Advances in Cancer Prevention
ISSN: 2472-0429
Eliaz, Adv Cancer Prev 2023, 7:3
Mini Review
Open Access

Anti-Cancer Drugs and their Pharmacological Formulation

Eliaz I*

Department of Integrative Oncology, Amitabha Medical Clinic and Healing Center, USA

Abstract

Cancer is a class of diseases characterized by out-of-control cell growth. There are over 100 different types of cancer, and each is classified by the type of cell that is initially affected. Cancer harms the body when damaged cells divide uncontrollably to form lumps or masses of tissue called tumors. Tumours can grow and interfere with the digestive, nervous, and circulatory systems and they can release hormones that alter body function. Tumours that stay in one spot and demonstrate limited growth are generally considered to be benign. More dangerous, or malignant, tumours form when two things occur, A cancerous cell manages to move throughout the body using the blood or lymph systems, destroying healthy tissue in a process called invasion that cell manages to divide and grow, making new blood vessels to feed itself in a process called angiogenesis.

Keywords: Tumour resemblance; Scientific study; Phases of development; Metastasis; Cancerous cells; Cell proliferation

Introduction

When a tumour successfully spreads to other parts of the body and grows, invading and destroying other healthy tissues, it is said to have metastasized. This process itself is called metastasis, and the result is a serious condition that is very difficult to treat. Cancer is not a new disease [1].Written descriptions of it can be found on Egyptian papyrus dating back to roughly 1600 BC. The word cancer came from the father of medicine, Hippocrates, a Greek physician. Hippocrates used the Greek words, carcinos and carcinoma to describe tumors, thus calling cancer karkinos. The Greek terms actually were words to describe a crab, which Hippocrates thought a tumour resembled. Although Hippocrates may have named Cancer, he was certainly not the first to discover the disease [2]. When the first autopsy was performed by Italian anatomist Giovanni Morgagni in 1761, the foundation was laid for the scientific study of cancer, also known as oncology. The world's oldest documented case of cancer hails from ancient Egypt, in 1500 B.C. The details were recorded on a papyrus, documenting eight cases of tumors occurring on the breast. It was treated by cauterization, a method to destroy tissue with a hot instrument called the fire drill.

Methodology

It was also recorded that there was no treatment for the disease, only palliative treatment [3]. There is evidence that the ancient Egyptians were able to tell the difference between malignant and benign tumors as shown in (Figure 1).

According to inscriptions, surface tumors were surgically removed in a similar manner as they are removed today. Today, we know so much about the human body; however early Greek physicians were not so fortunate [4]. Hippocrates believed that the body was composed of four fluids: blood, phlegm, yellow bile and black bile. He believed that an excess of black bile in any given site in the body caused cancer. This was the general thought of the cause of cancer for the next 1400 years. In ancient Egypt, it was believed cancer was caused by the Gods. There are three phases of development involved in the formation of cancerous growth. The first stage consists of a mutation of DNA which does not undergo DNA repair or undergoes faulty DNA repair [5]. The second step is promotion which involves an action promoting the uncontrolled growth and proliferation of mutated cells. In time these cells lose their normal abilities and just reproduce. The third step is metastasis. This is the invasion of cancerous cells into nearby tissues as well as the migration of cancerous cells to other tissues via circulatory or transport systems. Substances introduced to the body can cause mutation, promotion, or both. A carcinogen which causes both is called a complete carcinogen [6]. Physical damage to tissues can cause cell proliferation. Some mutagens can damage surrounding tissues, leading to cell proliferation. This may also lead to cancer. It is estimated that there will be more than 12 million new cancer cases in 2007 worldwide, of which 5.4 million will occur in economically developed countries and 6.7 million in economically developing countries [7].

