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Oral cancer epidemiology of Aurangabad district (Maharashtra) of India from 2005 to 2014: understanding the burden of disease

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ABSTRACT

Background: Oral cancer incidence is constantly rising in India and is one of the major public health issues. This is a retrospective study from Aurangabad district (MS) of India to evaluate epidemiologic profile of oral cancer patients from 2005 to 2014.

Methods: The 10 year data of oral cancer was obtained from the PCBR Aurangabad which was available from the National Cancer Registry Programme, Govt. of India web portal. The periodic data in three different spans was available as 2005 to 2008, 2009 to 2011 and 2012 to 2014. Statistical analysis used was age adjusted rate (AAR), crude rate (CR) and additive properties of CR.

Results: The oral cancer trends from 2005 to 2014 reveals significantly increase in oral cancer incidence in population. In males, cancer of mouth (RP: 11.84% and AAR 7.37) was most common followed by tongue (RP: 9.62% and AAR 6.32) and pharynx (RP: 4.71% and AAR 2.79). In females cancer of tongue (RP: 3.31% and AAR 2.42) is most common followed by cancer of mouth (RP: 2.77% and AAR 1.91). Incidence of oral cancer as a whole for all sites is second highest after lung cancer in Aurangabad in male (cumulative AAR 17.93) and fourth highest after breast, cervix and lung cancer (cumulative AAR 6.06) in female out of all cancer sites in region in 2012-2014. **Conclusions:** Understanding pattern and incidence of various oral cancers is crucial for primary prevention and early detection for comprehensive management of cases.

Keywords: Cancer epidemiology, India, Oral cancer, Tobacco, Needs of patients, Oral health

INTRODUCTION

Oral health is 'a state of being free from mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking, and psychosocial wellbeing'. This widely recognized definition is complemented by the acknowledgement of oral health as an integral element of the right to health, and thus of the basic human rights enshrined in the UN Universal Declaration of Human Rights adopted by all nations.^{1,2} Oral health is equally important to general health and is complimentary to each other. Oral diseases may directly affect a limited area of the human body, but their consequences and impacts affect the body as a whole. Among these, oral cancer remains a lethal disease for over 50% of cases diagnosed annually as the many cases are reported at advanced stages of cancer. Oral cancer is easily preventable diseases with regular examination of the oral cavity.³

Oral cancer is sixth most commonly occurring and debilitating type among the head and neck cancer diseases with approximately 263,000 new cases per year.⁴

India has largest prevalence of oral cancer patients among South Asian countries.⁵ It is the third most common cancer and accounts for almost 40% deaths. Among the men it's second most common site and among women it's fourth.⁶ At national level, in 2012, the incidence rate for male was 10.1/1, 00,000 and for female 4.3/1, 00,000.7 India has National Cancer Registry Programme (NCRP) since last thirty years.⁸ NCRP has established Population Based Cancer Registries (PBCRs) across the country which provides authentic data on incidence and mortality of cancer in various parts of the nation for a defined period.⁹ Aurangabad district is the headquarters of Marathwada, a geographic division of Maharashtra state. It covers an area of 10100 km² having a population of 3.695.928.¹⁰ The PBCR at Aurangabad was established in the 1978. It has been collecting data on the pattern of cancer of the local population with the aim to identify site patterns and incidence rates of cancer among different communities living in different geographic areas, exposed to different climatic conditions, dietary habits and social customs. It is one of the active cancer registries among all other PBCRs in India. Registration of cancer cases has been going on actively with the help of Govt. hospitals, private hospitals and diagnostic centers.^{11,12}

The authors have compiled the ten years data from NCRP with special focus on oral cancer in Aurangabad region from 2005 to 2014.

METHODS

Data collection

The 10 year data of oral cancer was obtained from the PCBR Aurangabad which was available from the National Cancer Registry Programme, Gov. of India web portal. The periodic data in three different spans was available as 2005 to 2008, 2009 to 2011 and 2012 to 2014. It included the data of all the different cancer sites, which author particularly selected data for oral cancer including lip, tongue, mouth, salivary glands, pharynx and tonsils. The population of the registry area by age group and census was estimated using the 2001-2011 census data.

