Section: Miscellaneous

Original Research Article

A STUDY ON RISK FACTORS OF TOBACCO RELATED CANCERS AMONG MALE POPULATION IN BHOPAL

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ABSTRACT

Background: Tobacco use remains a significant public health issue and is the leading preventable cause of cancer globally. An estimated 1.3 billion individuals worldwide use tobacco in some form, contributing to approximately 6 million deaths annually from cancer and other diseases.

Materials and Methods: This observational study was conducted over a 12-month period (2017–2018) at AIIMS Bhopal, with active data collection from the Departments of ENT, Surgery, and Radiotherapy. The study included all male patients diagnosed with tobacco-related cancers (TRCs), regardless of current tobacco usage status.

Results: A total of 300 male cancer patients were interviewed during the study period, all of whom were diagnosed with TRCs. Among them, 33.33% were associated with smoking and 27.03% with smokeless tobacco use. Most cases (36.67%) were in the 40–50-year age group. Notably, oral cancer was prevalent in 27.03% of patients with a history of smokeless tobacco use, while 33.33% of lung cancer cases were linked to smoking. Overall, mixed tobacco use ie smoking and chewing tobacco was the most common habit observed (38.60%), followed by smoking (33.33%) and smokeless tobacco use (28%).

Conclusion: Understanding the incidence and patterns of tobacco-related cancers is crucial for developing effective strategies for primary prevention. Curbing tobacco use remains a cornerstone in cancer control efforts.

Keywords: Mortality, tobacco-related cancers, smokeless tobacco, smoking.

INTRODUCTION

Epidemiological studies have long investigated the relationship between cancer incidence and exposure to environmental carcinogens. One of the earliest landmark reports was the 1964 US Surgeon General's Advisory Committee publication, which established a causal link between cigarette smoking and lung cancer. Since then, extensive research has been conducted to explore the etiological relationship between various types of cancer and both smoking and smokeless forms of tobacco use.

Cancer remains one of the leading causes of morbidity and mortality worldwide, accounting for an estimated 18.1 million new cases and 9.6 million deaths annually.[1] Tobacco use continues to be a critical and persistent public health issue and is recognized as the most preventable cause of cancer globally. Approximately 1.3 billion people use tobacco in some form,[2] contributing to nearly 6 million deaths each year from cancer and other tobacco-related diseases.[3] Alarmingly, these numbers are expected to rise, with projections suggesting up to 8 million tobacco-related deaths annually in the coming decades.[4] Approximately 40% of all cancers are related to tobacco use, and nearly 90% of oral cancers are directly attributed to tobacco consumption. In India, tobacco is consumed in a wide variety of forms, including both smoking (such as cigarettes and bidis) and smokeless tobacco (such as khaini, gutkha and betel quid with tobacco).[5,6]

Among all forms of tobacco use, smoking is considered the most addictive and remains the most

used tobacco product worldwide. Smoked tobacco primarily includes cigarettes and bidis—a traditional hand-rolled form of tobacco wrapped in dried temburni leaves. In men, the three most used tobacco products are khaini, bidis, and gutkha, whereas among women, betel quid with tobacco and khaini are commonly used in India.[7] Recent studies have reported an average reduction in life expectancy of approximately 2.4 years in men and 1 year in women associated with tobacco smoking.[8] Tobacco is also consumed in various smokeless forms, including chewing, sniffing, placing it in the oral cavity, and practices such as reverse smoking. Smokeless tobacco contains approximately 28 known carcinogens. Among these, the most significant are non-volatile alkaloid-derived tobacco-specific N-nitrosamines (TSNAs) and N-nitrosamino acids. Smokeless tobacco is one of the major risk factors associated with the high prevalence of head-and-neck and oral cancers.[10] According to the Global Adult Tobacco Survey (GATS-2, 2016–2017), 28.6% of Indian adults aged 15 years and above use tobacco in some form. Approximately one in five adults consumes smokeless tobacco, while one in ten adults is a smoker.[11]

