

Research Article

Clinical Profile and Surgical Outcome of Buccal Mucosa Carcinoma in a Rural Tertiary Care Setting: A Retrospective Study

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ABSTRACT

Background: Oral squamous cell carcinoma of the buccal mucosa presents significant clinical challenges in rural populations where smokeless tobacco use is endemic. This study aimed to evaluate the clinicopathological profile, surgical outcomes and factors influencing advanced-stage presentation in a rural tertiary care setting in Andhra Pradesh.

Methods: A retrospective observational study was conducted on 45 patients undergoing surgical resection for biopsy-proven primary buccal mucosa carcinoma. Clinical and demographic variables, risk habits, TNM staging at presentation, and surgical outcomes were extracted from institutional records. Statistical associations with clinical stage (Early [I-II] vs. Advanced [III-IV]) were evaluated using Pearson Chi-Square and Fisher's Exact tests.

Results: The cohort exhibited a distinct female preponderance (62.2%, n=28). Male patients presented with advanced disease at a significantly higher rate than females (76.5% vs. 46.4%, P 0.048). Patients with mixed habits (betelnut products with smoking or alcohol) predominantly presented with advanced disease (75.0%, n=9/12), as did exclusive betel leaf consumers (63.6%, n=7/11), though this association did not reach statistical significance (P 0.356). Advanced stage disease (57.8%) required complex composite resections and major flap reconstructions; the postoperative complication rate was 13.3%, with a mortality rate of 4.4%.

Conclusion: Buccal mucosa carcinoma in this rural cohort is characterized by a high proportion of advanced-stage disease, driven by endemic betelnut product consumption and mixed risk habits. The significant delay in male presentation identifies them as a uniquely vulnerable subgroup, underscoring the need for targeted, community-level screening and tobacco cessation initiatives.

Keywords: Oral Squamous Cell Carcinoma, Buccal Mucosa, Smokeless Tobacco, Betel Nut, Rural Health, Delayed Diagnosis.

INTRODUCTION

Oral squamous cell carcinoma (OSCC) represents a massive global health crisis, with contemporary epidemiological analyses tracking its high global incidence, multi-factorial risk profiles and variable survival rates [1]. Globally, India bears a disproportionate share of this disease burden, contributing to nearly one-third of all oral cancer cases worldwide [2]. Within the oral cavity, the buccal mucosa represents the single most dominant subsite for malignancies across India [3]. Institutional data from major teaching hospitals reveal that buccal mucosa carcinomas constitute approximately one-third of all diagnosed oral malignancies [4]. Longitudinal regional series

emphasize this comparative ranking, with 10-year audits in rural centers like Loni, Maharashtra demonstrating it as the most frequent subsite [5], a finding consistently mirrored in an independent 5-year tertiary audits, mapping out comprehensive site distributions across alternative Indian cohorts [6,7].

The socio-demographic profile of these patients highlights a characteristic vulnerability in specific groups, heavily skewed toward the male gender, older age groups, and rural populations [8,9].

This high regional burden is intimately linked to localized risk habits; evaluations from regional cancer institutes indicate that buccal mucosa

presentations carry the highest collective burden of intense smokeless tobacco consumption, betel-quid and areca nut chewing habits [3,10]. Due to the lower socio-economic status, typical of rural populations, combined with limited access to surgical oncology care in proximity and delayed health-seeking behaviours, the majority of these patients present with locally advanced disease (Stages III and IV) at initial diagnosis [4,11].

This regional crisis is acutely observed in South India, specifically within Andhra Pradesh [12]. Landmark 5-year retrospective data from high-volume tertiary referral centres in Hyderabad confirm that the buccal mucosa is the most common site for oral malignancies [13]. This local burden is further underestimated by hospital-based retrospective mapping in the Sri Potti Sriramulu Nellore district [14] and cross-sectional clinicopathological profiles from Andhra Medical College, Visakhapatnam, which provide essential regional baselines for managing oral malignancies within the state [15].

