Risk Factor Analysis for Oral Precancer among Slum Dwellers in Delhi, India

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Abstract

Background: An outfall of urbanization in developing countries has been the mushrooming of slums where dwellers live in pitiable environmental conditions representing the lowest rung of social strata. This group is more vulnerable to practicing deleterious social habits, including tobacco and alcohol abuse. **Aim:** The present study was undertaken to understand the strength of association between risk factors suspected of causing oral precancer among slum dwellers in Delhi. **Subjects and Methods:** A house-to-house survey was conducted in an urban slum cluster situated in the heart of Delhi city by a single trained investigator who recorded oral mucosal lesions according to WHO criteria. Demographic details and history of suspected risk factors was recorded by personal interview of each subject. The obtained data was coded, cleaned, and analyzed manually. Chi-square test was applied and Odds' ratios were calculated to analyze the association of risk factors with oral precancer. A statistically significant difference was set at 95% confidence interval. **Results:** A total of 479 subjects of both sexes were examined and 31 cases clinically diagnosed as having oral precancer, of which majority were leukoplakia. All cases except one reported practicing habits that are known risk factors for oral precancer, i.e., smoking/smokeless tobacco, chewing betel leaf/nut, and combination of these habits with alcohol. Association of oral precancer with smokeless tobacco was higher than that with smoking or chewing betel leaf/nut alone. **Conclusion:** Practicing combination of habits with alcohol was found to be the most strongly associated risk factor for oral precancer.

Keywords: Oral cancer, Risk factor analysis, Slum dwellers

Introduction

Cancer of the oropharyx is a problem of public health magnitude in many countries worldwide, including the Indian subcontinent where it is one of the most common of all body cancers.[1] Among all predisposing etiological factors, tobacco has been implicated as a major risk factor for oral cancers.[2] Use of tobacco, i.e., smoking or smokeless, in conjunction with/without alcohol is usually associated with causation of precancerous lesions such as leukoplakia and erythroplakia.

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Similarly, chewing betel quid or nut with/without tobacco is more often associated with precancerous conditions such as oral submucous fibrosis. Recent literature supports the high relative risk of precancerous lesions and conditions turning malignant.[3]

Reasons and physical form (s) of smoking and chewing are complex and largely influenced by the socio-economic backgrounds of individual (s) and communities. Of the various social classes, lower socio-economic groups are believed to practice these habits more often, which make them more vulnerable to developing oral precancer.[4] Urban slum dwellers represent a group of lower social strata due to their inherent limitations in the context of access to care, living environment, psychological factors, and health related behaviors. Since India is home to some of the largest slum clusters in the world, it provides an ideal setting to study the strength of association between known risk factors and oral

precancer. Furthermore, there is a paucity of data on slum dwellers.

Hence, the present investigation was undertaken with an aim to understand the strength of association between risk factors suspected of causing oral precancer among slum dwellers in Delhi, India. The results of this study may be used as pathfinder for developing suitable oral cancer screening and community intervention programs in urban slums.

Subjects and Methods

The present study was conducted in an urban slum cluster (viz. *Valmiki Basti*) situated in the heart of Delhi city and in close proximity to the investigators. The ethical clearance for the study was obtained from the Ethical Committee of ICMR, Delhi. A detailed list of all households in the slum was collected from a Health Center located within the slums and all houses were included in the study. Prior the investigation, an informed consent was obtained from the study subjects and those who failed to give consent were excluded from the study. The sample size was consisted of all the subjects residing in the urban slum cluster who were available at the time of investigation, which was conducted for a period of 3 months from March to May 2009. The informed consent was taken from all the subjects who participated in the investigation.

An open-ended interview based form was prepared by the investigators in order to record the exposure of the subjects to known risk factors for oral precancer. Along with questions related to the type, frequency and duration of deleterious habits, the demographic information on characteristics such as age, sex, occupation, educational level, and socioeconomic status was also obtained. The interview was conducted in regional language (Hindi). The questionnaire was initially prepared in English, translated into Hindi language and the retranslated back to English to check for consistency.

