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Undergraduate

# CANCER THERAPIES: A BANE AND A BOON

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The modern methods of treating cancer can be quite primitive – destroying the body at the cellular, physiological, and psychological levels, even while saving lives. Three of the most common cancer treatments used are radiation therapy, chemotherapy, and surgical removal of cancerous tissue and tumors. These treatments represent the forefront of medical practices and they can certainly be very effective and can often mean the difference between life and death for many cancer patients. However, one must also understand the vast amount and various types of side effects and damage that these treatments can cause.

One primary type of cancer therapy radiation therapy. It is the use of any sort of radiation, which can be photons such as UV and X-rays or particles such as protons, neutrons,  $\alpha$ -particles, or electrons, to target cancer cells and produce ionization in important biological molecules. The principle target of this ionizing radiation is often DNA. Ionization of DNA can cause single strand and double strand breaks in the molecule. In the targeted cancer cells, single strand breaks can often be mended by repair proteins, but double strand breaks are usually lethal events for the cancerous cells. If radiation is provided in overly large quantities, these double strand breaks can become carcinogenic and cause normal cells to transform in tumor cells. However, when proper dosage is applied, the double strand breaks caused by the radiation cause an arrest in the further growth of the tumor (He, 2011).

In Radiation Treatment for Benign Disease, Meyer (2001)

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maintains that radiation therapy has “better response or final cosmesis than with other modes of treatment”

despite negative side effects (p.12). Because of the tremendous positive benefits, radiation therapy is used on a vast majority of tumors, even benign ones. It is also often used in conjunction with other cancer therapies

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*Chemotherapy can also be used to indirectly treat individuals with cancer as a palliative therapy*

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to keep the cancer from growing or in order to keep remission, or relapse of a cancer that had been previously cured, in check. Recent developments in radiation therapy have made the treatment more specialized by targeting it specifically using the patient’s molecular gene expression, allowing the dose and type of radiation used to be tailored specifically to the patient, maximizing the benefits while minimizing many risks (Polgar, Major, & Fodor, 2012).

Chemotherapy is similar to radiotherapy in that it primarily causes lethal damage to the DNA in cells using toxic chemicals, which can lead to the death of both cancerous and normal human cells (He, 2011). However, cancer cells are more rapidly dividing and thus have more quantities of DNA. Therefore they have a much greater likelihood of being affected by the chemotherapy. Outside of being used as a direct treatment of cancer by killing overly proliferating cells, chemotherapy can also be used to indirectly treat individuals with cancer as a palliative therapy. Palliation means to relieve the pain of a condition without curing the underlying problem. Thus chemotherapy may reduce the size of a tumor to make it more manageable and decrease its effects even if it is not actually able to cure the cancer itself. Palliation is often used for patients who have incurable metastatic or recurring head and neck squamous cell cancer (HNSCC) (Pensak, 2001).

Chemotherapy is also often used in conjunction with the other two cancer treatments, radiation and surgical removal. Inductive chemotherapy can be given before surgery to decrease the tumor bulk, which makes

it easier to remove, and to possibly treat subclinical micrometastases. These micrometastases are small portions of the tumor that have broken off the larger tumor at the site of origin, have invaded blood vessels and traveled to a different part of the body, and have established themselves in faraway tissue. The micro part of the name implies that they are still too small to visualize during surgery and hence cannot be removed.

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***Sometimes, using surgical techniques can lead to greater proliferation of cancer cells that couldn't be removed completely.***

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This is why they are treated by chemotherapy before surgery. Concomitant chemotherapy is chemotherapy given to the patient along with radiation to improve the efficacy of the radiation. Lastly, adjuvant chemotherapy, a type of chemotherapy used when doctors suspect that the cancer has metastasized and moved to regions of the body other than where it developed, is given after surgery or radiation to help maintain remission of the cancer (Pensak, 2001).

The third cancer treatment in use today is surgical removal of cancerous tissue, which aims to remove as many of the cancer cells as possible. The final goal of the surgery can be either to cure the patient of cancer by removing all the cancer cells, or it can be palliative by removing a large part of the cancer and thus reducing pain associated with the tumor. One of the most common cancer types that can be treated with surgical removal is the variety of breast cancers (Torosian, 1995). The main reason why surgery is considered such a good treatment option for cancer is that it has the potential to completely remove the cancerous tissue, barring any sort of metastases or leaving behind of a miniscule portion.

