Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/5r7y8460

OBSERVATIONAL STUDY IN REFERENCE TO DEMOGRAPHIC PROFILE, CLINICAL PRESENTATION, TOBACCO ADDICTION, SITES AND SUBSITES OF HEAD & NECK SQUAMOUS CELL CARCINOMA AT A TERTIARY CARE CENTRE OF WESTERN RAJASTHAN

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Abstract

Background: Head and Neck Squamous Cell Carcinoma (HNSCC) constitutes a significant portion of the global cancer burden, with a distinct and alarming prevalence in the Indian subcontinent. Unlike Western populations where alcohol and smoking are synergistic drivers, the Indian demographic is uniquely characterized by the rampant consumption of smokeless tobacco products, leading to a specific epidemiological profile often termed "Indian oral cancer." This study aims to provide a comprehensive analysis of the demographic variables, risk factor profiles, clinical presentations, and anatomical distribution of HNSCC in Western Rajasthan, a region with high usage of areca nut and tobacco mixtures.

Methods: A prospective, observational, descriptive cross-sectional study was conducted at the Department of Otorhinolaryngology, Mathuradas Mathur Hospital, Dr. S. N. Medical College, Jodhpur, from February 1, 2024, to May 1, 2024. The study included 92 histopathologically confirmed cases of squamous cell carcinoma involving the oral cavity, oropharynx, nasopharynx, hypopharynx, and larynx. Data regarding age, gender, socioeconomic status, education, residence, addiction habits, and clinical symptoms were recorded. Tumors were staged according to the AJCC 8th Edition TNM

classification. Statistical analysis was performed to determine frequency distributions and associations.

Results: The study identified a strong male preponderance (77.17%) with a male-to-female ratio of 3.4:1. The disease primarily affected the elderly, with 66.29% of patients aged above 50 years. A distinct socioeconomic gradient was observed; 86.95% of patients belonged to low-income or economically weaker sections, and 67.38% were either illiterate or had only primary education. Rural residents constituted 59.78% of the cohort. Tobacco addiction was near-universal (98.9%), with a stark dichotomy in usage patterns: smokeless tobacco was the exclusive habit in 94% of oral cancer cases, while smoking was predominant in laryngeal and pharyngeal cancers. The oral cavity was the most common primary site (55.43%), followed by the oropharynx (18.47%), larynx (14.13%), and hypopharynx (10.86%). The anterior two-thirds of the tongue and gingivo-buccal sulcus were the most affected oral subsites. Notably, 90.21% of patients presented with advanced-stage disease (Stage III or IV).

Conclusions: HNSCC in Western Rajasthan is inextricably linked to poverty, illiteracy, and specific tobacco chewing habits. The predominance of advanced-stage disease at presentation highlights a critical failure in early detection mechanisms. The distinct subsite distribution, favoring the gingivo-buccal complex, reinforces the etiological role of local carcinogen placement. Urgent public health interventions focusing on tobacco cessation and rural screening programs are mandated to mitigate this preventable epidemic.

Keywords: Head and neck squamous cell carcinoma, Oral cancer, Gingivo-buccal sulcus, Tobacco chewing, Epidemiology, Rajasthan, Advanced stage presentation.

Introduction

Head and neck carcinoma (HNC) represents a formidable challenge to global public health systems, encompassing a heterogeneous group of malignancies that arise from the mucosal epithelium of the upper aerodigestive tract. Globally, it ranks as the seventh most common cancer overall, being the fifth most common in men and the twelfth in women. The burden of this disease is not distributed extensively across the globe; rather, it exhibits striking geographical variations that mirror the cultural and behavioral diversity of human populations. In 2018, an estimated 888,000 new cases and 453,000 deaths were attributed to head and neck cancers worldwide. However, recent projections from GLOBOCAN 2022 and subsequent analyses in 2024 and 2025 indicate a rising trajectory, particularly in developing nations where population growth interacts with the entrenchment of carcinogenic lifestyle habits.

The Asian continent bears the brunt of this oncological burden, accounting for approximately 57.5% of all head and neck cancer cases globally. Within this vast region, India occupies a precarious position, often described in epidemiological literature as the "oral cancer capital of the world." In India, head and neck cancers account for approximately 30% of all malignancies in males and 11% to 16% in females, statistics that far outstrip those of most Western nations. The sheer volume of disease is staggering; over 200,000 new cases are diagnosed annually in the country, with oral cancer alone contributing nearly 80,000 of these cases.

The Etiological Landscape: A Toxic Synergy

The etiology of Head and Neck Squamous Cell Carcinoma (HNSCC) is multifactorial, involving a complex interplay of genetic susceptibility and environmental exposure. However, in the Indian context, the environmental component is overwhelmingly dominant. Tobacco use, in its myriad forms, is the single most significant preventable risk factor, identified in 80% to 90% of patients with oral cancer.

Tobacco Smoking:

Combustible tobacco consumption, primarily in the form of cigarettes and bidis (a localized hand-rolled tobacco product), is a well-established carcinogen. Epidemiological data suggests that smokers face a five- to nine-fold increased risk of developing oral cancer compared to non-smokers. This risk

is dose-dependent; heavy smokers consuming more than 80 cigarettes per day may face a risk multiplier of up to seventeen. Cigarette smoke contains a cocktail of over 60 identified carcinogens, including polycyclic aromatic hydrocarbons and tobacco-specific nitrosamines, which induce DNA adducts and driver mutations in critical tumor suppressor genes like TP53.

Smokeless Tobacco and "Indian Oral Cancer":

While smoking is a global risk factor, the consumption of smokeless tobacco (SLT) is a defining characteristic of the Indian HNC epidemic. The Global Adult Tobacco Survey (GATS) indicates that 28.6% of adults in India use tobacco, with a significant proportion relying on smokeless forms. The cultural practice of chewing betel quid (paan)—a mixture of areca nut, lime, catechu, and tobacco wrapped in a betel leaf—is widespread. More modern, industrial variations such as gutka, zarda, khaini, and mawa have further permeated the market.

The International Agency for Research on Cancer (IARC) classifies betel quid chewing as a Group 1 carcinogen. The mechanism of carcinogenesis in SLT users is distinct; the presence of lime (calcium hydroxide) in the mixture raises the pH of the oral cavity, facilitating the rapid absorption of nicotine and carcinogens across the oral mucosa. Furthermore, the abrasive nature of the areca nut causes chronic micro-trauma to the mucosa, accelerating the penetration of toxins. This habit leads to a specific pattern of disease localization. Nearly two-thirds of oral cancers in India occur in the gingivo-buccal sulcus (GBS), the anatomical trough between the jaw and the cheek where the tobacco quid is typically "parked" or retained for hours. This prolonged contact time creates a field of cancerization, justifying the nomenclature "Indian oral cancer" for malignancies arising in this subsite.