According to the International Agency for Research on Cancer (IARC, 1987), tobacco use has been associated with cancers at several anatomical sites, including the lip, tongue, oral cavity, pharynx (including oropharynx and hypopharynx), esophagus, larynx, lung, and urinary bladder. Furthermore, the IARC Monograph Volume 86 (2004) expanded this list to include cancers of the cervix uteri, kidney, paranasal sinuses (PNS), and myeloid leukemia as being linked to tobacco use.[12]

Tobacco use remains one of the most significant preventable causes of cancer globally. In India, tobacco consumption—both in smoking and smokeless forms—is a major public health concern, particularly among men. Bhopal, the capital of Madhya Pradesh, represents a unique case with its mixed urban-rural population, varying literacy rates, and socioeconomic diversity, all of which may influence tobacco use patterns and cancer risk.

This study aims to highlight the incidence and risk factors of Tobacco Related Cancers in the male population of Bhopal.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Pathology at AIIMS Bhopal over a period of 12 months (2017–2018). Male patients aged 15 years and above were randomly selected from the Departments of ENT, Surgery, and Radiotherapy. The study included all male patients diagnosed with tobacco-related cancers (TRCs), regardless of their current tobacco use status.

Data were collected on various risk habits, including the use of smoked (cigarettes/bidis) and smokeless tobacco (e.g., gutkha, tobacco chewing), as well as non-tobacco substances such as betel nut, paan masala, and alcohol. Individuals with a combination of these habits for a minimum of 12 months were also included. Smoking was defined as the consumption of more than eight cigarettes or bidis per day. Exclusion criteria included individuals who were unwilling to participate, those with active infections, local trauma or irritation, or systemic diseases that could cause oral lesions and female.

Participants were interviewed using a structured questionnaire to collect socio-demographic data and detailed information about the duration and nature of their habits. Informed consent was obtained from all participants prior to the interviews and clinical examinations. Ethical approval for the study was obtained from the institutional ethics committee.

RESULTS

A total of 300 male patients with tobacco-related cancers (TRCs) were interviewed during the study period from 2017 to 2018. The proportion of older individuals in the male population was lower compared to younger age groups, which contrasts with patterns typically observed in developed countries. The incidence and distribution of cancer at specific anatomical sites varied according to the type of tobacco use and mode of consumption, reflecting diverse patterns of tobacco use among the male population studied. he ages distribution of participants was <30 years old n= 20(6.67%), 30-40 years were 55 (18.33%), 41-50 years old (n=110; 36.67%) 51-60 years old (n = 70; 23.33%), and >60 years old (n = 45; 15 %). Regarding educational status, 100 participants (33.33%) had completed primary school, 90 (30%) had secondary education, 65 (21.67%) were illiterate, and 45 (15%) had attained college-level education or higher. Most participants were employed in service sectors (government and private, including ward boys, peons, etc.) accounting for 55%, followed by laborers at 43.33%, and unemployed individuals constituted 1.67%, all engaging in various tobacco-related habits.

Statistical Analysis

The collected data was summarized by using frequency, percentage, mean & S.D. To compare the qualitative outcome measures Chi-square test or Fisher's exact test was used. To compare the quantitative outcome measures independent t test was used. If data was not following normal distribution, Mann Whitney U test was used. SPSS version 22 and Epi Info software were used to analyse the collected data. Statistical evaluation was carried out using the Pearson Chi-square test, with a p-value of <0.05 considered statistically significant, and a p-value of <0.001 considered highly significant.

Table 1: Tobacco use history of study participants

Variables	Frequency (300)	Percentage
Cancer related awareness		
Yes	160	53.33
No	140	46.67
Addiction history		
Yes	285	95.00
No	15	5.00
Type of addictions		
Smokeless tobacco	80	28.07
Smoking	95	33.33
Mixed	110	38.60
Duration of tobacco (years)		
<5	30	10.53
6-10	65	22.81
11-20	80	28.07
>20	110	38.60

Table 1 presents data on cancer awareness, addiction history, types of tobacco habits, and duration of tobacco use among participants.

