Cancer immuno-oncology: Combining immunotherapy with traditional treatments for better outcomes.

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Introduction

Over the past few decades, significant strides have been made in cancer treatment, with the development of novel therapies revolutionizing how we approach the disease. One of the most promising advances in cancer treatment has been immunotherapy, which harnesses the body's own immune system to fight cancer. Immunotherapy has shown incredible potential, particularly in cancers that have been historically difficult to treat. However, while immunotherapy offers great promise, it does not always work for every patient or every type of cancer. This has led to a growing focus on combining immunotherapy with traditional treatments like chemotherapy, radiation therapy, and surgery. The combination of immunotherapy and these established treatments is emerging as a powerful strategy, offering better outcomes and increasing survival rates for cancer patients [1].

Immuno-oncology refers to the use of immunotherapy to treat cancer. Immunotherapy works by stimulating the body's immune system to recognize and attack cancer cells more effectively. This treatment can take various forms, including immune checkpoint inhibitors, CAR-T cell therapy, monoclonal antibodies, and cancer vaccines. These therapies target specific molecules involved in the immune response, enhancing the ability of immune cells to identify and destroy tumor cells [2].

The advent of immuno-oncology marked a shift from the conventional approach of directly targeting the tumor with drugs, radiation, or surgery. Instead, immunotherapy focuses on enhancing or restoring the body's natural immune defenses to fight cancer. This approach has led to breakthroughs in the treatment of several cancers, such as melanoma, lung cancer, and certain types of lymphoma [3].

While immunotherapy has produced remarkable results, it does not work for every patient or every type of cancer. One of the major challenges is resistance. Not all tumors are equally vulnerable to immune system attacks. Some tumors develop mechanisms to evade immune detection, either by suppressing immune responses or by creating an immunosuppressive tumor microenvironment. These mechanisms can limit the effectiveness of immunotherapy and contribute to treatment failure [4].

Furthermore, not all patients respond to immunotherapy, even if their tumors do not have the usual mechanisms of resistance. This variability in response rates has driven researchers to explore ways to enhance the effectiveness of immunotherapy by combining it with traditional treatments like chemotherapy, radiation, and surgery. By using a combination of therapies, the goal is to overcome resistance and provide more durable responses [5].

Chemotherapy has long been a cornerstone of cancer treatment, and its role in treating various cancers remains critical. However, chemotherapy primarily targets rapidly dividing cells and can have significant side effects due to its effects on normal cells. Combining chemotherapy with immunotherapy has shown promise in improving the immune response to cancer and enhancing the effectiveness of both treatments [6].

Chemotherapy can help boost the effects of immunotherapy in several ways. First, it can increase the visibility of tumor cells to the immune system by causing the release of tumor antigens, which are proteins expressed on the surface of cancer cells. These antigens can help immune cells, particularly T cells, recognize and attack the tumor more effectively. Additionally, some chemotherapy agents can reduce the number of immunosuppressive cells in the tumor microenvironment, allowing the immune system to mount a stronger attack against the cancer [7].

Clinical trials have shown that combining immune checkpoint inhibitors, such as PD-1 inhibitors (e.g., pembrolizumab) or CTLA-4 inhibitors (e.g., ipilimumab), with chemotherapy can lead to improved survival outcomes in cancers like non-small cell lung cancer and triple-negative breast cancer. This combination therapy helps overcome some of the immune evasion tactics employed by tumors, enhancing the overall response [8].

Another powerful combination is the pairing of immunotherapy with radiation therapy. Traditionally, radiation therapy has been used to directly target and kill cancer cells by damaging their DNA. It is especially effective for localized tumors. However, radiation can also affect nearby healthy tissues and may not be effective for tumors that are widespread or difficult to reach [9].

Recent research has demonstrated that combining radiation with immunotherapy may improve the immune system's ability to recognize and attack cancer cells. Radiation-induced tumor cell death can release antigens into the bloodstream,

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***Received:** 1-May-2025, Manuscript No. JMOT-25-164956; **Editor assigned:** 5-May-2025, PreQC No. JMOT-25-164956 (PQ); **Reviewed:** 19-May-2025, QC No. JMOT-25-164956; **Revised:** 26-May-2025, Manuscript No. JMOT-25-164956 (R); **Published:** 31-May-2025, DOI: 10.35841/jmot-10.3.266*

***Citation:** Buatti S. Cancer immuno-oncology: Combining immunotherapy with traditional treatments for better outcomes. J Med Oncl Ther. 2025;10(3):266.*

stimulating a broader immune response. Radiation can also enhance the effectiveness of immune checkpoint inhibitors, promoting T-cell activation and improving the immune system's ability to target tumor cells that might have been resistant to radiation alone [10].

Conclusion

The combination of immunotherapy with traditional cancer treatments like chemotherapy, radiation, and surgery is a rapidly evolving area of cancer research that holds tremendous promise. By leveraging the strengths of each treatment modality, researchers aim to overcome the limitations of individual therapies and provide patients with more effective, durable treatment options. As our understanding of cancer immuno-oncology deepens and new combination strategies emerge, patients may benefit from improved survival rates, fewer relapses, and a better quality of life. The future of cancer treatment lies in the synergy between immunotherapy and traditional treatments, paving the way for a new era of personalized, precision medicine.

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Citation: *Buatti S. Cancer immuno-oncology: Combining immunotherapy with traditional treatments for better outcomes. J Med Oncl Ther. 2025;10(3):266.*