OPEN ACCESS Freely available online

Immunome Research

ISSN: 1745-7580

Opinion Article

Immune Checkpoint Inhibitors in Solid Tumor Treatment

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ABOUT THE STUDY

Solid tumors, including cancers of the lung, breast, colon, and more, are responsible for a significant portion of cancer-related deaths worldwide. Traditional cancer treatment modalities such as surgery, chemotherapy, and radiation therapy have been the standard of care for decades. However, the emergence of Immune Checkpoint Inhibitors (ICIs) has revolutionized solid tumor treatment by harnessing the body's immune system to fight cancer.

Immune checkpoint inhibitors are a class of immunotherapy drugs designed to block specific proteins on immune cells or cancer cells, thereby "releasing the brakes" on the immune system. These proteins, known as immune checkpoints, play a crucial role in regulating immune responses. Two of the most well-studied immune checkpoints are Cytotoxic T-Lymphocyte-Associated antigen 4 (CTLA-4) and Programmed cell Death protein 1 (PD-1), along with its ligand, PD-L1.

Mechanisms of action

CTLA-4 inhibition: CTLA-4 is primarily expressed on the surface of regulatory T cells (Tregs) and helps downregulate immune responses [1]. CTLA-4 inhibitors, such as ipilimumab, block this checkpoint, allowing T cells to remain activated, leading to enhanced antitumor immunity [2].

PD-1/PD-L1 inhibition: PD-1 is expressed on activated T cells, while its ligand, PD-L1, is often overexpressed on cancer cells. When PD-1 on T cells binds to PD-L1 on cancer cells, it inhibits T cell activity. PD-1/PD-L1 inhibitors, like pembrolizumab and nivolumab, prevent this interaction, restoring T cell function and enabling them to attack cancer cells [3].

Clinical efficacy

The introduction of ICIs has had a profound impact on the treatment of solid tumors. Numerous clinical trials and real-world data have demonstrated their efficacy in various cancers:

Lung cancer: In Non-Small Cell Lung Cancer (NSCLC), PD-1 inhibitors like pembrolizumab and nivolumab have become standard therapies, either alone or in combination with chemotherapy [4]. They have improved overall survival and quality of life for many patients.

Melanoma: Ipilimumab, a CTLA-4 inhibitor, was one of the first ICIs approved for the treatment of advanced melanoma [5]. Combining ipilimumab with PD-1 inhibitors has further increased response rates.

Renal cell carcinoma: PD-1 inhibitors have shown promise in the treatment of renal cell carcinoma, leading to improved outcomes for patients.

Head and neck cancer: Pembrolizumab and nivolumab have been approved for the treatment of recurrent or metastatic head and neck squamous cell carcinoma, offering new hope for patients [6].

Gastrointestinal cancers: ICIs have demonstrated efficacy in various gastrointestinal cancers, including colorectal, liver, and gastric cancers, often in combination with other therapies.

Breast cancer: Ongoing research is exploring the use of ICIs in breast cancer, particularly in the triple-negative subtype [7].

Challenges and limitations

While immune checkpoint inhibitors have shown remarkable success, they are not without challenges and limitations:

Response rate: Not all patients respond to ICIs, and response rates can vary significantly depending on cancer type and patient characteristics.

Immune-related Adverse Events (irAEs): ICIs can lead to irAEs, which are immune system-related side effects that can affect various organs. These require careful management [8].

Resistance: Some patients may initially respond to ICIs but later develop resistance, highlighting the need for ongoing research into combination therapies and predictive biomarkers.

Biomarker identification: Identifying reliable biomarkers to predict which patients will respond to ICIs remains a challenge, although PD-L1 expression has shown some utility [9].

Cost and access: ICIs can be expensive, and ensuring access to these therapies for all eligible patients is a global concern.

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Received: 07-Aug-2023, Manuscript No. IMR-23-26624; **Editor assigned:** 10-Aug-2023, PreQC No. IMR-23-26624 (PQ); **Reviewed:** 25-Aug-2023, QC No. IMR-23-26624; **Revised:** 01-Sep-2023, Manuscript No. IMR-23-26624 (R); **Published:** 08-Sep-2023, DOI: 10.35248/1745-7580.23.19.243

Citation: Tanegashima T (2023) Immune Checkpoint Inhibitors in Solid Tumor Treatment. Immunome Res. 19:243.

Future prospects

The field of immune checkpoint inhibitors in solid tumor treatment continues to evolve:

Combination therapies: Researchers are investigating combinations of ICIs, as well as combining ICIs with other treatment modalities such as radiation therapy, to enhance their effectiveness.

Biomarker discovery: Efforts are ongoing to identify new biomarkers that can predict response to ICIs more accurately, allowing for personalized treatment approaches.

Overcoming resistance: Strategies to overcome resistance to ICIs, including the development of novel drugs and therapies, are being explored [10].

Expanded indications: ICIs are being investigated in a broader range of cancers, including rare and pediatric tumors.

Improving safety: Research is focused on better understanding and managing immune-related adverse events to improve patient safety.

Immune checkpoint inhibitors have revolutionized the treatment landscape for solid tumors, offering new hope to patients with various cancer types. By targeting immune checkpoints like PD-1 and CTLA-4, ICIs unleash the body's immune system to recognize and attack cancer cells [11]. While challenges such as response rates, side effects, and resistance exist, ongoing research and clinical trials are advancing our understanding of these therapies and improving patient outcomes.

REFERENCES

1. Brierley J. The evolving TNM cancer staging system: An essential component of cancer care. Cmaj. 2006;174(2):155-156.
2. Greene FL, Sobin LH. The staging of cancer: A retrospective and prospective appraisal. CA Cancer J Clin. 2008;58(3):180-190.
3. Burke HB. Outcome prediction and the future of the TNM staging system. J Natl Cancer Inst. 2004;96(19):1408-1409.
4. Hankins JR, Miller JE, Salcman M, Ferraro F, Green DC, Attar S, et al. Surgical management of lung cancer with solitary cerebral metastasis. Ann Thorac Surg. 1988;46(1):24-28.
5. Billing PS, Miller DL, Allen MS, Deschamps C, Trastek VF, Pairolero PC. Surgical treatment of primary lung cancer with synchronous brain metastases. J Thorac Cardiovasc Surg. 2001;122(3):548-553.
6. Lo CK, Yu CH, Ma CC, Ko KM, Leung SC. Surgical management of primary non-small-cell carcinoma of lung with synchronous solitary brain metastasis: local experience. Hong Kong Med J. 2010;16(3):186-191.
7. Boyd JA, Hubbs JL, Kim DW, Hollis D, Marks LB, Kelsey CR. Timing of local and distant failure in resected lung cancer: implications for reported rates of local failure. J Thorac Oncol. 2010;5(2):211-214.
8. Hung JJ, Jeng WJ, Hsu WH, Huang BS, Wu YC. Time trends of overall survival and survival after recurrence in completely resected stage I non-small cell lung cancer. J Thorac Oncol. 2012;7(2):397-405.
9. Darvin P, Toor SM, Sasidharan Nair V, Elkord E. Immune checkpoint inhibitors: recent progress and potential biomarkers. Exp Mol Med. 2018;50(12):1-11.
10. Chirieac LR, Dacic S. Targeted therapies in lung cancer. Surg Pathol Clin. 2010;3(1):71-82.
11. Hiam-Galvez KJ, Allen BM, Spitzer MH. Systemic immunity in cancer. Nat Rev Cancer. 2021;21(6):345-359.