

The Devastating Disease Cancer- A Theoretical Study and Recent Trends: Review

Kashish Noor

Department of Biotechnology and Microbiology, Meerut Institute of Engineering and Technology, Meerut (UP), India

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Abstract: Cancer is a lethal disease and the whole world is affected by this. Cancer is the second most dangerous and death-leading disease all over the world. In the normal human body, cells can grow and after some time a cell leads to death and another cell grows, by this procedure, particular cells and all types of cells remain constant but in Cancer disease, abnormal cells develop and divide uncontrollably and destroy the normal body cells and tissues mainly mutation is responsible for cancer. This research paper is trying to help in understanding all the important points about cancer disease. Cancer is the elementary unit of tumors, it leads to uncontrolled division of cells. Chronological growth of mutation in oncogenesis is responsible for the origin of cancer. Unbounded division of cells gives birth to the tumor, which is of two types, benign tumor and another is a malignant tumor which is also known as cancer. There are many types of tumor antigens that are present in the human body and sometimes react against these antigens in the form of destroying tumors, NK cell activity, and many other ways. This lethal sickness is of many types like breast cancer, lung cancer, bladder cancer, kidney, and renal pelvis cancer, thyroid cancer, melanoma of the skin, pancreatic cancer, and liver cancer. In all among Cancer pancreatic cancer is difficult to recognize and diagnose that's why it is rapidly killing cancer. The death rate is higher among men than women. According to IARC in the year 2020, the graph of death by cancer increases, a total of 19.3 million cases appear and 10 million had to lose their lives. As reported by the National Cancer Institute there are some methods that are helping in the healing of carcinoma disease:- Hormone therapy, immunotherapy, radiotherapy, surgery, stem cell transplantation, etc. This research paper outlines the current research and development to prevention and cure of cancer and explains all about cancer, and we try to give some little contribution to get rid of this dangerous disease.

1. Introduction

Today Cancer is the most popular disease, and it is a hazardous illness as we know that most types of cancers are incurable and it can result in death. Cancer is a lethal disease in which cells multiply rapidly, it can damage whole cells of the body and spread into surrounding tissues. In the normal body or healthy body, cells receive signals and transfer to another cell, and at the end of the cell cycle, the cell stops dividing and leading to cell death that is called apoptosis but during cancer, cells neglect the signals and cannot remove unneeded cells [1-3]. Some expressions of cancer are responsible for the visible and detectable development that is known as tumors [2,4]. There are two types of tumor: benign and malignant, benign tumors form in one place without spreading and malignant tumors spread into surrounding tissues and it is very dangerous. Cancer or tumors arise genetically, and infection can be transferred from progeny to children [5]. Some environmental factors and our lifestyle is also responsible for the arising of cancer, our immune cells (effector cells- CD4+ & CD8+ lymphocytes and IFN- γ cells) recognize this abnormal growth of the tumor and start create immunity against this abnormality of cells, but without medical treatment, our immune system cannot kill the tumor cells. This dangerous illness is also known as the silent killer disease [6-7].

2. History of cancer

The Greek physician Hippocrates who is also known as the father of medicines used the word carcinoma and discovered the name of Cancer. The word tumor was invented by Galen and another Roman physician, Galen also made a contribution by introducing the mode of surgery for cancer [9-10].

Surgery was the primary tool accessible in the cure of cancer. In 1809 first surgery was present in the United States [11]. During the 19th and early 20th centuries, many surgeons proved that surgery is very effective in the cure of cancer because in 1867 Joseph Lister originated the antiseptic surgery that was very much useful in the cure of cancer [12-13]. In 1895 the period of radiation therapy began and after some years, 1928 is known as a milestone for cancer treatment because neck cancer was cured by fractionated radiation therapy [14-15]. During the 19th century, microorganisms were used to treat cancer, and this new invention was successful. Microbes secrete toxins, chemicals, and enzymes that have the ability to kill

tumor cells. In 1935 Clostridium. novyi-NT was used to treat tumors, it is an anaerobic bacteria and it directly enters in tumor cells and removes the tumor. In 1987 there was a high risk of lymphangiomas in children, this was a very serious illness, then scientists used bacteria to treat this cancer, they used the Streptococcus pyogenes OK-432 strain of bacteria against the tumor and killed the tumor cells [62-67].

