



Original Research Article

A clinico-epidemiological hospital based study of oral cancer patients in Gwalior district

Anil Kumar Agarwal¹, Ramniwas Mahore¹, Sumit S Bhadoriya¹, Ankita Tripathi^{1,*}, Swati Saraswat¹¹Dept. of Community, G R Medical College, Gwalior, Madhya Pradesh, India

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ABSTRACT

Background: Oral cancer is the most common form of carcinoma of oral cavity and ranks as the 12th most common cancer in the world. Oral cancer is one of the major social & health problems in India and Indian subcontinent countries. Tobacco use in different forms is the main etiological factor for oral carcinoma.

Objectives: (i) To define relations of oral cancer with respect to gender, age group, socioeconomic status and risk habits; (ii) To observe the distribution of affected oral cavity sites and observe the clinical profile in oral cancer patients.

Method: A cross-sectional study of 340 oral cancer patients from January 2019 to December 2019 was carried out in Department of oncology & radiotherapy, JA Group of hospital, G. R. Medical Gwalior, Madhya Pradesh India. Details of patient's sex, age, tobacco habit and site of cancer and status were noted. Data were analyzed by probability of patient with risk factors and chi-square (χ^2) test.

Results: The prevalence of oral cancer was significantly ($p < 0.001$) higher in males (91.5.9%) than females (8.5%). In both the sexes, most affected sites were the buccal mucosa and gingivo-buccal sulcus. However, the consuming form of tobacco was found to be significantly associated with oral cancer, in both sex.

Conclusion: The study revealed that oral cancer is more common in men, probably due to habit of large tobacco consumption.

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1. Introduction

In the present situation world is heading towards various types of non-communicable diseases, among these cancer is one of the leading cause of morbidity and mortality.¹ Worldwide, approximately >10 million new cases and > 6 million deaths occur each year due to cancer and oral cancer is approximated to be the 6th most common cancer.^{2,3} In India, twenty people per one lakh population are affected by oral cancer which accounts for about 30% of all types of cancer.⁴ According to World Health Organization, 40% of the oral cancer which were diagnosed worldwide occurs in India, Pakistan, Bangladesh and Srilanka.⁵ The incidence of oral cancers has shown an increasing trend worldwide. The mortality rates of patients with these malignancies

also continue to increase.⁶ Oral cancer is one of the ten most frequent cancers occurring globally.⁷ In India, approximately 30- 40% of all cancer cases are oral cancers, which are much higher as compared to Western world.⁸ As estimated by World Health Organization, 90% of oral cancer cases among Indian men are attributable to tobacco consumption. Oral cancer is the most common form of carcinoma of oral cavity and ranks as the 12th most common cancer in the world.⁹ Oral cancer is emerging out major health problems in India and Indian subcontinent countries and chewing tobacco is the main etiological factor for oral carcinoma. Tobacco is used in various forms in these countries including chewing tobacco, smoking in cigarette, bidi, hookah, etc. Human papilloma virus¹⁰ and dietary deficiencies¹¹ and poor oral hygiene¹² are minor etiological factors of oral carcinoma. People of lower socio-economic

* Corresponding author.

E-mail address: ank27trip@gmail.com (A. Tripathi).

strata of society are more commonly affected by oral cancer because of higher prevalence of life style risk factors.¹³ This high proportion is clearly associated with difficulties in accessing the health care system, with most cases eventually diagnosed at advanced clinical stages.¹⁴

The aim of this study was to identify the prevalence of oral cavity cancers; causes associated and determine the clinical and epidemiological features of oral cancer. The primary aim of the study was to find out the habit of taking various forms of tobacco (singularly or in combination). The another aim of the study was to find the effect of different socio-demographical conditions on the oral cancer. The study also revealed the predilection of the various socio-demographic profile of patients as independent risk for oral cancer in India. Hence, the aim of this study is to assess the socio-demographic profile of oral cancer patients.

