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Review on Advance Methods Used in Treatment of Cancer

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Abstract: *Cancer is one of the most dreaded diseases of the 20th century and spreading further with continuance and increasing incidence in the 21st century. The situation is so alarming that every fourth person is having a lifetime risk of cancer. India registers more than 11 lakh new cases of cancer Every year, whereas, this figure is above 14 million worldwide. Is cancer curable? The short answer to this question is "Yes." In fact, all cancers Are curable if they are caught early enough. Cancer cells continue to grow unless one of four things occur:*
(1) The cancerous mass is removed Surgically;
(2) using chemotherapy or another type of cancer‑specific medication, such as hormonal therapy;
(3) using radiation therapy;
(4) The Cancer cells shrink and disappear on their own.

Keywords: Cancer, Oncogenes, causes , Treatment ,Viral infection

I. INTRODUCTION

Cancer is a genetic disease. The expression of oncogenesis is an important event in early stages of tumour formation. Oncogenes are activated through two mechanisms: either by infection of cells by tumor viruses or by mutation of cellular proto-oncogenese(which are usually normal)to oncogenes.Thentumors originate by oncogenic transformation of only a single cell. Some tumors adopt the ability to escape the site of their origin and intrude other parts of the body. This process is called metastasis. Solid tumorsi.e. sarcomas, could be transferred from one animal to another using Rous sarcoma virus. Tumors could be caused either by the addition or by expression of genetic material, which in this case was viral DNA, to normal cells. Rous was presented a Nobel Prize for his work. In 1978, tumors of nonviral origin were also discovered .

1.1 Oncogenes in Cancer Development

Oncogenes are the tumor causing genes and have important role in development of many cancers. In 1970, SRC oncogene was discovered in chicken retrovirus. As a result of some mutation in the otherwise normal proto-oncogenes, their deregulation occurs and uncontrolled proliferation of cells starts and leads to cancer . At genomic level, only single oncogenic allele is required to alter normal gene function because of its dominant property. The origin of oncogene can be cellular i.e., from inside the body or viral i.e., from some virus .

1.2 History

Cancer has existed for all of human history. The earliest written record regarding cancer is from circa 1600 BC in the Egyptian Edwin Smith Papyrus and describes breast cancer. Hippocrates (c. 460 BC – c. 370 BC) described several kinds of cancer, referring to them with the Greek word καρκίνοςkarkinos (crab or crayfish).This name comes from the appearance of the cut surface of a solid malignant tumor, with "the veins stretched on all sides as the animal the crab has its feet, whence it derives its name". Galen stated that "cancer of the breast is so called because of the fancied resemblance to a crab given by the lateral prolongations of the tumor and the adjacent distended veins .738 Celsus (c. 25 BC – 50 AD) translated karkinos into the Latin cancer, also meaning crab and recommended surgery as

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treatment. Galen (2nd century AD) disagreed with the use of surgery and recommended purgatives instead. These recommendations largely stood for 1000 years.

In the 15th, 16th and 17th centuries, it became acceptable for doctors to dissect bodies to discover the cause of death. The German professor Wilhelm Fabry believed that breast cancer was caused by a milk clot in a mammary duct. The Dutch professor Francois de la Boe Sylvius, a follower of Descartes, believed that all disease was the outcome of chemical processes and that acidic lymph fluid was the cause of cancer. His contemporary Nicolaes Tulp believed that cancer was a poison that slowly spreads and concluded that it was contagious

The physician John Hill described tobacco sniffing as the cause of nose cancer in 1761.[This was followed by the report in 1775 by British surgeon Percivall Pott that chimney sweeps' carcinoma, a cancer of the scrotum, was a common disease among chimney sweeps.With the widespread use of the microscope in the 18th century, it was discovered that the 'cancer poison' spread from the primary tumor through the lymph nodes to other sites ("metastasis"). This view of the disease was first formulated by the English surgeon Campbell De Morgan between 1871 and 1874

1.3 Causes of Cancer

There are many causes which may causeCancer in different body parts like mainly 22 deathsare due to tobacco consumption, 10% of deaths are due to poor diet, obesity, Lackof physical activity, excessive drinking Of alcohol or other facts include certain Exposure to ionizing radiation, environmental Pollutants, and infection.