To ensure uniform interpretation, understanding and application by the examiner, of the codes and criteria for the precancer conditions to be observed and recorded in the proforma used, the investigator was priorly calibrated and trained in the Department of Public Health Dentistry, Maulana Azad Dental College, Delhi before the commencement of the study. The calibration procedure was performed on a group of 10 subjects, which were not included in the study. Duplicate examination was performed after 2 days on the same group of subjects to ensure the reliability of the examiner. The interview form was also checked for the validity at the same period and was modified accordingly.

For the purposes of this investigation, a subject was considered as having a habit (e.g. smoking) if he/she was practicing it at the time of the study and had not given it up. In addition, pertinent clinical description of observed oral mucosal lesions was made according to WHO criteria.[5] A single investigator (SM) was trained to record the findings.

The investigator made house-to-house visits and took verbal consent of the subjects before interviewing them. The subjects were seated on their front porticos and screened under natural illumination using plain mouth mirrors. In case some or all members of a household were not present on a particular day, a second visit was made to them on a later date. An attempt was also made to collect biopsy specimens from suspected cases of oral precancer in order to confirm the clinical diagnosis by histopathologic examination.

Statistical analysis

The resulting data was coded, cleaned and analyzed manually by using a Casio F × 991MS scientific calculator (manufactured by Casio Ltd., Shibuya, Tokyo, Japan). Chi-square test was applied to assess inter-group differences. A difference was considered to be statistically significant at 95% level of the confidence interval (CI). Odds' ratios (OR) were also calculated to analyze the association of known risk factors with oral precancer using controls selected from within the study population. Cases were matched to lesion free controls and restricted to sex and age groups in which oral precancer were observed.

Results

A total of 479 subjects of both sexes were examined in the present study of which youngest was 3½ months old and eldest was 85-years old. Since none of the subjects <20 years of age ($n = 246$) were found to have any precancerous lesions or conditions, they were not included in data analysis. Of the remaining 233 adult subjects (141 females and 92 males), 31 cases were clinically diagnosed, as having oral precancer, of whom 10 were females and 21 males. The mean age of the cases was 36.4 years, of whom the youngest was 21 and eldest was 65-years old. There was a statistically significant increase in the proportion of cases with an increase in age ($P < 0.001$)and illiteracy ($P < 0.001$). Similarly, significantly greater proportions of male subjects i.e., 22.8% (21/92) were found to have oral precancer compared with female subjects i.e., 7.1% (10/141) ($P < 0.001$) [Table 1].

Clinically, leukoplakia was the most commonly observed precancerous lesion of the oral cavity i.e., 51.6% (16/31). Leukoplakia was found to occur exclusively on the buccal mucosa. Table 2 shows the distribution of oral precancer in the subjects by clinical type and site. None of the subjects, except two, consented for the biopsy. Histopathologic examination confirmed the clinical diagnosis of leukoplakia in both these cases.

Since all cases, except two, were non-vegetarians and reported using a toothbrush to clean their teeth, any modifying effect of dietary or oral hygiene habits was ruled out. The cases not using toothbrush reported utilizing *Datun* (*Azadirachta indica*), which is an indigenous oral hygiene aid used in India.

Only 3.2% (1/31) cases reported practicing habits that are known risk factors for oral precancer. Majority of 35.5% (11/31) cases used smokeless tobacco, 29% (9/31) smoked, 9.7% (3/31) chewed betel leaf/nut and 22.6% (7/31) practiced a combination of habits, i.e., 9.7% (3/31) used tobacco with alcohol, 3.2% (1/31) tobacco with betel leaf/nut and 9.7% (3/31) smoked as well as chewed smokeless tobacco. All these habits were significantly associated with the occurrence of oral precancer ($P < 0.001$) [Table 3].

