Combination immunotherapy: Enhancing efficacy in cancer care.

Shabbir Lim*

Department of Radiology and Biomedical Imaging, University of California San Francisco, USA

Introduction

Cancer treatment has undergone transformative changes over the past decade, with immunotherapy emerging as a groundbreaking approach. While single-agent immunotherapies have demonstrated remarkable success in certain cancers, the complexity of tumor biology and the variability of immune responses often limit their effectiveness. Combination immunotherapy, which integrates multiple immunotherapeutic agents or pairs them with other treatment modalities, has shown promise in overcoming these limitations and enhancing overall efficacy [1].

Combination immunotherapy leverages different mechanisms of action to stimulate and sustain immune responses against cancer cells. For example, immune checkpoint inhibitors like PD-1/PD-L1 and CTLA-4 blockers can be paired to target different pathways of immune suppression, increasing the chances of robust antitumor responses. Clinical trials have demonstrated that combining agents such as nivolumab and ipilimumab significantly improves outcomes in cancers like melanoma and non-small cell lung cancer compared to monotherapy [2].

One of the primary advantages of combination immunotherapy is its ability to address tumor heterogeneity. Tumors often consist of diverse cell populations with distinct molecular and immunological characteristics. A single agent may not be sufficient to target all these variations. By combining therapies, multiple facets of the immune system can be activated, improving the likelihood of a comprehensive antitumor response [3].

Additionally, combination approaches often incorporate traditional therapies such as chemotherapy, radiotherapy, or targeted therapy. These treatments can modulate the tumor microenvironment, making cancer cells more susceptible to immune attack. For instance, radiotherapy has been shown to induce immunogenic cell death, releasing tumor antigens that activate immune cells, which can then be further stimulated by immune checkpoint inhibitors [4].

However, combination immunotherapy is not without challenges. The increased potential for immune-related adverse events (irAEs) is a significant concern. Toxicities such as colitis, hepatitis, and pneumonitis can arise when multiple immune pathways are simultaneously activated. Therefore, identifying biomarkers to predict responses and adverse effects is crucial to optimize patient outcomes [5].

Biomarker discovery remains a key area of research in combination immunotherapy. Biomarkers such as PD-L1 expression, tumor mutational burden (TMB), and immune gene signatures are being explored to guide treatment decisions. These predictive tools can help identify patients most likely to benefit from combination therapies while minimizing unnecessary exposure to toxicities [6].

Another critical aspect of combination immunotherapy is the timing and sequencing of treatment. Preclinical and clinical studies suggest that the order in which therapies are administered can significantly impact their effectiveness [7].

For example, administering chemotherapy before immunotherapy might reduce immune suppression within the tumor microenvironment, enhancing subsequent immune responses. Despite these challenges, the clinical results from combination immunotherapy trials have been encouraging [8].

Landmark studies have shown durable responses and improved survival rates in cancers previously considered difficult to treat. This has led to the FDA approval of several combination regimens for cancers such as melanoma, renal cell carcinoma, and lung cancer [9].

Looking forward, the development of next-generation immunotherapeutic agents and advanced computational tools for analyzing immune responses are expected to refine combination strategies further. Artificial intelligence and machine learning are being used to predict optimal therapy combinations and identify novel targets, paving the way for more personalized treatment approaches [10].

Conclusion

In conclusion, combination immunotherapy represents a powerful strategy to address the limitations of single-agent therapies in cancer care. By harnessing the synergistic effects of multiple treatment modalities, combination approaches offer the potential for better outcomes, longer-lasting responses, and improved quality of life for cancer patients. However, continued research is essential to optimize these strategies, manage toxicities, and ensure that patients receive the most effective and safe treatments possible.

References

1. Meric-Bernstam F, Larkin J, Tabernero J, et al. Enhancing anti-tumour efficacy with immunotherapy combinations. The Lancet. 2021;397(10278):1010-22.

***Correspondence to:** Shabbir Lim**,** Department of Radiology and Biomedical Imaging, University of California San Francisco, USA. E-mail: shabbir.lim@ucsf.edu

***Received:** 1-Jan-2024, Manuscript No. JMOT-25-157405; **Editor assigned:** 4-Jan-2024, PreQC No. JMOT-25-157405 (PQ); **Reviewed:** 17-Jan-2024, QC No. JMOT-25-157405; **Revised:** 24-Jan-2024, Manuscript No. JMOT-25-157405 (R); **Published:** 31-Jan-2024, DOI: 10.35841/jmot-10.1.242*

***Citation:** Lim S. Combination immunotherapy: Enhancing efficacy in cancer care. J Med Oncl Ther. 2025;10(1):242.*

2. Wang Y, Deng W, Li N, et al. Combining immunotherapy and radiotherapy for cancer treatment: Current challenges and future directions. Front Pharmacol. 2018;9:185.
3. Chyuan IT, Chu CL, Hsu PN. Targeting the tumor microenvironment for improving therapeutic effectiveness in cancer immunotherapy: Focusing on immune checkpoint inhibitors and combination therapies. Cancers. 2021;13(6):1188.
4. Inthagard J, Edwards J, Roseweir AK. Immunotherapy: Enhancing the efficacy of this promising therapeutic in multiple cancers. Clin Sci. 2019;133(2):181-93.
5. Vanneman M, Dranoff G. Combining immunotherapy and targeted therapies in cancer treatment. Nat Rev Cancer. 2012;12(4):237-51.
6. Yap TA, Parkes EE, Peng W, et al. Development of immunotherapy combination strategies in cancer. Cancer Discov. 2021;11(6):1368-97.
7. Yu S, Wang Y, He P, et al. Effective combinations of immunotherapy and radiotherapy for cancer treatment. Front Oncol. 2022;12:809304.
8. Reynders K, De Ruysscher D. Radiotherapy and immunotherapy: Improving cancer treatment through synergy. Immuno-Oncology. 2015;42:67-78.
9. Zhu S, Zhang T, Zheng L, et al. Combination strategies to maximize the benefits of cancer immunotherapy. J Hematol Oncol. 2021;14(1):156.
10. Ott PA, Hodi FS, Kaufman HL, et al. Combination immunotherapy: A road map. J Immunotherap Cancer. 2017;5:1-5.

Citation: *Lim S. Combination immunotherapy: Enhancing efficacy in cancer care. J Med Oncl Ther. 2025;10(1):242.*