International Journal of Pharmaceutics and Drug Research
ISSN: 2347-6346
Available online at http://ijpdr.com

Review Article

A COMPREHENSIVEREVIEW ON CANCER: PREVENTION AND THERAPY

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***Article History:**

Received: 04/07/2023
Revised: 29/07/2023
Accepted: 21/08/2023

ABSTRACT

More than 277 different forms of cancer diseases are included in the term "cancer" in its broadest sense. Different cancer stages have been identified by researchers, suggesting that a number of gene alterations are involved in the aetiology of cancer. The aberrant cell proliferation caused by certain gene mutations. A crucial role in the acceleration of cell proliferation is played by genetic diseases brought on by heredity or hereditary factors. Additional knowledge has been gathered that can be helpful for early diagnosis and appropriate treatment with the use of technical advancements in bioinformatics and molecular approaches.The negative effects of medications on cancer patients can be anticipated and in some cases managed. Recent molecular genetic investigations have identified the mechanisms of carcinogenesis. These research' findings enhanced our knowledge of how genetic abnormalities contribute to the development of cancer. Our goal in this work was to review cancer's molecular components.

Keywords: Cancer, Prevention, Chemotherapy, Antibodies.

INTRODUCTION

The second leading cause of death in the world is cancer. Overall, more individuals are developing cancer; in the United States alone, 1,665,540 people had the disease in 2014, and 585,720 of them passed away as a result of it. As a result, cancer is a significant issue that has an impact on the health of all human communities. At the tissue level, it is unfortunately a range of diseases, and this variety makes it extremely difficult to accurately diagnose the condition and treat it (Dunn *et al.*, 2004a). In men, the prostate, lung and bronchus, colon and rectum, and urinary bladder, correspondingly, have the largest percentages of cancer kinds. The breast, lung, and bronchi, colon, and rectum, uterine corpus, and thyroid are the areas of the female body where cancer is most common. According to the research, a significant share of cancer in men and women, respectively, is caused by the prostate and the breast (Jones & Baylin, 2007). Blood cancers, brain tumours, and lymph node cancers, in that order, account for the highest percentage of cancer cases in children. The development of cancer is caused by a succession of gene changes that alter how cells operate. Evidently, chemical substances have a part in the development of cancerous cells and gene alterations. Smoking also contains a number of chemical substances known to cause cancer and lung cancer. The cytoplasm and nucleus of cells are interestingly affected directly or indirectly by environmental chemicals having carcinogenic qualities, which results in genetic diseases and gene alterations. Another 7% of all cancers are caused by carcinogenesis agents such bacteria, viruses, and radiation. In general, cancer alters cellular relationships and causes critical genes to malfunction (Lujambio & Lowe, 2012).

The cell cycle is affected by this perturbation, which causes aberrant proliferation. Under normal circumstances, proto-oncogenes are in charge of cell division and proliferation; nevertheless, they transform into oncogenes during genetic mutation, which is the most risky for cell survival. Furthermore, the absence of tumour suppressor genes causes unchecked cell division. More than 30 different types of repair proteins have been discovered, and repair genes typically result in proteins and enzymes with repair abilities. Bypassing DNA damage and removing the primary DNA lesions brought on by ultraviolet radiation, which are essentially the functions of repair genes to successfully repair DNA, uracil removal from DNA (Adlercreutz, 2002; Bailar & Gornik, 1997).

When studying cell destiny and epigenetic alterations such DNA methylation, histone modifications, and nucleosome location, which are crucial in the development of cancer, epigenetics presents a dynamic situation. DNA methylation is drastically reduced in cancer cells (by approximately 5–6% of the total quantity of 5-methyl cytosine).The majority of histone changes in cancer cells are composed of a reduction in mono-acetylated H4K16 overall. Despite the fact that the majority of the time, the molecular processes underpinning the actions of these proteins are yet understood, all families of chromatin-modifying proteins are linked to cancer. In order to examine cancer more closely, we looked at it from the standpoint of the molecular level in our study (Weinberg, 1996).

History of Cancer

After cardiovascular disorders, cancer ranks as the second most common cause of death worldwide. In the US, one-third of women and half of men will develop cancer at some point in their lives. Today, early detection and treatment of cancer lengthen the lives of millions of patients. People all across the world have been affected by cancer, which is not a new illness. Hippocrates (460–370 B.C.) was a physician who first described carcinoma tumours with the Greek word karkinos, but he was not the first to learn of this illness. A few of the oldest examples of human bone cancer have been discovered in mummies from ancient Egypt and texts that date back to around 1600 B.C. The world's oldest case of breast cancer is from ancient Egypt, where it was diagnosed around 1500 BC. At the time, palliative care was the only option for the patient. Inscriptions claim that surface cancers were surgically removed in a manner similar to how they are done today (Blank *et al.,* 2016; Pantel *et al.,* 2009).