1950 is known as the modern era of radiation therapy as cobalt teletherapy found in this year in which gamma rays occurred and directly entered into the patient's body and killed tumor tissues, in this treatment radiotherapy or teletherapy machines are used [15-16]. Hormone therapy was discovered by Thomas Bealson in the 19th era. He used aromatase, tamoxifen inhibitors to stop breast cancer [17]. Immunotherapy was invented at the end of 1990, in this year monoclonal antibodies were discovered to cure breast cancer and lymphomas, after some years genetically engineered lymphocytes were used to treat cancer, and many therapies were discovered like cell transfer therapy [19]. In the nineteenth century, the technique named chemotherapy was developed by German chemist Paul Ehrlich. In this therapy, chemicals are used to treat cancer, and for example, lymphomas were cured by the chemical that is nitrogen mustard [10].

2.1 Tumor antigens

Tumor antigens are produced in tumor cells. They are specific and do not occur in normal cells. These are antigenic materials, the main reason by which tumor antigens have arisen is mutation. They are cellular proteins and responsible for inducing the buildup of helper T cells and antigens are helpful to induce the antibody in the body against cancer [19-21]. There are mainly three types of tumor antigens that are point mutation, viral proteins, and cancer germline genes. These tumor antigens are very important in the identification of the type of cancer [22]. Some antigens like Tyrosine, Alpha-Fetoprotein (AFP), and Epithelial Tumor Antigen (ETA) are used in the identification of breast cancer, lung cancer, and many other cancers. Tumor antigens are used for the preparation of tumor vaccines [23-24].

2.2 Categories of Cancer

- (1) Melanoma: It can originate in melanocytes.
- (2) Lymphomas: It can occur in B and T lymphocytes or lymph nodes.
- (3) Sarcoma: This is a type of muscle and bone cancer.
- (4) Leukaemia: It occurs in blood-forming tissues.

Corresponding Author,

E-mail address: kashishnoor148@gmail.com

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(5) Adenoma: This cancer arises in glands, like the pituitary gland, thyroid gland, and many others [6]. Carcinoma: It is initiated by epithelial cells, it can mainly affect the lungs, colon, and breast, it is the most common category of cancer [25-26].

2.3 Types of cancer

There are many types of cancer

- i. Breast Cancer
- ii. Pancreatic cancer
- iii. Liver cancer
- iv. Prostate cancer
- v. Colon and rectum cancer
- vi. Stomach cancer
- vii. Leukemia
- viii. Nasopharynx cancer
- ix. Kidney cancer
- x. Ovarian cancer
- xi. Lung cancer
- xii. Lip and oral cavity cancer
- xiii. Cervical cancer
- xiv. Brain tumor
- xv. Bladder cancer

Some common cancers are

2.3.1 Breast Cancer

The cells of the breast grow out of control in breast cancer. There are three main parts of the breast: lobules, connective tissues, and ducts. Cancer can start spreading from any part of the breast and start damaging the breast. Breast Cancer starts from lymph nodes and moves to further parts of the body [27-28].

2.3.2 Lung Cancer

Lung cancer is the highest killing cancer. Smoking and air pollution are the reasons for lung cancer. It causes many problems like coughing, breathing problems, bone pain, body ache, etc. [29-30].

2.3.3 Prostate Cancer

It is the main common cancer in men and it occurs when the cells of prostate glands begin to expand out of control, it is the main cause of death among men [31].

2.3.4 Brain Cancer

In this cancer, cells grow excessively and make a clump of tissues that is known as a tumor. This disease is very dangerous because, in this, the brain loses its memory, sensations and loses its activity. The main reasons for brain cancer are -smoking, headache, stress, radiation, etc. [32].

2.3.5 Pancreatic Cancer

The pancreas is the essential endocrine organ of the body. In this cancer occurs and starts disturbance of its function. Pancreatic cancer is the rapid killing cancer and it is very difficult to diagnose [33].