Data analysis

The statistical data analysis using SPSS version 23 (SPSS Inc., Chicago, IL, USA) included descriptive statistics. The crude, age-adjusted and truncated incidence rates per 100000 populations were calculated by the direct method using the world standard population. The oral cancer group, pooling the incidence data of individual sites i.e. lip, tongue, mouth, salivary glands, pharynx and tonsils, from which they are constituted. To calculate the above rates for group of cancers, it is calculated by carrying out the task at three steps. First, the individual sites are identified for desired group of cancer. Second, the individual number of cases is added for the individual

sites to arrive at the number of cases for the group. Third, by dividing the number of cases by population at risk, the crude rate is calculated. For calculation of age specific rates, the individual number of cases for group of sites is identified and then with the help of population at risk, the age specific rates are obtained.¹³ An attempt has been made to explore the mathematical properties of various rates to derive them directly for the group of cancer sites from the published data when the rates are provided only for the individual sites. It is referred as additive property of crude rate of cancer incidence. Takiar and Shrivastava found that the CR, Age Specific Rates and AAR, all rates follows additive properties.¹⁴ It means, given the above rates for individual sites, the above rates can be calculated for group of sites by simply adding them. This property facilitates the calculation of various rates for defined group of cancers by simply adding the above rates for individual sites from which they are made up of.

RESULTS

Total population at risk for the period of 2005-2014 was estimated for Aurangabad. According to the three segmental report of Aurangabad PBCR: 2005-2008, 2009-2011 and 2012-2014 were published by National Cancer Registry Programme (NCRP), India. The oral cancer trends from 2005 to 2014 as shown in Figure 1 reflect significant increase in oral cancer incidence over the years with increase in population. Only for cancer of pharynx, the incidence rate has decreased slightly.



Figure 1: Oral cancer trends from 2005 to 2014 in terms of age adjusted rate in Aurangabad.

Table 1 and 2 shows that relative proportion (%), average annual crude incidence rates (CRs); age-standardized incidence rates (AARs) and truncated rates by site among men and women respectively in the Aurangabad, 2005-2008. In males, cancer of mouth (RP: 6.9% and AAR: 4.2) was most common followed by tongue (RP: 6.47% and AAR: 3.7) and pharynx (RP: 5.92% and AAR: 3.9). In females cancer of mouth (RP: 3.85% and AAR: 2.8) is most common followed by cancer of tongue (RP: 3.23% and AAR: 2.1). With lack of appropriate data from 2009 to 2011, only AAR is obtained from Aurangabad PCBR as shown on Table 3. In males, incidence cancer of mouth (AAR: 7.0) remained high in oral cancer group, followed by pharynx (AAR: 3.8) and tongue (AAR: 3.3). While in females, incidence of cancer of mouth (AAR: 2.0) was high.

Table 1: Relative proportion, crude rates and age-
adjusted incidence rates by site among men in
Aurangabad during 2005-2008.

Cancer site	Total (N)	RP (%)	CR	AAR	TR
Lip	7	0.75	0.3	0.3	0.7
Tongue	60	6.47	2.6	3.7	7.7
Mouth	64	6.90	2.7	4.2	9.4
Salivary glands	3	0.32	0.1	0.1	0.2
Pharynx	55	5.92	2.2	3.9	7.1
Tonsils	12	1.29	0.5	0.9	1.5

Table 2: Relative proportion, crude rates and age-
adjusted incidence rates by site among women in
Aurangabad during 2005-2008.

Cancer site	Total (N)	RP (%)	CR	AAR	TR
Lip	0	0	-	-	-
Tongue	31	3.23	1.5	2.1	4.4
Mouth	37	3.85	1.7	2.8	6.8
Salivary glands	2	0.21	0.1	0.1	0.4
Pharynx	13	1.35	0.7	1.1	3.0
Tonsils	4	0.42	0.2	0.3	0.7

Table 3: Age adjusted incidence rates by site among
men and women in Aurangabad during 2009-2011.

Cancer site	AAR in men	AAR in women
Tongue	3.3	1.2
Mouth	7.0	2.0
Pharynx	3.8	0.8

Table 4: Relative proportion, crude rates and age-
adjusted incidence rates by site among men in
Aurangabad during 2012-2014.

