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Tobacco and Cancer

Cancer is a public health problem worldwide. It affects all people from the young to the old; the rich to the poor; men, women and children. Of the several causes investigated for cancer, the use of tobacco has shown strong and consistent associations with cancer at several sites of the body.

Magnitude of disease

Presently, more than 10 million people globally are diagnosed with cancer every year. It is estimated that by 2020, there will be 15 million new cases every year. Cancer causes 6 million deaths every year, or 12% of deaths worldwide.¹⁹

The tobacco-related cancers reported by the Population-based Cancer Registries of Bangalore, Barshi (rural), Bhopal, Chennai, Delhi and Mumbai constitute 56.4% and 44.9% of cancers in males and females, respectively. The top five or six cancers in men are all tobacco-related cancers: of the lung, oral cavity, larynx, oesophagus and pharynx. In women, the leading cancer sites include those related to tobacco: cervix, oral cavity, oesophagus and lung, in addition to other cancers not considered to be tobacco related (breast and ovary).²⁰

Global evidence

The International Agency for Research on Cancer (IARC) Monograph states that tobacco smoking is the major cause of lung cancer (all types) and is associated with oral cancer, cancers of the oropharynx and hypopharynx, oesophagus, stomach, liver, pancreas, larynx, nasopharynx, nasal cavity and nasal sinuses, urinary bladder, kidney and cervix, and myeloid

leukaemia.²¹ In addition, exposure to second-hand tobacco smoke has also been conclusively shown to be carcinogenic to the lungs.²²

The US Surgeon-General's report for 2004 states that the evidence is sufficient to infer a causal relationship between smoking and cancer of the lung, oral cavity, larynx, oesophagus, urinary bladder, kidney, stomach and pancreas, uterine cervix, as well as acute myeloid leukaemia.²³

Evidence for the causal role of tobacco in India

Case-control studies conducted in India on cancer at various sites have shown that both smoking and smokeless tobacco use (including tobacco with lime and *paan* with tobacco) cause elevated risks for intra-oral, oropharyngeal, oesophageal and cervical cancers, and cancer of the penis. They have shown that smoking in India causes elevated risks for cancer of the lungs, hypopharynx, larynx and stomach. In the following section, some examples are given. The current evidence for a causal association of tobacco use in India and cancer at various sites is based on case-control studies for specific anatomical sites. A brief summary is presented here, with the sites listed.²⁴

Lung

A case-control study on lung cancer conducted in Chandigarh showed that ever-smoking men (i.e. those who ever smoked regularly) had a 5-fold higher risk (odds ratio [OR] = 5.0) and ever-smoking women had a two-and-a-half-fold higher risk (OR = 2.47) of developing lung cancer compared to non-smokers.²⁵

Smoking *beedis*, *hookahs* and cigarettes was associated with similarly elevated risks. In a population-based case-control study in Bhopal, *beedi* and cigarette smokers had a 12-fold higher risk for lung cancer than non-smokers. A dose-response relationship was observed, indicating that the more often or the longer smokers used tobacco, the greater was their risk.²⁶

Oral cavity and tongue

The relationship between oral cancer and tobacco use, especially chewing of *paan* (betel quid) with tobacco, has been reported since the early twentieth century²⁷ and more recently through a variety of epidemiological and clinical studies.²⁸

All of the case-control studies conducted on tobacco and oral cancer in India show that the risk of oral cancer increases with the use of tobacco in various forms, compared to non-use of tobacco. Smoking increased the risk of oral cancer relative to non-smokers, and chewing (of tobacco or *paan* with tobacco) tended to have a higher risk for oral cancer than smoking. The risk of oral cancer for chewers of tobacco (in any form), compared to non-users was high to very high in different studies, with the risk for women being higher than the risk for men. For example, in a study in the three centres of Bangalore, Chennai and Thiruvananthapuram, women had a 46 times higher risk if they chewed *paan*-tobacco than those women who had never chewed it (RR = 45.9). The men in the study had a 6-fold greater risk of oral cancer if they were *paan*-tobacco users than if they were never users (risk adjusted for smoking).²⁹

The women who chewed *paan*-tobacco in a study in Bangalore had a 25-fold higher risk of oral cancer relative to non-users, while men who chewed *paan*-tobacco had a 3.6-fold RR compared to non-chewers. Men who smoked had a 3.5-fold significantly greater risk than non-users of tobacco.³⁰

There are numerous other case-control studies, all of which show high RRs for smokeless tobacco use (tobacco chewing and snuff). These studies also show a trend of increasing risk with increasing frequency of chewing per day, duration of the habit and with associated habits such as alcohol drinking.^{31,32} Case-control studies have also shown a significant relationship between smoking and oral cancer in India.²²

It is clear that the scientific evidence of the role of tobacco use in the causation of oral cancer is overwhelming, with tobacco chewing being of particular concern.

