



AN OVERVIEW OF ADVANCED TREATMENT OF CANCER WHERE ARE WE TODAY?

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ABSTRACT

The total population of the world today has exceeded 7.8 billion. Population growth is considered to be the biggest problem in the world. Four people are born every second. Death is happening in the same proportion? No, people die every moment, even if they don't die in proportion to birth. An average of 56 million people dies each year in the world. That means, two people leave the world in every second!

Cancer is considered the second leading cause of death globally, according to the report of world Health organization, 9.6 million deaths, or one in six deaths, in 2018. Lung, prostate, stomach and liver cancer are the most common types of cancer in men, while breast, lung, and thyroid cancer are the most common among women. (According to the WHO Report)

Cancer is not a contagious disease. It is not yet known exactly why these normal cells turn into abnormal cells. Harmful chemicals, 'hormone' radioactivity, occupations, habits (smoking, tobacco use, alcohol, etc.), injury, reproduction and perverted sexual behavior, air and water pollution, food (e.g., high fat or high fat diet), various racial, living systemic, geographical and environmental influences, parasites and viruses are generally universally recognized causes of cancer.

Once upon a time it was thought that cancer means death. But with the advancement and progress of medical science and technology, these ideas are no longer true at all, nor are the treatment of cancer invincible. It is possible to cure many cancers very easily. All that is needed is timely diagnosis and treatment.

Prospect of these studies

Currently Chemotherapy and radiotherapy is the most common treatment for the cancer. But, chemotherapy and radiotherapy have much more side effect due to less specificity, side effect including hair loss, Damage to lung tissue, Heart problems, Kidney problems, Nerve damage, Risk of a second cancer Chemotherapy mainly affect both normal and cancer cell which grow and divide so fast in the body. such as during the formation of new blood cells in the bone marrow or the cells in the mouth, stomach, skin, hair and reproductive organs.

So, scientists are trying to development of many new tumor and anti-cancer drug for actual targeted sites to reduce this dangerous side effect. In the last two decades, Scientist are being used nano technology for the treatment of cancer. And it is good news that they get many advantages for the cancer treatment by using nano medicine technology such as good pharmacokinetics, precise targeting of tumor cells, reduction of side effects, and drug resistance.

The nano technology for the cancer treatment including Lipid based nanoparticles (liposomes), Polymer/lipid-based nanoparticles and micelles, Carbon-based nanoparticles and EPR etc.

Keywords: Cancer, tumor, Nanotechnology, Drug delivery, Tumor targeting, EPR

INTRODUCTION

Cancer is one of the biggest causes of death in worldwide. Every year a huge number of people died due to this disease. Scientists of all over the world is trying to minimize the death rate by cancer. In 1971, the then President of the United States Richard Nixon stood up against cancer. He spent a lot of money on cancer research and he believed that this problem would be solved very quickly. But 44 years later, cancer is still one of the leading causes of death for the American people. According to the report of American cancer society, the rate death by cancer in the United States is reported 29% from 1991 to 2017, including a 2.2% drop from 2016 to 2017, In 2020, Around 1,806,590 new cases cancer patient is diagnosed in U.S.A and a large number of patients had died (606,520 people) by this life threatening cancer.[1]

The steps to treating cancer are so time consuming, expensive, and difficult that we often have to think about which is worse - cancer or postoperative treatment. In 1971, before the revolution of genetic engineering, cancer was a mystery.

But now scientists have realized that cancer is basically a disease of our genes. Sometimes due to the virus and sometimes due to various reasons including chemical radiation can cause cancer. Gene mutations occur in the early stages of cancer. As the cell loses control over itself, changes in cell size, volume, and behavior occur. These cells die one after the other over a period of time. These old cells are replaced by new ones. In general, cells divide in a controlled and regular way to give birth to new cells. Generally speaking, when these cells grow uncontrollably for any reason, a lump or lump of flesh appears under the skin, it is called a tumor. These tumors can be benign or malignant and malignant tumors are called cancers. The development of cancer is a matter of time. For example, year after year, sunburn can cause skin cancer.

