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# Breaking the Barrier: The Latest Advances in Cancer Treatment

# Priyanshu Sharma<sup>+</sup>

# ABSTRACT

Cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells. There are over 100 different types of cancer, and each requires a different approach to treatment. Cancer treatment has come a long way in recent years, with advances in technology, new drugs, and innovative therapies improving patient outcomes. In this article, we will explore the various types of cancer treatment and the advancements that have been made in the field.

Keywords: Cancer; Treatment; Advances; Targeted Therapy; Immunotherapy

#### Introduction

Cancer is a complex and devastating disease that affects millions of people worldwide. Over the years, significant advances have been made in cancer treatment, leading to improved outcomes and survival rates for many patients. Some of the most promising cancer treatment advances include targeted therapy, immunotherapy, and precision medicine.

Targeted therapy involves using drugs or other substances that can target specific molecules or proteins that contribute to the growth and spread of cancer cells. Immunotherapy, on the other hand, involves using the body's immune system to fight cancer cells [1]. This can be done by boosting the immune system's natural response to cancer or by using engineered immune cells to target and kill cancer cells.

Precision medicine is another promising area of cancer treatment, which involves using genetic and other molecular information to tailor treatment to a patient's specific cancer. This can help improve the effectiveness of treatment and reduce the risk of side effects.

Overall, these advances in cancer treatment offer hope for improving outcomes for patients with this devastating disease [2]. It is important for healthcare professionals to stay up to date on the latest advances in cancer treatment to provide the best possible care for patients.

Surgery

Surgery is one of the most common treatments for cancer. It involves removing the cancerous tumor and any surrounding tissue that may be affected. Depending on the location and stage of the cancer, surgery may be the only treatment needed or may be combined with other treatments such as radiation therapy or chemotherapy.

Advancements in surgical techniques have made it possible to remove cancerous tissue with greater precision and accuracy [3]. For example, minimally invasive surgery, which uses small incisions and specialized tools, allows surgeons to perform complex procedures with less trauma to the patient. In addition, robot-assisted surgery, which uses a robot to control surgical instruments, can provide even greater precision and control.

## **Radiation therapy**

Radiation therapy uses high-energy radiation to kill cancer cells. It can be delivered externally or internally, depending on the type and location of the cancer. External radiation therapy uses a machine to direct radiation to the cancerous area, while internal radiation therapy (also known as brachytherapy) involves placing a radioactive source inside the body near the cancer.

Advances in radiation therapy have made it possible to deliver higher doses of radiation to the cancer while sparing surrounding healthy tissue [4]. For example, Intensity-Modulated Radiation Therapy (IMRT) uses a computer-controlled

**Received:** 02-December-2022, Manuscript No. ijocs-23-90184; **Editor assigned:** 05-December-2022, PreQC No. ijocs-23-90184 (PQ); **Reviewed:** 11-December-2022, QC No. ijocs-23-90184 (Q); **Revised:** 19-December-2022, Manuscript No. ijocs-23-90184 (R); **Published:** 23-December-2022, DOI: 10.37532/1753-0431.2022.16(12).276

<sup>†</sup>Corresponding Author: Priyanshu Sharma, Department of Biotechnology, Meerut Institute of Engineering and Technology, Meerut, India, E-mail: priyanshu.sharma.bt.2018@miet.ac.in

machine to deliver radiation in varying intensities, allowing for greater precision and targeting. Another advancement is proton therapy, which uses protons instead of X-rays to deliver radiation, resulting in less damage to healthy tissue.

### Chemotherapy

Chemotherapy is a treatment that uses drugs to kill cancer cells. It can be given orally or intravenously and may be used in combination with other treatments such as surgery or radiation therapy. Chemotherapy is often used to treat cancers that have spread to other parts of the body.

Advancements in chemotherapy have led to the development of targeted therapies, which attack specific molecules that are involved in the growth and spread of cancer cells. This approach is less toxic to healthy cells and may be more effective in treating certain types of cancer. Another advancement is immunotherapy, which uses the body's own immune system to fight cancer. Immunotherapy drugs work by either boosting the immune system's ability to recognize and attack cancer cells or by blocking the mechanisms that cancer cells use to evade the immune system.

Chemotherapy is a type of cancer treatment that uses drugs to kill cancer cells. Chemotherapy drugs work by stopping cancer cells from dividing and growing. There are many different chemotherapy drugs, and they can be given in a variety of ways, including orally, intravenously (through a vein), or through injections.

Chemotherapy is often used in combination with other cancer treatments, such as surgery, radiation therapy, or targeted therapy [5]. The goal of chemotherapy is to destroy cancer cells and prevent them from spreading to other parts of the body.

Chemotherapy drugs can affect both cancer cells and normal cells in the body, which can cause side effects. The type and severity of side effects depend on the type of drug, the dose, and the individual's overall health. Common side effects of chemotherapy include nausea, vomiting, hair loss, fatigue, and increased risk of infection.

Your oncologist will discuss with you the best course of chemotherapy for your specific type and stage of cancer. They will also provide information on how to manage any potential side effects and support you throughout your treatment.

# Hormone therapy

Hormone therapy is a treatment that uses drugs to block or reduce the level of hormones in the body that are involved in the growth and spread of certain types of cancer, such as breast and prostate cancer. Hormone therapy may be used alone or in combination with other treatments.

Advancements in hormone therapy have led to the development of more effective drugs that target specific hormones and hormone receptors. For example, aromatase inhibitors are a type of hormone therapy used to treat breast cancer in postmenopausal women by blocking the production of estrogen, a hormone that can promote the growth of certain types of breast cancer.

Hormone therapy, also known as endocrine therapy, is a cancer treatment that works by blocking the hormones that cancer cells need to grow. Hormone therapy is mainly used to treat breast and prostate cancer, although it may be used to treat other types of cancer as well.

