Summary and Key Points

1. Exposure to many environmental agents is associated with an increased incidence of certain malignancies, although causation is usually difficult to prove.
2. Certain chemicals, infections (parasitic, viral, and bacterial) and ionizing radiation are known carcinogens.
3. Variable genetic susceptibility to such carcinogenesis is apparent.
4. Up to 2/3 of human cancers are believed to have an environmental component.

Introduction

Carcinogenesis of malignant tumors may be triggered by a variety of causes, including genetics, diet, poor oral hygiene, environmental and infectious causes.

The scientific information in this chapter is changing rapidly. It is not intended as a comprehensive catalogue, but merely a summary of the most important. Clearly, genetic susceptibility to an environmental insult plays a role for some if not all of these agents, but that role is not yet well defined. For example, some families have a high rate of lung cancer despite little or no smoking history, while some 100-pack-year smokers remain cancer free.

The first recognition of an environmental cause of cancer was through occupation exposure to soot among London chimney sweeps. These men experienced an increased incidence of an uncommon skin cancer on the scrotum. This phenomenon and the connection to occupation were initially noted in the nineteenth century. Since that time, many other carcinogens have been identified (e.g., tobacco, asbestos, radon). However, even these well-known carcinogens cause more types of cancer than commonly understood. In addition, there are hundreds of other known carcinogens with exposure rates ranging from rare to common.
Table 2. Infectious agents carcinogens

| Pathogens      | Tumor Type                  | References                                      |
|----------------|-----------------------------|-------------------------------------------------|
| Helicobacter pylori | Gastric, duodenal ulcer     | Wynder EL, Graham EA. Tobacco smoking as a possible etiologic factor in bronchiogenic carcinoma; a study of 684 proved cases. J Am Med Assoc. 1950; 27;143(4):329-36. Accessed 13 December 2010. |
| HPV (Human papilloma virus) | Carcinoma in situ, invasive cervical cancer | Wynder EL, Graham EA. Tobacco smoking as a possible etiologic factor in bronchiogenic carcinoma; a study of 684 proved cases. J Am Med Assoc. 1950; 27;143(4):329-36. Accessed 13 December 2010. |
| HTLV (Human T-Cell Leukemia Virus) | Leukemia, T-cell lymphoma | Wynder EL, Graham EA. Tobacco smoking as a possible etiologic factor in bronchiogenic carcinoma; a study of 684 proved cases. J Am Med Assoc. 1950; 27;143(4):329-36. Accessed 13 December 2010. |
| EBV (Epstein-Barr virus) | Burkitt lymphoma, nasopharyngeal carcinoma | Wynder EL, Graham EA. Tobacco smoking as a possible etiologic factor in bronchiogenic carcinoma; a study of 684 proved cases. J Am Med Assoc. 1950; 27;143(4):329-36. Accessed 13 December 2010. |

Thought Questions

1. As noted in this chapter, tobacco smoking is associated with a number of malignancies, including bladder and cervical cancers. Suggest plausible hypotheses that would explain how smoking can cause bladder and cervical cancer.

2. A sixteen year old girl is treated with thoracic radiation for a lymphoma. Fourteen years later she is advised to begin screening breast MRI exams because therapeutic chest irradiation of female adolescents is associated with a marked increase in the risk of breast cancer. Explain why radiation would convey a higher risk of breast cancer when given to an adolescent, but not to a small child (less than eight years old) or a mature woman (more than thirty years old).