UNDERSTANDING CANCER [2]

The bodies of all the animals including human in the world are made up of countless tiny cells. These cells die one after the other over a period of time. These old cells are replaced by new ones. Cells usually divide in a controlled and regular way to give birth to new cells. When these cells grow uncontrollably for any reason, this is called a tumor. These tumors can be benign or malignant. Malignant tumors are called cancers. In detail, a tissue that grows uncontrollably is called a neoplasia (tumor), and a cell with a similar function is called a neoplastic cell. When neoplastic cells cannot penetrate the surrounding tissue, it is called a benign or benign tumor. Benign tumors are not cancers. When neoplasia is complete, it is called malignant tumor or cancer, and the cells with its uncontrolled differentiation are called cancer cells. Many cancers first start as benign tumors, then some of the cells in them become malignant (i.e., penetrating). However, there is no guarantee that benign tumors will turn into cancer. There are some benign tumor-like disorders that are unlikely to cause cancer - these are called pre-cancer. Benign in name means innocuous but benign tumors can also damage the surrounding collar with pressure. Metastasis is a stage of cancer in which cancer cells penetrate other tissues and spread to distant tissues through the blood, lymphatic system, etc.

Cancerous cells cannot show its normal activity or cannot response to the signals that activate the normal cell cycle because cancerous cells different from other normal cell due to lack of normal cell properties. As a result, cancer cell grows uncontrolled. If this condition of cancerous cells going continuedly, it can be dangerous. About 80-90% of deaths occurs due to the spread of cancer cells to other tissues which is called metastasis.

There are about 200 types of cancer in our body. Cancer is basically a combination of different problems in many parts of the body. It starts in any part of the body. Then when it spreads to different parts of the body, only then is it called cancer.

Abnormal cells in a tumor can travel to different parts of the body and sometimes become new tumors, sometimes simply disrupting the function of other cells there. While benign tumors that do not spread in this way spread to other parts of the body and cause problems, those malignant tumors are mainly responsible for most cancers, while the problems they create are simply called cancers. In this case, the organ or part from which the change of cells begins, then it is called cancer of that part.

Again, there are some exceptions. Such as- blood cancer, leukemia. In this case, there are more abnormal cells in the blood than normal blood cells do not allow the blood to do its normal work.

Tumor and its relation with cancer

When we hear the word tumor, we think it is cancer, Sometime people say - have a brain tumor, and brain cancer is same. But the two are the same.

Tumor is the accumulation of some abnormal tissue, where the cells increase in number in an abnormal process. Tissue means some cells of the same type, while somewhere becoming one and doing the same type of work.

There are trillions upon trillions of cells in our body, not billions. It is estimated that an adult has an average of thirty trillion cells. Inside the cell, according to some rules, old cells die, new cells are produced, some cells increase in size, some cells increase in number. But which cell will die and which cell will be able to produce new cells, what will be the size of a cell, there are some instructions or rules inside the cell to control all such features of the cell. And those rules are maintained by DNA. If the instruction of DNA is changed due to any reason or abnormalities cells begin produce abnormal cells, the old cells continue to grow without dying.

Because the cells do not have instructions on where to stop. Then, under the direction of altered DNA, new cells are born one after the other like robots, the number of new abnormal cells increases and the work of normal cells is disrupted, the process of picking up old cells stops and accumulates in the body.

THERE ARE TWO TYPES OF TUMORS

One type of tumor grows in one place and stays in one place. These are called benign tumors. They are not so harmful. Another type of tumor accumulates in body and spread other parts of the body through certain blood or lymph and disrupt the normal functioning of that part of the cells, this is called malignant tumor. This malignant tumor is differently called cancerous tumor.

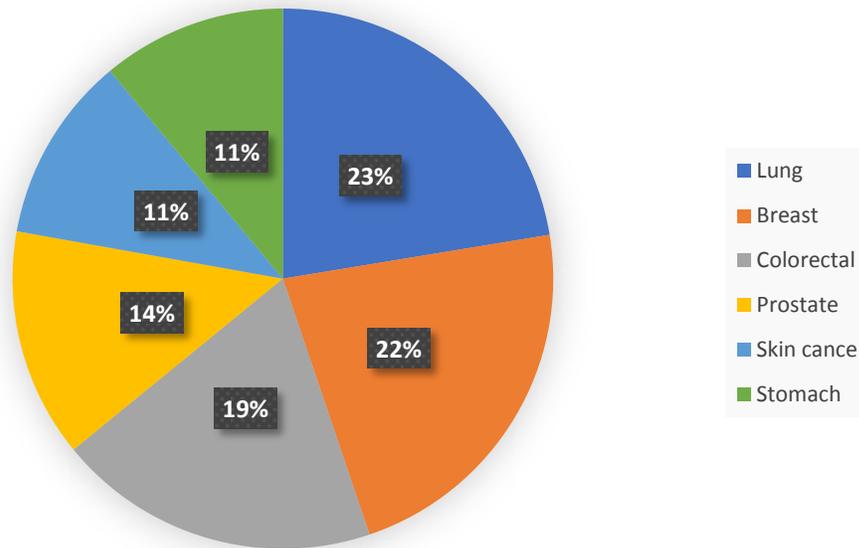
So not all tumors are cancers, some tumors are just cancers, when the cells in those tumors move to other parts of the body to create more new tumors or work problems. Again, not all cancers are tumors, where abnormal cells clot somewhere in the form of tissue. Such tumors do not occur in blood cancer.