Table 2: Distribution of tobacco related cancers by tobacco use habits

S No.	Smokeless tobacco (n%)	Smoking (n%)	Mixed (n%)	Total
Oral	60 (75.00)	14 (14.74)	75 (68.18)	154 (49.67)
Lung	10 (12.50)	44 (46.32)	9 (8.18)	63 (21.00)
Neck region*	5 (6.25)	21 (22.11)	20 (18.18)	46 (15.33)
Other**	5 (6.25)	16 (16.84)	6 (5.45)	27 (9.00)
	80	95	110	300

(Chi square 92.432, p-value is 0.0001. Significant at $p < 0.001$)
Neck region* (Esophageal, hypopharyngeal, laryngeal and oropharyngeal)
Other** (Rectal, urinary bladder, thyroid, leukemia)

Table 2 details the distribution of cancer sites relative to tobacco use among the male population. Of the 300 participants, 80 were exclusive smokeless tobacco users, with 75% presenting oral cancer. Among 95 smokers, 14.74% had lung cancer. Mixed tobacco users (n=110) showed 68.18% incidence of oral cancer. The association between tobacco use type and cancer site was statistically significant ($p < 0.001$).

DISCUSSION

Tobacco remains the single greatest avoidable risk factor for cancer mortality worldwide, with projections estimating tobacco-related deaths to rise to 8–10 million annually by 2025. Smoking alone accounts for approximately one-third of these deaths. In India, tobacco use contributes to nearly half of all cancers among males and one-quarter of cancers among females. Our study corroborates these findings, with 50% (2386/4794) of cancers in men and 25% (944/3767) in women being tobacco-related.[13,14]

Head-and-neck cancers are particularly prevalent in the Northeastern region of India, where tobacco use is a major risk factor. Cancer of the tongue shows a notably high incidence, especially in females, with an age-adjusted rate (AAR) of 3.5 in the Kashmir Urological Database (KUD), closely comparable to 3.7 reported from the Bhopal registry. Among males, the AAR for tongue cancer reaches 8.4 in KUD. Similarly, oral cancer rates in KUD (AAR: 9.7 in males and 7.3 in females) are significantly influenced using smokeless tobacco, indicating its critical role as a risk factor.[14,15]

Besides tobacco, other risk factors for oral cancer include alcohol consumption, bile reflux, consumption of hot beverages, and a diet low in fruits and vegetables. Betel quid chewing, a common practice in India, has been linked to increased risk, partly due to contamination of fermented areca nuts with fungi such as Aspergillus flavus, Aspergillus niger, and Rhizopus species, which may contribute to carcinogenesis. Extensive research has confirmed that cigarette smoking and other tobacco products are major sources of carcinogenic exposure in humans. Large cohort studies have established a strong causal link between cigarette smoking and lung cancer, with smoking accounting for approximately 80% of lung cancer cases in males and at least 50% in females worldwide. This pattern is reflected in our regional data, with an AAR of 18.7 in males and 8.19 in females in the KUD. Lifelong smokers face a 20–40fold increased risk of developing lung cancer compared to nonsmokers, and 90% of lung cancer deaths are attributable solely to smoking.[13-19]

The prevalence of tobacco use among men in India remains alarmingly high, with recent nationally representative data indicating that approximately 45.5% of men use tobacco in some form. This includes 24.6% who smoke tobacco and 29.1% who use smokeless tobacco, with a noteworthy 8.4% using both forms concurrently. Factors associated with tobacco use among Indian men include older age, lower education levels, manual labor occupation, rural residence, alcohol consumption, and certain socio-demographic characteristics such as being separated, divorced, or widowed. Additionally, regional variations exist, with higher tobacco use

reported in the northeastern regions of India and among certain ethnic groups. These findings highlight the persistent challenge tobacco consumption poses in India despite ongoing public health efforts, underscoring the need for targeted interventions addressing high-risk groups and social determinants of tobacco use.[20-21]

