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Cancer an Overview

Sekar M[1], Yuvansasi V[2], Arunavarsini K[3], Durga Devi L[4], Dr. Muthukrishan P[5] and Dr. Mahenthiran R*

[1,2] *PG Students,* [3,4] *Ph.D Scholars, Department of Microbiology, Dr. N.G.P. Arts and Science College, Coimbatore-641048, Tamil Nadu, India.*

[5] *Associate Professor, Department of Microbiology, PSG College of Arts and Science, Coimbatore -641 014.*

**Corresponding Author: Assistant Professor, Department of Microbiology, Dr. N.G.P. Arts and Science College, Coimbatore-641048, Tamil Nadu, India.*

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ABSTRACT:
Cancer is the one most prevalent life threatening disease. Cancer is due to uncontrolled growth of cells which can be cured if diagnosed in an early stages of life. Cancer treatment depend on the various internal and external factors causing cancer. There are 100 types of cancers that affect humans including breath,prostate lung, stomach, colorectal cancer etc.., Different screening test and a number of treatments are now available these days such as gene therapy, chemotherapy, surgery, radiation therapy, immunotherapy etc ..,Stem cell transplant is also the best therapy for cancer. Around 22.2 million cases are expected to be diagnosed for cancer by 2030.

Key words: cancer, life threatening, diagnosis, treatment, uncontrolled growth.

I. INTRODUCTION:

Cancer in the broader sense refers to more than 277 different types of cancer disease. Scientists have identified different stages of cancers, indicating that several gene mutations are involved in cancer pathogenesis. These gene mutations lead to abnormal cell proliferation. Genetic disorders caused by heritance or inheritance factors have a pivotal role in the increase of cell growth. With the assistance of technological advances in bioinformatics and molecular techniques, additional information has been obtained that can be useful for early diagnosis and proper treatment. The effects of drugs on patients with cancer can predict and even manage some aspects of side effects. In recent years, carcinogenesis mechanisms have been detected by molecular genetic studies. The results of these studies led to an improved understanding of the role of genetic disorders in cancer formation. In this study, our aim was to review molecular aspects of cancer.

Despite decades of basic and clinical research and trials of promising new therapies, cancer remains a major cause of morbidity and mortality.[13] We assessed overall progress against cancer in the United States from 1970 through 1994 by analyzing changes in age-adjusted mortality rates.

Cancer cells have developed mechanisms to protect themselves from being destroyed by a body's immune system. Researchers around the world are looking at different ways to overcome these complex mechanisms. An international team of researchers has been investigating the role of the immune receptor Tim-3 and its related protein galectin-9 in shielding breast cancer cells. They found that breast tumors express significantly higher levels of Tim-3 and galectin-9 than healthy tissue. The team partnered with Diamond scientists and used synchrotron radiation circular di-chroism spectroscopy on the B23 beamline to investigate these defense mechanisms. The research also revealed increased levels of these key proteins in nine other cancers, highlighting the important role of the Tim-3-galectin-9 pathway in cancer development. Further research is required to discover the best way to disable the pathway to allow the immune system to attack cancer cells. There is growing evidence that excess body weight increases the risk of cancer at several sites, including kidney, endometrium, colon, prostate, gallbladder and breast in postmenopausal women. The proportion of all cancers attributable to being overweight has, however, never been systematically estimated. Estimates were then combined with sex-specific estimates of the prevalence of overweight [body mass index (BMI) 25-29 kg/m(2)] and obesity (BMI > or = 30 kg/m(2)) in each country in the European Union to obtain the proportion of cancers attributable to excess weight.[8].

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What Is Cancer?

Cancer is a disease in which some of the body's cells grow uncontrollably and spread to other parts of the body. Cancer can start almost anywhere in the human body, which is made up of trillions of cells. Normally, human cells grow and multiply (through a process called cell division) to form new cells as the body needs them. When cells grow old or become damaged, they die, and new cells take their place.Sometimes this orderly process breaks down, and abnormal or damaged cells grow and multiply when they shouldn't. These cells may form tumors, which are lumps of tissue. Tumors can be cancerous or not cancerous (benign)[6] Cancerous tumors spread into, or invade, nearby tissues and can travel to distant places in the body to form new tumors (a process called metastasis). Cancerous tumors may also be called malignant tumors. Many cancers form solid tumors, but cancers of the blood, such as leukemias, generally do not.Benign tumors do not spread into, or invade, nearby tissues. When removed, benign tumors usually don't grow back, whereas cancerous tumors sometimes do. Benign tumors can sometimes be quite large, however. Some can cause serious symptoms or be life threatening, such as benign tumors in the brain. Central to the development of cancer are genetic changes that endow these "cancer cells" with many of the hallmarks of cancer, such as self-sufficient growth and resistance to antigrowth and pro-death signals. However, while the genetic changes that occur within cancer cells themselves, such as activated oncogenes or dysfunctional tumor suppressors, are responsible for many aspects of cancer development, they are not sufficient. Tumor promotion and progression are dependent on ancillary processes provided by cells of the tumor environment but that are not necessarily cancerous themselves. Inflammation has long been associated with the development of cancer.[10][17].