The name of tumors is depending upon the type of cell from which they originate. These include:

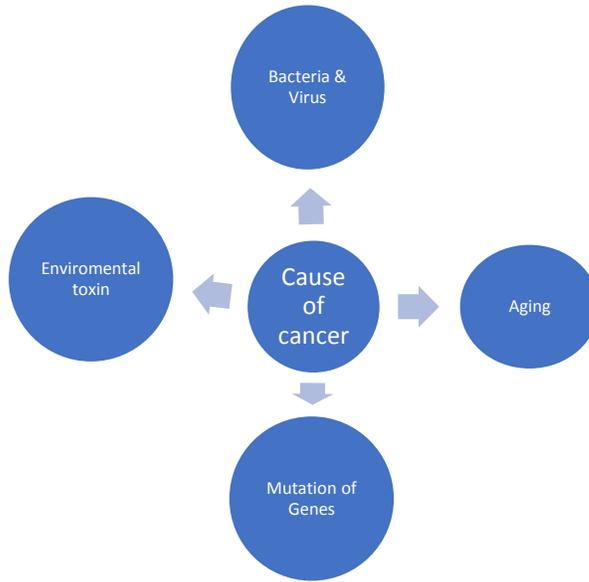
- **Carcinomas:** Cancer arising from epithelial cells is known as "carcinomas". This type of cancer is one of the most common cancers, especially in older people. Carcinomas mainly occur in the breast, prostate, lungs, pancreas, and colon.
- **Sarcoma:** This type of cancer originates from "connective tissue" (e.g., bones, cartilage, fat, nerves). It grows in mesenchymal cells outside the bone marrow.
- **Lymphoma and leukemia:** These two types of cancer grow from hematopoietic (blood-forming) cells and leave the marrow, respectively, to reach full maturity in the lymph nodes (glands). Leukemia cancer is most common in children.
- **Germ cell tumor:** It is a type of cancer that originates from pluripotent cells (in this case the early cell)

Accounting to the report of world health organization for an estimated 9.6 million deaths in 2018.[3]

Most common cancer cause of death



Common cause of cancer [4]



METHOD

We have selected several update researches papers related to oncology and also some keyword. Then we searched through the Google Scholar, PubMed, ResearchGate and some other online Journal using relevant keywords with cancer, tumor, Nanotechnology, radiotherapy, chemotherapy, surgery, immunotherapy, stem cell therapy. We found various advanced treatment process, drug and techniques of cancer treatment.

ADVANCED TREATMENT OF CANCER

Treatment Name	Discussion
Nanotechnology	<p>Nanomedicine is nothing more than a nano form of a common medicine. Docetaxel, Doxorubicine, Paclitaxel is some of the most widely used anti-cancer drugs. These drugs are called nanomedicines when they are converted to "nano size" by various processes.</p> <p>Chemotherapy, Radiotherapy and other various types of drug therapy is given in the last two decades for the treatment of cancer.</p> <p>Cancerous drug usually does not have a specific target or specificity. As a result, some amount of the drug is deposited in normal cells and the remaining drug is deposited in cancer cells. As a result, much less therapeutics effect is obtained.</p> <p>Besides, drugs that are used as anti-cancer, they are naturally high toxic and destroy both cancer cells and good or normal cells.</p>

