

Cancer and different treatments

Objective: Examination of different types of cancer treatments, how they work to improve survival rates and their social and psychological consequences.

I. Introduction

Cancer is one of the world's leading causes of death, accounting for nearly 10 million deaths in 2020 alone. As cancer is a global issue that impacts many aspects worldwide, such as economically, socially and psychologically, we decided to research the different methods by which tumour cells are treated.

“Cancer” is a term many are familiar with. However, there are many misconceptions about the disease itself. Unlike common beliefs, cancer is not infectious and cannot be transmitted by human contact. Cancer occurs when cells are grown uncontrollably and spread to other parts of your body. Unlike normal cells, they don't stop growing nor die naturally. These cells may form tumours (clusters of cells) which can spread or invade other parts forming other additional tumours.

II. Radiation Therapy

Radiation therapy is a cancer treatment used to kill cancer cells and decrease the size of tumours through large doses of radiation. This can be used for two purposes: to treat cancer and ease cancer symptoms. This treatment can cure cancer, stop its return, or prevent or slow its growth. The easing of cancer symptoms, also known as palliative treatments, uses external beam radiation to relieve pain and other tumour-related problems. For instance, difficulty breathing or losing control of one's bowels or bladder (National Cancer Institute, 2019). Systemic radiation therapy, also known as radiopharmaceuticals, treats the pain caused by bone cancer. Palliative treatments are used to relieve symptoms rather than cure and are mostly used for patients in advanced stages of cancer where there is little chance of cure. This can include increased access to oral painkillers, home-based care and other public health strategies to decrease the psychological and physical pain patients experience, especially in their terminal phases.

The radiation therapy kills the actively dividing cells to disable cell growth and spread. Radiation causes a small break in the DNA. The radiosensitivity is the response of cell (usually tumour cells) irradiation that the extent of regression can measure, rapidity of response, and response durability. Therefore, the speed

and effect of radiotherapy will depend on the cells' radiosensitivity. In the cell cycle, the G₀ phase is the initial cell cycle step where all cells are in the resting stage. The cells are not dividing, yet they do normal work in the body. Therefore, radiotherapy should be carried out in the early stages of the cell cycle before the cell division, G₀, G₁, and G₂ phase, to prevent malignant tumour cells from spreading on the body that might lead to secondary tumours. According to Catheryn M. Yashar MD, FACR, FACRO, in *Clinical Gynecologic Oncology* (Ninth Edition), "Cells in late G₂ and mitosis (M-phase) are the most sensitive to radiation, and cells in late synthesis (S-phase) are the most resistant".

According to *Principal Cellular and Tissue Effects of Radiation*, There are two different ways that radiation therapy works to kill tumour cells:

1. Apoptosis: Programmed cell death or interphase death
 - a. Cells undergoing apoptosis as an immediate consequence of radiation damage usually die in interphase within a few hours of irradiation, irrespective of and without intervening mitosis.
2. Radiation-induced reproductive failure
 - a. Radiation in sufficient doses can inhibit mitosis, that is, the cell's ability to divide and proliferate indefinitely. The inhibition of cellular proliferation is the mechanism by which radiation kills most mammalian cells.

Cancer cells conduct faster cell division, therefore, strong radiation has to be exposed to kill tumour cells in the long run. However, this inevitably affects the normal cells negatively. This will cause DNA damage and mutation that bring unwanted side effects in the future. Therefore, the radiation therapy should aim to maximise therapy efficiency yet minimise the damage to the normal cells. The patients need to undertake rehabilitation after the radiation therapy to reintegrate the tissue injury and inflammation, which eventually leads to scar tissue formation and can cause tissue damage and loss of skin mobility and flexibility in the irradiation field.

Not only does radiation help control the growth of cancer, but it also provides patients, such as those with borderline resectable cancer, with the choice of surgery. In the case of advanced cancer, radiotherapy can help the patient relieve pain as well. Even though the use of radiation leads to treatment sessions, these sessions only last around 30 minutes; this allows the patient to proceed with daily activities. However, Radiation therapy can lead to minor side effects such as tiredness and diarrhoea. For patients with a history of chemotherapy the patient could once again have the side effects such as loss of appetite and peripheral neuropathy (Pancreatic Cancer UK, 2022).

III. Chemotherapy

Chemotherapy, simply put, is the use of drugs to treat cancer by destroying cancerous cells. It follows the principles of systemic treatment, which means the chemicals circulate throughout the body in the bloodstream. This process allows the treatment of cancer cells everywhere around the body. By killing the cancerous cells in the process of splitting into two daughter cells, chemotherapy prevents the mass reproduction of cancer cells. Due to the cancer cells' tendency to split more often than normal cells, chemotherapy is much more likely to kill those specific cancerous cells. There are 2 major ways drugs in chemotherapy kill the cells. Some drugs kill by damaging the nucleus of the cancerous cell and preventing it from dividing. This is done by damaging the gene inside the nucleus. . Other drugs stop the dividing process by interrupting the metabolic processes involved in cell division (Pancreatic Cancer UK, 2022).

