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Review Article

Recent Advances in Bacterial and Viral Genomics for Cancer Therapy

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Abstract

Bacterial and viral therapies have gained enough success and attention for biological cancer treatments. There is a need to protect the living tissues of the body that are helpful for activating the immune responses. Many failures are associated with the conservational therapies that render them for the current era of medical sciences. Viral and bacterial genomes have been used for targeting the initial basis of metastasis and inhibiting the growth of cancerous cells. *S. pyogenes* OK-432 strain showed action against cancerous cells with intact bindings to the proliferative tissues. Phenazine 1-carboxylic acids have anticancer nature and pose a high level of cytotoxicity against the. *Salmonella strain* (KST0650) showed maximum potential against CT26 cancer cells. Oncolytic biologically and virologically group of the controlled viruses that have been used for tumor treatment. Some critical cancers under medications such as hormone therapy- induced helpful for prolonged life span. Pro-active drugs and combinations of probiotics also prevent the bacteria from synthesizing the protective layer of peptidoglycan.

Keywords: Bacterial, viral therapies, *S. pyogenes* OK-432, proliferative tissues.

INTRODUCTION

Bacteria-mediated cancer therapy is widely used for controlling the different cancers and mutational events that occur during the progression of cancers. Currently, different approaches have been used for targeting tumors and malignancy events [1-2]. One of them is genetic engineering, which is capable of targeting tumors and exerting various antitumor effects. Various treatment options are available for diagnosis and biological quantification for targeting some cancers as there is a high rate of progression active proliferating cancerous cells that multiply in such a way that the growth of normal cells is affected. Now, a day, bacterial and viral therapies have gained enough success and attention for biological cancer treatments. These therapies have made achievements in the fields of biological and medical sciences for clinical diagnosis and treatment [3-5].

The cancer rate is one of the highest morbidity and mortality worldwide. It is usually caused by a variety of environmental and genetic factors. Normally, it occurs due to abnormal growth and malignant cells with DNA mutations. These mutations proliferate to normal cells and cause the development of metastasis. It occurs in two forms as the immune system reacts in case of an attack on the body cells. Cancerous cells target normal cells and slow down their activities for growth and development. In case of a compromise immune system, cancerous cells targeting rate is high to the normal cells and disrupt the functions of the protein necessary for growth and development. Most of these malignant neoplasms have the same etiopathogenesis. There is a need for the development of specific biomarkers and individualized therapy to improve patient prognosis in metastasis mechanisms [6-7].

It has been observed that many advanced technologies are used against cancer in different

subtypes. Still, most of them are expensive, and high-quality materials are required for their sample preparation. These technologies also have biohazard effects that reduce their efficiency. These practices produce many adverse effects and have shown limited tumor penetrance. Radiation therapy damages cells by destroying the genetic material that controls how cells grow and divide [1, 4, 6]. Some of the recent investigations and clinical investigations for cancer research have clinically proven that cancerous cells are damaged by radiation therapy; the goal of radiation therapy is to destroy as few normal, healthy cells as possible. There is a need to protect the living tissues of the body that help activate the immune responses. Many failures are associated with the conservational therapies that render them for the current era of medical sciences. Viral and bacterial genomes have been used for targeting the initial basis of metastasis and inhibiting the growth of cancerous cells [7-8].

Bacteria-Mediated Cancer Therapies

Streptococcus pyogenes is widely used as a potential therapy for the treatment of bone diseases. It is also used as an anti-inflammatory agent for reducing the risk of osteoarthritis. Its mechanism of action usually follows in two patterns. *S. pyogenes* OK-432 strain showed action against cancerous cells with intact bindings to the proliferative tissues and increased the chances of cure of lots of inflammatory diseases. Lymphangiomas are the fibrous type of tumors formed caused by the excessive division of lymphatic vessels' endothelial cells that are found in the head and neck area of children. These unusual conditions in children can cause the formation of swelling of the neck, and not being treated well leads to the formation of goiter [9-12].