	Nanotechnology techniques is the potential to increase the selectivity and potency of chemical, physical, and biological approaches for eliciting cancer cell death and possible to minimizing toxicity to normal cells.[5]
Tumor targeting	The enhanced permeability retention (EPR): A technique by which certain sizes of drug molecules, usually macromolecular drugs Liposome, tend to bind in tumor tissue much more specifically. They usually not distribute the other non-tumorous tissues and the normal cell is not destroyed. EPR based chemotherapy is much useful for targeting and delivering of therapeutic agents to tumors for anticancer drug development, and macromolecular drug are plays to development of anticancer drug but also for cancer diagnosis.The enhanced permeability and retention (EPR) effect was first discovered or describe by Matsumura and Maeda in 1986. They described that certain small sizes of compound or macro molecule (biologically active nano compounds) may be deposited in tumor tissue in a high amount compare to normal tissues. In Previously- EPR based nanomedicine was used for the treatment of tumor targeting worldwide. [6]
Active targeting based on EPR	In the concept of tumor targeting, any ligand which show preferential binding toward malignant cells relative to nonmalignant can be used to actively target malignant cells. In this condition, the human growth factor receptors such as epidermal growth factor receptor (EGFR) transferrin death receptor (DR) complexes (e.g., DR5), and folate ligand as well as tumor-specific antigens (e.g., PSMA) have all been utilized to localize NPs to malignant cells via active targeting. A variety of chemical and biological molecules have been used to direct NPs to malignant cells expressing the molecular target receptor including monoclonal antibodies, small molecules, and nucleic acid aptamers. Factors that contribute to one type of targeting molecule being preferentially utilized include molecular weight (MW), targeting affinity, valency, and biocompatibility. Though active targeting in cancer or tumor cells is considered straightforward, this type of targeting does not uniformly enhance tumor localization. Like, monoclonal antibody (mAb) targeting was found in some instances not to enhance tumor localization. Further, active targeting may impact other variables, such as time in circulation, and these indirect effects may confound the effects of direct targeting. Using variable amounts of targeting ligand, it was shown that active targeting of NPs affects cellular uptake within a tumor, but not the targeting to the tumor itself. Thus, active targeting plays a significant role for NP localization; however, caution must be exercised in attributing the biological effects observed to active targeting.[7]
Passive targeting based on EPR	Passive targeting has a good significant due to unique pathophysiological characteristics of tumor vessels, binding nanodrugs to the sites of the tumor. Generally, part of tumor cell or vessel are disorganized and consist a high number of pores.

	<p>Due to this condition the junction gaps between junction and epithelial cell are enlarged. The 'leaky' vascularization, which refers to the EPR effect, allows migration of macromolecules up to 400 nm in diameter into the surrounding tumor region. One of the earliest nanoscale technologies for passive targeting of drugs was based on the use of liposomes. Meanly, liposomes are coated with adding of synthetic polymer that protects the agents from immune destruction.</p> <p>Passive targeting meanly based form the clinical therapeutic has some limitation</p> <p>During the targeting of cancer cells or tumor cells are not within a tumor is not always possible. This condition is happened, diffuse efficiently some drugs, and the random nature of the approach makes it difficult to control the process. The passive strategy is further limited because certain tumors do not exhibit an EPR effect, and the permeability of vessels may not be the same throughout a single tumor.[8]</p>
<p>Photodynamic therapy</p>	<p>Photodynamic therapy, it is another type of modern cancer therapy. PDT is clinically proved both effective and safe. It is significant much more and effective for cancer targeting or tumor targeting cells with small quantities of concentration. Thus, possible to minimize the undesirable toxicity or side effect. Due to this good significant, it binds only targeted tumor tissue and does not show any effect nearby non-tumorous tissue.</p> <p>Nano-carriers to target tumors ability is possible due to the enhanced permeability and retention (EPR) effect.[9]</p>
<p>Cancer treatment with vaccine</p>	<p>Another</p> <p>It is really good news for those who are suffering from cancer. There are still some difficult methods to treat this deadly disease, such as chemotherapy and radiation. This time maybe we will be freed from this far-reaching medical system. A small team of Cuba scientists has discovered a wonderful vaccine to eradicate the deadly disease.</p> <p>They claim that it is possible to eradicate cancer with the help of this vaccine. More than 4,000 victims have already been tested to prove it. Who are now as healthy as normal people. Do you think the price of this vaccine will be too high? But according to Cuban scientists, this is very urgent vaccine will fit within the means of the middle class.</p> <p>The scientific community has praised the Cuban scientists for their impossible work. Not only scientists, but also many doctors have noticed changes in the affected people by applying this vaccine. It was later found that no cancer cells were found in the bodies of those patients.</p>