Consequently, the prognosis for buccal mucosa carcinoma remains notoriously poor compared to other oral sub-sites, primarily due to aggressive local infiltration and early nodal metastasis [4,8]. Large-scale survival analyses from Indian tertiary care centers indicate that the overall 5-year survival rate sits at approximately 50%, a figure that drops precipitously to 30% or lower when patients present with advanced-stage disease [2]. Managing these tumours often requires highly aggressive surgical treatment with complex and varied reconstructive procedures to close extensive cheek defects [16]. Even when achieving clear margins or managing early-stage lesions involving critical zones like the commissure [17], or utilizing advanced primary modalities like definitive accelerated hypofractionated radiotherapy [18], loco-regional recurrence (LRR) is seen in 10% to 30% of patients following treatment completion and is generally considered a predictor of unfavourable prognosis regarding survival [3,8,11,19]. Short-term failures and local relapses remain a continuous therapeutic burden throughout Central and Southern India [20].

While broad oncological benchmarks exist across Central India [15], general head-and-neck outcomes frameworks, and international series [19,20], there remains a distinct scarcity of data focusing specifically on the clinical realities, risk-habit correlations, and immediate

post-therapeutic outcomes in rural tertiary-care centers [18]. To bridge this gap, this retrospective observational study evaluates the clinico-epidemiological characteristics, staging at presentation, treatment selections, and short-term post-operative and loco-regional outcomes of buccal mucosa carcinoma patients at a rural tertiary care hospital in Kuppam, Andhra Pradesh. The derived data aim to provide localized, real-world evidence to optimize early detection strategies and refine surgical care pathways for this high-risk population [18].

MATERIALS AND METHODS

Study Design and Setting

A retrospective observational study was conducted in the Department of General Surgery at the PESIMSR hospital, located in Kuppam, Andhra Pradesh. The research activities and data collection were carried out retrospectively from cancer registry and outpatient department records over a predefined study period of 12 months, evaluating patient records from January 2025 to January 2026. The study was conducted following formal approval from the institutional ethics committee, in accordance with the ethical standards prescribed by the ICMR guidelines.

Inclusion and Exclusion Criteria

To ensure a standardized cohort, the inclusion criteria were restricted to patients aged above 18 years who were admitted to the Department of General Surgery with definitive, histopathologically-proven buccal carcinoma. Patients aged below 18 years were excluded from the study. Furthermore, patients who were not willing to undergo further clinical evaluation and subsequent management within the institution, and patients lost to follow-up, were also excluded.

Clinical Investigations and Staging

Following initial admission, patients underwent thorough clinical examinations. Necessary diagnostic and staging investigations were performed based on clinical need and suspicion; these included primary histopathological examinations, as well as imaging modalities such as ultrasonography (USG), X-rays, computed tomography (CT), positron emission tomography-CT (PET-CT), or magnetic resonance imaging (MRI). These clinical presentations and investigations were utilized to determine the precise TNM stage and

lesion characteristics (site/side) at the time of presentation.

Treatment Protocol

Following histological confirmation, patients underwent comprehensive preoperative staging using contrast-enhanced computed tomography (CECT) of the face, neck, and chest. Primary surgical management involved a wide local or composite resection—including a mandibulectomy as needed—paired with suitable neck dissection. Surgical defects were subsequently reconstructed using appropriate techniques, ranging from skin grafts to local, regional, or free flaps.

