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Cancer Gene Therapy

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Abstract - *Genetic therapy is the use of the delivery of nucleic acid regeneration cells to a patient's somatic cells to prevent or treat the disease. In the last few years, much research has been done worldwide in the field of genetic cancer treatment. In the current situation, there are many types of cancer treatments like viral replication, tumor suppression, tumor immunogenicity, suicidal gene therapy, etc. Cancer is a disease caused by mutations in cells that remain unprotected and lead to cell growth and division. There are more than 100 types of cancer. Viral vectors can produce tumor anti future research genes (proteins found in tumor cells) to stimulate the body's immune response. Therefore, vector development remains an important area for future research.*

***Key Words*: cancer, gene therapy, nucleic acid, mutation**

1. INTRODUCTION

The ultimate goal of gene therapy is to develop genetically modified non-toxic genes that can insert and deliver foreign genes to specific types of cells such as cancer cells. Over the past two decades, much research has been done in the field of genetic engineering around the world explicitly in the use of cancer. Virus vectors are biological systems found in mutations that can transmit their genes to infected cells. Many viruses like retrovirus, adenovirus, herpes simplex virus [HSV], adeno-associated virus [AAV], and poxvirus have been modified to eliminate their toxins and maintain their high genetic transmission capacity. The limitations associated with viral vectors, for their safety especially immune defenses and their limited ability of transgenic substances have encouraged research workers to focus more on non-burgeoning carriers as another means of carrying viruses. Vein-free vectors are usually cationic in nature [1]. Gene treatment has had a bad 10 years. In fact, it started badly before the 1990S and began with two unauthorized trials in the early 70S and early 80S. First, an attempt was made to treat two young girls with arginase defense syndrome using Vivo gene therapy with the wild-type shope papillomavirus in the hope that the viral arginase would replace an enzyme that was not present in patients. The second was ex vivo therapy for β-thalassemia bone marrow transplant using asthma-globin-treated bone marrow cells in two patients. There is no real follow-up because both trials were discontinued but apparently did not improve or harm patients. Restorative vaccines epitomize a feasible option for treating late-stage cancer with effectual tumor viral therapy and the patient's immunity. Recent clinical tests have provided encouraging outcomes leading to the adoption of the first curative cancer vaccine by the U.S. Food and drug administration. These breakthroughs not only provide a new way to treat and manage cancer but also open the way for meaningful evolution and improvement of future drugs through effective anti-cancer antidotes [2].

2. TYPES OF CANCER GENE THERAPY

There are more than 100 types of cancer, the most fatal being lung cancer. There are many types of gene therapy to cure cancer like lung cancer, lymphatic, prostate, brain tumor and many more.

1. Tumor suppressor gene

Tumor suppressor genes can be grouped into the following categories: caretaker genes, gatekeeper genes, and more recently landscaper genes. Part of a tumor or anti-oncogene is a cell that controls the cell during cell division and recurrence when the uncontrollable cell can lead to cancer when the type of stress plant changes leading to loss or reduction of its function through another genetic mutation. This may allow the cell to grow abnormally of human cancer compared with activation of plant genetic stress can be subdivided into new genes and new care improved genes ensure gene sequence. DNA sequence and those genetic mutations allow genetic mutations to accumulate at present gatekeepers by directly controlling cell growth by inhibiting cell growth apoptosis in retaining genes that control growth by contributing to the environment where mutations can create an environment that promotes uncontrolled growth. Therapeutic approaches based on mutations in cancer cells include regeneration of gene mutations in deficient genes. Genetic therapy p53 provides an attractive strategy to test the viability of this technique [3].