2. Materials and Methods

This study was a cross-sectional study done at the oncology/radiotherapy department of JA Group of Hospital, G. R. Medical College Gwalior. The study populations were subjects with oral cancer who reported for treatment at the hospital. The sample size consisted of 340 individuals (male = 311, female = 29). All oral cancer patients reported during the month of July-Dec, 2019 and clinically diagnosed with oral cancer. These patients formed the study group and were included in the study. The subjects who were not willing to participate in the study were excluded. Prior to the start of the study ethical clearance was obtained from the concerned institutional ethical committee. A pre-tested and pre-structured questionnaire was used to assess their clinical-epidemiological profile. The information comprised of demographic factors, socioeconomic status, enquiries regarding modifiable risk factors as tobacco usage, site involved, staging and treatment modality used of oral cancer patients. Data collection was scheduled for a period of six months. Data was collected using a standard questionnaire protocol (which included name, sex, age, religion, type of habit, duration and frequency of habit, duration of lesion, and socioeconomic background) through in person interview. From this data, the unadjusted/adjusted odds ratio (OR), the 95% confidence interval (CI), and the P value were calculated to correlate patients with/without different kinds of habit and having/not having various kinds of oral lesions. The differences between the distributions of the oral cancer among patient of different age groups, other social factors as well as the various sites have been done on the basis of percentages. Cases were classified according to the TNM classification of the Union for International Cancer Control (7th edition) staging of carcinoma of oral cavity.¹⁵ Socioeconomic status was assessed using Agarwal scale¹⁶ based on consumer price index and family per capita income.

3. Results

The study sample consisted of 340 study subjects with oral cancer. The age of patients ranged from 20 to 78 years with mean (\pm SD) 46.45 \pm 12.09 years. Table 1 shows the distribution of study subjects according to the age groups and gender. Among the study subjects, 311 (91.47%) were males and 29 (8.53%) were females. The age group of the study subjects ranged from 21 to 78 years. Majority of cases in both sexes were found in the age group in between 41-60 years of age group. In which 33.19% of the males and 32.65% belonged to the 41 – 50 years age group in males and female respectively. Based on socio-economic status, majority of oral cancer patients belonged to lower middle and lower socio economic class 141(41.5%) and 181(53.2%) respectively according to their per capita income of family. Based on education, most of the cases were pronounced to oral cancers was illiterate 103 (30.3%) and just literate only up to middle class were more 132 (38.8%). By the occupation most of the cases 233(68.5%) and 69(20.3%) belonged to unskilled/labourer and semiskilled respectively.

The frequency of oral cancer according to tobacco habits and gender is summarized in Table 2. In males, the frequency of oral cancer was highest in patients with history of smokeless tobacco chewing (41.1%) followed by person with history of smoking and tobacco chewing users (31.8%) together accounting for 72.9% prevalence. Similarly, in females, the frequency of oral cancer was highest in tobacco chewing users accounting for 86.2% prevalence. Thus, in oral cancer patients, the prevalence of oral cancer differed significantly according to habits (OR=6.19 and 3.08 respectively in tobacco chewing and smoking plus tobacco chewing) but there was no significant difference in prevailing of cancer in no tobacco versus only smoking patients (OR = 1.23). The frequency of oral cancer according to site and gender is summarized in Table 3. In both males and females, the oral cancer was most prevalent in buccal mucosa and gingivum (gingivo-buccal sulcus) accounting for 47.9% and 48.3% prevalence following by at lip & tongue 41.8% & 41.4, respectively. The prevalence of oral cancer significantly differ between different sites in our patients ($p = 0.003$), i.e. found to be statistically significant.

Table 4 shows that the first symptom felt by the participants for whom they approached doctor was ulcer in mouth in 280 (82.35%) participants followed by difficulty in swallowing in 18 (5.29%) participants. There were also others symptoms i.e., difficulty in swallowing (5.3%), burning sensation in mouth (3.5%) associated with major symptom ulceration in mouth. There was may be more than one symptoms associated at the same time or simultaneously, so statistically not analyzed for any statistical comparisons.

Likewise, the frequency of oral cancer according to stage and gender is summarized in Table 5. The highest frequency

of both male and female oral cancer patients presented with stage III disease followed by Stage IV, together accounting for 87.9% prevalence in both the sexes. The prevalence of oral cancer at stage I is very little just only 0.58%. Moreover, also did not differ significantly with reference to stage between the sexes in oral cancer patients.

The Table 6 shows staging and treatment modality used of oral cancer patients. Maximum no of participants i.e. 87 (25.58%) were advised surgery + radio therapy followed by only chemo therapy alone in 68 (20%) participants because of majority of patients come for treatment at advanced stage of oral cancer i.e., TNT stage III & TNT stage IV.