2.3.6 Liver Cancer

As we know that the liver is a very important organ of the human body because it helps in the excretion of waste material from our body, liver cancer is a very serious type of cancer because it disturbs the whole system of the body. Liver cancer is of two types:-

- 1.Primary Liver Cancer (Hepatocellular Carcinoma):- It affects directly on liver tissues and cells and causes cancer.
- 2.Secondary Liver Cancer (Metastatic):- It originates in any part of the body, and after some time it comes into the liver and spreads infection among all liver tissues.

The main reasons for liver cancer are-

- Side effects of heavy drug
- Drinking alcohol
- Suffering from Hepatitis illness [51][52].

2.3.7 Kidney Cancer

Renal cell carcinoma is the most common type of cancer of the kidney, it infects the kidney and creates a disturbance in whole kidney function, mainly adults suffering from this dangerous illness. Some reasons for kidney cancer are-

- High blood pressure problem
- Alcohol consumption
- Smoking [53-55].

2.3.8 Ovarian Cancer

Ovaries are the main gland of females that helps in reproduction, that's why it's called the reproductive gland. Ovaries play a major role in the production of ova or eggs during reproduction. The female hormones, progesterone, and estrogen are produced by ovaries. Ovarian cancer is very dangerous because it is undetectable until it has spread inside the pelvis and abdomen. This cancer is detected at the last stage, that's why it is untreated, and death leading illness of females [56-57].

2.3.9 Cervical Cancer

In cervical cancer abnormal growth of cells occurs in the cervix, mainly around the part of the uterus that connects the vagina. It is the fourth most common type of cancer in females. The main cause of this cancer is the Human Papilloma Virus (especially HPV-16 and HPV-18) [58].

3. Symptoms of Cancer [34-38]

- (1) Fatigue
- (2) Blood in the urine
- (3) Night sweat
- (4) Loss of appetite
- (5) Changes in bowel
- (6) Difficulty swallowing
- (7) Headache
- (8) Cough
- (9) Body ache
- (10) Indigestion

3.1 Causes of cancer [39-40]

- i. U.V.Rays
- ii. Viruses
- iii. Pollution
- iv. Smoking
- v. Unhealthy foods
- vi. Chemical and physical carcinogens
- vii. Plastic
- viii. Genetic abnormalities
- ix. Alcohol

3.2 Detection of cancer [59]

- Through biopsy
- By MRI
- Through Complete Blood Count
- By observing ESR
- By ultrasound
- By X-ray
- Through the pap test.

3.3 Numbers of deaths by cancer till 2018 [41-43]

- i. Because of colorectal cancer 862000 people died.
- ii. Due to lung cancer 1.76 million people dead,
- iii. Stomach cancer killed 783000 people.
- iv. Due to liver cancer, 782000 people are dead.
- v. Breast cancer killed 627000 people.

4. Prevention of Cancer

- (1) Stop smoking
- (2) Reducing the use of alcohol
- (3) Take a healthy diet
- (4) Protect themselves from infections disease
- (5) Avoid direct contact with the sun
- (6) Reduce the use of plastic, and never burn it
- (7) Exercise regularly
- (8) Change lifestyle
- (9) Avoid direct contact with carcinogens
- (10) Always take care of yourself when working in a laboratory.

4.1 Therapies to treat cancer [44, 45, 60, 61, 68-76]

4.1.1 Surgery

If cancer is spread only in only one part of the body then surgery is used to diagnose cancer, in this treatment surgeons may detach lymph nodes to stop the spreading of this deadly illness.

4.1.2 Radiation therapy

In this therapy, high-energy particles are used to demolish the cancer cells.

4.1.3 Immunotherapy

These medicines and some other treatments like yoga, meditation, and exercise are used to boost immunity.

4.1.4 Hormone therapy

In this treatment hormones are used to control the growth of cancer, mainly prostate and breast cancers are treated by therapy.

4.1.5 Laser treatment

In this, a beam of light is used as a surgery tool for treatment.

4.1.6 Chemotherapy

In this therapy chemicals, medicines and drugs are used to cure cancer, these drugs block the cell division of uncontrolled cells and destroy cancer cells. Drugs are developed by scientists and researchers, manufacturing of drugs contains 3 steps, these are-
1. Primarily scientists do research on the disease, afterward, they compare a particular disease with another and then make a drug using plant parts, microorganisms, and many chemical agents, this first step is known as Pre- Clinical research.