Therapy type	Mechanism of Action	Therapeutic availability	Biological Targets
Bacteria-mediated	Controlling the different cancers and mutational events	Yes	Cancers
S. pyogenes OK-432	Cancerous cells with intact bindings to the proliferative tissues	Yes	Cancerous tissues and inflammatory cells
Sclerotherapy	For treating lymphangiomas and carcinoma	Yes	Medical remedy for the treatment of infections and inflammatory diseases.
Phenazine 1-carboxylic acid	Anti-bacterial biofilm therapy	Low	Anticancer Nature and poseses high level of cytotoxicity against the metastatic cells
Viral therapy	Oncolytic viruses	Yes	The normal tissues compete with the tumor cells and not harming normal tissue.

Many factors increase the risk of neck swelling, and some researchers investigate that increased inflammation rate is the indirect cause of death. It is promoted by the excessive growth of pathogens (germs) like bacteria, viruses, or fungi—external injuries like scrapes or damage through foreign objects. Sometimes defective gene of bacterial cells leads to the activation of cancerous cells in the proliferative tissues, and the survival rate decreases in such an environment. Therefore, it is essential to recognize the gene patterns of bacterial strains for particular disease targeting with maximal efficacy. Different delivery methods and techniques are used for targeting the pathogens and their inactivation, but most of them need furthermore clinical trials and experimental models [13-16].

Advanced Sclerotherapy

Sclerotherapy is most widely used as a medical remedy for treating infections and inflammatory diseases. *Streptococcus pyogenes* OK-432 can be injected into the pathologically changed lymphatic vessels, which makes the infected area less restricted. OK-432, penicillin-killed *Streptococcus pyogenes*, is used in treating lymphangiomas and carcinoma. Some limitations exist for using some bioengineered bacteria and viral strains. These are involved in causing the immunological reactions to living cells, and many inflammatory markers usually arise at the site of infections [11, 14, 16].

Various cellular responses are involved in combining cell therapies for bacterial cultures. It also depends upon the sensitization of the immune system and inflammatory cytokines. Activated cells destroy the neoplasm, inhibit further growth, and reduce lymphangioma. Natural killer cells and VEGF (vascular endothelial growth factor) levels also contribute to immune responses. Sometimes, chronic inflammation appears in tissues that leads to the formation of a lesion may be swollen, but therapeutic effects are noticeable after a few months. It has been observed that chronic inflammation is also another major cause of cancerous cells [17-20].

Anti-Biofilm Targeting Compounds

Many chemical compounds are contributing to inhibiting bacterial biofilm formation. These are phenazine 1- carboxylic acid (PCA) and Phenazine 1, 6-dicarboxylic acid (PDC). These compounds are naturally obtained from bacteria strains such as *Pseudomonas aeruginosa*. These compounds have anticancer nature and pose a high level of cytotoxicity against metastatic cells and newly growing tumors such

as MCF7 cell lines, with less activity on DU145 (Human prostate cancer cell lines). Due to increasing pathogenic infections, antibiotic resistance has become a significant obstacle in cancer and microbial treatments. There is a need to design biologically active compounds with high cytotoxic Nature that exhibit pharmaceutical activities against cancerous tissues. These novel compounds can be developed through drug designing and have improved efficacy compared to other lethal chemicals [21-23].