Cancer Treatment Methods

Surgery and use of modern technology

Ancient doctors were aware that when cancer has been surgically removed, it typically returns. Many individuals still today believe that many tumours are incurable, which may prevent them from seeking medical attention at an early stage. The surgeons Bilroth, Handley, and Halsted performed cancer surgeries by removing the complete tumour together with lymph nodes when anaesthesia was created in 1846. Later, Paget, a surgeon, found that cancer cells were transported by the bloodstream from the main tumour to other locations (metastasis). Recognizing the limitations of cancer surgery required an understanding of the mechanism(s) through which cancer spreads. The majority of exploratory surgeries were supplanted by

advancements in ultrasound (sonography), computed tomography (CT scans), magnetic resonance imaging (MRI scans), and positron emission tomography (PET scans) in the beginning of the 1970s. Tubes are used by surgeons to remove cancers from the bladder, oesophagus, and colon using endoscopy and small video cameras. Liquid nitrogen spray to freeze and kill cancer cells is one of the recent less intrusive methods of eliminating tumours without removing them that is being researched (cryosurgery). Lasers can also be utilised to remove malignant tissue from the skin, rectum, liver, cervix, larynx, and other organs (Dunn *et al.*, 2004b; Rath & Kozielski, 2012).

Chemotherapy

By combining surgery with chemotherapy and/or radiation during the later decades of the 20th century, surgeons created novel ways for the treatment of cancer. After anaesthesia was established 50 years prior, Roentgen discovered Xrays. Later, scientists discovered that nitrogen mustard can destroy lymphoma cancer cells that are multiplying quickly. Numerous forms of cancer have been successfully treated over time thanks to the use of chemotherapy medications. The use of (a) novel drug combinations, (b) liposomal and monoclonal antibody therapy to specifically target cancer cells, (c) chemoprotective agents to lessen the side effects of chemotherapy, (d) hematopoietic stem cell transplantation, and (e) agents that overcome multidrug resistance are currently being studied as new methods to reduce the side effects of chemotherapy (Visone & Croce, 2009).

Hormonal therapy

Thomas Beatson observed in 1878 that rabbit breasts stopped producing milk after their ovaries were removed. Later researchers discovered that the removal of the testes caused a significant remission of metastatic prostate cancer. These days, prostate and breast cancers are being treated with novel pharmacological classes (aromatase inhibitors, LHRH analogues). Research into how hormones affect cancer growth has helped to develop new treatments and lower the risk of breast and prostate cancer (Zha *et al.*, 2004).

Radiation therapy

Radiation was used to diagnose and cure cancer three years after Roentgen's invention of the "X-ray" in 1896. Researchers learned in the early 20th century that radiation might both cause and treat cancer. Currently, a number of radiation treatments are being used, including: (a) conformal proton beam therapy (proton beam will be used to kill tumour cells instead of X-rays); (b) stereotactic surgery and stereotactic therapy (gamma knife can be used to deliver and treat common brain tumours); and (c) intra-operative radiation therapy (cancer has been removed surgically followed by radiation to the adjacent tissues) (Zur Hausen, 2002).

Adjuvant therapy

Chemotherapy is used to eradicate the body's last few cancer cells following surgery. The use of adjuvant therapy in testicular and colon cancer (Olsson & Zhivotovsky, 2011).

Immunotherapy

Immunotherapy is the use of biological agents that imitate a few of the body's natural signals used to regulate tumour growth. These naturally occurring biological substances,

such as interferons, interleukins, cytokines, endogenous angioinhibitors, and antigens, can now be synthesised in the lab. Rituximab and trastuzumab, two therapeutic monoclonal antibodies that were created in the 1990s that particularly targeted lymphoma and breast cancer cells, respectively. Currently, researchers are working on vaccinations to improve the body's immunological response to cancer cells (Sporn, 1996).

Targeted Cancer Treatments

Most of the medications used in cancer therapy up until the late 1990s killed cancer cells. Unfortunately, the chemotherapeutic medicines utilised killed some normal cells as well while primarily targeting cancer cells (Danguy *et al.,* 2002).

Growth signal inhibitors

Cells will be guided by growth factors as to when to divide and expand. In the 1960s, scientists began to understand the role that growth factors play in embryonic development and tissue healing. Later, they discovered that aberrant amounts of growth factors promote the development of cancer cells. Scientists realised in the 1980s that alterations in growth factor signalling cause cancer cells to behave abnormally. Trastuzumab, Gefitinib, Imatinib, and Cetuximab are currently available targeted treatments that inhibit growth factor signaling (Zitvogel *et al.,* 2006).

