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Immunotherapy: Transforming Oncology

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Immunotherapy is a form of treatment seen primarily in oncology that uses natural killer (NK) cells, B, and T lymphocytes from the immune and lymphatic systems to combat cancerous cells within a patient's body. Throughout the years many clinical trials have tested the use of immunotherapy on different types of cancers. Some of the leading trials dealt with patients who are affected by leukemia, lymphoma, and lung cancer. Great successes have been seen and it has pushed researchers to dive deeper into continuing to perfect the treatment and to explore outlets of improvement. There are cases where immunotherapy has been coupled with other already existing treatments options, like radiotherapy, and this has paved the way for increased success rates. There are still many obstacles for researchers and providers to overcome with immunotherapy, but this treatment option is truly paving the way for the betterment of the oncology field as a whole.

Introduction

Cancer continues to affect the lives of millions of people around the globe. Today's technologies are allowing scientists to explore, adjust, and implement new forms of treatment to combat such an aggressive condition. Immunotherapy, in generalized terms, is the use of specified cells from different parts of the immune system in a concentrated format to target specific cells more naturally and directly. In oncology, Immunotherapy focuses primarily on the body's adaptive immunity response because of its antigen-specific properties in order to combat cancerous cells (Raj et al., 2019). It is a common misconception that Immunotherapy is a very new thing that has been developed within the last decade or two. However, the use of immunotherapy dates back to even the 1800s where William Bradley Coley, who is known as the Father of Immunotherapy, applied immunotherapy as treatment for bone cancer in 1891 (Dobosz et al., 2019). Since then, this form of treatment has been studied and applied to many different cases in order to evolve the treatment style.

With understanding Immunotherapy and how it has come about, it's important to recognize and understand the different parts of the immune system that make up this form of treatment and how it functions overall. Immunotherapy utilizes the two parts of the immune system and their response mechanisms. The first part is the innate immune system. The innate response is the body's first line of defense. It consists primarily of natural killer (NK) cells which have the ability to detect cells that are under "attack" by foreign bodies (Raj et al., 2019). When there is cancer present in the body, the NK cells can recognize this and begin to combat the cancerous cells that are distressing the body's healthy cells. Next, is the adaptive immune system which is composed of B and T lymphocytes. These lymphocytes have specified functions which allow them to recognize antigens. When they come across cancerous cells, they detect the cells' unique antigens and begin to signal an immune response against those cancerous cells (Raj et al., 2019). Through these natural responses that the immune system has, scientists are then able to concentrate these types of cells to formulate a more natural approach to cancer treatment.

Application

There have been many different cases and trials in which the use of Immunotherapy has been applied. In one recent instance, the FDA approved the use of CAR T-cells in B-cell acute lymphoblastic leukemia in children in 2017 (Dobosz et al., 2019). B-cell acute lymphoblastic leukemia

is a type of blood cancer where there are too many premature white blood cells in the blood and bone marrow. This approval opened many doors for the development of Immunotherapy by fostering the exploration of isolation of NK cells and circulation of those cells within the patient's body to combat cancer. Along with that, this encouraged the FDA to then approve the use of this treatment on large B-cell lymphoma and other types of lymphoma the following year (Dobosz et al., 2019).

Immunotherapy has also been tested on and studied in cases of lung cancer. Lung cancer is one of the leading cancers that results in death around the world and finding new routes of treatment has been crucial in revolutionizing the field of oncology. One clinical trial that focused on the use of immunotherapy with lung cancer was documented in Volume 10, Issue 12 of the *Journal of Thoracic Oncology*. In this trial, the researchers focused on patients with metastatic non-small-cell lung cancer (NSCLC) and worked to identify the cancer's immune checkpoint inhibitors (ICIs) (Daley et al., 2015). This was incredibly important work as they not only got to pinpoint what molecular signals are aiding in the growth and development of the cancer, but also were able to explore combined treatment plans.

Comparisons

There are many well-known treatment options in the realm of oncology that are typically utilized first before immunotherapy. Some of these treatment options include chemotherapy, radiotherapy, and surgery. Chemotherapy is the use of drugs to destroy the cancer cells. This form of treatment is a powerful and aggressive form of treatment that does affect the body heavily, especially the immune system. Radiotherapy is the use of radiation to target and overall destroy the cells. Lastly, surgery is simply the removal of tumors through the means of surgery. Surgical treatment is limited to specific types of cancers and can be difficult depending on the complexity of the tumor as well. Compared to these three more traditional options, Immunotherapy is much less aggressive on the body and is a strong option to essentially boost the immune system.

There have been multiple cases where researchers have even combined one of these treatments with the use of immunotherapy. One of these cases was the NSCLC clinical trial. After the researchers collected data and explored the immune checkpoint inhibitors, they decided to couple immunotherapy with radiotherapy. With immunotherapy alone, there was about a 20% response rate to the treatment in the non-small-cell lung cancer patients. From there, the treatment plan was adjusted into a combined strategy. It was decided to combine immunotherapy with radiotherapy because "…radiotherapy has potent immunomodulatory effects and may contribute not only to local control but may also augment systemic antitumor immune response" (Daley et al., 2015). This trial is just one of many examples of how combination of immunotherapy and other treatments can be beneficial and more efficient to not only rid the patient's body of cancer but also to do this while not jeopardizing the patient's overall health.

Discussion

Understanding how cancer treatment is evolving is crucial for researchers and oncologists to determine the best practices for patients around the globe. Immunotherapy is a practice that still needs perfection to increase success rates. Drug resistance, adverse reactions, immune resistance, and primary and acquired immunities are all issues that have inhibited the success of immunotherapy before. It may be important for researchers to next move down the path of recognizing and targeting the mutations of cancer cells and being able to predict mutations before they happen. This would be especially helpful when dealing with tumor mutational burdens (TMB). "TMB has a great effect on the immunotherapy of tumors. With the increase of tumor mutation load, the more new antigens are released" (Tan et al., 2020). Research to discover and predict when these mutations will occur and the new antigens will be presented can help providers to determine a more structured and scheduled treatment plan, possibly even decreasing the duration of treatment necessary. Overall, Immunotherapy's development has made great advances in modern medicine and will continue to be the forefront of evolution in the field of oncology to deliver excellent care and treatment plans to cancer patients.

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