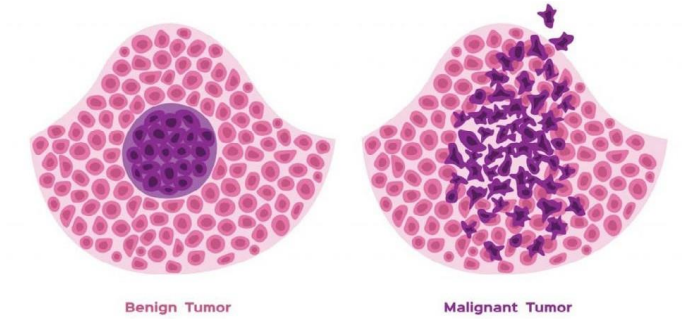

Figure 1: Malignant and benign tumours.

Discussion

The corresponding estimates for total cancer deaths in 2007 are 7.6 million, 2.9 million in economically developed countries and 4.7 million in economically developing countries. By 2050, the global burden is expected to grow to 27 million new cancer cases and 17.5 million cancer deaths simply due to the growth and aging of the population [8]. The World Cancer Report is a concise manual describing the global burden, the causes of cancer and major types of malignancies, early detection and treatment. The 351-page global report is issued by IARC, which is part of the World Health Organization. Dr Gro Harlem Brundtland,

***Corresponding author:** Isaac Eliaz, Department of Integrative Oncology, Amitabha Medical Clinic and Healing Center, USA, E-mail: issaceliaz@gmail.com

Received: 28-Apr-2023, Manuscript No. ACP-23-99006; **Editor assigned:** 01-May-2023, PreQC No. ACP-23-99006(PQ); **Reviewed:** 15-May-2023, QC No. ACP-23-99006; **Revised:** 21-May-2023, Manuscript No. ACP-23-99006 (R); **Published:** 28-May-2023; DOI: 10.4172/2472-0429.1000169

Citation: Eliaz I (2023) Anti-Cancer Drugs and their Pharmacological Formulation. Adv Cancer Prev 7: 169.

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Director-General of WHO. WHO is also engaged in preparing a Global Strategy on Diet, Physical Activity and Health, under a May 2002 mandate from Member States to address the growing global burden of chronic diseases, including cancers, cardiovascular diseases, diabetes and obesity. WHO is consulting widely with Member States, other UN agencies, the private sector and civil society on the strategy, which will be presented to the World Health Assembly in May 2004 [9]. The strategy will contain recommendations for government on nutrition and physical activity goals and population-based interventions to reduce the prevalence of chronic disease including cancer. Asia consists of almost 50 countries. These can be subdivided into four regions. Japan is included in Eastern Asia, along with China, Republic of Korea, Democratic People's Republic of Korea, and Mongolia. The proportion of the population over 50 years of age is higher in Eastern Asia compared with figures for the World or the rest of Asia: 18% for the World, 16% for Asia, 20% for Eastern Asia, and 14% for the rest of Asia. Under these circumstances the burden of cancer has increased in size [10]. Overall, there were 10.9 million new cases, 6.7 million deaths, and 24.6 million persons alive with cancer. The most commonly diagnosed cancers are lung, breast, and colorectal, the most common causes of cancer death are lung cancer, stomach cancer, and liver cancer. The most prevalent cancer in the world is breast cancer. There are striking variations in the risk of different cancers by geographic area. Cancer was estimated to account for about 7 million deaths worldwide in 2000 only preceded by cardiovascular diseases, and by infectious and parasitic diseases [11]. Cancer was also estimated to account for almost 6% of the entire global burden of disease in that same year. More than 70% of all cancer deaths occurred in low- and middle-income countries and, although the risk of developing/dying from it is still higher in the developed regions of the world, the control of communicable diseases as well as the ageing of the population in developing countries, point to an increasing burden of cancer worldwide [12]. In fact, Pisani et al have projected a 30% increase in the number of cancer deaths in developed countries, and more than twice this amount, in developing countries, between 1990 and 2010, due to demographic changes alone. In the year 2000, malignant tumours were responsible for 12 per cent of the nearly 56 million deaths worldwide from all causes [13]. In many countries, more than a quarter of deaths are attributable to cancer. In 2000, 5.3 million men and 4.7 million women developed a malignant tumour and altogether 6.2 million died from the disease. The report also reveals that cancer has emerged as a major public health problem in developing countries, matching its effect in industrialized nations [14]. Global cancer rates could increase by 50% to 15 million by 2020 World Cancer Report provides clear evidence that action on smoking, diet and infections can prevent one third of cancers, another third can be cured as shown in (Figure 2).