As effective as the discussed treatments of cancer are, they all have downsides. Surgical removal of tissue can of course be physiologically damaging. Sometimes, using surgical techniques can lead to greater proliferation of cancer cells that couldn't be removed completely. It is not known why, but physical disturbance has been shown to increase the proliferation of any cancer cells left behind during surgery (He, 2011). Equally important is the psychological burden that the surgery may cause. Alderman et al. (2008) found

that women with breast cancer whose physicians talked to them about reconstructive surgery were significantly more receptive to mastectomies than women whose physicians had not discussed reconstructive surgery with them. However, the study found that only 33% of patients with breast cancer had this discussion with their doctors, and this group was a primarily younger and more educated portion of the population.

Cancer survivor Lucy Grealy (1994) illustrates some of the psychologically negative effects of surgical removal of cancerous tissue in her memoir *Autobiography of a Face*. Grealy had Ewing's sarcoma at a young age and had more than a third of her jaw removed. This cured her cancer and she never went into remission, but the consequences of having a form disability stayed with her throughout her life. She was bullied in school and plagued by low self-esteem ever since. As a consequence she had over thirty reconstructive surgeries, most of which failed dismally due to the effect that previous chemotherapy and radiation therapy treatments had on her body.

Radiation therapy consequences can include the irradiation of other non-cancerous cells in the body, that would lead these previously healthy cells to undergo apoptosis (self-regulated programmed cell death), necrosis (premature death of cells in living tissue), senescence (aging of cells), and terminal differentiation (a state where the cell becomes fixed in the G0 phase of the cell cycle, thus ensuring that it will never proliferate). While all these four results would be beneficial if they happened to a cancer cell, if they happen to a normal body cell, they will lead to unnecessary death (He, 2011). As alluded to in the case of Lucy Grealy, radiation therapy also weakens body in general and can prevent its receptiveness to future to reconstructive surgery or therapy.

Chemotherapy is often the first thing people think of

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***Radiation therapy also weakens body in general and can prevent its receptiveness to future to reconstructive surgery or therapy.***

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when considering cancer treatment and it is often the best choice we have today in cancer therapies, but it too can have negative side effects. Since chemotherapy

agents are toxic chemicals used to kill cancer cells, they can also kill healthy body cells indiscriminately. They are especially harsh on normal body cells that proliferate very quickly, such as epithelial cells, because they are similar in this respect to cancerous cells. Thus some of the most common chemotherapy side effects are hair loss and sores on the skin, especially the inside of the mouth. Other common side effects include bone marrow depression and nausea (Weinberg, 2007). Descriptions of the visceral feeling during rounds of chemotherapy found in Grealy's autobiography portray a horrifying scene. She shows the reader how her "stomach outlined itself for me; my intestines, my liver, parts of me I didn't even know the names of began heating up, trembling with their own warmth, creating friction and space by rubbing against the viscera, the muscles of my stomach, my back, my lungs" (90). She also gives accounts of the nausea and weakness in the days following the weekly injections.

However, no matter how horrible the downsides of current cancer treatments are, the truth is that these therapies are

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***Since chemotherapy agents are toxic chemicals used to kill cancer cells, they can also kill healthy body cells indiscriminately.***

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some of the best that we have in today's scientific world. There are some complementary and alternative (CAM) cancer treatments in use, including prayer and spiritual practice, relaxation, faith and spiritual healing, and nutritional supplements and vitamins ("Complementary and Alternative Medicine in Cancer Treatment", 2012) which have been affective to some degree in managing the side effects of both the cancer itself and of cancer treatments. But until developments in technology and research can better cancer treatment methods we will have to rely on radiation therapy, chemotherapy and surgical removal to combat cancer. Despite their side effects, these methods really do work. But is it worth it? Is destroying the body through treatment worth the potential of saving the life of an individual? Every patient and their families will have a different answer for that question. And there really is no right or wrong answer.

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