2. After pre-clinical research, scientists go ahead with Clinical research, in this step they start testing this new drug on human body cancerous cells in the laboratory, if they succeed in this test, then they begin trials on 3-4 species of animals.

3. After success in the above steps, the drug is finally approved by the U.S. Food and Drug Administration (FDA) and launched into the market.

Name of some drugs are-

- Dactinomycin- for bone cancer
- Afinitor- for brain tumor
- Docetaxel- for breast cancer
- Lenvatinib Mesylate- for thyroid cancer
- Enzalutamide- for prostate cancer.

4.1.7 Stem cell transplantation

It is very good therapy because in which healthy stem cells transfer into the patient's body by needle, this blood-forming stem cell takes the place of the dead cell.

4.1.8 By the use of Microorganisms

Microorganisms are tiny particles that are present everywhere in the atmosphere, these are helpful as well as harmful for us, but at the time to treat cancer, these organisms are playing a very important role.

4.1.9 Immunotherapy

During the 19th century Dr. William Coley used microorganisms in the treatment of cancer, and luckily he cured 100 people, he used a combination of the microbial colony, and manufacture the vaccine against cancer, his vaccine was very effective. By injecting into the body vaccine stimulates the immune system and kills the cancerous cells. Because of his wonderful invention, he is known as Father Of Immunotherapy. Treatment of immunotherapy is very effective as during this therapy our CD8+ and CD4+ T Lymphocytes activate and start recognizing tumor cells and kill them.

4.1.10 Bacteriotherapy

Specifically bacteria is an ideal microorganism that is used in the treatment of many illnesses. Bacteria are omnipresent so that's why there's no issue of isolation of bacteria, we can isolate bacteria from any sources, and grow on a culture medium and provide optimal temperature as well as the suitable environment, along with we can control its pathogenic power and make it suitable for our use. Since the 19th-century bacteria is used in cancer therapy. Bacterial Colonies produce the lipase and protease enzymes that have the power to kill the tumor tissues after entering in tissues. There's numerous utilization of different types of bacteria to treat cancer or tumor:-

- Genetically prepared bacteria are used for cancer treatment, they have been modified accurately so that they can kill the tumor antigen and increase immunity power; for example- Salmonella typhimurium serovar VNP20009, and Clostridium. butyrium M55, both bacteria are used to treat cancer.
- Bacteria have the ability to stop the growth of unnecessary cells and cure cancer. Unquestionably in cancer, the cell grows uncontrollably, because during this illness apoptosis (cell death) is not done, but bacteria help in inducing apoptosis by releasing toxins,

in the cancerous cells. The toxin is an effective chemical produced by bacteria, it is an enzyme that helps to kill tumor cells. These are some toxins produced by bacteria-

- Cytolethal Distending Toxin (CDTs)
- Cytolysin A (Cly A)
- Cytotoxic Necrotizing Factor (CNF)

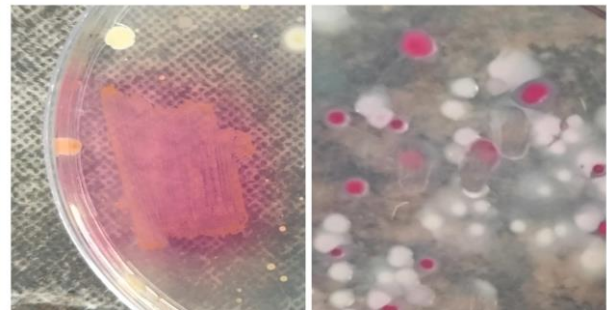


Fig. 1: Colonies of E.coli bacteria on culture medium

- Anaerobic bacteria use their spores to kill the tumor because spores of bacteria act as anticancer agents. Spores activate and start replication inside the hypoxic zone of tumor cells, and kill the tumor. Many bacteria have this ability, for example- E.coli, Salmonella species, Bifidobacteria, Clostridium species of bacteria.