Breast cancer cells can be fueled by estrogen and progesterone hormones, while prostate cancer cells can be fueled by testosterone. Hormone therapy works by either stopping the body from producing these hormones or blocking their effects on cancer cells.

There are several types of hormone therapy, including:

- 1. Selective estrogen receptor modulators (SERMs) and selective estrogen receptor degraders (SERDs), which block the effects of estrogen on breast cancer cells.
- 2. Aromatase inhibitors, which reduce the amount of estrogen in the body by blocking an enzyme called aromatase.
- 3. Luteinizing hormone-releasing hormone (LHRH) agonists and antagonists, which block the production of testosterone in the testicles.
- 4. Anti-androgens, which block the effects of testosterone on prostate cancer cells.

Hormone therapy can be given in different ways, such as pills, injections, or skin patches. The length of treatment will depend on the type and stage of cancer, as well as the individual's overall health.

Like any cancer treatment, hormone therapy can have side effects, such as hot flashes, fatigue, weight gain, and loss of sex drive. Your doctor

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will discuss with you the best course of hormone therapy for your specific cancer, as well as how to manage any potential side effects.

#### Stem cell transplant

Stem cell transplant is a treatment that replaces damaged or destroyed bone marrow with healthy stem cells. Stem cells are immature cells that can develop into red blood cells, white blood cells, and platelets. Stem cell transplant may be used to treat certain types of cancer, such as leukemia and lymphoma, as well as other blood disorders. Stem cell transplant, also known as Hematopoietic Stem Cell Transplant (HSCT), is a medical procedure that involves the transplantation of healthy stem cells to replace damaged or diseased cells in the body. Stem cells are undifferentiated cells that have the ability to differentiate into different types of cells, including blood cells, bone cells, and muscle cells. Stem cells can be obtained from different sources, including bone marrow, peripheral blood, and umbilical cord blood.

#### **Indications for Stem Cell Transplant**

Stem cell transplant is used to treat a variety of medical conditions, including:

- 1. Cancer: Stem cell transplant is used to treat certain types of cancer, including leukemia, lymphoma, and multiple myeloma. It is typically used when other treatments, such as chemotherapy and radiation therapy, have been unsuccessful.
- 2. Non-cancerous blood disorders: Stem cell transplant is also used to treat non-cancerous blood disorders, such as sickle cell anemia, thalassemia, and aplastic anemia.
- **3.** Autoimmune diseases: Stem cell transplant is sometimes used to treat autoimmune diseases, such as multiple sclerosis, systemic lupus erythematosus (SLE), and rheumatoid arthritis.

#### **Types of Stem Cell Transplant**

There are two main types of stem cell transplant:

- 1. Autologous Stem Cell Transplant: In an autologous stem cell transplant, the patient's own stem cells are collected and stored before high-dose chemotherapy or radiation therapy. After the chemotherapy or radiation therapy is completed, the stored stem cells are transplanted back into the patient's body to replace the damaged or destroyed cells.
- 2. Allogeneic Stem Cell Transplant: In an allogeneic stem cell transplant, stem cells are obtained from a matched donor. The donor can be a family

member or an unrelated donor. Allogeneic stem cell transplant is typically used for patients with cancer or blood disorders.

# Procedure

Stem cell transplant is a complex medical procedure that requires specialized medical expertise and resources. The procedure typically involves the following steps:

- 1. Collection of Stem Cells: The stem cells are collected from the patient or a donor using a procedure called apheresis. During apheresis, blood is drawn from the patient or donor and passed through a machine that separates the stem cells from the blood.
- 2. Conditioning: Before the stem cells are transplanted, the patient undergoes high-dose chemotherapy or radiation therapy to destroy the diseased cells and make room for the new stem cells.
- **3.** Transplantation: After conditioning, the healthy stem cells are transplanted into the patient's bloodstream through a central venous catheter.
- 4. Recovery: After the transplant, the patient is closely monitored for complications and side effects. The recovery period can be several weeks or even months, depending on the patient's condition.

# **Risks and Complications**

Stem cell transplant is a complex medical procedure that carries certain risks and complications, including:

- 1. Graft-versus-host disease (GVHD): In allogeneic stem cell transplant, the donor's immune system may attack the patient's healthy cells, causing GVHD.
- **2.** Infection: Patients undergoing stem cell transplant are at increased risk of infection due to the high-dose chemotherapy or radiation therapy.
- **3.** Bleeding: Patients undergoing stem cell transplant are at increased risk of bleeding due to low platelet counts.
- 4. Organ damage: The high-dose chemotherapy or radiation therapy can cause damage to the liver, lungs, and other organs.

#### Conclusion

In conclusion, cancer treatment has come a long way in recent years, with significant advances in

targeted therapy, immunotherapy, and precision medicine. These treatment options have shown great promise in improving outcomes and survival rates for cancer patients, as well as reducing the risk of side effects associated with traditional treatments such as chemotherapy and radiation.

Targeted therapy, which involves using drugs or other substances to target specific molecules or proteins in cancer cells, has been particularly effective in treating certain types of cancer. Immunotherapy, which harnesses the power of the body's immune system to fight cancer, has also shown great promise, especially in treating cancers that have proven difficult to treat with traditional therapies. Precision medicine, which involves using genetic and molecular information to tailor treatment to a patient's specific cancer, is another promising area of cancer treatment. By providing more personalized care, precision medicine has the potential to improve outcomes and reduce the risk of side effects associated with traditional treatments.

Overall, cancer treatment advances offer hope for improving outcomes for cancer patients and reducing the burden of this devastating disease on individuals, families, and society. Ongoing research, education, and advocacy will be essential for continuing to advance cancer treatment and improving care for patients.

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