When chemical carcinogens are internalized by cells, they are often metabolized, and the resulting metabolic products are either excreted or retained by the cell [15]. Inside the cell, carcinogens or their metabolic products can either directly or indirectly affect the regulation and expression of genes involved in cell-cycle control, DNA repair, cell differentiation or apoptosis. Some carcinogens act by genotoxic mechanisms, such as forming DNA adducts or inducing chromosome breakage, fusion, deletion, mis-segregation and non-disjunction. For example, carcinogenic ions or compounds of nickel, arsenic and cadmium can induce structural and numerical chromosome aberrations [16]. Others act by non-genotoxic mechanisms such as induction of inflammation, immunosuppression, formulations of reactive oxygen species, and activation of receptors such as aryl-hydrocarbon receptor or oestrogen receptor and epigenetic silencing [17]. Together, these genotoxic and non-genotoxic mechanisms can alter signal-transduction pathways that finally result in hypermutability, genomic instability, loss of proliferation control, and resistance to apoptosis some of the characteristic features of cancer cells. There are five broad groups that are used to classify cancer. Carcinomas are characterized by cells that cover internal and external parts of the body such as lung, breast, and colon cancer. Sarcomas are characterized by cells that are located in bone, cartilage, fat, connective tissue, muscle, and other supportive tissues [18]. Lymphomas are cancers that begin in the lymph nodes and immune system tissues. Leukemia's are cancers that begin in the bone marrow and often accumulate in the bloodstream. Adenomas are cancers that arise in the thyroid, the pituitary gland, the adrenal gland, and other glandular tissues. Cancers are often referred to by terms that contain a prefix related to the cell type in which the cancer originated and a suffix such as sarcoma, carcinoma, or just oma. Common prefixes include Adenogland, Chondro-cartilage, Erythro-red blood cell Hemangio-blood vessels, Hepato-liver, Lipo-fat, Lympho-white blood cell Melano-pigment cell, Myelo-bone marrow, Myo-muscle, Osteo-bone, Uro-bladder, Retino-eye, Neuro-brain [19]. The four most common cancers are: Breast Cancer, Colon Cancer , Lung Cancer , Prostate Cancer Cancers of Blood and Lymphatic Systems, Hodgkin's

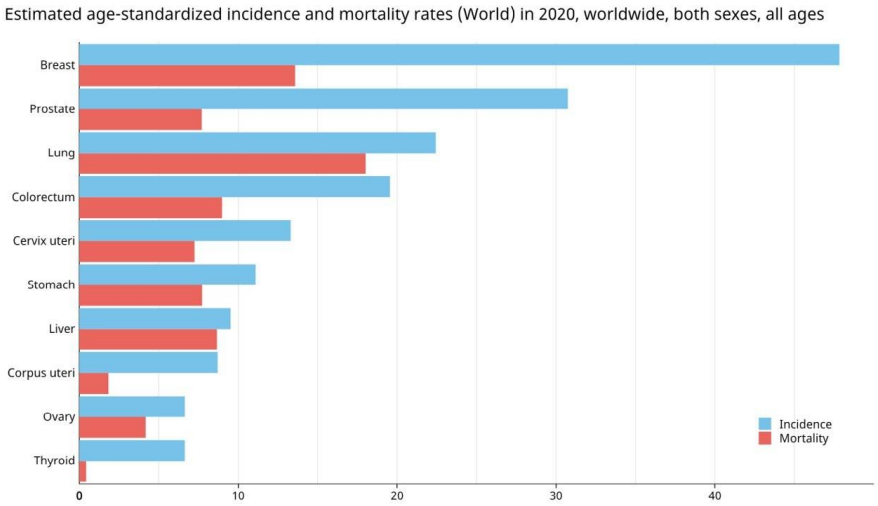

Figure 2: Global cancer report.