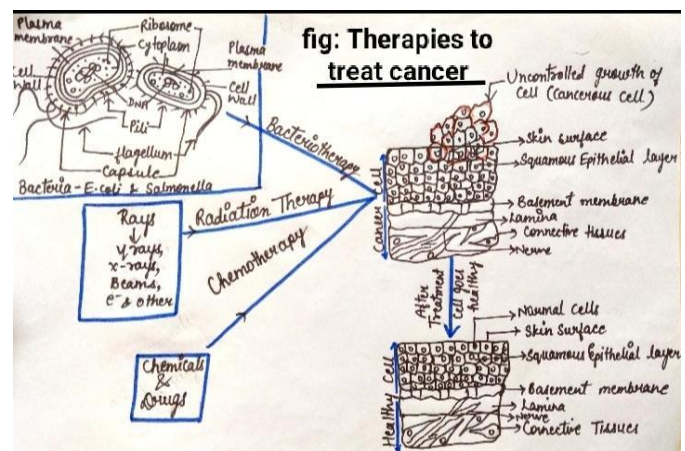


Fig.2: Therapies to treat cancer

4.2 Side effects due to Cancer treating therapies [77]

Cancer is a very devastating illness, it kills most of the people who suffered from cancer, only some people's life is secured after treatment, but they face several problems during their lifetime because, at the time of treatment patient treated with heavy drugs, medicines, chemicals, and radiations, that creates many side effects and many serious problems in the body, some issues are-

- Diarrhea
- Swelling in body
- Pain in the body
- Fertility problem
- Insomnia
- Fungal or algae infection
- Sexual issue
- Bacterial infection
- Depression
- Heart problem
- Kidney failure
- Hair loss and hunger loss.

4.3 Recent discoveries about cancer

- Researchers invented that the behavior of cancer is different in all persons [46].
- Scientists claim that vaccines are helpful to treat cancer because they are helping in boosting our immune power [47].
- Scientists said that exercise may help to inhibit the abnormal growth of cancer cells because exercise is responsible for many

changes in our body like the production of hormones, and metabolites, these metabolites activate the immune cells [48].

(4) Robot surgery is very helpful because, in this, doctors insert the tools into small cuts [49].

(5) Researchers at IISC Bangalore have discovered a technique that can detect cancer; this treatment of nanomotors is helpful in the detection of cancer [50].

(6) IISC researchers developed a bandage made with magnetic nanofibers; they claim that this bandage is used to treat skin cancer by administering heat to the tumor cells. They said that skin cancer is mainly caused by exposure to UV rays that's why this bandage is very effective to cure cancer [50].

5. Conclusions

Cancer is undoubtedly a devastating disease. It is the second death leading illness all over the world. In this review paper, I tried to highlight all the important information about cancer because of the lack of awareness people didn't understand the symptoms of cancer, and at the last stage, they lost their lives, so that's why the death rate increased. We know that 4 February is known as World cancer day. On this day we should start some knowledgeable programs to spread awareness to common people. In the above review paper, I tried to explain the reasons, symptoms, prevention, types, therapies, and discoveries of cancer that will help in understanding cancer. We discussed therapies to treat cancer but many therapies like radiotherapy, chemotherapy create many harmful side effects because of the use of chemicals and powerful radiation, so we can use microorganisms for the cancer treatment because they are naturally occurring entities and by control their pathogenic power, we use them in the treatment of cancer and they will destroy the cancer cells by their toxins and enzymes and they have the ability to induce apoptosis and create defense environment around the cells and provide immunity to the cells. We can also use microbes along with chemotherapy and radiotherapy to avoid their harmful chemical side effects. According to a survey, 20-30% of cancer deaths happen because of uncontrolled growth of cells, by using microbes we can control the unnecessary development of body cells and decrease the death rate which occurs due to Cancer. We know that cancer treatment is very costly, so the government should start a free-of-cost checkup for every person that will help in controlling the cases of cancers. I think that we can make a prototype, which is similar to a glucometer or pregnancy test kit, in which needle is situated, and by inserting the needle we can easily test the cancer disease and detect the abnormal growth of cells, but it is difficult to search which type of material is required for this device. In my opinion, microorganisms should be used in cancer treatment because they are omnipresent and very helpful entities. We need more research to create new ones. It is concluded that we need to study more and more about cancer and try to discover new techniques and therapies to cure cancer and change the lifestyle to prevent cancer.

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