4. Discussion

Since some studies of this type have been carried out and for further exploration this sectional study was done to obtain baseline information on the socio demographic profile among the oral cancer patients and to ascertain its validity as a risk factor in the occurrence of oral cancer.

Around 300,000 patients are annually estimated to have oral cancer worldwide.¹⁷ India has world's highest number (nearly 20%) of oral cancers with an estimated 1% of the population having oral premalignant lesions.¹⁸ In the present study, male cases of oral cancer outnumbered females' oral cancer cases. Male to female ratio was around 10:1 which is not consistent with other North Indian studies on oral carcinoma.^{19,20} Socio-cultural norms and values favour easy availability of tobacco products to males. Advent of ready to use tobacco products and aggressive marketing attracts not only youths but also children.²¹ Most of the males and female cases were in 4th and 5th decade of life at the time of diagnosis of carcinoma. The age incidence of oral cancer is consistent with other studies conducted in North India.^{19,22,23} A youngest male patient was 21 years old while oldest was 78 years of age. In case of female patients, youngest was 24 years old; while oldest was 74 years of age.

Most of the study subjects belonged to lower middle and lower socio economic class based on their family per capita income. This was similar to findings of the same study by Khandekar et al²⁴ and Ganesh.²⁵ The lower socioeconomic status may be a risk factor for poor oral hygiene thereby further increasing the risk of oral cancer in tobacco consumers.²⁶ The risk of oral cancer is inversely proportional to increasing level of education, income and occupation. Different Occupational categories had a significant increased relative risk of cancer. True to this statement, In our study most of the patients 233(68.5%) of oral cancer belonged to unskilled with an adjusted odds ratio of 5.9 (CI: 4.6; 7.6).

Majority of oral cancer patients (i.e.) 181 (53.7% and 141(41.5% belonged to lower & lower-middle class had family income below Rs.5000 & Rs. 10000 respectively. The percentage of illiterates and low education was high

both in male and female (i.e.) 66.2% and 82.7% oral cancer patients respectively. The difference in prevalence of oral cancer among different levels of literacy was found to be significant statistically with high OR=7.3 (CI: 5.4; 9.9). These findings are consistent with similar study conducted by Abdoul et al.²⁷ in cancer institute at Pune, which concluded low education, occupation and low monthly household income as significant independent risk factors for oral cancer.

Tobacco contains many carcinogens which makes oral cavity more vulnerable to cancer. Amount and duration of tobacco consumption is directly proportional to early occurrence of carcinoma. Buccal mucosa and gingivo-buccal sulcus were the most affected sites both in males (47.9%) and females (48.3%) followed by lips & tongue which was 41.8% and 41.4% respectively. These finding are consistent with other studies.^{19,28,29} Placement of tobacco quid in the gingivo-buccal sulcus region has been attributed to the development of carcinoma.³⁰ In western countries, smoking is the major mode of tobacco consumption while in India and Indian subcontinent countries smokeless forms, including pan masala, khaini, gutkha, etc., are major modes of tobacco consumption. Around 12% percent male patients and 13.8% female patients never consumed tobacco. The maximum number of the participants 280 (82.35%) who approached Doctor had ulceration in the oral cavity followed by difficulty in swallowing 18 (5.29%). Similarly found in the study of Ohkuma et al.³¹ and others.^{24,32} For tongue cancer, 5-year survival in the United States is 71% for stage I disease and 37% for late-stage disease.³³ In India, late diagnosis of carcinoma is one of the major factors which worsen the disease prognosis. In the present study, majority of patients were at advanced stage of disease, while comparatively less number of patients were diagnosed in early stage of cancer development. Studies conducted in other parts of India also found diagnosis of carcinoma at advanced stages.^{24,34} In the present study, majority of the cases of carcinoma buccal cavity may be correlated with the tobacco chewing habit. Smokeless tobacco chewing contains many chemicals, many of which have been directly related to causing cancer. Wrapped inside a betel leaf and plated in the side of the mouth, tobacco has been chewed for centuries in India. This are commonly called as khaini. But now days it has been available in ready-packaged small sachets. Mostly these quids are kept under lips from where it is gradually absorbed after dilution with saliva. Thus the side of the tongue (deep in the mouth), the floor of the mouth (below the tongue) and alveolus are the site of maximum insult and thus are maximally affected.³⁵ The crux of the oral cancer problem is that large sum of the cases report late to the health care facility. As evident from the findings of present study majority of the participants were found in stage III i.e. 163 (47.94%) followed by stage IV i.e. 102 (30%), stage II 73 (21.47%) and stage I 2 (0.58%).