About 15% of cancer in the world is due to Some infections like hepatitis b, hepatitis c, Human papillomavirus infection, helicobacter Pylori, and immunodeficiency virus (HIV), Epstein – Barr virus. These factors are at least Partly responsible for changing the genes.

Inherited genetic defects from patient's Parents are also responsible for 5-10% of Cancer.

1.4 Treatment Method

A. Biomarker Testing for Cancer Treatment

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.

B. Chemotherapy

Chemotherapy is a type of cancer treatment that uses drugs to kill cancer cells. Learn how chemotherapy works against cancer, why it causes side effects, and how it is used with other cancer treatments

C. 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 precancers that hyperthermia is used to treat, how it is given, and the benefits and drawbacks of using hyperthermia.

D. Immunotherapy

Immunotherapy is a type of cancer treatment that helps your immune system fight cancer. This page covers the types of immunotherapy, how it is used against cancer, and what you can expect during treatment.

E. Photodynamic Therapy

Photodynamic therapy uses a drug activated by light to kill cancer and other abnormal cells. Learn how photodynamic therapy works, about the types of cancer and precancers it is used to treat, and the benefits and drawbacks of this treatment.

F. Radiation Therapy

Radiation therapy is a type of cancer treatment that uses high doses of radiation to kill cancer cells and shrink tumors. Learn about the types of radiation, why side effects happen, which side effects you might

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G. Stem Cell Transplant

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. Learn about the types of transplants, side effects that may occur, and how stem cell transplants are used in cancer treatment.

H. Surgery

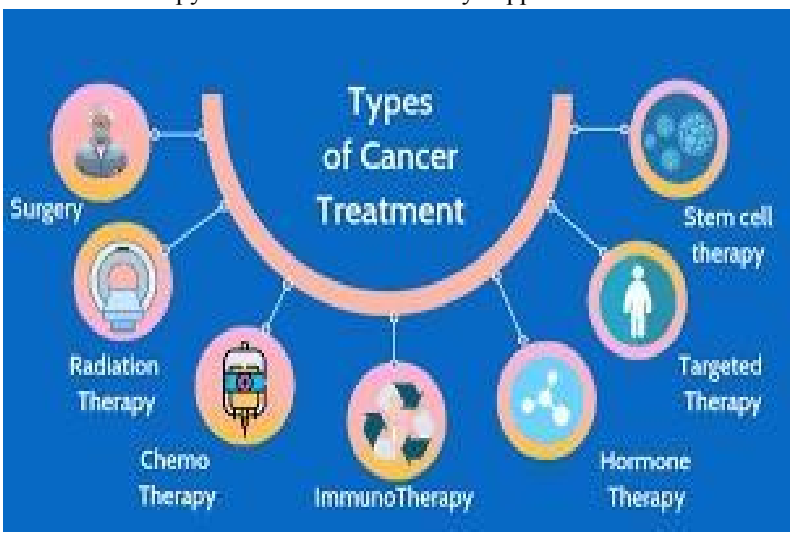
When used to treat cancer, surgery is a procedure in which a surgeon removes cancer from your body. Learn the different ways that surgery is used against cancer and what you can expect before, during, and after surgery.

I. Targeted Therapy

Targeted therapy is a type of cancer treatment that targets the changes in cancer cells that help them grow, divide, and spread. Learn how targeted therapy works against cancer and about common side effects that may occur.

J. Hormone Therapy

Hormone therapy is a treatment that slows or stops the growth of breast and prostate cancers that use hormones to grow. Learn about the types of hormone therapy and side effects that may happen.



II. TREATMENT: THEN & NOW

Different treatment techniques and therapies have been applied for the treatment of cancer at different times. Some of the most common methods used include surgery, radiation therapy, chemotherapy, hormonal therapy, immunotherapy, adjuvant therapy, targeted-growth signal inhibition, drugs that induce apoptosis, nanotechnology, RNA expression and profiling. Few of these shall be later discussed in this review.