Drugs that induce apoptosis

Apoptosis causes cancer cells to die without the ability to repair their DNA, as opposed to the natural process in which cellular DNA is destroyed and cells eventually die (DePinho, 2000).

Endogenous angioinhibitors

The growth of new blood vessels from preexisting blood vessels is known as angiogenesis. Angiogenesis normally aids in the body's ability to mend wounds and replace damaged body tissues, but in the case of cancer, it promotes the growth of new blood vessels that supply a tumour with its own blood supply, nutrition, and space to grow. Angioinhibition is a sort of targeted therapy that uses drugs to stop tumours from sprouting new blood vessels. Judah Folkman of Harvard Medical School was the first to put up this idea, but it wasn't until 2004 that the first angioinhibitor, bevicizumab, received clinical approval. Approximately 25 endogenous angioinhibitors are now being tested for the treatment of cancer, and many more are being investigated in preclinical investigations. Angioinhibitors often fall into one of two categories: I Antibodies or small molecules that target VEGF, bFGF, or PDGF, which are pro-angiogenic factors found in tumour cells; and (ii) naturally occurring angioinhibitors that work by concentrating on vascular endothelial cells, including thrombopondin-1, angiostatin, interferons, endostatin, arresten, canstatin, and tumstatin. We have learned about a number of angioinhibitors' signalling pathways and the importance of these findings in the fight against cancer (Chen *et al.,* 2017).

Current Antibodies Used in Cancer Therapy

56 percent of the 228 mAbs that have entered clinical investigations since 1988 for a variety of illnesses are currently in clinical development. Rituximab (RituxanTM), a chimeric antibody directed against CD20, for non-lymphomas, Hodgkin's was the first

mAblicenced for cancer therapy. Since then, a large number of additional medications have entered the market, including those used to treat breast cancer (trastuzumab, Herceptin®), acute myeloid leukaemia (gemtuzumabOzogamicin, MylotargTM), chronic lymphocytic leukaemia (alemtuzumab, Campath-1H®), colorectal tumour (cetuximab, ErbituxTM), and various other cancers (bevacizumab, AvastinTM). Only a small percentage of the pharmaceutical firms operating in the antibody market for cancer therapy are represented by organisations like Genentech Inc., Amgen, Bristol-Myers-Squibb, Imclone Systems, and Trion Pharma. The field of immunoconjugates has also seen recent advancements, many of which are actively being investigated by the pharmaceutical sector. Antibodies associated with cancer-fighting substances such medicines, cytokines, poisons, and radioisotopes are known as immunoconjugates. The goal is for the antibody to serve as a transporter for the cancer-killing substance, concentrating it mostly in the cancer cell with the least amount of harm to normal cells. Although conjugated antibodies have previously demonstrated toxicity, more modern methods that are now being developed seem to lessen adverse effects. Pharmaceutical companies are independently creating immunoconjugates, partnering with specialist players, and even purchasing tiny biotech firms that specialise in immunoconjugates. Immunoconjugates have a number of advantages over single antibodies in real-world applications, despite the fact that their potential immunogenicity poses a distinct problem. The reintroduction of antibodies that have historically demonstrated low efficacy in isolation, the possibility of producing immunoconjugates using bacterial or plant cells rather than mammalian cell cultures (decreasing costs and complexity), and the wide range of possible combinations (antibodies-cancer killing agents) are a few examples. Lower dosages may also result in lower treatment costs and fewer side effects. Immunoconjugates are essential players in the development of new cancer therapies due to their benefits over single antibodies (Chen *et al.,* 2017; Program, 1999).

CONCLUSION

Researchers have published a significant amount of knowledge during the last three decades about genes, proteins, and their functions in the development of cancer cells. One of the most significant findings concerned the function of altered genes in cancer cells. Environmental factors linked to genetic mutations have recently been discovered. We are able to identify novel cancer biomarkers, as well as the potency of gene expression and faulty proteins, with the use of various molecular techniques. These discoveries may help treat cancer and lessen its side effects. Numerous investigations into the processes of epigenetic regulation and how they relate to the onset and progression of numerous diseases, particularly cancer, are also ongoing. Furthermore, it appears that there are still many unknowns regarding epigenetics. However, by identifying all relevant environmental factors and important genes, this provides us with a thorough road map for future initiatives to further reduce cancer.

DECLARATION OF INTEREST

The authors declare no conflicts of interests. The authors alone are responsible for the content and writing of this article.

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