Alcohol and Synergism:

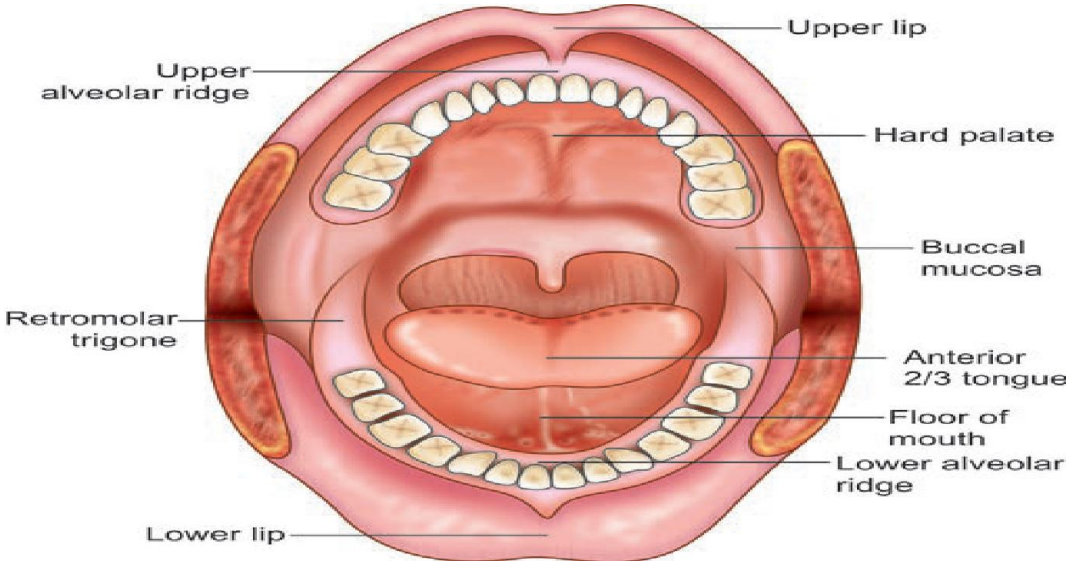
Alcohol consumption acts as a potent co-factor. While alcohol is not a direct mutagen, it acts as a solvent, increasing the permeability of the mucosal epithelium to tobacco carcinogens. Heavy drinkers who also smoke have an exponentially increased risk of HNC—up to 11 times that of abstainers. In the Indian population, while alcohol use is rising, tobacco remains the primary driver.

Socioeconomic Determinants:

HNSCC in India is inextricably linked to the social determinants of health. It is disproportionately a disease of the marginalized—those with low income, poor education, and limited access to healthcare. This socioeconomic disadvantage translates into a delay in diagnosis; approximately 60% to 80% of Indian patients present with locally advanced disease (Stage III or IV), compared to only 40% in developed countries. This late presentation is the single most critical factor influencing the dismal survival rates observed in the region.

Anatomical and Clinical Considerations

To understand the patterns of spread and clinical presentation of HNSCC, a detailed review of the anatomy of the upper aerodigestive tract is essential. The biological behavior of the tumor is strictly dictated by its site of origin and the associated lymphatic drainage.



Oral cavity overview{Fig1}

1. The Oral Cavity

The oral cavity extends from the skin-vermilion junction of the lips anteriorly to the junction of the hard and soft palate superiorly and the circumvallate papillae of the tongue inferiorly. It comprises several critical subsites: the lips, buccal mucosa, anterior two-thirds of the tongue, floor of the mouth, hard palate, alveolar ridges (upper and lower), and the retromolar trigone{Fig1}.

• Lymphatic Drainage: The lymphatic network of the oral cavity is rich and complex. The lower lip drains primarily to the submental (Level I) and submandibular nodes. The upper lip drains to preauricular, infraparotid, and submandibular nodes. The tongue, a highly muscular and vascular organ, has a dense lymphatic network. The tip drains to submental nodes, while the lateral borders drain to submandibular nodes. Importantly, the central tongue drains directly to the deep cervical nodes (Level III), often bilaterally, necessitating aggressive management of the neck even in early-stage disease. The buccal mucosa drains to Level I and II nodes but can also spread to the deep cervical chain.

2. The Oropharynx

Posterior to the oral cavity lies the oropharynx, extending from the level of the hard palate to the hyoid bone. It includes the soft palate, the base of the tongue (posterior third), the palatine tonsils (housed in the tonsillar fossa between the anterior and posterior pillars), and the posterior pharyngeal wall.

• Clinical Relevance: The base of the tongue and tonsils are rich in lymphoid tissue (part of Waldeyer's ring). Tumors here often remain submucosal and asymptomatic until they metastasize to the neck. Consequently, a cystic neck mass may be the first and only sign of an occult oropharyngeal carcinoma.

3. The Nasopharynx

The nasopharynx is the uppermost part of the pharynx, situated behind the nasal cavities and above the soft palate. It is bounded by the skull base (basisphenoid) superiorly and communicates with the oropharynx inferiorly.

• Anatomical Landmarks: The lateral wall contains the opening of the Eustachian tube, bounded by the torus tubarius and the Fossa of Rosenmuller—the most common site of origin for nasopharyngeal carcinoma (NPC). The Sinus of Morgagni, a space between the skull base and the superior constrictor muscle, allows the passage of the Eustachian tube and levator veli palatini muscle.

• Pathology: NPC is unique; it is often undifferentiated, associated with Epstein-Barr Virus (EBV) infection, and endemic in Northeast India and Southern China. It frequently presents with otological symptoms (serous otitis media due to Eustachian tube obstruction) or cranial nerve palsies (due to skull base invasion via the foramen lacerum).

4. The Hypopharynx

The hypopharynx acts as the conduit to the esophagus, extending from the hyoid bone to the lower border of the cricoid cartilage. It is divided into three subsites: the pyriform sinus (fossa), the post-cricoid region, and the posterior pharyngeal wall.

• Pyriform Sinus: This potential space lies lateral to the larynx. It is a "silent" area where tumors can grow to considerable size without causing obstruction. By the time dysphagia manifests, the tumor is often advanced. The rich lymphatic drainage through the thyrohyoid membrane leads to early metastasis to the upper jugular chain.

• Post-Cricoid Region: This area is the pharyngoesophageal junction. Cancers here are historically associated with Plummer-Vinson syndrome (iron deficiency anemia) and are more common in women.

5. The Larynx

The larynx is located anterior to the hypopharynx, spanning from the third to the sixth cervical vertebrae. It is compartmentalized into the supraglottis (epiglottis, aryepiglottic folds, ventricular bands), glottis (vocal cords, anterior/posterior commissures), and subglottis.

• Lymphatic Isolation: The glottis is embryologically distinct with sparse lymphatic drainage. Therefore, glottic cancers (vocal cord cancers) rarely metastasize early. They present early with hoarseness, leading to high cure rates. In contrast, the supraglottis is rich in lymphatics, and tumors here present late with vague symptoms like throat pain or referred otalgia, often accompanied by nodal disease.