Table 1: Prevalence of oral cancer patients according to demographic variables and gender

Demographic Variables	Gender N=340			Adjusted Odds Ratio	P value
	Male (n=311) No(%)	Female (n=29) No(%)	Total No(%)		
Age in yrs	21-30	24(7.71)	1(3.44)	25(7.35)	1
	31-40	73(23.47)	5(17.24)	78(22.94)	3.75 (CI; 2.32:6.06)
	41-50	103(33.19)	8(27.58)	111(32.65)	4.78(CI:3.4:6.6)
	51-60	67(21.54)	9(31.03)	76(22.35)	4.4(CI:3.3:5.7)
	>60	44(14.15)	6(20.69)	50(14.70)	3.7(CI:2.9:4.7)
Socio-Economic Status	Upper	3(0.96)	0	3(0.88)	1
	Upper Middle	14(4.5)	1(3.4)	15(4.4)	4.8 (CI: 1.3;6.9)
	Lower Middle	139(44.7)	2(6.8)	141(41.5)	9.5 (CI: 6.6;13.2)
	Lower	155(49.8)	26(89.6)	181(53.2)	
Education	≥Graduate	18(5.8)	0	18(5.3)	1
	≤Secondary	87(27.9)	0	87(25.6)	4.2(CI:2.4;7.2)
	≤Middle	127(40.8)	5(17.2)	132(38.8)	7.1 (CI:4.9;10.3)
	Illiterate	79(25.4)	24(82.7)	103(30.3)	7.3 (CI: 5.4;9.9)
Occupation	Unskilled / Laborer	207(66.5)	26(89.6)	233(68.5)	5.9 (CI: 4.6;7.6)
	Semi skilled	66(21.2)	3(10.3)	69(20.3)	2.02 (CI: 1.3;3.1)
	Others (including skilled, clerical, etc.)	38(12.2)	0	38(11.1)	1

*Significant Statistically

Table 2: Prevalence of oral cancer according to type of tobacco habits (N= 340)

Tobacco habits	Gender		Total No (%)	Odds ratio	P value
	Male(N=311) No (%)	Female(N=29) No (%)			
Chewing tobacco	128(41.1)	25(86.2)	153(45.0)	6.1 9(CI:4.14;9.09)	0.001*
Smoking	48(15.4)	0	48(14.1)	1.23(CI:0.78;1.23)	0.42
Smoking + Chewing	99(31.8)	0	99(29.1)	3.08 (CI:2.05;4.61)	0.001*
No Tobacco	36(11.6)	4(13.8)	40(11.8)	1	

*Significant Statistically

Table 3: Prevalence of oral cancer according to site and gender (N=340)

Site of Cancer	Gender			P value (Chi –square test: Goodness of fit)
	Male (N=311) No(%)	Female (N=29) No(%)	Total No(%)	
Alveolus & Oropharynx	8(2.57)	0	7(2.05)	0.003 (Significant Statistically)
Mouth (Buccal mucosa) and Gingivum (gingivo-buccal sulcus)	149(47.9)	14(48.3)	163(47.9)	
Lip & Tongue	130(41.8)	12(41.4)	142(41.8)	
Floor of Mouth & Cheek	8(2.6)	2(6.9)	10(2.9)	
Palate	14(4.5)	1(3.4)	15(4.4)	
Retro-molar trigone	2(0.6)	0(0)	2(0.6)	

Table 4: Showing the first symptom felt by the participants for which they approached doctor

S. No.	First symptom	Male, No. (%)	Female, No. (%)	Total, No. (%)
1	Gum bleeding	9 (2.90)	1 (3.44)	10 (2.94)
2	Helitosis	0 (00)	0 (00)	0 (00)
3	Trismus	3 (0.95)	0 (00)	3 (0.88)
4	Burning sensations in mouth	10 (3.21)	2 (6.90)	12 (3.52)
5	Ulceration	255 (82.00)	25 (86.20)	280 (82.35)
6	Difficulty in swallowing	17 (5.45)	1 (3.44)	18 (5.29)
7	Swelling in area of head and neck	12 (3.85)	0 (00)	12 (3.52)
8	Pain in gums	4 (1.30)	0 (00)	4 (1.17)
9	Whitish tongue	1 (0.32)	0 (00)	1 (0.29)
Total		311 (100)	29 (100)	340 (100)