How Does Cancer Develop?: The non-communicable diseases, such as cancers, are emerging health problems that need to be dealt with appropriately to sustain public health advances that have already been achieved. Increases in the prevalence of tobacco consumption and immunosuppression induced by the human immunodeficiency virus (HIV), coupled with such existing risk factors for cancer as alcohol; the high prevalence of cancer-associated infectious agents like human papillomaviruses (HPV), hepatitis B viruses (HBV), and human herpesvirus-8 (HHV8); and environmental exposure to toxins, such as aflatoxins, will have an important impact on future cancer patterns and incidence.[7] Cancer is a genetic disease—that is, it is caused by changes to genes that control the way our cells function, especially how they grow and divide.The body normally eliminates cells with damaged DNA before they turn cancerous. But the body's ability to do so goes down as we age. This is part of the reason why there is a higher risk of cancer later in life. Each person's cancer has a unique combination of genetic changes. As the cancer continues to grow, additional changes will occur. Even within the same tumor, different cells may have different genetic changes. Cancer development requires the acquisition of six fundamental properties: self-sufficient proliferation, insensitivity to anti-proliferative signals, evasion of apoptosis, unlimited replicative potential, the maintenance of vascularization, and, for malignancy, tissue invasion and metastasis.Cancer development requires the acquisition of six fundamental properties: self-sufficient proliferation, insensitivity to anti-proliferative signals, evasion of apoptosis, unlimited replicative potential, the maintenance of vascularization, and, for malignancy, tissue invasion and metastasis. Cancer can also be considered with regard to a stepwise development functionally grouped into three phases: initiation, promotion, and progression. Initiation is characterized by genomic changes within the "cancer cell," such as point mutations, gene deletion and amplification, and chromosomal rearrangements leading to irreversible cellular changes.Tumor development is promoted by the survival and clonal expansion of these "initiated" cells. Progression encompasses a substantial growth in tumor size and either growth-related or mutually exclusive metastasis. Essential to the development of cancer is the accumulation of genetic lesions in cells. Such events are obviously required for initiation but may also be involved in the promotion or progression of tumor development. long-standing inflammation secondary to chronic infection or irritation predisposes to cancer.[17]

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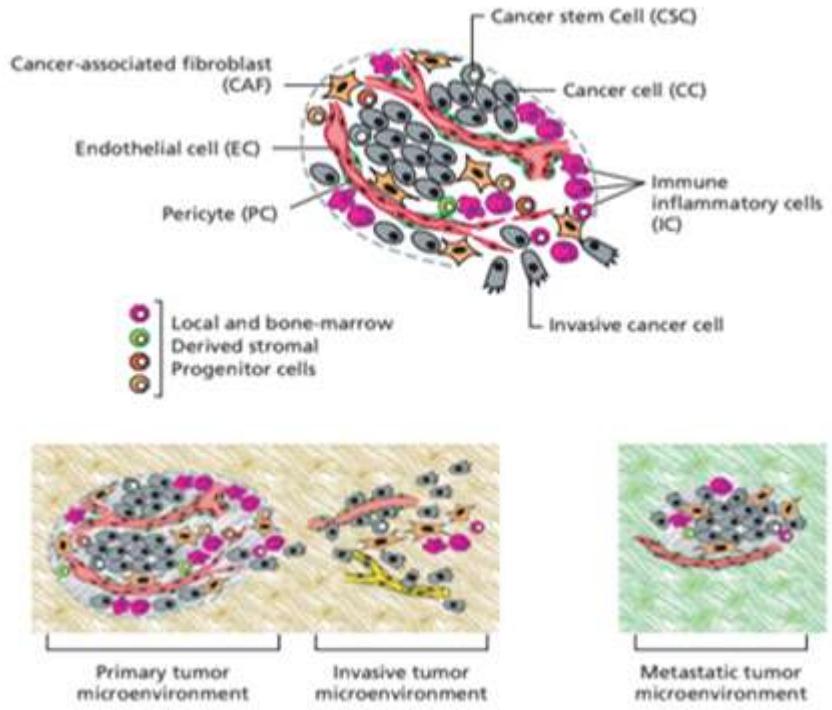

