McCance: Pathophysiology, 6th Edition

Chapter 12: Cancer Epidemiology

Key Points – Print

SUMMARY REVIEW

Gene-Environmental-Lifestyle Interaction and Risk Factors

1. The frequency and consequences of genetic mutations can be altered by a number of environmental factors. The most significant factors include smoking, radiation, obesity, and a few oncogenic viruses.
2. Since the 1950s the death attributable to smoking has sharply increased. Smoking causes cancer of the lung and is associated with cancers of the renal gland, bladder, penis, oral cavity, pharynx, larynx, nasal cavities, sinuses, esophagus, stomach, liver, kidney, uterus, and myeloid leukemia.
3. Involuntary smoking is also carcinogenic for the lungs.
4. Some mechanisms of carcinogenesis from smoking include polycyclic aromatic hydrocarbons and mutations in p53, nitroso compounds, arylamines form DNA adducts in bladder cells, and benzo[a]pyrene metabolites found in cervical mucus are related to DNA adducts; however, studies did not adjust for HPV, and smokers have higher levels of benzene, an inducer of leukemia.
5. Health risks from ionizing radiation involve neoplastic diseases but also birth defects and eye maladies.
6. The risks of low-dose radiation are being debated.
7. Radiation-induced damage depends on dose response, LET, fractionation, protraction, repair mechanisms, bystander effects, and antioxidants.
8. Two opposing dose-response models have been used to estimate cancer risk: (1) LNT relationship because any dose has the potential to cause cancer, and (2) a threshold dose below that which radiation may not cause cancer.
9. The validity of the dose-response model is questionable.
10. Progeny of irradiated cells can exhibit an increased death rate and loss of reproductive potential.
11. Low levels of radiation can induce bystander effects and genomic instability. Both findings appear to be associated with oxidative stress and cell-to-cell intercellular communication.
12. ROS (oxidative stress) are involved in skin carcinogenesis from UVL.
13. UVL causes basal cell carcinoma and squamous cell carcinoma.
14. An activating mutation in the *B-raf* proto-oncogene was noted in 60% to 70% of melanoma cell lines and tissues. UVB light and sunburn trigger inflammation, causing cytokine release and activation of growth factors that may be related to the *B-raf* mutation.

15. Chronic alcoholism is a strong risk factor for cancer of the oral cavity, pharynx, hypopharynx, larynx, esophagus, and liver. It is less strongly related to breast cancer and colorectal cancer; however, breast carcinogenesis can be enhanced with relatively low daily amounts.
16. Multiple mechanisms are involved in alcohol-related carcinogenesis and include acetaldehyde, induction of cytochrome P-450, and ROS, increased procarcinogen activation, cell cycle effects, and nutritional deficiencies.
17. Sexually transmitted infection with high-risk types of HPV is required for the development of virtually all cervical cancers.
18. Physical activity reduces the risk of breast and colon cancers and may reduce the risk of other cancers.
19. A substantial percentage of cancers of the upper respiratory passages, lung, bladder, and peritoneum is attributed to occupational factors.
20. Air pollution is a concern in regard to cancer because of inhalation of emissions, including arsenicals, benzene, chloroform, vinyl chloride, and acrylonitrile. Indoor pollution is considered worse than outdoor pollution because of cigarette smoke and possibly radon gas.
21. The connection between EMFs and carcinogenesis is controversial. The evidence does not provide clear or consistent results; however, the results cannot establish the absence of any hazard.
22. Obesity is linked to cancer. High BMI is associated with higher rates of death from esophageal, stomach, colorectal, liver, breast, gallbladder, pancreatic, prostate, kidney, non-Hodgkin, ovarian, and cervical cancers as well as lymphoma, multiple myeloma, and leukemia.
23. Adipose tissue is active endocrine and metabolic tissue. Increased release of free fatty acids, resistin, TNF-α, and reduced release of adiponectin give rise to insulin resistance. Adipose tissue cells produce steroid-hormone-metabolizing enzymes and are an important source of estrogens in postmenopausal women. IGF-I regulates cell proliferation and inhibits apoptosis and the synthesis and biologic availability of female and male sex hormones.
24. Numerous dietary factors are discussed in association with cancer risk. Table 12-5 summarizes major findings**.**