ANATOMY OF HYPOPHARYNX

Rationale for the Study

Despite the overwhelming burden of HNSCC in India, regional data is crucial because risk factors and tumor patterns vary significantly across the subcontinent. Western Rajasthan presents a unique demographic landscape characterized by a large rural population, arid climatic conditions, and specific cultural habits regarding tobacco consumption (high prevalence of specific smokeless products). Existing literature often aggregates data from major metropolitan centers, which may not accurately reflect the epidemiological reality of this specific region.

Understanding the precise distribution of subsites (e.g., buccal mucosa vs. tongue) and their correlation with demographic variables (age, gender, SES) is vital for designing targeted screening and awareness programs. This study, conducted at a tertiary care center in Jodhpur, aims to fill this knowledge gap by providing a granular analysis of HNSCC cases in this population.

Methods

The primary aim of this study is to observe and analyze the distribution of head and neck squamous cell carcinoma (HNSCC) at a tertiary care center in Western Rajasthan by examining demographic profiles, clinical presentation, tobacco addiction patterns, and tumor sites and subsites. Specifically, the study seeks to describe the proportional involvement of various anatomical sites and subsites, analyze the demographic characteristics (age, sex, residence, education, income) of the affected patients, characterize the patterns of tobacco addiction (smoking versus smokeless) and their correlation with tumor sites, and document the clinical presentation and stage of the disease at the time of diagnosis.

Study Design and Location

This research was designed as an observational descriptive cross-sectional study. It was conducted at the Department of Otorhinolaryngology, Mathuradas Mathur Hospital, which is attached to Dr. S. N. Medical College in Jodhpur, Rajasthan. This institution serves as a major tertiary referral center for the western districts of Rajasthan, catering to a diverse patient population from both urban Jodhpur and the surrounding rural hinterlands.

Study Duration and Timeline

The data collection for the study was prospective, covering a period of three months from February 1, 2024, to May 1, 2024. The study protocol was initiated after obtaining ethical clearance and continued until the calculated sample size was achieved.

Sampling Strategy

Sample Size Calculation:

The sample size was determined using the standard formula for single sample proportion:

Where:

• Z_{1-\alpha/2} is the standard normal deviate for 95% confidence interval (1.96).

• P is the expected proportion of oral cavity SCC among all HNCs, taken as 58.4% based on previous literature (Chauhan R et al.).

• E is the absolute allowable error, set at 10%.

Based on these parameters, the minimal sample size required was calculated to be 92 patients.

Sampling Technique:

A consecutive sampling method was employed. All patients presenting to the ENT outpatient or inpatient departments during the study period who met the inclusion criteria were recruited sequentially until the target sample size was reached.

Eligibility Criteria

Inclusion Criteria:

1. Diagnosis: Newly diagnosed cases of squamous cell carcinoma of the head and neck.
2. Confirmation: Diagnosis must be histopathologically proven via biopsy.
3. Anatomical Site: Tumors originating from the Oral Cavity, Oropharynx, Nasopharynx, Hypopharynx, or Larynx.
4. Demographics: Patients of all ages and genders were eligible.
5. Consent: Patients willing to provide informed written consent for participation.

Exclusion Criteria:

1. Recurrence: Patients presenting with recurrent disease who had been previously treated.
2. Metastasis: Patients with metastatic disease to the head and neck from a primary tumor outside the upper aerodigestive tract.
3. Histology: Non-squamous malignancies (e.g., adenoid cystic carcinoma, lymphoma, sarcoma).
4. Consent: Patients refusing to participate or unable to provide history.

Data Collection and Variables

A structured proforma was utilized to collect data systematically. The data collection process involved:

1. Demographic Profiling:

• Age: Recorded in years and stratified into groups (<30, 31-40, 41-50, 51-60, >60).

• Gender: Male or Female.

• Residence: Classified as Rural (areas under Gram Panchayat administration) or Urban (areas under Municipality or Corporation).

• Socioeconomic Status (SES): Income was used as a proxy for SES, categorized based on Ministry of Housing and Urban Poverty Alleviation guidelines:

• Economically Weaker Section (EWS): Up to 3 Lakh INR/annum.

• Low Income Group (LIG): 3 Lakh to 6 Lakh INR/annum.

• Middle Income Group (MIG): 6 Lakh to 18 Lakh INR/annum.

• High Income Group (HIG): Above 18 Lakh INR/annum.

• Education: Classified as Illiterate, Primary Education (Grades 1-8), Secondary Education (Grades 9-12), and Above Secondary.

2. Clinical History and Risk Assessment:

• Addiction History: Detailed elicitation of habits including tobacco smoking (bidi, cigarette), smokeless tobacco (gutka, khaini, zarda), and alcohol consumption. The duration and frequency were noted.

• Symptoms: Presenting complaints such as mouth ulcer, trismus, dysphagia, hoarseness, neck swelling, epistaxis, and foreign body sensation were recorded.

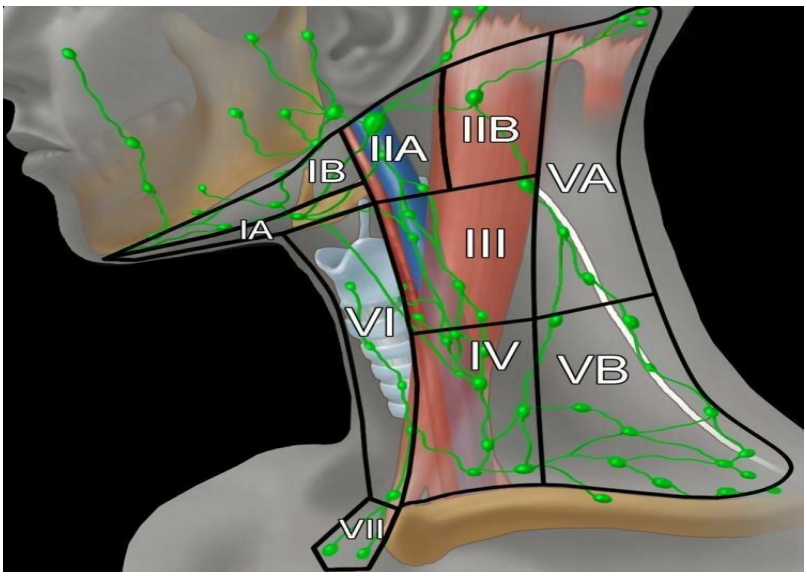
3. Physical Examination:

A comprehensive Head and Neck examination was performed, including:

• Oral Cavity: Inspection and palpation to define tumor extent.

• Oropharynx/Hypopharynx/Larynx: Evaluated using indirect laryngoscopy and/or Hopkins telescopic examination (70/90 degree) to visualize subsites like the base of tongue, pyriform sinus, and vocal cords.

• Neck: Palpation of all cervical lymph node levels (I-VII) to assess regional metastasis. {Fig. 2}



{Fig. 2} Cervical Lymph Nodes

4. Staging (TNM Classification):

Staging was strictly adhered to the AJCC (American Joint Committee on Cancer) 8th Edition guidelines.

• Tumor (T) Staging:

• Oral Cavity: Differentiated by size (2cm/4cm cutoffs) and Depth of Invasion (DOI - 5mm/10mm cutoffs). T4a involves cortical bone, deep muscle, or skin; T4b involves masticator space or skull base.

