observation supports the concept that recurrence in advanced oral cavity cancer is multifactorial and is influenced by the combined effect of tumour biology, host factors and treatment-related variables rather than by any single clinicopathological parameter.

Overall, this study provides a contemporary description of the clinicopathological profile of advanced lower gingivobuccal carcinoma managed surgically in an Indian tertiary care centre. The findings reinforce the continued burden of advanced disease at presentation and the importance of meticulous pathological assessment and long-term surveillance following treatment.

Limitations

The findings of this study should be interpreted in the context of several limitations. The retrospective design and single-centre setting introduce the possibility of selection and information bias. As the data were collected between 2008 and 2010, current staging systems and treatment protocols have evolved since the study period. In addition, recurrence analysis was limited to 109 evaluable patients because some patients had incomplete follow-up or unavailable recurrence data. The relatively small number of recurrence events prevented multivariable analysis and limited the ability to identify

independent predictors of recurrence. Despite these constraints, the study provides useful clinicopathological information from a relatively large surgically treated cohort of advanced lower gingivobuccal carcinoma.

CONCLUSION

Advanced carcinoma of the lower gingivobuccal complex continues to present predominantly as locally advanced disease with a high frequency of adverse pathological features. In this cohort, lymphovascular invasion was the only variable that demonstrated a statistically significant association with recurrence on univariate analysis, whereas bone invasion, depth of invasion, nodal status, paramandibular disease and surgical margin status were not significantly associated with recurrence. These findings should be interpreted cautiously because of the retrospective design and limited number of recurrence events. Strengthening tobacco-control measures, promoting earlier diagnosis and maintaining careful postoperative surveillance remain important strategies for improving the management of patients with advanced lower gingivobuccal carcinoma.

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Conflicts of interest

The authors declare no conflicts of interest.

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