Table 1: Distribution of oral precancerous lesions and conditions by age, sex and education

Factors	N (%)		Statistical inference
	Diseased	Healthy	
Age group (years)			
20-24	5 (7.7)	60 (92.3)	χ^2 value=9.98
25-34	10 (10.9)	82 (89.1)	P value=0.001
35-44	8 (15.7)	43 (84.3)	
≥45	8 (55.6)	17 (44.4)	
Sex			
Males	21 (22.8)	71 (77.2)	χ^2 value=11.948
Females	10 (7.1)	131 (92.9)	P value=0.001
Education			
Literate	21 (17.07)	102 (82.93)	χ^2 value=12.194
Illiterate	10 (52.63)	9 (47.37)	P value=0.001

*One individual did not specify educational status

Table 2: Distribution of oral precancerous lesions and conditions by clinical type and site

Lesion (clinical type)	Cases N (%)	Site	
		Buccal mucosa	Palate
Leukoplakia	16 (51.6)	16	Nil
Other red-white (R and W) lesions			
Erythroplakia	2 (6.5)	2	Nil
Oral submucous fibrosis	9 (29)	9	Nil
Smokers' palate	4 (12.9)	Nil	4
Total R and W lesions	15 (48.4)	11	4
Total number of cases	31	27	4

Table 3: Risk factor analysis of habits with oral precancer

Habit	N (%)		Statistical inference
	Diseased	Healthy	
Smoking alone	9 (27.27)	24 (72.73)	OR=53.25 (95% CI: 6.45-439.58) P value=0.001
Tobacco chewing alone	11 (37.93)	18 (62.07)	OR=86.78 (95% CI: 10.57-712.24) P value=0.001
Chewing betel leaf/nut	3 (21.43)	11 (78.57)	OR=38.73 (95% CI: 3.71-404) P value=0.001
Combination of habits	7 (50.0)	7 (50.0)	OR=142 (95% CI: 15.29-1318.61) P value=0.001
No habit	1 (0.69)	142 (99.31)	

OR: Odds ratio, CI: Confidence interval

Cases who reported smoking ($n = 15$) exclusively or in combination with other habits, a majority 66.7% (10/15) reported using bidi, i.e., shredded, sun-cured tobacco hand rolled into a piece of temburni leaf (*Diospyros melanoxylon*), 20% (3/31) used cigarettes and 13.3% (2/31) used both [Figure 1]. The frequency of smoking ranged from 2 to 30 cigarettes/day and 2 to 50 bidis/day. The duration of smoking ranged from 5 to 45 years (mean = 21.1 years) and that of chewing smokeless tobacco ranged from 1 to 30 years (mean = 11.9 years). The duration of chewing betel leaf/nut exclusively ranged from 1 to 7 years (mean = 4.3 years). Association of oral precancer with smokeless tobacco ($P < 0.001$, OR = 86.78, 95% CI = 10.57-712.24) was found to be higher than that with smoking ($P < 0.001$, OR = 53.25, 95% CI = 6.45-439.58) or chewing betel leaf/nut alone ($P < 0.001$, OR = 38.73, 95% CI = 3.71-404). A combination of habits were most strongly associated with oral precancer ($P < 0.001$, OR = 142, 95% CI = 15.29-1318.61) [Table 3].

Discussion

The present study was done to assess the distribution and strength of risk factors for oral precancer in a group of 479 slum dwellers in Delhi. None of the children or adolescents was found to have any oral precancerous lesion or condition. A single case was found in 20-24 years age group and the proportion of cases was found to increase with age. This finding is in agreement with the findings of Ali *et al.*,[6] who conducted a prevalence study of oral precancerous lesions in Malaysia and Fisher *et al.*,[7] in West Virginia. A significantly greater proportion of male subjects were found to have oral precancer when compared to their female counterparts and this observation is in accordance with reports by Ikeda *et al.*,[8] in Cambodian population.