• Nasopharynx: T1 confined to nasopharynx; T2 parapharyngeal extension; T3 bony structures; T4 intracranial/orbital/cranial nerve involvement.

• Oropharynx (p16-): T1 (<2cm), T2 (2-4cm), T3 (>4cm), T4a (moderately advanced local), T4b (very advanced local).

• Hypopharynx: T1 (<2cm, one subsite), T2 (2-4cm, adjacent subsite), T3 (>4cm or hemilarynx fixation), T4a (thyroid/cricoid cartilage invasion), T4b (prevertebral fascia).

• Larynx: Differentiated by subsite (Supraglottis/Glottis/Subglottis) and vocal cord mobility. T3 involves vocal cord fixation; T4a involves thyroid cartilage penetration.

• Nodal (N) Staging: Assessed based on size, laterality, and presence of Extranodal Extension (ENE).

• Group Staging: Patients were grouped into Stages I through IVC based on the TNM combinations.

Statistical Analysis

The collected data were compiled into a Microsoft Excel spreadsheet. Statistical analysis was performed using the SPSS version 22.0 software package (SPSS Inc., Chicago, IL, USA).

• Descriptive Statistics: Qualitative data (categorical variables like gender, site, stage) were expressed as frequencies and percentages.

• Presentation: Results were visualized using tables and bar charts to elucidate trends and distributions.

Ethical Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was granted by the Institutional Ethics Committee of Dr. S. N. Medical College. Written informed consent was obtained from all participants (or their legal representatives) in their local language prior to inclusion.

Results

A total of 92 patients with biopsy-proven Head and Neck Squamous Cell Carcinoma were enrolled and analyzed during the study period. The results provide a detailed demographic and clinical characterization of the disease burden in this specific population.

1. Demographic Distribution

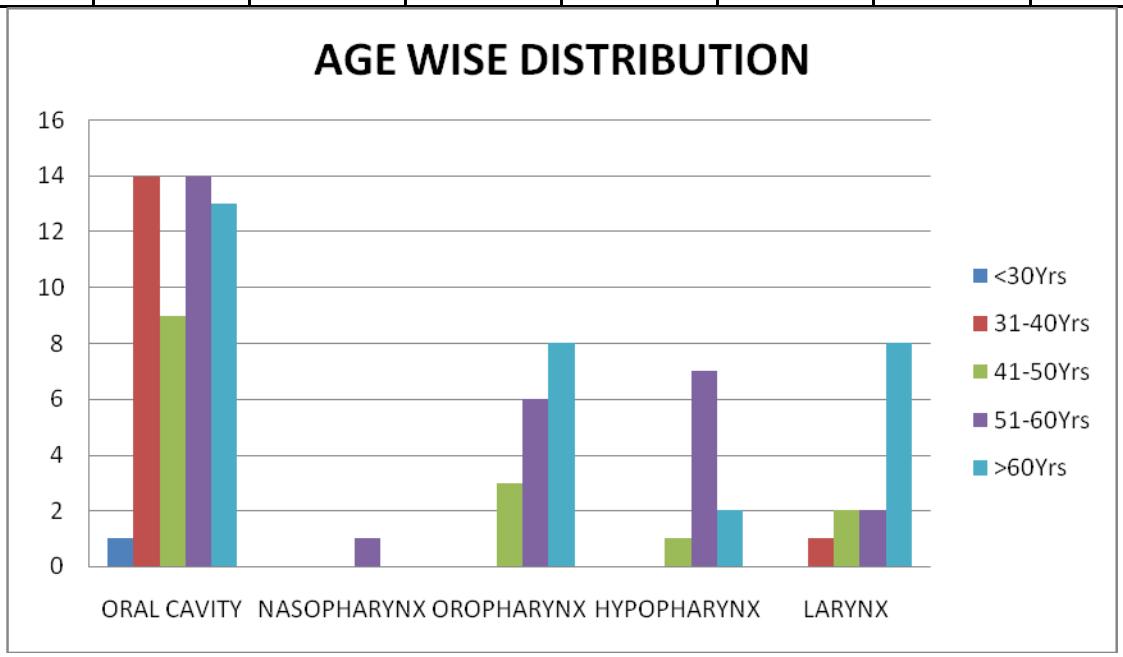
Age Distribution:

The study population ranged in age from 26 to 80 years. The highest incidence was observed in the geriatric population. Patients aged over 60 years constituted the largest group (33.69%), followed closely by those in the 51-60 years bracket (32.60%). Cumulatively, 66.29% of the cohort was over the age of 50 years.

However, a significant burden was also noted in younger age groups. 16.30% of patients were between 31 and 40 years old. The youngest patient was a 26-year-old male diagnosed with oral cavity carcinoma, highlighting the early onset of disease in tobacco chewers.

Table 1: Age-wise Distribution of HNSCC Cases

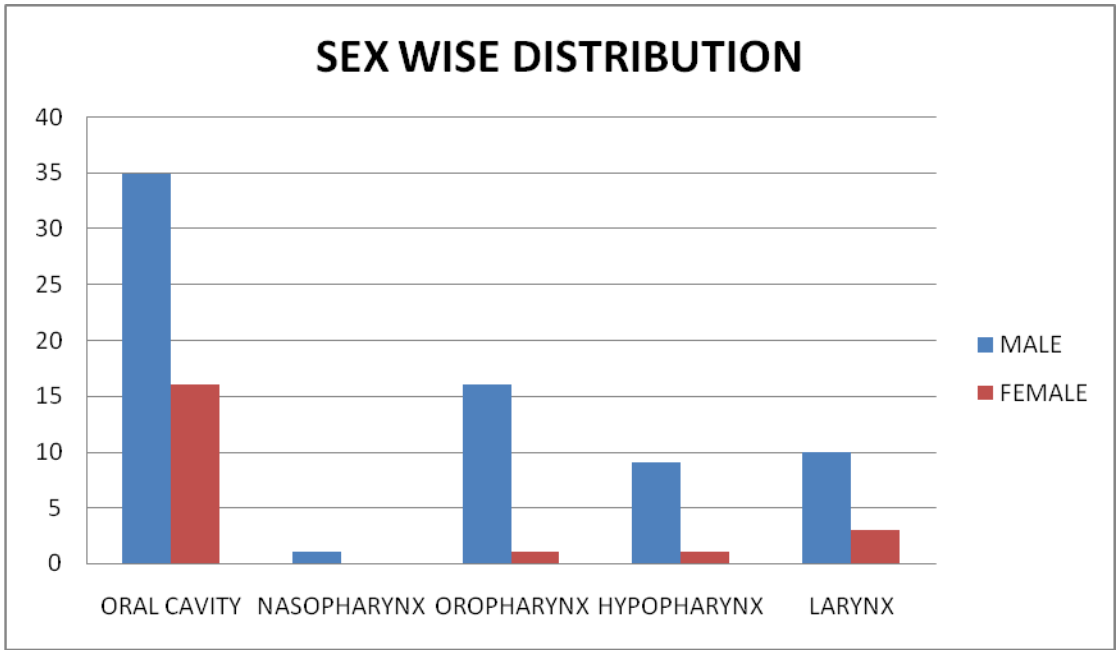
Age Group	Oral Cavity	Nasopharynx	Oropharynx	Hypopharynx	Larynx	Total	Percenta
<30 yrs	1	0	0	0	0	1	1.08%
31-40 yrs	14	0	0	0	1	15	16.30%
41-50 yrs	9	0	3	1	2	15	16.30%
51-60 yrs	14	1	6	7	2	30	32.60%
>60 yrs	13	0	8	2	8	31	33.69%
Total	51	1	17	10	13	92	100%