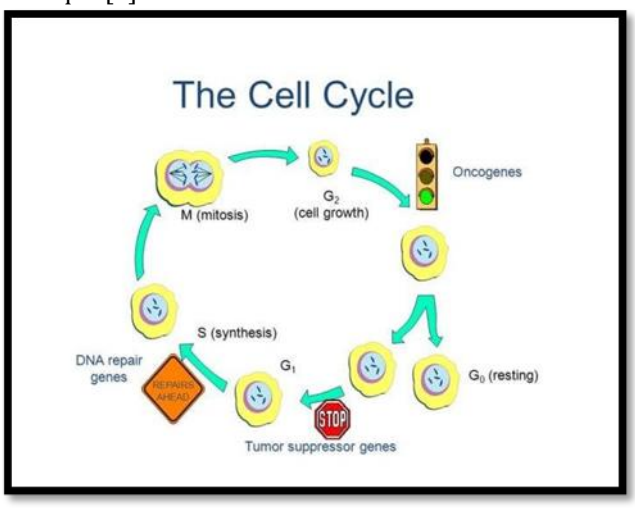

Figure 1: Cell cycle of a tumor suppressor gene

2. Suicide gene therapy

Suicide genetic therapy is a therapeutic strategy, in which gene mutations are performed in cancer cells. Suicide gene therapy is based on the introduction into tumor cells of a viral or a bacterial gene, which allows the conversion of a non-toxic compound into a lethal drug. Although suicide gene therapy has been successfully used in a large number of in vitro and in vivo studies, its application to cancer patients has not reached the desirable clinical significance. Side effects of this treatment are still present, as major problems doctors have to deal with in clinical practice. Although unspecified cytotoxic agents form an effective treatment against cancer cells, they also tend to kill normal cells, rapidly differentiating. On the other hand, genetic therapies are both under investigation, and some have already been planned for clinical practice. Several approaches have been investigated to find a targeted treatment for cancer cells, while not affecting normal cells.[4]

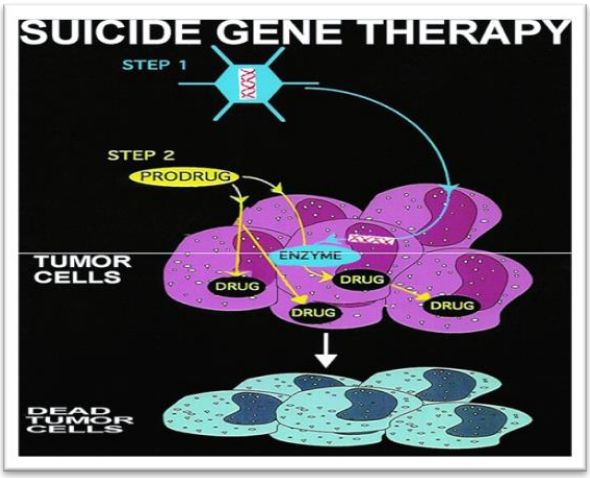

Figure 2: Pro drug activating systems in suicide gene therapy

3. Adeno associated virus vector

Adeno associated virus type 2 (AAV) is a non-viral DNA virus used as a eukaryotic gene transfer vector in vitro and in vivo AAV has a variety of features that can make it useful in human gene therapy the AAV virus does not require an increase in host cells. We can show selections related to active cell division of both wild AAV species and AAV vector. AAV vector tends to persist in infected cells for a long time without adverse effects on the wildlife species that normally congregate in the same chromosome region nineteen while removed AAV vectors interact in some way in the cell genome can also continue in the form of episomal cells. AAV carriers used to transfer various cell types to in vitro epithelial bone marrow cells and lymphocyte cells. [5]

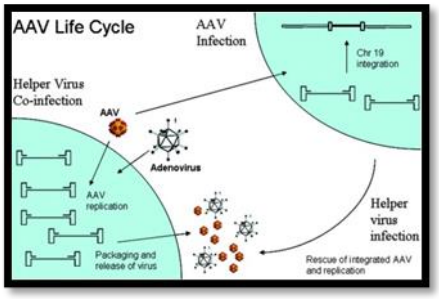

Figure 3: Gene therapy using adeno-associated virus vectors

4. Oncolytic virotherapy

Oncolytic virotherapy is an arising therapy that utilizes antiretroviral drugs that keep butchering disorder late advances join the chance of a solitary virotherapy therapy with the accessibility of remedies that breath life into the spread of intratumoral tainting systems to refresh the shielded reaction to oncolytic illnesses and the presence of the intratumoral pollution the major clinical achievement was the coordination of stage 3 herpes simplex defilement therapy utilizing talimogene laherparepvec (imlygic) of metastatic melanoma challenges in the field to pick the champs in a developing number of intelligent stages and arranging things and anticancer security to improve clinical-level models and to pass on defilements that think about more requesting orders than can be masculine.[6]