Table 5: Showing the TNM staging of oral cancer among participants

Stage of Cancer	Gender		Total No(%)
	Male No(%)	Female N0(%)	
Stage I	1(0.32)	1(3.45)	2(0.58)
Stage II	67(21.54)	6(20.69)	73(21.47)
Stage III	151(48.55)	12(41.38)	163(47.94)
Stage IV	92(29.58)	10(34.48)	102(30.0)
Total	311(91.47)	29(8.53)	340(100)

Table 6: Showing association of treatment provide to participants according to TNM staging

S. No	Type of Treatment	Stage I, No. (%)	Stage II, No. (%)	Stage III, No. (%)	Stage IV, No. (%)	Total, No. (%)
1	Surgery	1 (2.27)	23 (52.27)	12 (27.27)	8 (18.18)	44 (12.94)
2	Chemotherapy	0 (00)	2 (2.94)	21 (30.88)	45 (66.18)	68 (20)
3	Radiotherapy	1 (7.69)	3 (23.08)	5 (38.46)	4 (30.77)	13 (3.82)
4	Surgery + Radio	0 (00)	30 (34.48)	47 (54.02)	10 (11.49)	87 (25.59)
5	Surgery + Chemo	0 (00)	6 (13.95)	24 (55.81)	13 (30.23)	43 (12.65)
6	Chemo + Radio	0 (00)	3 (6.52)	34 (73.91)	9 (19.57)	46 (13.53)
7	Surgery + Chemo + Radio	0 (00)	6 (15.38)	20 (51.28)	13 (33.33)	39 (11.47)
Total		2 (0.59)	73 (21.47)	163 (47.94)	102 (30)	340 (100)

Similar results were found in the study of Shenoi et al.²⁹ and Khandekar et al.²⁴ This reduces the chances of survival because the studies have shown that detecting oral cancer in early stages, when these are amendable to single modality therapies, offers the best chance of long term survival.³⁶ In our study surgery & radiotherapy i.e. 87 (25.58%) was the most commonly advised treatment modality followed by chemotherapy in 68 (20%) chemotherapy & radiotherapy 47 (13.82%) and surgery alone in 44 (12.94%). Similarly in the study of Lype et al.³⁷ showed that Majority of the patients with early disease, 33(73.3%), were treated by radiotherapy as the primary modality, either alone 19 (57.6%) or followed by either surgery 4 (12.1%) or chemotherapy 10 (30.3%). Similarly, in the study of Anand et al.³⁸ in year 2018 showed that Surgery and radiotherapy are commonly used for the treatment of oral cancer at early stages. Priorities of particular treatment method depend on the lesion location, age of patient, cosmetic and functional outcomes, associated illnesses, and the availability of expertise. Early-stage

oral cancers are generally operated by surgery. Tumors at advanced stage i.e., Stage III and IV have high treatment failure rates, and combined modality approach including surgery, radiotherapy, and chemotherapy is preferred.

5. Conclusion

The present data will serve as a part of initial data collection effort. Though the study is cross sectional and facility based and it represents only people obtaining treatment during the duration of the study. Moreover, inference of oral cancer results to the varied general population was not possible in this study. Commonest age of presentation of oral cancer was 5th decade of life in our study due to late reporting of disease. Any ulcer or lesion at a younger age should not be dismissed easily, even it is not habit related of clinical suspicion lead to further investigate in order to identify the disease in early phase, which is perhaps the only way to ensure good prognosis.

