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GENETIC AND ENVIRONMENTAL FACTORS IN CANCER PATHOGENESIS

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ABSTRACT

With modern civilization cancer pathogenesis has become a very serious problem in our society. There have been many causes of cancer that includes person's life style and environmental factors. Successful management of life style and environmental pollution can reduce risks of cancer in our society.

Keywords:

Cancer, Pathogenesis, Environmental Factors, Pollution.

INTRODUCTION

Cancer is the second most common cause of death after heart disease in India and worldwide. Researchers are still trying to determine whether cancer is preventable. Mostly cancer is caused by both internal factors and environmental factors. The diet affects the incidence of cancer in various countries. Asians have 25 times lower incidence of prostate cancer and ten times lower incidence of breast cancer than Western countries. It has been estimated that only 5–10% of all cancers are due to an inherited gene defect. All cancers are caused by multiple mutations (Loeb and Loeb, 2000) and these mutations are due to interaction with the environment (Mucci et al., 2001). Most cancers are not having genetic link but lifestyle factors have a profound influence on their development. The important lifestyle factors that affect the incidence and mortality of cancer include tobacco, alcohol, diet, obesity, infectious agents, environmental pollutants, and radiation. In the present paper an attempt has been made to analyze the potential risk factors of cancer.

LIFE STYLE RELATED RISK FACTORS IN CANCER PATHOGENESIS

The cancer causing effects of tobacco are well documented. There are at least 50 carcinogens detected in tobacco. Benzopyrenediol epoxide, one tobacco metabolite, has a direct etiologic association with lung cancer (Denissenko et al, 1996). Due to the awareness of cancer causing effects of tobacco smoking, the prevalence of smoking has been slowly declining worldwide. However, the prevalence of smoking is increasing in the developing countries, where 85% of the world's population resides. The education, with an emphasis in reducing tobacco smoking, will be the only way to reduce the rates of tobacco-related cancer mortality. The mechanism how smoking contributes to cancer is not fully understood.

A number of studies have revealed that chronic alcohol consumption is a risk factor for several types of cancers including cancers of the oral cavity, pharynx, hypopharynx, larynx, and esophagus (Tuyns, 1979). There are reports that alcohol increase risk of breast cancer. A synergistic effect

has been reported between heavy alcohol ingestion and hepatitis C virus or hepatitis B virus that increases the risk of hepatocellular carcinoma (Donato et al., 2006). How alcohol cause cancer is yet not fully understood. Studies suggested that ethanol generates free radicals which are believed to be responsible for alcohol-associated carcinogenesis via binding to DNA. Alcohol can activate the NF- κ B proinflammatory pathway (Szabo et al., 2007), which can also contribute to tumor and cancer pathogenesis (Aggarwal. 2004).

Diet is linked to cancer deaths in as many as 70% of colorectal cancer cases. How diet contributes to cancer is not fully understood. Most carcinogens that are contributed by diets are nitrates, nitrosamines, pesticides, and dioxins that come from food or food additives or from cooking. Red meat heavy consumption is a risk factor for the gastrointestinal tract cancer and also colorectal, breast, gastric, pancreatic, and oral cancers. During the cooking of meat heterocyclic amines are produced which are carcinogens. Nitrites and nitrates that bind to myoglobin, inhibiting botulinum exotoxin production, are powerful carcinogens and are used in meat processing very commonly. In addition saturated fatty acids, trans fatty acids, and refined sugars and flour present in most foods have also been associated with various cancers.

ENVIRONMENTAL POLLUTION RELATED RISK FACTORS IN CANCER PATHOGENESIS

Environmental pollution has been linked to various cancers. These pollutions include: air pollution by carbon particles, indoor air pollution by environmental tobacco smoke, formaldehyde, and food pollution by food additives and by carcinogenic contaminants such as nitrates, pesticides, dioxins, and other organochlorines; pharmaceutical medicines; and cosmetics (Belpomme et al., 2007). Environmental carcinogens are the causes of various cancers. Outdoor air pollutants such as PAHs increase the risk of cancers, especially lung cancer. Exposure to PAH-containing air for long time was found to increase the risk of lung cancer deaths. Studies have shown that nitric oxide can induce lung cancer and promote metastasis. Indoor air pollutants such as volatile organic compounds and pesticides increase the risk of childhood leukemia and lymphoma and also increased risk of brain tumors. Chlorinated drinking water when exposed for long time has been associated with increased risk of cancer.

Both ionizing and nonionizing radiations may cause cancer. Radiation induces cancer including leukemia, lymphoma, thyroid cancers, skin cancers, sarcomas, lung and breast carcinomas. Radon decay products in the home and/or at workplaces (such as mines) are the most common sources of exposure to ionizing radiation. Radiation exposure from x-rays used in medical settings for diagnostic or therapeutic purposes may also induce cancer. Nonionizing radiation includes UV rays derived primarily from sunlight are carcinogenic to humans. Clastogenic DNA damage can be induced by low-frequency electromagnetic fields. The chief sources of electromagnetic field exposure are high-voltage power lines, transformers, electric train engines, and more generally, all types of electrical equipments. Daily prolonged use of mobile phones for 10 years or more showed a consistent pattern of an increased risk of brain tumors (Belpomme et al., 2007).

CONCLUSION

On the basis of data presented in this brief report it can be concluded that various lifestyle and environmental factors can be the major causes of cancer. Inflammatory markers such as cytokines, enzymes and adhesion molecules have been closely linked with tumorigenesis and cancers. Mostly carcinogens produce cancer via inflammatory pathways. Therefore the drug that suppresses these inflammatory pathways can be the best treatment or strategy of prevention of cancers via inhibiting

the proliferation of tumors, inhibiting invasion, and suppressing angiogenesis. In addition, successful management of life style and environmental pollution can reduce the risk of cancers in our society.

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