Cancer site	Total (N)	RP (%)	CR	AAR	TR
Lip	3	0.27	0.2	0.16	0.5
Tongue	108	9.62	5.5	6.32	13.8
Mouth	133	11.84	6.7	7.37	15.7
Salivary glands	3	0.27	0.2	0.17	0.3
Pharynx	53	4.71	2.5	2.79	4.7
Tonsils	16	1.42	0.8	1.12	1.8

Table 4 and 5 shows that relative proportion (%), average annual crude incidence rates (CRs), age-standardized incidence rates (AARs) and truncated rates by site among men and women respectively in the Aurangabad, 2012-2014. In males, cancer of mouth (RP: 11.84% and AAR: 7.37) was most common followed by tongue (RP: 9.62% and AAR: 6.32) and pharynx (RP: 4.71% and AAR: 2.79). In females cancer of tongue (RP: 3.31% and AAR: 2.42) is most common followed by cancer of mouth (RP: 2.77% and AAR: 1.91).

Table 5: Relative proportion, crude rates and age-
adjusted incidence rates by site among women in
Aurangabad during 2012-2014.

Cancer site	Total (N)	RP (%)	CR	AAR	TR
Lip	0	0	-	-	-
Tongue	37	3.31	2.0	2.42	4.9
Mouth	31	2.77	1.7	1.91	4.3
Salivary glands	4	0.36	0.2	0.26	0.6
Pharynx	14	1.25	0.8	0.94	1.2
Tonsils	8	0.72	0.4	0.53	0.3

Table 6: Additive property of crude rate (CR) -Aurangabad – males & females - oral cancers - (2012-14).

O	Male		Female	
Cancer site	No.	CR	No.	CR
Lip	3	0.2	0	-
Tongue	108	5.5	37	2.0
Mouth	133	6.7	31	1.7
Salivary glands	3	0.2	4	0.2
Pharynx	53	2.5	14	0.8
Tonsils	16	0.8	8	0.4
Total no. of cases	316	15.9	94	51
(oral cancer)	510	15.7	74	5.1
Population	1980880		1850731	
Additive crude rate=				
total no. of cases	15 95		5 079	
(oral cancer)/	15.75 5.077			
population*100000				

The individual number of cases for selected Oral cancer sites, for the registry of Aurangabad from 2012-2014 is shown in Table 6. From the knowledge of population at risk (male- 1980880, female-1850731), the individual CR is calculated for each site. The total number of cases for Oral cancer sites is shown to be 316 for males and 94 for female. From the knowledge of population at risk, over all CR for Oral cancer is calculated and shown to be 15.9 for male and 5.1 for female. Again, it can be verified from the table that sum of individual CRs also gives the number like 15.95 for male and 5.079 for female which tallies with CR derived from total cases and population at risk.^{14,15}

DISCUSSION

Descriptive epidemiology

Incidence of oral cancer (age adjusted rate -AAR) as a whole for all sites is second highest after lung cancer in Aurangabad in male (cumulative AAR: 17.93) and fourth highest after breast, cervix and lung cancer (cumulative AAR: 6.06) in female out of all cancer sites in region in 2012-2014. Although less than other NCBR, incidence of oral cancer is significantly high in the region.¹⁵

Cancer of lip

It has a low incidence in India and has sunlight being the main etiology. Indian population has higher melanin content which naturally protects against UV light induced skin changes.¹⁶ In Aurangabad region; it has affected 7 men in 2005-2008 and 3 men in 2012-2014.