Gender Distribution:
The study demonstrated a significant male preponderance. Out of 92 cases, 71 (77.17%) were males and 21 (22.82%) were females, yielding an overall male-to-female ratio of 3.4:1.
When analyzed by site, males dominated all categories. However, the proportion of females was highest in oral cavity cancers (31.37%), whereas laryngeal and pharyngeal cancers were overwhelmingly male-dominated (e.g., 94% male in oropharynx, 90% male in hypopharynx).

Table 2: Sex-wise Distribution of HNSCC Cases

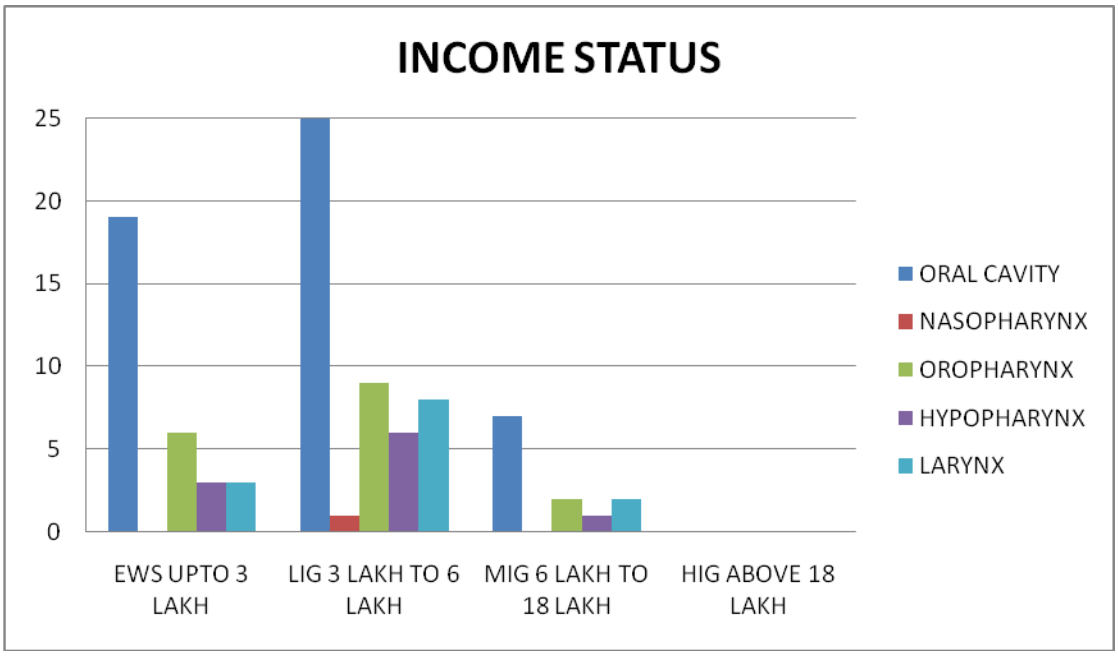
SEX	ORAL CAVITY	NASOPHARYNX	OROPHARYNX	HYPOPHARYNX	LARYNX	TOTAL
Male	35	1	16	9	10	71
Female	16	0	1	1	3	21
Total	51	1	17	10	13	92



Residence:
A clear rural dominance was observed. 55 patients (59.78%) hailed from rural areas (villages), while 37 patients (40.21%) were from urban areas. This distribution underscores the penetration of HNSCC risk factors into the rural hinterland of Rajasthan.
Socioeconomic and Educational Status:
The disease burden was heavily skewed towards the lower socioeconomic strata.
• Income: Over half the patients (53.26%) belonged to the Low Income Group (LIG), earning between 3-6 Lakh INR annually. Another 33.69% fell into the Economically Weaker Section (EWS), earning less than 3 Lakh INR. Notably, zero patients from the High Income Group were recorded in this study.
• Education: Educational attainment was correspondingly low. 27.17% of patients were illiterate, and 40.21% had only primary education. Only 5 patients (5.43%) had education above the secondary level.
Table 3: Income Status of HNSCC Patients

Income Group	No. Of Cases	Percentage

Economically Weaker Section (<3 Lakh)	31	33.69%
Low Income Group (3-6 Lakh)	49	53.26%
Middle Income Group (6-18 Lakh)	12	13.04%
High Income Group (>18 Lakh)	0	0.00%



2. Risk Factor Profile (Addiction)

Tobacco use was identified as the nearly universal risk factor in this cohort. Out of 92 patients, 91 (98.9%) reported a history of tobacco use. Only one patient (a female with post-cricoid cancer) reported no addiction.

The pattern of addiction varied significantly by tumor site:

• Smokeless Tobacco: 48 patients (52.17%) were exclusive users of smokeless tobacco. Strikingly, all 48 of these patients had oral cavity carcinoma. This indicates a 100% concordance between exclusive smokeless tobacco use and oral cavity malignancy in this study.

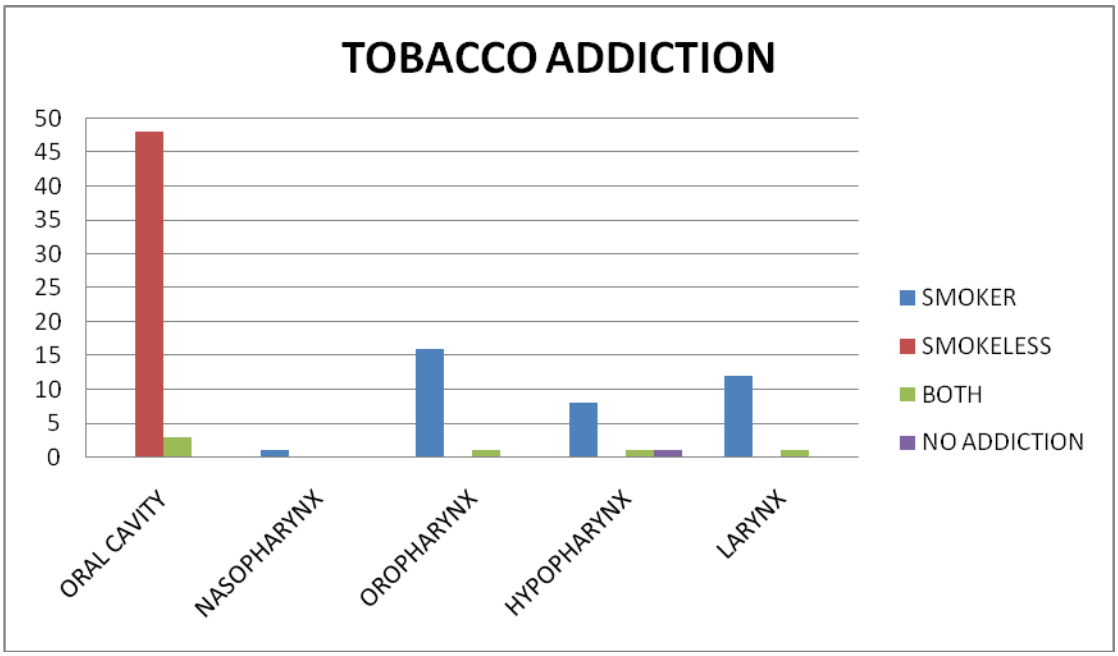
• Smoking: 37 patients (40.21%) were exclusive smokers. Smoking was the dominant habit for patients with Oropharyngeal (16/17), Hypopharyngeal (8/10), and Laryngeal (12/13) cancers.