However, like all treatments in the medicinal sphere, it is essential to analyse the effectiveness of chemotherapy. The chance of chemotherapy curing cancer depends on the type of cancer present in the patient. For example, chemotherapy works effectively with testicular cancer and Hodgkin lymphoma. Patients with bowel and breast cancer must use other treatments alongside chemotherapy to prevent remission. Chemotherapy includes alkylating agents, antimetabolites and antitumor antibiotics (Cochise Oncology, 2022). The alkylating agents work by damaging the DNA of the cancer cells thus damaging the cell's reproductive abilities. Antimetabolites kill cancer cells by disturbing the metabolic processes and preventing cell division.

Chemotherapy is not necessarily a one-time treatment. Instead, it is a course of treatment that consists of numerous chemotherapy cycles. The duration of a chemotherapy course differs for each patient, usually ranging from around 3 to 6 months. The treatment includes one or more drugs, which can be ingested as tablets or capsules or infused into the vein (intravenous drugs). One major reason behind the chemotherapy course is to allow the body to rest and recover from the potential side effects of chemotherapy (Cancer research UK, 2020).

After the surgery is performed, “with the intention of curing the disease” (Shrouff, S. & Tharu, R., 2020), undergoing chemotherapy lowers the chances of cancer relapse as it controls cancer's growth. However, chemotherapy could lead to the patient's mental discomfort which could require further medication after a discussion with the doctor. Even though medication can be used after chemotherapy, some cases require

hospitalisation. Furthermore, improving the prognosis doesn't necessarily mean an immediate cure.

IV. Conclusion

While cancer is a leading cause of death worldwide, there are many ways to treat cancer. The most prominent ones are Radiation Therapy and Chemotherapy. Radiation therapy works by using radiation to kill cancer cells directly or by disrupting mitosis in the cells. Chemotherapy uses drugs to circulate in the body and kill or shrink cancerous cells. Some treatment is more effective for a specific type of cancer. For example, Chemotherapy is more effective in treating testicular cancer and Hodgkin lymphoma. The common side effects of both treatments are hair loss, tiredness, diarrhoea etc. It is also worth noting that Radiation therapy side effects are more noticeable in the treatment area.

V. Bibliography

Shrouff, S. & Tharu, R., 2020 Chemotherapy - pros and cons. *Medindia*. Available at: <https://www.medindia.net/patients/patientinfo/chemotherapy-pros-cons.htm>

Cancer research UK, 2020. Your chemotherapy plan. *Your chemotherapy plan | Cancer in general | Cancer Research UK*. Available at: <https://www.cancerresearchuk.org/about-cancer/cancer-in-general/treatment/chemotherapy/planning/your-chemotherapy-plan#:~:text=A%20course%20of%20chemotherapy%20usually,or%20as%20tablets%20or%20capsules>

Pancreatic Cancer UK, 2022. Side effects of chemotherapy. *Pancreatic Cancer UK*. Available at: <https://www.pancreaticcancer.org.uk/information/treatments-for-pancreatic-cancer/chemotherapy/side-effects-of-chemotherapy/>

Anon, Guidelines for rehabilitation exercise after radiation therapy for head and neck cancer. *vinmec.com*. Available at: <https://www.vinmec.com/en/news/health-news/guidelines-for-rehabilitation-exercise-after-radiation-therapy-for-head-and-neck-cancer/#:~:text=Why%20is%20rehabilitation%20after%20radiation,flexibility%20in%20the%20irradiati>

Little JB. Principal Cellular and Tissue Effects of Radiation. In: Kufe DW, Pollock RE, Weichselbaum RR, et al., editors. *Holland-Frei Cancer Medicine*. 6th edition. Hamilton (ON): BC Decker; 2003. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK12344/>

National Cancer Institute. 2019. Radiation Therapy for Cancer. [online] Available at: <https://www.cancer.gov/about-cancer/treatment/types/radiation-therapy>

Little JB. Principal Cellular and Tissue Effects of Radiation. In: Kufe DW, Pollock RE, Weichselbaum RR, et al., editors. *Holland-Frei Cancer Medicine*. 6th edition. Hamilton (ON): BC Decker; 2003. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK12344/>

Cochise Oncology, 2022. What is chemotherapy made of?: Chemotherapy Sierra Vista: Cochise Oncology. *Cochise Oncology* |. Available at: <https://www.cochiseoncology.com/blog/what-is-chemotherapy-made-of/>