Statistical Analysis

The extracted data were analysed to fulfil several primary objectives. The study assessed the predominant risk habits among patients, specifically documenting the use of smokeless tobacco, betel-quid/areca nut, smoking, and alcohol, and evaluated their association with the clinical stage at presentation. Furthermore, the study documented the specific treatment modalities offered to these patients, categorizing them into surgery alone, surgery with adjuvant therapy, definitive radiotherapy/chemoradiotherapy, or palliative care. Finally, the short-term outcomes were evaluated by tracking postoperative complications, the overall length of hospital

stay, and any early loco-regional events or mortality observed during the available follow-up window. Statistical associations between clinico-demographic factors, risk habits, and clinical stage (Early [I–II] vs. Advanced [III–IV]) were evaluated using the Pearson Chi-Square test and Fisher's Exact test, as appropriate. A P value of less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Results

The study included 45 patients who underwent surgical management for histopathologically proven squamous cell carcinoma of the buccal mucosa during the specified study period. Within this cohort, a distinct female preponderance was observed, with females constituting 62.2% of the study group, whereas males accounted for 37.8%. The mean age of the patients at the time of presentation was 56.9 years, ranging from 35 to 91 years. A significant majority of the affected individuals resided in rural areas, accounting for 77.8% of the study group, compared to 22.2% from urban demographics. Furthermore, systemic co-morbidities were highly prevalent; 30 patients (66.7%) presented with at least one concomitant condition, most frequently hypertension and type 2 diabetes mellitus (Table 1).

Table 1: Demographic and Clinical Characteristics

Variable	Frequency (n=45)	Percentage (%)
Age Group		
< 50 years	10	22.2
≥ 50 years	35	77.8
Gender		
Female	28	62.2
Male	17	37.8
Area of Residence		
Rural	35	77.8
Urban	10	22.2
Systemic Comorbidities		
Absent	15	33.3
Single comorbidity	24	53.3
Mixed (multiple comorbidities)	6	13.3
Specific Comorbidities*		
Hypertension	14	31.1
Type 2 diabetes mellitus	11	24.4
Hypothyroidism	6	13.3
Asthma	5	11.1

*Specific comorbidities do not sum to 30 because the 6 patients in the "Mixed" category presented with overlapping conditions (e.g., hypertension + type 2 diabetes mellitus). Percentage is calculated out of the total cohort (n=45).

An analysis of risk habits revealed a profound reliance on smokeless tobacco and areca nut products among the study population. Patients consuming smokeless tobacco exclusively—including betel nut, betel leaf, and quid—comprised the largest segment of the cohort at 66.7%. A mixed habit profile, characterized by the concurrent use of smokeless tobacco alongside smoking or regular alcohol consumption, was identified in 26.7%. Only a small minority of the cohort, representing 6.7%, admitted to an exclusive smoking habit. Regarding clinical presentation, the disease distribution demonstrated a slight predilection for the left buccal mucosa, which was affected in 53.3%, while the right side was involved in 46.7%. The pathological tumor (T) staging highlighted a predominantly advanced local

disease burden; early-stage primary tumors (T1 and T2) were documented in 15.6% and 31.1% of patients respectively, while advanced primary extensions characterized by T3 and T4 lesions constituted nearly half of the cohort, presenting in 13.3% and 40.0% of cases. Analysis of the regional lymph nodes revealed that 66.7% of patients presented with a clinically and pathologically negative neck (N0), while nodal metastasis (N1–N3) was confirmed in the remaining 33.3% of patients. On microscopic evaluation, tumor differentiation was relatively evenly distributed: well-differentiated squamous cell carcinomas were observed in 35.6% of cases, moderately differentiated tumors in 33.3%, and poorly differentiated variants in 31.1% (Table 2).

Table 2: Pathological Tumor Profile (TNM Staging and Differentiation)

Tumor Characteristics	Frequency (n=45)	Percentage (%)
Laterality (Tumor Side)		
Left buccal mucosa	24	53.3
Right buccal mucosa	21	46.7
Primary Tumor (T) Stage		
T1	7	15.6
T2	14	31.1
T3	6	13.3
T4 (includes T4a)	18	40.0
Regional Nodal (N) Stage		
N0 (node negative)	30	66.7
N1	4	8.9
N2 (includes N2a/N2b)	10	22.2
N3	1	2.2
Nodal Status (Grouped)		
Node negative	30	66.7
Node positive	15	33.3
Histopathological Differentiation		
Well differentiated	16	35.6
Moderately differentiated	15	33.3
Poorly differentiated	14	31.1