Oesophagus

A case-control study in Delhi reported a 2.6-fold greater risk for developing oesophageal cancer in chewers of tobacco with betel quid, relative to non-chewers, and a nearly 2-fold greater risk for *beedi* smokers (RR = 1.95) in a multivariate model.³³

In a case-control study in Bangalore, tobacco chewing gave users a nearly 3-fold higher risk (OR = 2.9) than non-chewers (adjusted for smoking), and *beedi* smoking a 4-fold greater risk than non-smokers (adjusted for chewing). The risk of cancer in the lower third of the oesophagus for *paan*-tobacco chewers was 6.6-fold greater than for non-chewers. *Beedi* smoking in males was a significant risk factor for cancer of all the three segments of the oesophagus, but conferred a 7-fold greater risk for the upper third (OR = 7.1) compared to that of non-smokers.³⁴

Other studies in Chennai and Thiruvananthapuram have also shown that *paan*-tobacco chewing and smoking are significant risk factors for cancer of the oesophagus. Dose-response relationships for daily frequency as well as duration of the habit were also found.^{35,36}

A case-control study on oesophageal cancer in Assam found that men chewing dried tobacco (*chadha*) had a nearly 5-fold greater risk of oral cancer compared to non-users. It also found dose-response relationships similar to that in the other studies. Among chewers of more than 20 years' duration, men had more than a 10-fold higher risk (OR = 10.6) and women a 7-fold higher risk (OR = 7.2) relative to non-chewers.³⁷

In summary, evidence based on a variety of case-control studies show that both tobacco chewing and smoking increase the risk of developing oesophageal cancer several-fold.

Larynx

In a population-based case-control study conducted in Mumbai, *beedi* smoking emerged as a significant risk factor for laryngeal cancer, with around 2 times greater risk as compared to non-smokers (RR for *beedi* smoking: 2.3).³⁸ A study in Thiruvananthapuram found that, among smokers of over 20 years' duration, *beedi* smokers had a 7-fold higher risk than non-smokers, and cigarette smokers had a 5-fold higher risk (OR = 7.12 for *beedi*; OR = 5.18 for cigarette).³⁹

In summary, two case-control studies found that smoking was a significant risk factor for cancer of the larynx.

Oropharynx

A population-based case-control study in Bhopal found a greater than 7-fold higher risk of oropharyngeal cancer for smoking (OR = 7.3; adjusted for chewing tobacco).²⁶ In a case-control study in Mumbai, *beedi* smokers had a greater than 5-fold higher risk (OR = 5.6) of cancer of the oropharynx relative to non-smokers.³⁸

In a case-control study in Nagpur, tobacco chewers had a nearly 8-fold higher risk (OR = 7.98) and tobacco smokers had an over 2-fold higher risk (OR = 2.25) for oropharyngeal cancer compared to non-users in a multivariate model. Dose-response relationships were also observed for increasing frequency, duration and retention time of tobacco in the mouth.⁴⁰

Stomach

In a hospital-based case-control study on lifestyle risk factors and stomach cancer in Chennai, smokers had a greater than 2-fold increased risk of stomach cancer (OR = 2.7)

compared to non-smokers. Significant dose-response relationships were observed with age at which smoking was initiated and with lifetime exposure to smoking. Chewers were not found to have a significant risk of stomach cancer in this study.⁴¹

Cancer of the cervix

A case-control study on the association of *paan*-tobacco chewing and dietary habits with cervical carcinoma was carried out in Chennai, in which 205 women with invasive cervical cancer were age-matched with 213 women controls. A dose-dependent direct association of *paan*-tobacco chewing with invasive cervical cancer was observed.⁴²

A study on 1962 women screened at a rural cancer detection unit in West Bengal found that 54% of the women with the habit of *paan*-tobacco chewing had cervical dysplasia (a precursor of cervical cancer), while only 4.1% of non-chewers had such dysplasia (OR = 28.5).⁴³

Other sites

Gallbladder: In a case-control study conducted in Delhi on cancer of the gallbladder among patients with gall stones, smokers had an 11-fold increased risk of developing gallbladder cancer in comparison to non-smokers.⁴⁴

Urinary bladder: In a case-control study conducted in Mumbai, tobacco smoking was found to be a risk factor for cancer of the urinary bladder.⁴⁵

Penis: A case-control study in Chennai found that men who used snuff had a 4-fold greater risk of penile cancer than non-users; those who chewed tobacco had a 4-fold higher risk in comparison to non-chewers; and men who smoked had a 1.7 times higher risk than non-smoking men.⁴⁶

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KEY MESSAGES

- Case-control studies in India have shown that tobacco chewing in its various forms is directly responsible for cancers of the oral cavity, oesophagus, pharynx, cervix and penis.
- *Beedi* and cigarette smoking cause oral, pharyngeal, oesophageal, laryngeal, lung, stomach, gallbladder, urinary bladder and penile cancers.
- Global data show that cancers in certain other anatomical sites such as the kidney, liver and pancreas and myeloid leukaemia have also been associated with the use of tobacco.