Disease, Leukemias, Lymphomas, Multiple Myeloma, Waldenström's Disease Malignant Melanoma Cancers of Digestive Systems, Head and Neck Cancers, Esophageal Cancer ,Stomach Cancer ,Cancer of Pancreas, Liver Cancer, Colon and Rectal Cancer ,Anal cancer Cancers of Urinary system, Kidney Cancer, Bladder Cancer ,Testis Cancer ,Prostate Cancer. Cancers in women, Breast Cancer, Ovarian Cancer, Gynecological Cancers, Choriocarcinoma. Miscellaneous cancers, Brain Tumors ,Bone Tumors ,Carcinoid Tumor, Nasopharyngeal Cancer, Retroperitoneal sarcomas ,Soft Tissue Tumors ,Thyroid Cancer. Cancer arises from one single cell. The transformation from a normal cell into a tumour cell is a multistage process, typically a progression from a pre-cancerous lesion to malignant tumours [20]. These changes are the result of the interaction between a person's genetic factors and three categories of external agents, including Physical carcinogens, such as ultraviolet and ionizing radiation, biological carcinogens, such as infections from certain viruses, bacteria or parasites. Viruses: hepatitis B and liver cancer, Human Papilloma Virus (HPV) and cervical cancer, and human immunodeficiency virus and Kaposi sarcoma. Bacteria: Helicobacter pylori and stomach cancer. Bladder cancer Arsenic; solvents; aromatic amines; petrochemicals and combustion products; metalworking fluids and mineral oils; ionising radiation. Bone cancer Ionising radiation. Brain and other central nervous system cancers Lead; arsenic; mercury; solvents, including benzene, toluene, xylene and methylene chloride; pesticides; n-nitroso compounds. Breast cancer Ionising radiation; endocrine disrupters; solvents; passive smoking; PCBs; pesticides; combustion by-products; reactive chemicals including ethylene oxide; possible links to non-ionising radiation, phthalates. Colon cancer Limited evidence for solvents xylene and toluene and ionising radiation. Hodgkin's disease Solvents, pesticides; woodworking. Kidney cancer Evidence sketchy because of high survival rates, but some links to arsenic, cadmium and lead; solvent exposure; petroleum products; pesticides linked to Wilms' tumour in children, and to the children of fathers employed as mechanics or welders. Laryngeal cancer Metalworking fluids and mineral oils; natural fibres including asbestos; some evidence for wood dust; exposure to reactive chemicals including sulphuric acids. Excesses in rubber workers, nickel refining, and mustard gas and chemical production. Leukaemia Organic solvents and chlorinated solvents, paints and pigments; reactive chemicals; ionising radiation; conflicting evidence on non-ionising radiation; pesticides. Liver and biliary cancer Ionising radiation; vinyl chloride and angio-sarcoma of the liver; PCBs. Some evidence for arsenic, chlorinated solvents and reactive chemicals. Lung cancer Arsenic; beryllium; cadmium; chromium; nickel; solvents, particularly aromatics; ionising radiation, including radon-exposed uranium, haematite and other ore miners; reactive chemicals including BCME, CCME, mustard gas, plus suggestive evidence for sulphuric acids; passive smoking; petrochemicals and combustion by products; asbestos; silica; wood dust; some man-made fibres, including ceramic fibres.

Conclusion

Multiple myeloma Some evidence for a link to solvents, ionising radiation, pesticides and dye products. Nasal and nasopharynx cancer Chromium; nickel; some evidence for benzene, reactive chemicals and formaldehyde; metalworking fluids; natural fibres including wood dust; ionising radiation.

Acknowledgement

None

Conflict of Interest

None

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