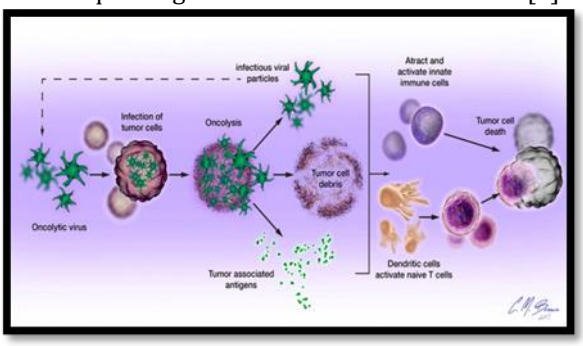

Figure 4: Gene therapy using oncolytic virotherapy

5. Germline gene therapy

Genetic therapy is an inadequate definition of the mechanism and purpose of genetic mutation. The alternative use of the term 'Human Germline Genome Modifications' (HGLGM) can avoid the misleading label that the boundaries between treatment prevention and improvement are not clear in genetics. HGLGM can be an appropriate restorative and moral way to prevent genetic birth defects in only a few cases. The basic germline therapy technology exists used successfully *in* animal testing for genetic work research showing *that* are very important in the operation of genetic controls for the growth and advancement of human illness learning models while transgenic animal studies provide a powerful tool to study effective gene therapy. It is unlikely to be the most widely used clinical practice and of course

should not be considered considering risks due to its improved comparative eugenic properties[7].

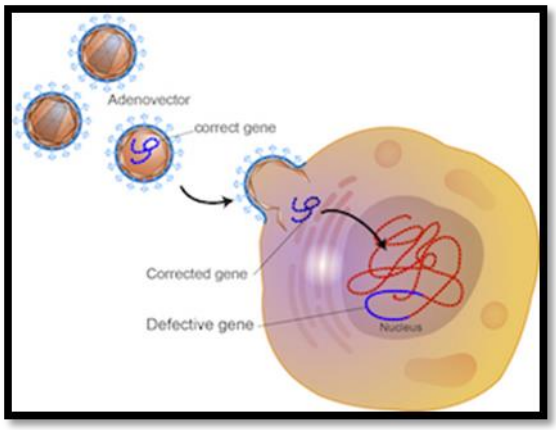

Figure 4: Germline Gene Therapy

6. Antiangiogenic cancer therapy

Tissue cells are usually abnormally leaky and poorly associated with endothelial cell wall cells in plant tissues are also programmed to produce uneven molecules on the surface. inhibiting tumor angiogenesis mainly without obvious effects on normal vasculature as a result of these inhibitors producing potent antitumor effects in mice enjoyed by more than 60 obstetric studies angiogenesis inhibitors tested its anti-cancer effects in human patients despite the final clinical trial results of antiangiogenic to detect the first few observations reported disappointing results[8].

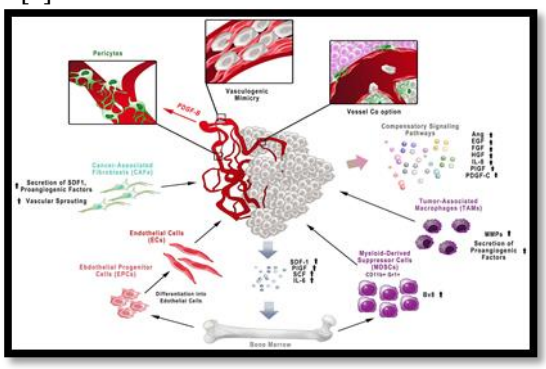

Figure 5: Anti-angiogenic cancer therapy

7. Tumor invasion pathways

The molecular analysis of invasion-associated cellular activities, namely, homotypic and heterotypic cell-cell adhesion, cell-matrix interactions and ectopic survival, migration, and proteolysis, reveal branching signal transduction pathways with extensive networks between individual pathways. Cellular responses to invasion-stimulatory molecules such as scatter factor, chemokines, leptin, trefoil factors, and bile acids or inhibitory factors such as platelet-activating factor and thrombin depend on activation of trimeric G proteins, phosphoinositide 3-kinase, and the Rac and Rho family of small GTPases [9].