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References

- Mathur A, Jain M, Shiva M, Navlakha M, Prabu, Kulkarni S. Tobacco habits and risk of oral cancer: a retrospective study in India. *Iranian J Blood and Cancer*. 2007;3:111–6.
- Warnakulasuriya S. Causes of oral cancer – an appraisal of controversies. *Br Dent J*. 2009;207(10):471–5. doi:10.1038/sj.bdj.2009.1009.
- WHO (2004). The world health report 2004: changing history Geneva. Available from: http://www.who.int/whr/2004/en/report04_en.pdf.
- Sankaranarayanan R, Ramadas K, Thomas G, Muwonge R, Thara S, Mathew B, et al. Effect of screening on oral cancer mortality in Kerala, India: a cluster-randomised controlled trial. *Lancet*. 2005;365(9475):1927–33. doi:10.1016/s0140-6736(05)66658-5.
- Parkin DM, Bray F, Ferlay J, Pisani P. Estimating the world cancer burden: Globocan 2000. *Int J Cancer*. 2001;94(2):153–6. doi:10.1002/ijc.1440.
- Ahluwalia KP. Assessing the oral cancer risk of South-Asian immigrants in New York City. *Cancer*. 2005;104(S12):2959–61. doi:10.1002/cncr.21502.
- Patel PS, Raval GN, Patel DD, Sainger RN, Shah MH, Shah JS. A study of various socio-demographic factors and plasma vitamin levels in oral and pharyngeal cancer in Gujarat. *India Asian Pac J Cancer Prev*. 2001;2:215–24.
- Control of oral cancer in developing countries. A WHO meeting. *Bull World Health Organ*. 1984;62:817–30.
- Misra S, Chaturvedi A, Misra NC. Management of Gingivobuccal Complex Cancer. *Ann R Coll Surg Engl*. 2008;90(7):546–53. doi:10.1308/003588408x301136.
- Furniss CS, McClean MD, Smith JF, Bryan J, Applebaum KM, Nelson HH, et al. Human papillomavirus 6 seropositivity is associated with risk of head and neck squamous cell carcinoma, independent of tobacco and alcohol use. *Ann Oncol*. 2009;20(3):534–41. doi:10.1093/annonc/mdn643.
- Sánchez MJ, Martínez C, Nieto A, Castellsagué X, Quintana MJ, Bosch FX, et al. Oral and oropharyngeal cancer in Spain: influence of dietary patterns. *Eur J Cancer Prev*. 2003;12(1):49–56. doi:10.1097/00008469-200302000-00008.
- Talamini R, Vaccarella S, Barbone F, Tavani A, Vecchia CL, Herrero R, et al. Oral hygiene, dentition, sexual habits and risk of oral cancer. *Br J Cancer*. 2000;83(9):1238–42. doi:10.1054/bjoc.2000.1398.
- Conway DI, Petticrew M, Marlborough H, Berthiller J, Hashibe M, Macpherson LMD. Socioeconomic inequalities and oral cancer risk: A systematic review and meta-analysis of case-control studies. *Int J Cancer*. 2008;122(12):2811–9. doi:10.1002/ijc.23430.
- Kumar V, Singh MP, Misra S, Rathanaswamy SP, Gupta S, Tewari BN. Clinical profile and epidemiological factors of oral cancer patients from North India. *Natl J Maxillofac Surg*. 2015;6(1):21. doi:10.4103/0975-5950.168215.
- The Union for International Cancer Control. In: TNM Classification of Malignant Tumours. Wiley Blackwell; 2010.
- Agarwal AK. Social classification: The need to update in the present scenario. *Indian J Community Med*. 2008;33:50–1.
- Babshet M, Pervatkar SK, Nandimath K, Naikmasur VG. Efficacy of oral brush cytology in the evaluation of the oral premalignant and malignant lesions. *J Cytol*. 2011;28(4):165–72. doi:10.4103/0970-9371.86342.
- Chaturvedi P. Effective strategies for oral cancer control in India. *J Can Res Ther*. 2012;8:55–6.
- Singh MP, Kumar V, Agarwal A, Kumar R, Bhatt MLB, Misra S. Clinico-epidemiological study of oral squamous cell carcinoma: A tertiary care centre study in North India. *J Oral Biol Craniofac Res*. 2016;6(1):32–5. doi:10.1016/j.jobcr.2015.11.002.
- Ray JG, Ganguly M, Rao BHS, Mukherjee S, Mahato B, Chaudhuri K. Clinico-epidemiological profile of oral potentially malignant and malignant conditions among areca nut, tobacco and alcohol users in Eastern India: A hospital based study. *J Oral Maxillofac Pathol*. 2013;17(1):45–50. doi:10.4103/0973-029x.110720.