When evaluating the overall clinical stage at presentation, 57.8% of cases presented with advanced-stage disease (Stage III and IV), compared to 42.2% of patients who were diagnosed with early-stage disease (Stage I and II). To fulfill the study's objective, clinico-demographic factors and risk habits were evaluated for their association with clinical stage. Demographic analysis revealed a statistically significant association between gender and disease stage; male patients presented with advanced-stage disease at a significantly higher rate than their female

counterparts (76.5% vs. 46.4%, $P = 0.048$). Other baseline factors, including age cut-off (≥ 50 years) and the presence of systemic comorbidities, did not demonstrate a statistically significant association with the stage at presentation ($P = 0.872$ and $P = 0.328$, respectively). Regarding specific risk habits and their association with stage at presentation, a distinct clinical pattern was observed wherein patients with mixed habits—combining betel products with smoking or alcohol—predominantly presented with advanced-stage disease (75%, $n=9/12$). While variations were

also observed among exclusive smokeless tobacco users, such as a higher rate of advanced presentation in exclusive betel leaf consumers (63.6%, n=7/11), the overall

association between these detailed habit subtypes and clinical stage did not reach statistical significance within the confined sample of this cohort (P 0.356) (Table 3).

Table 3: Association of Clinico-Demographic Factors and Risk Habits with Clinical Stage

Variable	Early Stage (I–II)	Advanced Stage (III–IV)	P value
Gender			
Female (n=28)	15	13	0.048*
Male (n=17)	4	13	
Age			
<50 years (n=10)	4	6	0.872
≥50 years (n=35)	15	20	
Systemic Comorbidities			
Absent (n=15)	6	9	0.328
Single (n=24)	12	12	
Mixed (n=6)	1	5	
Risk Habits (Detailed)			
Betel nut only (n=18)	10	8	0.356
Betel leaf only (n=11)	4	7	
Quid only (n=1)	1	0	
Mixed habits – betel + smoking/alcohol (n=12)	3	9	
Smoking only (n=3)	1	2	

*Statistically significant finding ($P < 0.05$). Derived using Pearson Chi-Square / Fisher's Exact tests. Therapeutic interventions were tailored to match pathological staging and institutional protocols.

Surgical management ranged from wide local excisions for early superficial lesions to complex composite resections, including marginal or segmental mandibulectomies for advanced disease, coupled with selective or modified radical neck dissections. Surgical defects were subsequently reconstructed utilizing pectoralis major myocutaneous flaps, free fibular flaps, buccal pad tissue, or split-thickness skin grafts based on defect volume. In the postoperative follow-up period, the overall complication rate was 13.3%, with early events such as hematoma, orocutaneous fistula, flap failure, or acute respiratory distress syndrome. The early mortality rate was 4.4%, which included one postoperative systemic complication and one unrelated event.

DISCUSSION

Buccal squamous cell carcinoma represents a major oncological burden in India, with the buccal mucosa frequently emerging as the predominant anatomical sub-site. This site-specific predilection is overwhelmingly documented in both rural and tertiary healthcare settings across the subcontinent

[4,5,13]. The present study evaluated the clinical profile of buccal mucosa carcinoma within a specific rural demographic in Andhra Pradesh. A defining characteristic of this study was the distinct female preponderance (62.2%). This finding stands in contrast to the heavily male-dominated clinico-epidemiological cohorts frequently reported in large Indian tertiary care centers [6,9] and international analyses. However, this gender inversion is highly reflective of localized cultural practices within rural Andhra Pradesh—specifically the high use of smokeless tobacco products among rural women—which is consistent with regional demographic studies detailing localized oral malignancy profiles [14,21].