	<p>Scientists claim that this vaccine will also work well in advanced stages of cancer. The vaccine does not have serious side effects like chemotherapy and radiation. Cuban scientists say the vaccine will cure breast, uterus and prostate cancer faster. And these three cancers have the highest incidence. Note that antibodies in the body turn into cancer cells and spread rapidly. Many avoid it, and most are caught at the very end. However, it has been possible to cure this disease through several therapies. But the new discovery is that patients are recovering fast with the application of this vaccine. The vaccine is currently available in Bosnia, Paraguay, Colombia and Peru.</p> <p>Scientist prove that new discovering vaccine capable of both specific and non-specific responses against tumor cells. For a cancer vaccine development to be successful, the vaccine should be capable to stimulate the immune system to act primarily in a tumor-specific fashion. In this mode, it would present tumor antigens to immune cells and activate which is called helper T cells and the other CD8 T cells is called cytotoxic or killer T cells. It is proven when the cytotoxic T cells is activated then it can directly kill tumor cells [11&12]</p>
<p>Chemotherapy [13]</p>	<p>Chemotherapy is one of the most widely used methods of modern cancer treatment. Chemotherapy is a type of treatment that destroys cancer cells and stops them from spreading. However, this treatment does not apply to all types of cancer. Different types of cancer cells respond to different types of medications. Chemotherapy involves a combination of eight types of medications for the best results. Scientists are trying to combine new types of medicine to improve treatment through chemotherapy. Most of the time the body becomes weak due to chemotherapy. But some modern chemotherapy creates little problems.</p> <p>When is chemotherapy given?</p> <p>Chemotherapy drugs are injected into the body through the blood. It then spreads throughout the body. As a result, cancer cells will be destroyed wherever they are found. Chemotherapy is given when doctors think that the cancer cells are in more than one place in the body. If the cancer is undetectable, some of its cells are isolated from the original tumor and invade the surrounding area.</p> <p>Many times, cancer cells go far. For example, it spreads to the liver or lungs. A physician can surgically remove the cancerous tumor and the surrounding tissue. Cancer cells can also be destroyed through radiotherapy. But radiotherapy can be given in a certain small place. However, there is a possibility of destroying the healthy cells of the body. Chemotherapy is given if there is a possibility of more malignant cancer cells after the cancerous part has been removed. Some cancers, such as leukemia, are treated with chemotherapy. Because leukemia spreads throughout the body. Many times, chemotherapy is given even before surgery. This is done to</p>

	<p>reduce the size of cancerous tumors. The smaller the size of the tumor, the easier it is for the doctor to surgically remove it.</p> <p>How does chemotherapy work? Chemotherapy for cancer cells is a kind of poison. This destroys the cancer cells. It is called cytotoxic chemical. But keep in mind that the thing is being seen as toxic to the body's cancer cells, it can also damage the body's healthy-normal cells. Chemotherapy is about finding and destroying as many harmful cancer cells as possible in the body and destroying as few good cells as possible.</p> <p>Scientist are now having much more success with chemotherapy, because it is able to identify and differentiate cancer cells in the body and the good cells around it. There is a fundamental difference between cancer cells and healthy cells in the body. Cancer cells quickly disintegrate and regenerate into cancer cells. Healthy cells, on the other hand, do not differentiate and spread as fast as cancer cells. Tumors are formed because cancer cells make new cells through rapid proliferation. The body's normal immune system does not attack cancer cells. Because cancer cells are made inside the body. As a result, the body's immune system doesn't think cancer is something that comes from outside. Some chemotherapy attempts to alter the body's immune system in such a way that it sees cancer cells as invading cells and attacks them.</p> <p>What are the side effects? Since some chemotherapy attacks fast-growing cancer cells, it also has the potential to damage good cells. The cells in the body that are attached to the hair can be affected by chemotherapy. That is why hair falls out during chemotherapy. However, after the completion of chemotherapy, the hair grows back. Chemotherapy can weaken the body and cause diarrhea. On the other hand, the body's blood cells can be damaged by chemotherapy. Red blood cells carry oxygen and keep other cells alive. Other blood cells help prevent infection.</p> <p>Because they are damaged, there is a risk of infection for the person taking chemotherapy. A person taking chemotherapy may suffer from fatigue. Chemotherapy can cause loss of fertility in both men and women.</p>
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CONCLUSION

Millions of people die with cancer every year. Although modern treatments for cancer have been invented, these treatments still have serious side effects. So, we need to be aware of cancer. We need to know how cancer occurs. We have to change lifestyle. Then we will be able to protect ourself and our family from this Life threatening disease.

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