• Dual Usage: 6 patients used both forms of tobacco.

Table 4: Tobacco Addiction Patterns by Site

Addiction	Oral Cavity	Nasopharynx	Oropharynx	Hypopharynx	Larynx	Total

Smokers	0	1	16	8	12	37
Smokeless	48	0	0	0	0	48
Both	3	0	1	1	1	6
No-Addiction	0	0	0	1	0	1



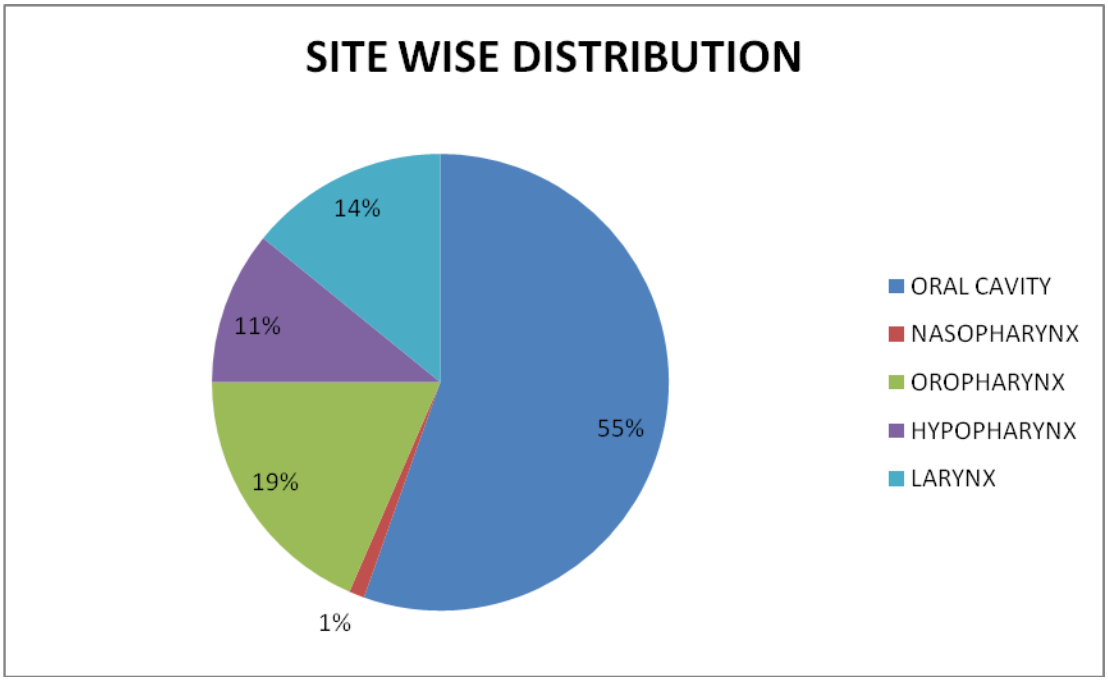
3. Anatomical Distribution

Primary Site Distribution:

The oral cavity was the most frequently affected site, accounting for more than half of the total caseload.

Table 5: Site-wise Distribution of HNSCC

Site	Number of Cases	Percentage
Oral Cavity	51	55.43%
Oropharynx	17	18.47%
Larynx	13	14.13%
Hypopharynx	10	10.86%
Nasopharynx	1	1.08%
Total	92	100%



Subsite Analysis:

• Oral Cavity: The Anterior two-thirds of the tongue was the most common subsite (29.41%), closely followed by the Gingivo-Buccal Sulcus (GBS) & Alveolus (27.45%) and Buccal Mucosa (21.56%). The prominence of GBS and Buccal Mucosa (combined ~49%) highlights the role of quid placement.

• Oropharynx: The Anterior Wall (comprising Base of Tongue, Vallecula, Lingual Epiglottis) accounted for the majority (52.94%) of cases. The Lateral Wall (Tonsils) accounted for 41.17%. No posterior wall tumors were seen.

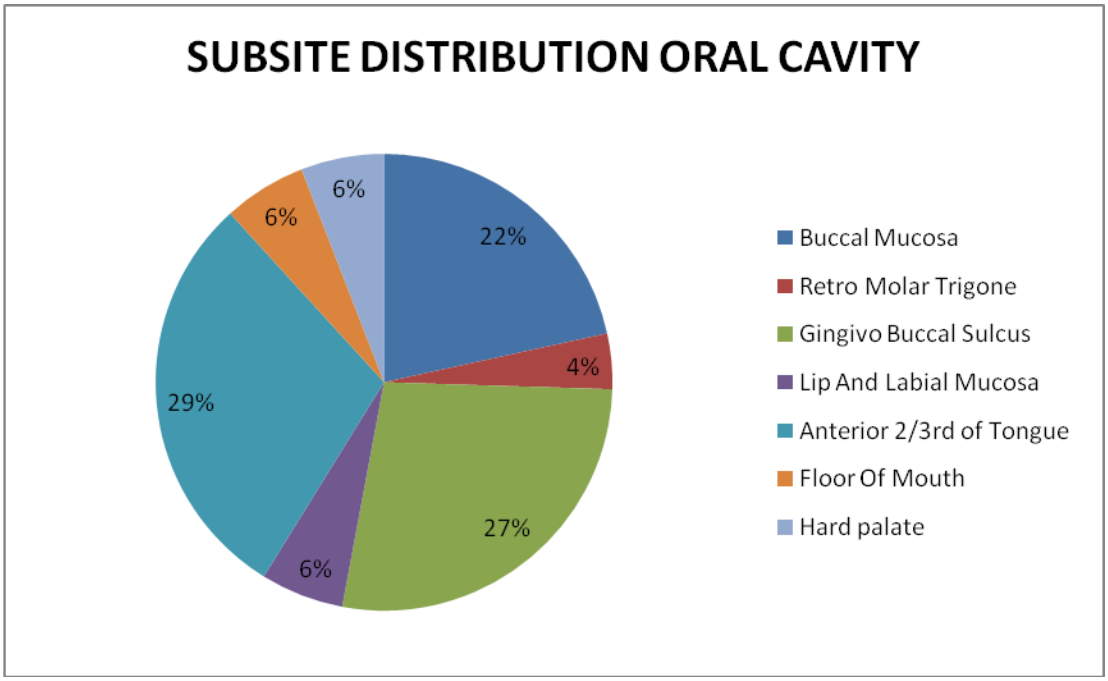
• Hypopharynx: The Pyriform Sinus was the overwhelming dominant subsite, accounting for 70% of hypopharyngeal malignancies. The post-cricoid region accounted for 20%.