A critical finding of this analysis was the statistically significant association between gender and clinical stage at presentation (P 0.048). While the overall disease burden was higher in females, males demonstrated a significantly higher propensity to present with advanced, stage III or stage IV disease. The high rate of advanced-stage presentation (57.8%) in this study aligns with broader epidemiological challenges where delayed

diagnosis severely compromises long-term survival [2,11,19]. The significant delay in male presentation suggests a potential disparity in healthcare-seeking behaviour or an increased intensity of carcinogenic exposure, reflecting patterns of treatment failure and loco-regional recurrence commonly linked to advanced primary presentation [3].

The carcinogenic impact of smokeless tobacco observed in this cohort further validates the established risk-habit burden specific to buccal mucosa carcinomas [7,10]. Notably, a pronounced clinical trend emerged wherein patients with mixed habits (75%, n=9/12) and exclusive betel leaf consumption (63.6%, n=7/11) predominantly presented with advanced-stage disease. Although this association did not reach statistical significance (P 0.356) owing to the sample size, this aggressive clinical phenotype closely mirrors the severe tissue destruction patterns documented in larger global cohorts. The intense localized carcinogen exposure—arising from the prolonged mucosal exposure to betel products—inevitably drives deep tissue invasion and alters the histopathological landscape, necessitating aggressive surgical resection irrespective of the statistical power of the immediate cohort [15,19].

This delayed, advanced presentation was a substantial surgical and reconstructive burden. The high proportion of T3 and T4 primary tumors necessitated complex composite resections, frequently involving marginal or segmental mandibulectomies accompanied by selective or modified radical neck dissection. Consequently, reliance on major reconstructive options such as pectoralis major myocutaneous flaps and free fibular flaps was pronounced. This therapeutic reality is consistent with established oncological protocols for early and advanced cheek carcinomas, where advanced primary tumors, nodal involvement, and the necessity for clear resection margins dictate the extent of surgical morbidity and reconstructive choice [15,17]. Furthermore, aggressive surgical resection remains the cornerstone of achieving loco-regional control, often requiring multi-modality adjuvant therapies (such as radiotherapy) for advanced-stage disease [8,18].

Nevertheless, the data provide a vital, accurate reflection of the aggressive clinical profile of buccal carcinoma in rural populations. The high morbidity associated with delayed diagnosis necessitates the development of robust, community-level screening aids [13]. Targeted

preventive strategies, such as addressing the pervasive use of smokeless tobacco and delayed presentation in male demographics, remain critical in improving oncological outcomes in this region.

Limitations

The interpretation of these findings must be contextualized within the limitations of the study design. The retrospective nature of data collection introduces the risk of selection bias and limits the ability to track longitudinal survival outcomes or the continuation of risk habits post-treatment, which are parameters often explored in head-and-neck cancers. Moreover, the relatively small sample size (N=45) restricted the statistical power required to validate specific habit-to-stage associations.

CONCLUSION

This study highlights a concerning clinical paradigm for buccal mucosa carcinoma within a rural area of Andhra Pradesh, characterized by a predominantly advanced stage at presentation and a heavy reliance on complex, morbid surgical reconstructions. The distinct female preponderance observed underscores the severe oncological impact of localized cultural habits, specifically the pervasive use of smokeless tobacco products. Notably, while the overall disease burden was higher in females, male patients presented with advanced-stage disease at a significantly higher rate, identifying them as a highly vulnerable clinical subgroup. The aggressive local tissue destruction driven by these habits necessitates extensive surgical intervention, reflecting a critical delay in diagnosis. These findings strongly advocate for the implementation of targeted, community-level oral cancer screening programs in rural areas. Early detection initiatives and aggressive public health campaigns aimed at smokeless tobacco cessation are imperative to shift the presentation of buccal carcinoma to earlier stages, thereby reducing treatment morbidity and improving overall prognosis.

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Ethical Approval

This study was conducted following formal approval from the Institutional Ethics Committee, P.E.S Institute of Medical Sciences and Research, Kuppam, Andhra Pradesh, in accordance with ICMR ethical guidelines for human research.

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