Cancer of tongue

Tongue cancer in Aurangabad showed second highest incidence from 20005 to 2014 in male. Regional Cancer Center of Trivandrum reported incidence tongue cancer as 43.6%, amongst all the cases of oral cancer below the age 35 years.¹⁷ High blood rich supply and maximum propensity of regional spread is probably reason for high incidence of tongue cancer.¹⁸ Tongue is although the most common intra-oral site of cancer in South Asian countries linked to use of betel quid, areca nut, tobacco, gutkha and pan masala.¹⁹ Increase in tongue cancer cases among young adults and adolescents are mostly associated with tobacco use.^{16,20}

Cancer of mouth

In Aurangabad, incidence of mouth cancer is highest in both male and female. Kalyani et al found 1:2 male to female ratio for mouth cancer among adolescents and young adults, while Dikshit et al reported mouth and pharynx cancer as one of the leading cause death in nationally representative survey.^{20,21} Having the habit of placing tobacco in buccal mucosa leads to irritation, premalignant lesions and late developed to mouth cancer. Incidence of cancer of buccal mucosa is second highest in Sangli region of Maharashtra, highest prevalence of cancer of buccal mucosa (49.9%) outnumbering that of tongue (23.97%) from Regional Cancer Center Trivandrum (Nair et al), cancer of the gingiva and mandibular alveolar ridge is most common site.²²⁻²⁴

Cancer of salivary glands

Similar to lip cancer, incidence of salivary gland cancer is low in Aurangabad region. Worldwide, India ranks low while Eskimos rank higher for salivary gland cancer incidence. Epstein barr virus and hormonal changes are considered as associated with this cancer.^{16,26,27}

Cancer of pharynx

Oropharyx, nasopharynx and hypopharynx are combined considered in pharynx cancer and has significantly high incidence among men and women in Aurangabad region. Nasopharyngeal carcinoma in India has a low incidence, mostly prevalent in North-East region of India and linked to Epstein Barr viral infection, chronic rhino-sinusitis, poor ventilation, inhalation of smoke, and ingestion of salted fish containing dimethylnitrosamine, smoked meat, use of herbal nasal medicine and preserved foodstuff.¹⁶ The dietary factors, spicy food, chilies might contribute to high risk of hypopharyngeal cancer in India.²⁸ In addition to tobacco and alcohol, dietary deficiency particularly vitamin A and iron, low vegetable diet are strong risk factors for pharyngeal cancer.¹⁶

Cancer of tonsils

Incidence of cancer of tonsils has increased over the time in Aurangabad men and women. The incidence of tonsil cancer in India in males is highest in the west (Ahmadabad) followed closely by the northern parts (Delhi) while in females the maximum ASR is seen in the northern parts of the country.¹⁶ The recently developed Atlas of cancer in India clearly reports the higher prevalence along the west coast.²⁸

Analytical epidemiology

Risk factors

Oral cancer etiology is multifactorial. The most important etiological factors include tobacco, excess consumption of alcohol, betel quid usage, viral infection and behavioural risk factors. All forms of tobacco are carcinogenic and evidence for smokeless tobacco causing oral and pharyngeal cancer was evaluated and confirmed.²⁹ The consumption of a diet deficient in antioxidants predisposes towards the development of precancer lesionand oral cancer. Commonly vitamin deficiencies (A, C, E) may contribute to the high prevalence of the oral cancers in India.³⁰ Viral infections as HPV, EBV may also be involved particularly for tonsil and oropharynx in young people.³

Tobacco accounts for majority of cancers and causal prevalence of lung cancer and oral cancer is highest. Developed countries have prevalence of 25-30% tobacco related cancers.³¹ India is the third largest producer and consumer of smoked and smokeless forms of tobacco. Country has Tobacco-related cancers account for nearly 50% of all cancers among men and 25% of all cancers among women with the burden of tobacco-related cancers in 2001 estimated to be nearly 0.33 million cases annually. It was predicted that incidence of 7-fold increase in tobacco-related cancer morbidity between 1995 and 2025 with overall increase by 220% of cancer deaths simply related to tobacco use by the year 2025.³²

Alcohol is considered to be causally associated with oral cancer.³³⁻³⁵ As heavy alcohol drinkers are frequently heavy smokers as well, a synergistic effect with cigarette smoking has implicated to cause oral cancer.³²

Diet and oral cancer are both positively and negatively associated as studied from epidemiological, experimental, clinical/metabolic and intervention studies. While spicy food and acidic reflux are associated with risk for oral cancer, diet enriched of fruits and vegetables is associated with reduced risk of several cancers including oral cancers.³⁶ Indian continent has chronic energy deficiency and deficiencies of vitamin A, folate, riboflavin, iodine and iron which add risk of cancer as high dietary fibre, vitamins C, E and A, and selenium offer protection against cancer.^{15,27,32,37}