• Larynx: Supraglottic cancers were the most common (53.84%), followed by Glottic (38.46%). Subglottic cancer was rare (1 case, 7.69%).

Table 6: Subsite Distribution for Oral Cavity SCC

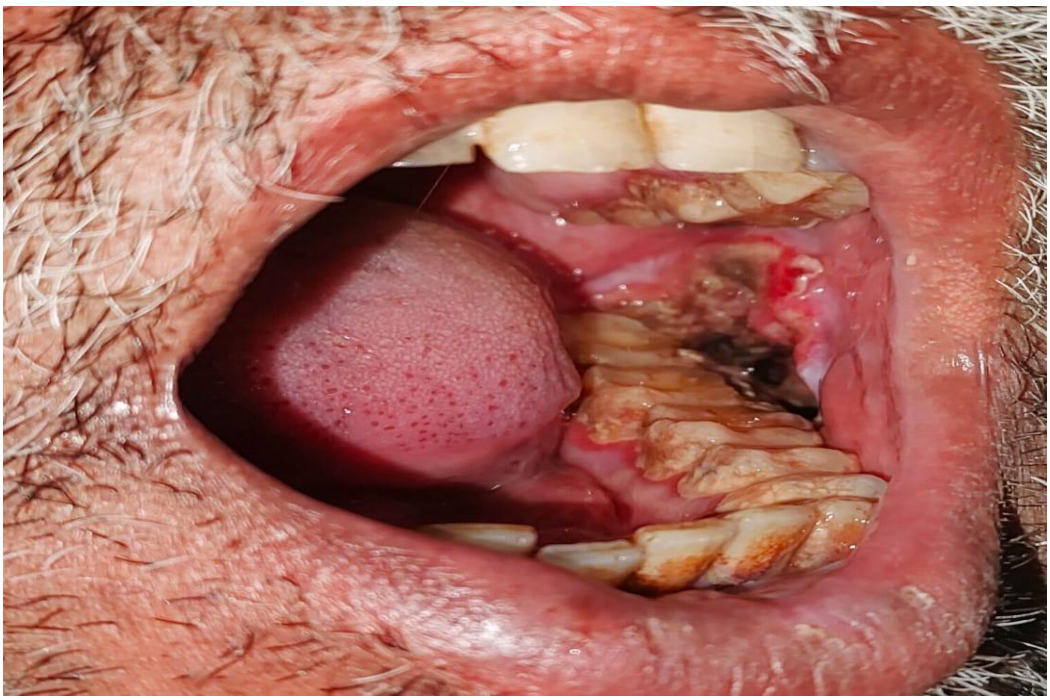
Oral Cavity Subsite	Cases	Percentage
Anterior 2/3rd Tongue	15	29.41%
Gingivo-Buccal Sulcus & Alveolus	14	27.45%
Buccal Mucosa	11	21.56%
Lip and Labial Mucosa	3	5.88%
Floor of Mouth	3	5.88%
Hard Palate	3	5.88%

Retromolar Trigone	2	3.92%





{Lateral Border Of Tongue tumour}



{**Buccal Mucosa RMT Tumor**}

4. Clinical Presentation and Staging

Clinical Symptoms:

The presenting complaints were strongly correlated with the anatomical site:

• Oral Cavity: All 51 patients presented with an oral ulcer. Significantly, 23 patients (45%) presented with trismus (restricted mouth opening), suggesting advanced locoregional spread or concurrent Oral Submucous Fibrosis (OSMF).

• Oropharynx: Dysphagia was the universal symptom (100% of cases), often accompanied by neck swelling (58%).

• Hypopharynx: Dysphagia (80%) and foreign body sensation (50%) were predominant.

• Larynx: Glottic cancers presented with change in voice (100% of glottic cases). Supraglottic cancers presented with foreign body sensation (100%) and dysphagia (85%), but voice change was less common initially.

• Nasopharynx: The single case presented with nasal obstruction and epistaxis.

Staging at Diagnosis:

The study revealed a disturbing trend of late presentation.

• Stage III: 47 cases (51.08%)

• Stage IV: 36 cases (39.13%)

• Stage II: 8 cases (8.69%)

• Stage I: 1 case (1.08%)

Combined, 90.21% of patients presented with advanced-stage disease (Stage III or IV). Early-stage detection (Stage I/II) was extremely rare (9.78%), and more than half of these early cases (5/9) were glottic carcinomas, likely detected early due to the symptom of hoarseness.

T-Stage Distribution:

• T3: 47.82% (44 cases)

• T4: 29.34% (27 cases)

• T2: 20.65% (19 cases)

• T1: 2.17% (2 cases)

N-Stage Distribution:

Nodal metastasis was highly prevalent.

• N1: 53.26% (49 cases)

• N2: 36.95% (34 cases)
• N0: 8.69% (8 cases)
Only 8.69% of patients had a clinically negative neck (N0) at presentation, indicating a high burden of regional metastasis.

Discussion

This study provides a detailed epidemiological snapshot of Head and Neck Squamous Cell Carcinoma in Western Rajasthan, offering insights that are both consistent with national trends and unique to the region's cultural fabric. The data underscores the dominance of tobacco-driven malignancies in a socioeconomically disadvantaged population and highlights the tragic reality of delayed diagnosis.

1. The Demographic Burden: Age, Gender, and Poverty

The demographic profile of HNSCC in this study—predominantly affecting males over 50 years of age—aligns with data from the National Cancer Registry Programme (NCRP) and other Indian studies. The peak incidence in the 51-60 and >60 age groups reflects the long latent period of tobacco carcinogenesis. However, the presence of 16.3% of cases in the 31-40 age group is alarming. This "shift to the left" in age distribution suggests early initiation of tobacco habits, potentially in adolescence. In rural Rajasthan, gutka and areca nut are often socially acceptable and easily accessible to youth, leading to a cumulative carcinogenic exposure that manifests as malignancy in early adulthood.

Gender Disparity:

The male-to-female ratio of 3.4:1 reflects the gendered nature of addiction in India. Men are more likely to smoke and chew tobacco publicly. However, the study found that 31% of oral cavity cancer patients were female, a higher proportion than in laryngeal or pharyngeal cancers. This is consistent with cultural norms where women in rural areas are less likely to smoke but frequently use smokeless tobacco (often as mishri for teeth cleaning or zarda). This distinct pattern of female addiction drives the incidence of oral, rather than pharyngeal, cancers in women.