Extensive research in India has established a robust link between tobacco use, particularly smokeless tobacco (SLT), and various cancers, especially those affecting the oral cavity, esophagus, and pancreas. Systematic reviews and meta-analyses have revealed that the risk of oral cancer among SLT users is significantly elevated compared to non-users, with odds ratios ranging widely but consistently indicating a strong positive association. The carcinogenicity of SLT is attributed to numerous chemical compounds present, including tobacco-specific N-nitrosamines (TSNAs), heavy metals, and polycyclic aromatic hydrocarbons, which contribute to DNA damage, mutations in tumor suppressor genes, and carcinogenesis through multiple molecular pathways. The regional differences in SLT products and usage patterns add complexity to understanding the precise risk but reinforce that all forms of SLT contribute substantially to cancer risk. These data emphasize the imperative for stricter regulation and public awareness regarding SLT products in India.[22-25]

A comprehensive meta-analysis focusing on the Indian population has confirmed that both smoked and smokeless tobacco significantly increase the risk of cancer, with pooled risk estimates roughly 2.7 times higher for tobacco users than non-users. The meta-analysis showed consistent associations across cancer types, with head and neck cancers and respiratory system cancers demonstrating particularly elevated risk ratios. Gender-based analysis indicated similar elevated risks for males and females, although female smoking prevalence remains culturally lower in India. This meta-analysis consolidates earlier studies' findings and underscores tobacco's critical role as a prime etiological factor for cancer in India. These outcomes provide critical evidence for policymakers to design tobacco-specific control measures, including cessation programs that address both smoked and smokeless forms of tobacco.[21-25]

Head and neck cancers (HNCs), constituting approximately 30% of all cancers in India, show a strong association with tobacco use. Retrospective studies in Indian tertiary cancer centers reveal that over 80% of patients with HNC have a history of tobacco addiction, with a notable prevalence of smokeless tobacco use among these patients. Further, gender differences in tobacco use patterns and cancer sites have been observed; for instance, oral cavity cancers are more frequently seen in males who use tobacco, while females present a higher proportion of oropharyngeal cancers despite lower tobacco use rates. The high burden of tobacco-associated cancers in India calls for intensified preventive strategies, including increased public awareness, early screening, and interventions focused on reducing tobacco use across all population strata. Additionally, these findings highlight the necessity for further research into non-tobacco causes of HNCs, especially among non-users.[9,10]

Our findings, alongside data from the Global Adult Tobacco Survey (GATS), demonstrate that the incidence of tobacco-related cancers (TRCs) increases in parallel with the prevalence and patterns of tobacco use. Continuous monitoring of TRC incidence is essential for prioritizing healthcare resources and planning effective cancer control programs. To curb the rising burden of tobacco-related cancers, multifaceted interventions are urgently needed. Primary prevention efforts should include widespread awareness and health education programs targeting schools and colleges, the establishment of tobacco cessation clinics, and community outreach through camps highlighting the dangers of tobacco use. Strict enforcement of the Cigarettes and Other Tobacco Products Act (COTPA) of 2003—which prohibits smoking in public places, restricts tobacco sales to minors, and bans direct and indirect advertising—is crucial. Additionally, increasing tobacco taxes has proven to be one of the most effective strategies for reducing tobacco initiation and promoting cessation.

CONCLUSION

The results of the present study provide valuable insights into the incidence of tobacco-related cancers at various anatomical sites in the male population of Bhopal, Madhya Pradesh, India. Education and occupation were found to have a direct impact on the prevalence of tobacco use and the associated cancer risk. Understanding the incidence and patterns of tobacco-related cancers is essential for developing effective primary prevention strategies. Reducing tobacco consumption remains a fundamental component of cancer control efforts. In conclusion, reducing tobacco consumption through comprehensive policy measures and targeted public health interventions is imperative to lower the incidence of tobacco-related cancers and improve population health outcomes.

Limitations of the study: However, this study has some limitations. Being hospital-based and conducted in a single institution with a relatively small sample size of only male patients, the findings may not be generalizable to the broader population. These constraints were primarily due to limited time and resources.

Declarations

Funding: None **Conflicts of interest/Competing interests**: None **Availability of data and material**: Department of Pathology, AIIMS Bhopal with active data collection from the Departments of ENT, Surgery, and Radiotherapy. **Code availability**: Not applicable **Consent to participate**: Consent taken **Ethical Consideration**: There are no ethical

conflicts related to this study. **Consent for publication**: Consent taken.

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