Viral infections related prevalence of oral cancers is less, but they exist. Human papillomavirus (HPV) usually cause cervix cancer, but studies suggest that it is associated with oral cancer. Epstein–Barr virus and nasopharyngeal cancer association is also well established.³⁸ In India, Balaram et al reported prevalence of 42% and 47% for HPV16 and HPV18, respectively, in a study of oral cancers in Indian betel quid chewers.³⁹ There are 34% of oral squamous cell carcinoma (SSC) patients were identified as HPV-positive in eastern India, compared with 67% in southern India and 15% in western India. Globally, HPV infection is relatively more common in oral SCC patients in India than in those from other countries.⁶

Delay in diagnosis

It is common that patient report at advanced stage of oral cancers. Inspite of health education, awareness for oral cancer is the main reason for delay in diagnosis of oral cancer.³ Health promotion and prevention are best implemented to control the oral cancer incidence as it a preventable disease.

Primary prevention

Quitting tobacco and reduced alcohol consumption reduces 3/4th of the oral cancers. Tobacco cessation advices and practice should be implemented.⁴⁰ Extensive health education programmes in school, workplaces, legislative measures for tobacco control i.e. tobacco products ban, smoking ban at public places; and advocacy for tobacco control are effective strategies for tobacco uptake. Protection against solar irradiation would further reduce the incidence of lip cancers.³ Heavy consumers of alcohol should be advised to limit their consumption.

Nutrition and dietary education is important for increasing the public awareness, promoting good health and for control of cancers. Raising the awareness for adopting safe sexual practices is crucial from prevention of viral infection related oral cancer.³² Early detection,

healthy lifestyle promotions are to be implemented through collative efforts of NGO, medical and dental practitioners, public health researchers and political support. This is consistent with the approach of the Lancet non-communicable disease (NCD) action group and the NCD alliance.^{6,41} Improved oral health care policies and school health programmes can both help in oral cancer prevention and management.^{42,43}

Secondary prevention

The early the detection, lesser spread, lesser invasive treatment and high survival rate is scientifically evident with oral cancer. Therefore, screening for premalignant or early stage oral cancers is essential. A randomized control trial on screening for oral cancer conducted in India has demonstrated a significant mortality reduction in tobacco users.⁴⁴ Regular oral mucosal examination in dental practices is a cost effective and cost beneficial for health care system in India.³

Tertiary prevention

Survival rates of oral cancer affected patients can be increased with advanced diagnostics and treatments with skillful multidisciplinary doctors. Although this would never reduce the incidence of oral cancer, systematic, cost-effective, equitable and evidence-based treatment guidelines should be spread as the burden of oral cancer is high in the country. Oral cancer causes severe physical, psychological pain along with economical and social burden to patients and their families. This significantly affects the quality of life of these patients. Palliative care through trained staff and facilities for caring for terminally ill patients and their families are required.⁶

CONCLUSION

Trend in incidence of oral cancers over this ten year span from 2005-2014 is on rise in Aurangabad. Oral cancers are mostly tobacco related and are encountered in a relatively advanced stage. Understanding pattern and incidence of various oral cancers is of utmost importance for primary prevention and early detection to adequately manage these cancers comprehensively in the population. Extensive persuasive health education and promotion is needed to be directed to control/reduce the tobacco habit. Nutrition and dietary education, safe sexual practices, limit alcohol and healthy lifestyle factors implementation among the high risk groups such as farmers, labourer, poor people, young adults and adolescents. Oral cancer is a multidimensional public health issue which has tremendous impact on individuals and their families, on all health services and on wider society. Hence, it is recommended to re-orient oral health research, practice and policy towards a model based on social determinants and medical support and collaboration between, and integration of, dental and general health research. This is one of the first studies to compile cancer prevalence data of the PBCR at Aurangabad which helps to understand the pattern of oral cancer trend. Further research related to oral cancer care, quality of life of oral cancer survivors, tobacco control policies should be studied in the region.

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