Socioeconomic Factors:

The overwhelming concentration of cases in the Low Income (53%) and Economically Weaker (33%) sections is a critical finding. Poverty acts as a double-edged sword: it increases exposure to cheap, unregulated tobacco products and creates barriers to healthcare access. The high rate of illiteracy (27%) further compounds this by limiting awareness of early warning signs. The absence of High-Income patients in this cohort suggests that affluent patients may seek care at private centers, or perhaps have different risk profiles, but it reinforces that HNSCC remains a disease of the poor in the public sector.

2. The "Indian Oral Cancer": Anatomy of an Epidemic

The study unequivocally confirms the supremacy of the oral cavity as the leading site of HNC in India (55.43%), a sharp contrast to Western data where oropharyngeal and laryngeal cancers often predominate due to HPV and smoking.

Mechanism of Site Specificity:

The subsite analysis provides compelling evidence for the direct contact theory of carcinogenesis.

• Gingivo-Buccal Sulcus (GBS) & Buccal Mucosa: Combined, these sites accounted for nearly 50% of oral cancers. This distribution is uniquely Indian. In the West, the tongue and floor of mouth are common sites due to the "pooling" of alcohol and dissolved smoke carcinogens. In contrast, the Indian habit of quid retention—placing the tobacco mixture in the GBS and leaving it for hours—exposes this specific mucosa to high concentrations of nitrosamines and reactive oxygen species. This leads to the classic progression from Oral Submucous Fibrosis (OSMF) or leukoplakia to frank carcinoma in the GBS, earning it the moniker "Indian Oral Cancer".

• The Tongue: The anterior tongue was the single most common subsite (29%). While often linked to sharp teeth or trauma, in this cohort, it is also heavily exposed to the chemical milieu of the oral cavity.

The Tobacco Dichotomy:

The study found a near-perfect separation of risk factors: 94% of oral cancer patients were exclusive chewers, while smokers dominated the laryngeal/pharyngeal groups. This reinforces that mode of consumption dictates the site of malignancy. Smokeless tobacco acts locally (Oral Cavity), while inhaled smoke acts on the downstream respiratory epithelium (Larynx/Pharynx).

3. Clinical Presentation and the Tragedy of Late Stage

The most distressing finding of this study is that 90.21% of patients presented at Stage III or IV. This figure is significantly higher than in developed nations and highlights a systemic failure in early detection.

Why the Delay?

1.Anatomical Silence:

Hypopharynx (Pyriform Sinus): This subsite accounted for 70% of hypopharyngeal cases. The pyriform sinus is a capacious space; tumors can grow large without causing obstructive symptoms. By the time the patient experiences dysphagia (seen in 80% of cases here), the tumor is often T3 or T4. Furthermore, the rich lymphatics mean N-stage is usually advanced at presentation.

Supraglottis: Similarly, supraglottic cancers (53% of larynx cases) do not cause hoarseness early. They present with vague symptoms like "foreign body sensation," which are often ignored or treated as pharyngitis.

2.Symptom Normalization:

Oral Cavity: Despite being visible, oral cancers presented late. The high prevalence of trismus (45%) suggests that patients often ignore the initial ulcer and seek help only when functional limitation (inability to open mouth) sets in. In a population where chewing tobacco is common, minor oral irritation may be considered "normal" until it becomes severe.

3.Educational Barriers: With 67% of the cohort having primary education or less, the lack of health literacy prevents self-examination or early recognition of red flags.

Comparison with Glottic Cancer:

The only subgroup with a reasonable rate of early detection was glottic (vocal cord) cancer. Because the vocal cords are critical for phonation, even a small T1 lesion causes hoarseness. This compels the patient to seek medical attention early. Consequently, 5 of the 9 early-stage cases in this study were glottic, proving that symptom visibility drives early diagnosis.

4. Comparison with National and Global Data

The findings of this study are largely congruent with the National Cancer Registry Programme (NCRP) and Madras Metropolitan Tumour Registry (MMTR) data.

Site: NCRP reports oral cavity cancer as the leading site (52.2%), matching our 55.43%.

Age: Our peak age (>50) aligns with NCRP (40-64) and MMTR (40-60) trends.

Emerging Trends: The study notes a higher prevalence of tongue cancers (29%) compared to some historical data where buccal mucosa was the undisputed leader. This might reflect changing habits or the specific composition of newer gutka mixtures.

Globally, this profile contrasts sharply with the West, where HPV-positive oropharyngeal cancer is rising in younger, non-smoking populations. In this study, oropharyngeal cancer was 18.47%, but it was strongly linked to smoking, suggesting the Indian epidemic is still largely tobacco-driven rather than viral.

Limitations

This study was hospital-based, which carries referral bias; tertiary centers often see more advanced cases than primary clinics. The sample size (n=92) was sufficient for statistical validity but small compared to population registries. Molecular testing for HPV (p16 immunohistochemistry) was not part of the protocol, limiting insights into the viral contribution to the oropharyngeal cases observed.

Conclusion

This observational study from Western Rajasthan paints a clear and concerning picture of Head and Neck Squamous Cell Carcinoma in the region. It is a disease defined by three pillars: Poverty, Tobacco, and Late Presentation.

1. The Burden is Preventable: With 99% of patients using tobacco, HNSCC in this region is almost entirely preventable. The direct correlation between smokeless tobacco and oral cancer (particularly gingivo-buccal subsites) confirms the urgent need for stricter regulation of gutka and areca nut products.
2. The Diagnosis is Delayed: The presentation of 90% of patients at Stage III/IV is a public health emergency. It transforms a potentially curable disease into one requiring mutilating surgery and aggressive chemoradiation, often with poor survival outcomes.
3. The Anatomy is Critical: Understanding the subsite distribution helps target screening. The high incidence of "silent" cancers (supraglottic/pyriform sinus) necessitates a lower threshold for endoscopic evaluation in smokers with vague throat symptoms.

Recommendations:

• Rural Screening: Given the rural dominance, screening camps utilizing visual inspection for oral lesions must be conducted at the village level (Gram Panchayat).
• Awareness: Educational campaigns must move beyond "tobacco causes cancer" to specific symptom awareness (e.g., "Any mouth ulcer lasting >2 weeks requires a check-up").
• Policy: The ban on smokeless tobacco products needs rigorous enforcement, as their consumption remains the primary driver of the "Indian Oral Cancer" epidemic.

Future research should focus on longitudinal follow-up to assess the survival outcomes of these patients and evaluate the efficacy of community-based intervention programs in this high-risk demographic.

Acknowledgements

The authors express their gratitude to the faculty and residents of the Department of Otorhinolaryngology at Dr. S. N. Medical College, Jodhpur, for their clinical support. Special thanks to the patients who participated in this study.

Funding: No funding sources.

Conflict of Interest: None declared.

Ethical Approval: The study was approved by the Institutional Ethics Committee.

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