Cellular component of the tumor environment
Source: Hallmark of cancer-Hanahan Weinberg

The constitution of the hallmark-enabling tumor microenvironment. An assemblage of distinct cell types constitutes the tumor micro environments of most solid tumors, involving two distinct compartments—the parenchyma of cancer cells and the stroma of supporting cells. Both compartments contain distinct cell and subcell types that collectively enable tumor growth and progression. Notably, the immune inflammatory cells present in tumors can include both tumor-promoting and/or immuno-suppressive as well as tumor-killing subclasses. The lower panels illustrate an important characteristic: the tumor micro environments is dynamic, varying both in composition and abundance of constituent cell types (and sub-cell types) and in their effects on the histologically distinct stages in multistep tumor-genesis, namely premalignant stages (not shown) and malignant stages, including the cores of primary tumors, invasive margins and frankly invasive lesions, and metastases.[2]

Mechanisms of Carcinogenesis

Mutations. Mutations in several critical genes can lead to tumors. Mutations in the tumor-suppressor gene p53 are found in about half of human tumors. The p53 protein guards a cell cycle checkpoint, and inactivation of p53 allows uncontrolled cell division.[15]

DNA Lesions.

DNA lesions (damaged bases or chromosome breaks) have a certain probability of giving rise to mutations when the cell divides. Endogenous DNA damage is high. An exogenous mutagen produces an increment in lesions over the background rate of endogenous lesions. The mutagenic effectiveness of a particular lesion depends on its rate of excision by DNA repair enzymes and on the probability that it gives rise to a mutation when the cell divides.[15]

Cell Division.

This is a critical factor in mutagenesis, because when the cell divides a DNA lesion can give rise to a point mutation, deletion, or translocation. Thus, an important factor in the mutagenic effect of an agent is the increment it causes over the background cell division rate in those cells that matter. Those cells that appear to matter most for cancer are the stem cells, which are not discarded, whereas their daughter cells are.

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Increasing the cell division rate of stem cells increases mutation and therefore cancer. As expected, there is little cancer in non-dividing cells. Increased cell division, and therefore an increased risk for cancer, can be caused by such diverse agents as increased levels of particular hormones, excess calories, chronic inflammation, or chemicals at doses causing cell division.[2]

Cell Cycle Checkpoints.

These checkpoints prevent division of cells with too many DNA lesions, thus inhibiting the formation of mutations. This defense, like DNA repair, is not perfect. The sensing of lesions in transcribed genes is done by the transcription apparatus that makes mRNA. The presence of lesions appears to induce DNA repair and also to halt cell division at a cell cycle checkpoint. The mechanism may be that the p53 protein, which controls the G1-to-S check-point, is associated with the replication and repair protein RPA (19, 20). When DNA damage occurs, RPA appears to bind to single-strand DNA and release p53, which in turn causes a block of cell division at the checkpoint, thus preventing conversion of lesions to mutations.[11]

Defense Systems

Defense systems such as the glutathione transferases protect DNA against mutagens. These defenses are almost all inducible and, thus, buffer cells from increments in reactive electrophilic chemicals that can cause DNA lesions. DNA repair enzymes, almost all of which are inducible, buffer the cell against increments in DNA lesions. Therefore, the effect of a particular chemical insult is dependent on the level of each defense, which in turn is dependent on the past history of exposure. Defenses can be partially disabled by lack of particular micronutrients in the diet (e.g., antioxidants).[21]

Strategic Study:

Five-year age-specific incidence rates between 35 and 74 years of age were recorded for 31 types of cancer (22 in men and 9 in women) in 11 populations.The data for cancer of the prostate were found to fit the equation adequately in all 11 populations, when it was 32.5 years. Even within this age group, some of these cancers become more or less common as people age. For example, lymphomas are more common before age 25, whereas breast, cervical, and colorectal cancers become more common after age 25.**Breast cancer** will be diagnosed in 12% of women in the United States over the course of their lifetimes and more than 250 000 new cases of breast cancer were diagnosed in the United States in 2017.[1] **Hodgkin lymphoma** is most common in 2 age groups: early adulthood (ages 15 to 40, but usually people in their 20s) and late adulthood (after age 55). This type of cancer is similar in all age groups, including which types of treatment work best. Non-Hodgkin lymphoma (NHL) is less common than Hodgkin lymphoma in young adults, but the risk of NHL goes up as people get older. **Melanoma** is a type of skin cancer. It's more likely to occur in older adults, but it's also found in younger people. In fact, melanoma is one of the most common cancers in people younger than 30 (especially younger women). Melanoma that runs in families can occur at a younger age.Soft tissue sarcomas, these cancers can start in any part of the body, but they often develop in the arms or legs. **Rhabdomyosarcoma**, a cancer that starts in cells that normally develop into skeletal muscles, is most common in children younger than 10, but it can also develop in teens and young adults.**Cervical cancer** tends to occur in midlife. Most often it is found in women younger than 50. It rarely occurs in women younger than 20 **ovarian cancer** is much more common in older women than in women younger than 40. But some less common types of ovarian cancers, known as germ cell tumors, are more common in teens and young women than in older women.The risk of **thyroid cancer** tends to go up as people get older, but it's often found at a younger age than most other adult cancers. It's much more common in women than in men.**Testicular cancer** most often develops in younger men. About half of testicular cancers occur in men between the ages of 20 and 34, but it can occur at any age. **Cancers of the colon and rectum** are much more common in older adults, but they can occur at younger ages. In young adults, they are more likely to be linked to an inherited genetic condition that greatly increases a person's risk.[6]

Types of cancer:

Classification by types of origin

1. Breast cancer

Breast cancer is the most common cancer diagnosed in women, accounting for more than 1 in 10 new cancer diagnoses each year. It is the second most common cause of death from cancer among women in the world.Breast cancer develops due to DNA damage and genetic mutations that can be

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influenced by exposure to estrogen. Sometimes there will be an inheritance of DNA defects or pro-cancerous genes like BRCA1 and BRCA2.[19]

2. Lung cancer

Lung cancer arises from the cells of the respiratory epithelium and can be divided into two broad categories. Small cell lung cancer (SCLC) is a highly malignant tumor derived from cells exhibiting neuroendocrine characteristics and accounts for 15% of lung cancer cases. Non–small cell lung cancer (NSCLC), which accounts for the remaining 85% of cases, is further divided into 3 major pathologic subtypes: adenocarcinoma, squamous cell carcinoma, and large cell carcinoma.

3. Prostate cancer

Prostate cancer is one of the malignancies that affects men and significantly contributes to increased mortality rates in men globally. Patients affected with prostate cancer present with either a localized or advanced disease. In this review, we aim to provide a holistic overview of prostate cancer, including the diagnosis of the disease, mutations leading to the onset and progression of the disease, and treatment options. Prostate cancer diagnoses include a digital rectal examination, prostate-specific antigen analysis, and prostate biopsies. Mutations in certain genes are linked to the onset, progression, and metastasis of the cancer. Treatment for localized prostate cancer encompasses active surveillance, ablative radiotherapy, and radical prostatectomy. Men who relapse or present metastatic prostate cancer receive androgen deprivation therapy (ADT), salvage radiotherapy, and chemotherapy

4. Liver cancer renal cell carcinoma

Liver cancer is one of the main causes of death related to cancer worldwide; its etiology is related with infections by C or B hepatitis virus, alcohol consumption, smoking, obesity, nonalcoholic fatty liver disease, diabetes, and iron overload, among other causes.Liver cancer remains a global health challenge and its incidence is growing worldwide. It is estimated that, by 2025, >1 million individuals will be affected by liver cancer annually. . Hepatocellular carcinoma (HCC) is the most common form of liver cancer and accounts for ~90% of cases. Hepatitis B virus (HBV) infection is the most prominent risk factor for HCC development, accounting for ~50% of cases.The risk attributed to hepatitis C virus (HCV) infection has substantially decreased owing to patients achieving sustained virological response (SVR) with antiviral drugs[18]

5. Oral cancer

Most cancer found in the mouth is oral squamous cell carcinoma. This disease is uncommon in the developed world, except in parts of France, but it is common in the developing world, particularly Southeast Asia and Brazil. Oral cancer typically is seen in men past middle age (although it is increasingly common in younger people), tobacco users, and members of lower socioeconomic groups.

