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Cancer characteristics and its causes

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Short Commentary

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Introduction

Cancer is a state of an abnormal growth of cells which tend to proliferate in an uncontrolled way. Cancer is not just one disease, it is a group of more than 100 different and distinctive diseases characterized by uncontrollable cell growth, body's cells begin to divide without stopping and spread into surrounding tissues. Cancer is ultimately the result of cells that uncontrollably grow and do not die. Usually, normal cells in the body follow an orderly path of growth, division, and death. Programmed cell death is called apoptosis [1, 2], and when the cell death process breaks down, cancer begins to form. Unlike regular cells, cancer cells do not experience apoptosis and instead continue to grow and divide, as cells become more and more abnormal, old or damaged cells survive when they should die, and new cells [3] form when they are not needed. These extra cells can divide without stopping and may form growths called tumors (masses of tissue).

Cancerous tumors are malignant, which means they can spread or invade into nearby tissues, as these tumors grow, some cancer cells can break off and travel to distant places in the body through the blood or the lymph system [4] and form new tumors far from the original tumor [5].

Differences between Cancer Cells and Normal Cells

Cancer cells differ from normal cells in many ways, as follows:

1. Growth: Normal cells stop growing (reproducing) when enough cells are present, but in the case of cancer cells, these cells don't stop growing when there are enough cells present, thus forming a tumor.
2. Communication: Cancer cells don't interact with other cells (as normal cells). Normal cells respond to signals sent from other nearby cells and they stop growing. Cancer cells do not respond to these signals.

3. Cell repair and cell death: Normal cells are either repaired or die (apoptosis) when they are damaged or get old. Cancer cells are either not repaired or do not undergo apoptosis.
4. Stickiness: Normal cells secrete substances that make them stick (in group). Cancer cells fail to make these substances, and can travel to locations nearby or to distant regions in the body (through the bloodstream or lymph channels).
5. Ability to Metastasize (Spread): Normal cells stay in the area of the body where they belong. Cancer cells (as they lack the adhesion molecules that cause stickiness) are able to travel to other regions of the body. Once they reach a new region they begin to grow (forming tumors far removed from the original tumor) [6-8].
6. Appearance (Under microscope): Normal cells and cancer cells may look differently. Cancer cells often exhibit much more variability in cell size, larger or smaller than normal. In addition, cancer cells often have an abnormal shape, both of the cell and nucleus. The nucleus (contains excess DNA) appears larger and darker. Cancer cells often have an abnormal number of chromosomes that are arranged in a disorganized manner.
7. Rate of growth: Normal cells reproduce themselves and then stop when required cells are produced. Cancer cells reproduce rapidly before the cells have a chance to mature.
8. Maturation: Normal cells mature. Cancer remain immature.
9. Evading the immune system: When normal cells become damaged, the immune system (via lymphocytes) identifies and removes those damaged cells. Cancer cells can trick the immune system to grow into a tumor (by escaping detection or by secreting chemicals that inactivate immune cells).
10. Functioning: Normal cells perform their respective function that they are meant to perform, whereas cancer cells may not be functional.
11. Blood supply: Normal cells undergo a process called angiogenesis (cells attract blood vessels to grow and feed the tissue) as part of normal growth and development and when new tissue is needed to repair damaged tissue. Cancer cells undergo angiogenesis even when growth is not necessary.

Causes of Cancer

Tobacco: 80% to 90% of lung cancer cases occur in smokers. Smoking has been a contributory factor in cancers of upper respiratory tract [9], esophagus [10], larynx, bladder, pancreas and as well as liver [11], stomach, breast, and kidney [12].

Alcohol: Excessive consumption of alcohol [13], in combination with tobacco significantly increases the chances of liver [14], mouth, pharynx, larynx, and esophageal [15] cancers.

Diet: Excessive intake of fat (leading to obesity) has been associated with cancers of the breast, colon, rectum, pancreas, prostate, gall bladder, ovaries, and uterus.

Sexual and reproductive behavior: Having too many sex partners and becoming sexually active early has been shown to increase chances of contracting human papillomavirus (which is sexually transmitted)

cause cancer of the cervix. In addition, women who don't have children or have children late in life have an increased risk for ovarian and breast cancer.

Infectious agents: approximately 15% of the world's cancer deaths are caused by viruses [16-19], bacteria [20] and parasites. The most common cancer-causing pathogens and the cancers associated with them are shown in table below.

COMMON PATHOGENS AND THE CANCERS ASSOCIATED WITH THEM	
Causative Agent	Type of Cancer
Viruses	
Papillomaviruses	Cancer of the cervix
Hepatitis B virus	Liver cancer
Hepatitis C virus	Liver cancer
Epstein-Barr virus	Burkitt's lymphoma
Cancers of the upper pharynx	Hodgkin's lymphoma, Non-Hodgkin's lymphoma, Gastric cancers
Human immunodeficiency virus (HIV)	Kaposi's sarcoma Lymphoma
Bacteria	
Helicobacter pylori	Stomach cancer Lymphomas

Family history: cancers like breast, colon, ovarian [21,22] and uterine recur generation after generation in some families (linked to certain genes).

Occupational hazards: certain occupational hazards account for 4% of overall cancer deaths. (Leukemia [23-25] with glue and varnish workers; liver cancer with PVC manufacturers; and lung, bone and bone marrow cancer [26-28] with radiologists and uranium miners)

Environment: Radiation [29, 30] (sources are x rays, radon gas, and ionizing radiation [31, 32] from nuclear material) causes 1-2% of all cancer deaths. Ultra-violet radiation from the sun is responsible for the majority of melanoma [33-35] deaths

Pollution: 1% of cancer deaths are due to air, land, and water pollution. Chlorination [36, 37] of water may have small rise in cancer risk [38]. The main danger from pollution [39] occurs when dangerous chemicals from the industries escape into the environment [40] (surrounding to them).

Approximately 40% of cancer deaths [41-46] were due to tobacco and excessive alcohol use and in addition to that one-third of the deaths were related to diet and nutrition [47]. Many of the one million skin [48, 49] cancers were due to over-exposure to ultraviolet radiation from the sun rays.

Frequency Of Cancer-Related Death	
Cancer Site	Number of Deaths Per Year

Lung	160,100
Colon and rectum	56,500
Breast	43,900
Prostate	39,200
Pancreas	28,900
Lymphoma	26,300
Leukemia	21,600
Brain	17,400
Stomach	13,700
Liver	13,000
Esophagus	11,900
Bladder	12,500
Kidney	11,600
Multiple myeloma	11,300

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