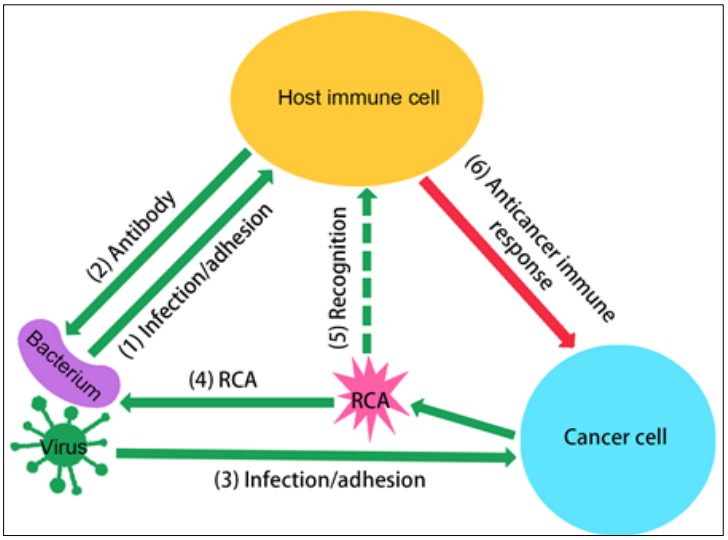

Fig-1: Shows the biological factors of bacterial and viral particles

Anti-Angiogenesis Therapy

The metastatic growth of solid tumors depends on forming new blood vessels leading to angiogenesis. Some approaches have been adopted to reduce the expression of genes responsible for angiogenesis. One of the combination therapy through the application of *Salmonella* (attenuated, auxotrophic). It results from the stunted growth of tumor cells and becomes significant in case of tumor progression and actively dividing cells. Researchers have recently developed novel drugs called angiogenesis inhibitors. These drugs bind with the metastatic cells and disrupt the growth process. These drugs also can bind with the VEGF molecules. It resulted from the inhibition of receptors found on the upper layer of endothelial cells. These receptors' expression indicates the damage inside blood vessels [24-28].

Bifidobacterium adolescentis also used as a biological vector for tumor expression. Some studies revealed that it counters the effect of angiogenesis via inhibiting the formation of local tumor growth. Recently, *Bifidobacterium adolescentis* was efficiently delivered to the liver cells of murine liver tumors against vesicular endothelial growth factor receptor 2 (VEGFR-2). It was also effective for lowering the expression of some abnormal proteins in malignant melanoma. Its activation into the colonic environment also promotes the use of probiotics in preventing folate deficiency in colonic epithelial cells and more efficiently protecting the colon against tumors and biological inflammations in case of arthritis [2, 7, 9, 12].

Some studies are consistent with bacterial uses in clinical applications for cancer and therapeutic purposes. One ideal example is the *Salmonella strain* (KST0650) which showed maximum potential against CT26 cancer cells. Its proliferation ability depends on the culture media and type of cancerous tissues. The mechanism of action of KST0650 tumor tissues is known in some studies. Its treatment reply on forms. The active state of *Salmonella strain* (KST0650) has a high ability to bind with tumor cells and the thus high chance of inhibiting the growth of biologically active tissues in mice. At the same time, inactive form of *Salmonella strain* (KST0650) has a poor binding with tumor cells and thus lowers the inhibiting of the growth of biologically active tissues in mice. KST0650 also activates the promotion of expression of sATF6 was controlled by the radiation-inducible recN promoter [29-32].

Viral Therapies

Oncolytic biologically and virologically group of the controlled viruses that have been used for tumor treatment. However, monotherapies are unlikely to completely overcome the loss. Oncolytic viruses are present in the normal tissues competing with the tumor cells and not harming normal tissue. This novel and promising option for using the viral strains for cancer at the early and middle stages may provide sensible solutions. These viruses bind with a host in terms of pathogens association through the activation of MHC. Also, some antibodies can be inserted as transgenes that achieve maximum benefits, such as familial adenomatous polyposis (FAP), have demonstrated promising preclinical results. It usually activates the

responses from normal cells by the immune system. Sometimes, these therapies are needed under brutal conditions and cancer events for further extensive case-based studies with clinical relevancy [12, 18, 19, 22].

Drug Interactions

Different medications are currently used for the remedies, but some cause serious adverse effects on living cells. Therefore, appropriate use of drugs is necessary for the early stage of infections, and type of medications in coinfections such as diabetes and kidney failures have a high mortality risk. These drugs are S-nitrosated human serum albumin, actinomycin-D, bleomycin, Poly-s-nitrosated albumin, daunorubicin, and doxorubicin, among others. High doses of antitumor antibiotics also risk developing multiple infections [22, 28, 29].

Some critical cancers under medications such as hormone therapy-induced helpful for prolonged the life span. The most important biological function of hormones is directly involved in prostate cancer, while some hormones are active in the reproductive system. Removing those hormones from the body or blocking their effects may cause the cancer cells to stop growing [29-34].

CONCLUSION

Although, a variety of drugs are available for killing the pathogens and their associated populations. Bacterial resistance is increasing daily, a primary alarming signal for drug targets. Some viral drugs also induce the complications of liver and blood-borne infections. There is more need for drug development through case studies and larger populations. Pro-active drugs and combinations of probiotics also prevent the bacteria from synthesizing the protective layer of peptidoglycan.

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