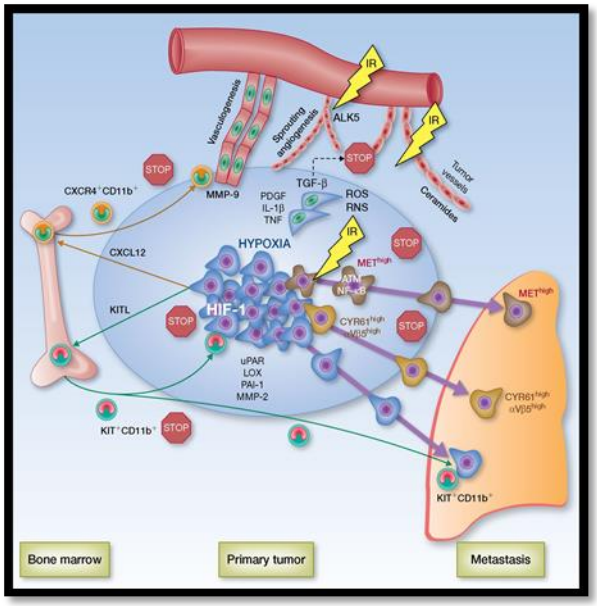

Figure 7: Tumor invasion pathways

8. Gene Immunomodulation

Laboratories around the globe have tried to use different gene therapy-based approaches to modulate the immune response. By definition, gene therapy is based on the introduction of a DNA fragment, expressing a gene or part of a gene, into a host cell in order to reverse, replace, amplify or correct its function. Replacement of genes involved in cell death has been used to trigger apoptosis in inflammatory joints of animal models[10].

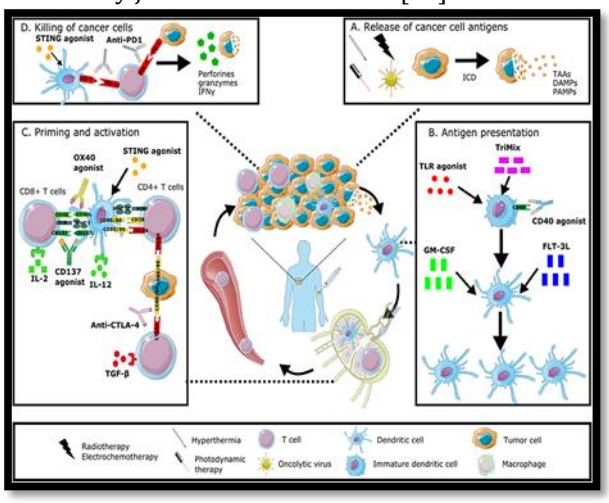

Figure 8: Gene immunomodulation

9. Immunotherapy

Immunotherapy uses genetically modified cells and viruses to stimulate the immune system to destroy cancer cells. Recent clinical trials of second and third-generation vaccines have shown encouraging effects on a variety of cancers, including lung cancer, pancreatic cancer, prostate cancer, and terminal melanoma. One approach uses mononuclear circulating blood

cells or bone marrow gathered from the patient. A tumor antigen, or other stimulatory genes, is then added to the selected cell type. These altered cells are now primed to cause an immune reaction to the cancer cells leading to cancer eradication.[11]

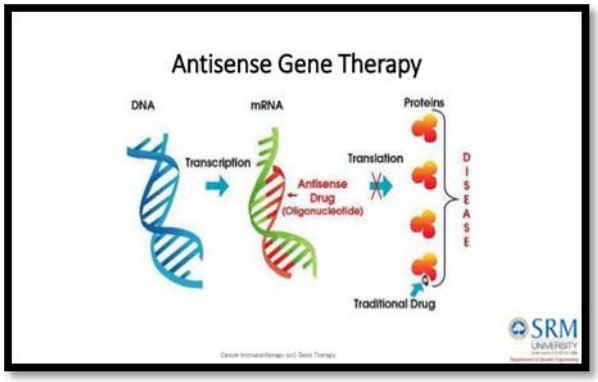

Figure 9: Immunotherapy

10. Gene Transfer

Gene transfer is a new treatment modality that introduces new genes into a cancerous cell or the surrounding tissue to cause cell death or slow the growth of cancer. This treatment technique is very flexible, and a wide range of genes and vectors are being used in clinical trials with successful outcomes. Gene transfer technology encompasses such a diverse set of therapeutic options. It is impossible to describe examples for every treatment. TNFerade is one such treatment option that is currently in late-stage II trials. Another exciting gene therapy treatment agent is Rexin-G, the first injectable gene therapy agent to achieve orphan drug status from the Food and Drug Administration for the treatment of pancreatic cancer. [12]

3. CONCLUSION

With this we can conclude that the field of disease quality treatment is quickly developing and will no uncertainty be essential for the eventual fate of malignancy therapeutics. A few energizing malignancy immunization medicines are in late-stage preliminaries, on account of the coming of hereditary designing. Likewise, quality exchange innovation for malignant growth treatment holds an incredible guarantee for expanding the adequacy of current chemotherapeutic treatment regimens. Huge advances have been made in the field of oncolytic virotherapy, and preliminaries are in advancement that joins this strategy for precancerous, just as destructive therapy. As these therapies mature, they may be used alone or in combination with current treatments to help make cancer a manageable disease.

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