Cancer cells can also be killed by gene replacements or by knocking out oncogenes. Oncolytic viruses can be used in combination with chemo-therapeutic agents to destroy cancer cells as well

Researchers have made a breakthrough in the fight against cancer with the use of artificial DNA. In laboratory tests, the method effectively targeted and destroyed human cervical and breast cancer cells, as well as malignant melanoma cells from mice. The team designed a pair of chemically synthesized DNA, shaped like hairpins, specifically to kill cancer cells. When injected into cancer cells, the DNA pairs attached to microRNA (miRNA) molecules that are overproduced in certain cancers.

The DNA pairs, upon attaching to the miRNA, unraveled and combined, forming longer chains of DNA that activated an immune response. This response not only eliminated the cancer cells but also prevented the continuation of cancerous growth. This innovative approach stands apart from traditional cancer drug treatments and is hoped to usher in a new era in drug development.

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Cancer is a sadly familiar global health concern and current methods of treatment have their limitations. However, drugs based on nucleic acids — namely DNA and RNA, the vital information-carrying molecules — can control the biological functions of cells and are expected to transform the future of medicine and provide a significant boost towards efforts to overcome cancer and other hard-to-treat illnesses, caused by viruses and genetic diseases

Cancer cells can overexpress, or make too many copies of, certain DNA or RNA molecules, causing them to not function normally. The team created artificial oncolytic (cancer-killing) hairpin DNA pairs called oHPs. These oHPs were triggered to form longer DNA strands when they encountered a short (micro) RNA called miR-21, which is overexpressed in some cancers.

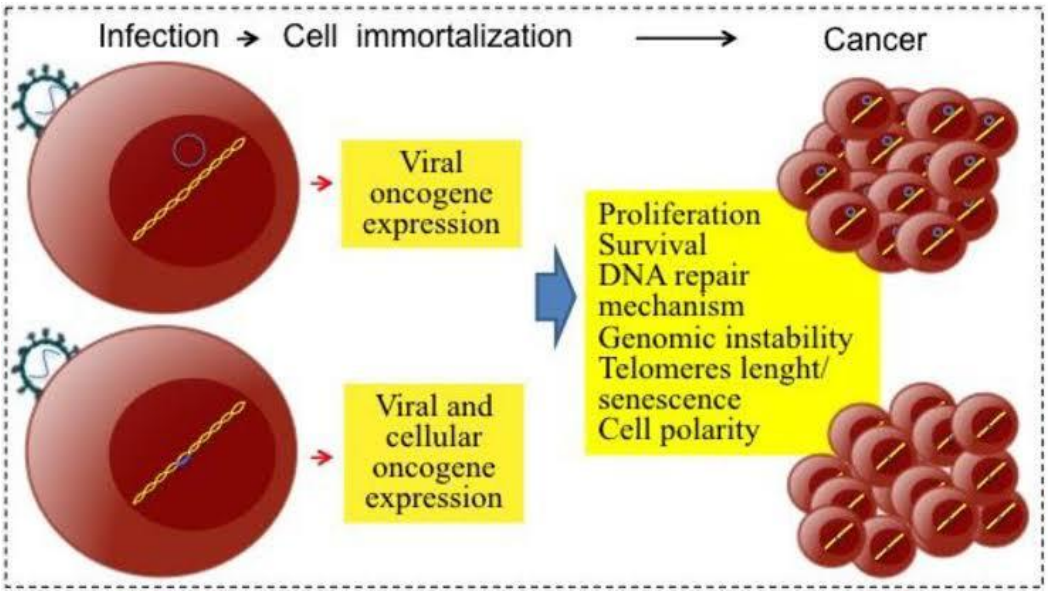
Typically, oHPs don't form longer strands due to their curved hairpin shape. However, when the artificial oHPs enter a cell and encounter the target microRNA, they open up to combine with it and form a longer strand. This then causes the immune system to recognize the presence of the overexpressed miR-21 as dangerous and activate an innate immune response, which ultimately leads to the death of the cancer cells

Role of Oncogenes to Treat Cancer

The oncogenes are targeted to treat oncogenic cancer. Several oncogenes discussed above are targeted by drugs and gene therapies to inhibit, arrest, regulate or senescence their genes. For example, Imatinib (ABL kinase inhibitor) or Gleevec is used to treat BCR-ABL. Gefitinib or Iressa, erlotinib or Tarceva are used to target EGFR. VEGF oncogenes are targeted by bevacizumab or sorafenib. Sorafenib is also used to downregulate or inhibit B-Raf oncogene. These agents/drugs are used, sometimes in combination, for chemotherapy to inhibit proliferation of oncogenes or to downregulate signaling oncoproteins in several signaling pathways to treat oncogenic cancers . However, it is difficult to target "non-kinase oncogenes" through drugs such as Myc and Ras.