The most common lesion was leukoplakia and it was found to occur exclusively on the buccal mucosa. Ali *et al.*,[6] and Pearson *et al.*,[9] have reported similar observations in their study on south Asians.

A significant association between smoking and oral precancer was observed. Garrote *et al.*,[10] in their study of oral cancer risk in Cuba found an OR of 20.8 (95% CI: 8.9-48.3) for the smoking. In addition to smoking, smokeless tobacco was also

Figure 1: Various forms of tobacco used in the study (bidi, gutkha, raw tobacco, etc.)

found to be associated with oral precancer in the present study. In similar studies of smokeless tobacco on Indian population Hashibe *et al.*,[11] found an OR of 44.1 (95% CI: 22.0-88.2) for oral submucous fibrosis and Thomas *et al.*,[12] found an OR of 37.8 (95% CI: 16.2-88.1) for multiple oral premalignant lesions.

In the present study, an association was also found between oral precancer and chewing of betel nut/quid (without tobacco), which is in accordance with observations made by Thomas and Wilson[13] as well as Trivedy *et al.*,[14] in their respective reviews of literature. Jacob *et al.*,[15] calculated the association of various oral precancer with betel quid as OR of 22.2 (95% CI: 11.3-43.7) for leukoplakia, 56.2 (95% CI: 21.8-144.8) for oral submucous fibrosis, 29.0 (95% CI: 5.63-149.5) for erythroplakia and 28.3 (95% CI: 6.88-116.7) for multiple oral precancers.

Subjects who used a combination of habits had the strongest association with oral precancer. Jaber *et al.*,[16] observed that alcohol when used in combination with smoking had a synergistic action on oral epithelial dysplasia. Lee *et al.*,[17] in their study on Taiwanese reported that betel quid was associated with leukoplakia as well as oral submucous fibrosis and when used in conjunction with smoking, it had an additive effect.

The odds of oral precancer occurrence were lower in subjects who used smoking or smokeless tobacco alone as compared to those who practiced a combination of habits. Roed-Petersen *et al.*,[18] showed bidi smoking to be more important than tobacco chewing as a factor associated with leukoplakia. Similarly, Gupta[19] reported that leukoplakia had a higher association with smoking when compared to smokeless tobacco. However regarding erythroplakia, Hashibe *et al.*,[20] found that the OR was 19.8 (95% CI: 9.8-40.0) with smokeless tobacco and 1.6 (95% CI: 1.6-5.7) with smoking. More recent reports by Shiu and Chen[21] observe that the OR for leukoplakia was 17.7 (95% CI: 9.03-34.5) with betel quid chewing and 4.26 (95% CI: 2.21-8.23) with the smoking.

No attempt was made to relate the OR with the duration or frequency of habits.

Last but not the least, there was a single case in the present study that did not report having any of the known risk habits for oral precancer. This is in agreement with observations of Ali *et al.*,[6] and emphasizes the need to conduct more elaborate studies in the future to study risk factors for oral precancer that are still unknown to researchers.

Limitations of the present study were: (1) Lack of generalization value of the present study due to geographical variations in the forms of tobacco usage and its composition and (2) dose-response relationship could not be analyzed for frequency and duration of habit due to the small sample size of the study.

Within the limitations of the present study, it can be recommended that periodic screening of urban slum dwellers is the key to preventing oral cancer in this vulnerable population. Training dental surgeons and other categories of health workers using WHO recommended methodology for examining oral mucosa would be one step in this direction. Screening should be followed by confirmatory tests, i.e., biopsy, for which community based motivational techniques would have to be applied. In addition to diagnostic facilities the detected cases of oral precancer require counseling using experts who can encourage them to cease tobacco and accept treatment. Besides educational and service approach, political commitment for enforcement of legislation (such as) in urban slums needs to be underscored.

Furthermore, future studies are advocated to relate the OR of oral pre-cancerous conditions with the duration or frequency of habits.

Acknowledgments

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