6. Brain cancer

Brain tumors are common, requiring general medical providers to have a basic understanding of their diagnosis and management. The most prevalent brain tumors are intracranial metastases from systemic cancers, meningiomas, and gliomas, specifically, glioblastoma. Central nervous system metastases may occur anywhere along the neuroaxis, and require complex multidisciplinary care with neurosurgery, radiation oncology, and medical oncology. Meningiomas are tumors of the meninges, mostly benign and often managed by surgical resection, with radiation therapy and chemotherapy reserved for high-risk or refractory disease.

7. Bladder cancer

a) Transitional cell carcinoma, cancer that begins in cells in the innermost tissue layer of the bladder. These cells are able to stretch when the bladder is full and shrink when it is emptied. Most bladder cancers begin in the transitional cells.
b) Squamous cell carcinoma, cancer that begins in the squamous cells, and may form after long-term infection or irritation.
c) Adenocarcinoma, cancer that begins in glandular (secretory) cells that are found in the lining of the bladder. This is a very rare type of bladder cancer.

Based on tissue types-

- Carcinoma - Originates from the epithelial layer of cells that form the lining of external parts of the body or the internal linings of organs within the body.
- Sarcoma- Originates in connective and supportive tissues including muscles, bones, cartilage and fat. Bone cancer is one of the sarcomas termed osteosarcoma. It affects the

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young most commonly. Sarcomas appear like the tissue in which they grow.

- Myeloma- These originate in the plasma cells of bone marrow. Plasma cells are capable of producing various antibodies in response to infections. Myeloma is a type of blood cancer.
- Leukemia- These cancers affect the bone marrow which is the site for blood cell production. When cancerous, the bone marrow begins to produce excessive immature white blood cells that fail to perform their usual actions and the patient is often prone to infection.
- Lymphoma- These are cancers of the lymphatic system. Unlike the leukemias, which affect the blood and are called "liquid cancers", lymphomas are "solid cancers". These may affect lymph nodes at specific sites like stomach, brain, intestines etc. These lymphomas are referred to as extra-nodal lymphomas.

Classification by grade-pool

Grade 1 – well differentiated cells with slight abnormality
Grade 2 – cells are moderately differentiated and slightly more abnormal
Grade 3 – cells are poorly differentiated and very abnormal
Grade 4 – cells are immature and primitive and undifferentiated

Types of Cancer Treatment.

There are many types of cancer treatment. The types of treatment that you receive will depend on the type of cancer you have and how advanced it is.

1. Biomarker testing.

Biomarker testing is a way to look for genes, proteins, and other substances (called biomarkers or tumor markers) that can provide information about cancer. Biomarker testing can help you and your doctor choose a cancer treatment.

2. Chemotherapy.

Chemotherapy is a type of cancer treatment that uses drugs to kill cancer cells.

3. Hormone therapy.

Hormone therapy is a treatment that slows or stops the growth of breast and prostate cancers that use hormones to grow.

4. Hyperthermia.

Hyperthermia is a type of treatment in which body tissue is heated to as high as 113 °F to help damage and kill cancer cells with little or no harm to normal tissue. Learn about the types of cancer and pre-cancers that hyperthermia is used to treat, how it is given, and the benefits and drawbacks of using hyperthermia.

5. Immunotherapy.

Immunotherapy is a type of cancer treatment that helps your immune system fight cancer.

6. Photodynamic.

Photodynamic therapy uses a drug activated by light to kill cancer and other abnormal cells.

7. Radiation therapy.

Radiation therapy is a type of cancer treatment that uses high doses of radiation to kill cancer cells and shrink tumors

8. Stem cell transplants.

Stem cell transplants are procedures that restore stem cells that grow into blood cells in people who have had theirs destroyed by high doses of chemotherapy or radiation therapy.

9. Surgery.

When used to treat cancer, surgery is a procedure in which a surgeon removes cancer from your body.

10. Targeted therapy.

Targeted therapy is a type of cancer treatment that targets the changes in cancer cells that help them grow, divide, and spread.[6]

II. CONCLUSION:

All cancers arise as a result of changes that have occurred in the DNA sequence of the genomes of cancer cells. Decreases in physical activity and increases in smoking, obesity, and recreational sun exposure have contributed importantly to increases in some cancers in the modern industrial world, whereas improvements in hygiene have reduced other cancers related to infection. This review will discuss the types of cancer and its effects along with the available treatments. Even with the advancements in the medical field a pre-diagnostic procedure has not been well defined.

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