Viral Infection

Retroviruses or DNA viruses cause viral infections. These viruses infect the host either by inserting oncogenes in host chromosome, interfering proto-oncogene transcription factors/regulators or by inserting homologous sequences corresponding to normal protooncogene of host. For example, retrovirus carrying SRC oncogenes infects the host, integrates viral chromosome in host chromosome, further divides the viral progeny and infects the surrounding cells, inducing over expression of cellular normal genes and deregulated proliferation of cells in order to cause cancer.



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Classification Oncogenes

Growth Factors

Growth factors are secreted polypeptides that function as extracellular signals to stimulate the proliferation of target cells.41,42 Appropriate target cells must possess a specific receptor in order to respond to a specific type of growth factor. A well-characterized example is platelet-derived growth factor (PDGF), an approximately 30 kDa protein consisting of two polypeptide chains.43 PDGF is released from platelets during the process of blood coagulation. PDGF stimulates the proliferation of fibroblasts, a cell growth process that plays an important role in wound healing. Other well-characterized examples of growth factors include nerve growth factor, epidermal growth factor, and fibroblast growth factor.

Signal Transducers

Mitogenic signals are transmitted from growth factor receptors on the cell surface to the cell nucleus through a series of complex interlocking pathways collectively referred to as the signal transduction cascade.56 This relay of information is accomplished in part by the stepwise phosphorylation of interacting proteins in the cytosol. Signal transduction also involves guanine nucleotide-binding proteins and second messengers such as the adenylate cyclase system.57 The first retroviral oncogene discovered, src, was subsequently shown to be involved in signal transduction.

Transcription Factors

Transcription factors are nuclear proteins that regulate the expression of target genes or gene families.63 Transcriptional regulation is mediated by protein binding to specific DNA sequences or DNA structural motifs, usually located upstream of the target gene. Transcription factors often belong to multigene families that share common DNA-binding domains such as zinc fingers. The mechanism of action of transcription factors also involves binding to other proteins, sometimes in heterodimeric complexes with specific partners. Transcription factors are the final link in the signal transduction pathway that converts extracellular signals into modulated changes in gene expression.

Programmed Cell Death Regulation

Normal tissues exhibit a regulated balance between cell proliferation and cell death. Programmed cell death is an important component in the processes of normal embryogenesis and organ development. A distinctive type of programmed cell death, called apoptosis, has been described for mature tissues.71 This process is characterized morphologically by blebbing of the plasma membrane, volume contraction, condensation of the cell nucleus, and cleavage of genomic DNA by endogenous nucleases into nucleosome-sized fragments. Apoptosis can be triggered in mature cells by external stimuli such as steroids and radiation exposure. Studies of cancer cells have shown that both uncontrolled cell proliferation and failure to undergo programmed cell death can contribute to neoplasia and insensitivity to anticancer treatments.

III. CONCLUSION

Treatments of cancer were illustrated in detail like sign or symptoms, diagnosing tests and how the cancer cause, spread, etc. The cancer treatments include surgery, immunotherapy, chemotherapy, target therapy, hormone therapy, radiation therapy, stem cell transplant, precision medicine. These therapies include many drugs, like antibiotics,which are mainly used in chemotherapies, different targeted systems to treat cancer directly like nanotechnology, microspheres, etc. Different radiations are used to treat cancer in radiation therapies that directly attack cancer cells. In hormone therapy, different hormones are used to treat cancer, mainly breast and prostate cancer which are caused by hormones. In immunotherapy, the immune system is making stronger to fight against the cancer cells by different drugs. A brighter future towards creating a Cancer Free World.

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