- Mehrotra R, Singh M, Kumar D. Age specific incidence rate and pathological spectrum of oral cancer in Allahabad. *Indian J Med Sci*. 2003;57:400–4.
- Sharma P, Saxena S, Aggarwal P. Trends in the epidemiology of oral squamous cell carcinoma in western UP: An institutional study. *Indian J Dent Res*. 2010;21(3):316–9. doi:10.4103/0970-9290.70782.
- Addala L, Pentapati CK, Thavanati PKR, Anjaneyulu V, Sadhnani MD. Risk factor profiles of head and neck cancer patients of Andhra Pradesh, India. *Indian J Cancer*. 2012;49(2):215–9. doi:10.4103/0019-509x.102865.
- Khandekar SP, Bagdey PS, Tiwari RR. Oral cancer and some epidemiological factors: A hospital based study. *Indian J Community Med*. 2006;31:157–9.
- Ganesh R, John J, Saravanan S. Socio demographic profile of oral cancer patients residing in Tamil Nadu - A hospital based study. *Indian J Cancer*. 2013;50:9. doi:10.4103/0019-509x.112270.
- Balaram P, Sridhar H, Rajkumar T, Vaccarella S, Herrero R, Nandakumar A, et al. Oral cancer in southern India: The influence of smoking, drinking, paan-chewing and oral hygiene. *Int J Cancer*. 2002;98(3):440–5. doi:10.1002/ijc.10200.
- Madani AH, Dikshit M, Bhaduri D, Aghamolaei T, Moosavy SH, Azarpaykan A. Interaction of Alcohol Use and Specific Types of Smoking on the Development of Oral Cancer. *Int J High Risk Behav Addict*. 2014;3(1):12120. doi:10.5812/ijhrba.12120.
- Mehrotra R, Singh M, Kumar D. Age specific incidence rate and pathological spectrum of oral cancer in Allahabad. *Indian J Med Sci*. 2003;57:400–4.
- Shenoi R, Devrukhkar V, Chaudhuri, Sharma BK, Sapre SB, Chikhale A. Demographic and clinical profile of oral squamous cell carcinoma patients: a retrospective study. *Indian J Cancer*. 2012;49(1):21–6. doi:10.4103/0019-509X.98910.
- Piccirillo J, Costas I, Reichman M, SEER Survival Monograph: Cancer Survival Among Adults: U S SEER Program, 1988–2001, Patient and Tumor Characteristics NIH Pub No 07-6215 National Cancer Institute, SEER Program; Bethesda. *Cancers of the head and neck*; 2007. p. 7–22.
- Ohkuma T, Peters SAE, Woodward M. Sex differences in the association between diabetes and cancer: a systematic review and meta-analysis of 121 cohorts including 20 million individuals and one million events. *Diabetologia*. 2018;61(10):2140–54. doi:10.1007/s00125-018-4664-5.
- Krishnamurthy A, Ramshankar V. Early Stage Oral Tongue Cancer among Non-Tobacco Users - An Increasing Trend Observed in a South Indian Patient Population Presenting at a Single Centre. *Asian Pac J Cancer Prev*. 2013;14(9):5061–5. doi:10.7314/apjcp.2013.14.9.5061.
- Park K. Textbook of Preventive and Social Medicine. 14th ed. Jabalpur: Banarsidas Bhanot Publishers; 1994. p. 261–5.
- Mehta FS, Gupta MB, Pindborg JJ, Bhosale RB, Jafnawalla PN, Snor PN. An intervention study of oral cancer and precancer in rural populations: a preliminary report. *Bulletin WHO*. 1982;60(3):441–6.
- Iype EM, Pandey M, Mathew A, Thomas G, Sebastian P, Nair MK. Squamous Cell Carcinoma of the Tongue Among Young Indian Adults. *Neoplasia*. 2001;3(4):273–7. doi:10.1038/sj.neo.7900172.
- Yeole BB, Ramanakumar AV, Sankaranarayanan R. Survival from oral cancer in Mumbai (Bombay), India. *Cancer Causes Control*. 2003;14:945–52. doi:10.1023/b:caco.0000007965.61579.b2.
- Iype EM, Pandey M, Mathew A, Thomas G, Sebastian P, Nair MK. Squamous Cell Carcinoma of the Tongue Among Young Indian Adults. *Neoplasia*. 2001;3(4):273–7. doi:10.1038/sj.neo.7900172.
- Anand A, Goyal AK, Bakshi J, Sharma K, Vir D, Didi A. Yoga as an integrative approach for prevention and treatment of oral cancer. *Int J Yoga*. 2018;11:177. doi:10.4103/ijoy.ijoy_49_17.

Author biography**Anil Kumar Agarwal**, Professor**Ramniwas Mahore**, Assistant Professor**Sumit S Bhadoriya**, PG Student**Ankita Tripathi**, PG Student**Swati Saraswat**, PG Student

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