T-cell immunotherapy

T-cell immunotherapy is a type of cancer treatment that harnesses the power of the body's own immune system, specifically T cells, to target and destroy cancer cells. This approach is a form of immunotherapy, which is a broad category of treatments that stimulate the immune system to recognize and attack cancer cells.

T cells are a type of white blood cell that plays a crucial role in the immune system's ability to fight infections and diseases, including cancer. In T-cell immunotherapy, the patient's own T cells are collected from their blood or tumor tissue and then genetically modified or activated in the laboratory to enhance their ability to target cancer cells.

T-cell immunotherapy has demonstrated significant clinical benefits in certain cancer patients, leading to durable responses and even long-term remissions in some cases. However, it's important to note that T-cell immunotherapy can be associated with serious side effects, including cytokine release syndrome (CRS) and neurotoxicity, which need to be carefully managed.

- Oncolytic virus-mediated immunomodulation in glioblastoma: Insights from clinical trials and challenges
- Adoptive cell therapy with macrophage-drug conjugates facilitates cytotoxic drug transfer and immune activation in glioblastoma models
- Probiotic-mediated tumor microenvironment reprogramming with protease-sensitive interleukin-15 and photothermal therapy
- Targeting tumor metabolism to augment CD8(+) T cell anti-tumor immunity
- Selective expansion and differentiation of antigen-specific CD4⁺ T-helper cells by engineered extracellular vesicles
- Spatial Distribution and Prognostic Value of T Cell Subtypes and Immune Biomarkers in p16-Negative HNSCC
- 5-ALA Assisted Surgery of Human Glioblastoma Samples Reveals an Enrichment of T Cells Expressing PD-1 and CD103 in the Intermediate and Marginal Layers
- Inhibition of CCT5-mediated asparagine biosynthesis and anti-PD-L1 produce synergistic antitumor effects in colorectal cancer

There are several key approaches to T-cell immunotherapy:

CAR-T cell Therapy

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T-cell transfer therapy

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T-cell engagers

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T-cell transfer therapy, T-cell engagers, CAR-T cell therapy, T-cell receptor (TCR) therapy, and tumor-infiltrating lymphocytes (TIL) therapy are all immunotherapeutic approaches that involve T cells in the treatment of cancer. However, they differ in their mechanisms, customization, and the way they use T cells to target cancer cells:

T-Cell Transfer Therapy (Adoptive Cell Therapy - ACT):

Mechanism: ACT involves isolating and expanding a patient's own T cells ex vivo (outside the body). These T cells are then modified or activated to enhance their cancer-fighting abilities. Customization: T cells in ACT are customized for each patient. This can involve genetic engineering, such as CAR modification or TCR modification, to make T cells express receptors targeting specific cancer antigens. Infusion: Customized T cells are infused back into the patient's bloodstream, where they can seek out and directly attack cancer cells expressing the targeted antigen. Target: ACT primarily targets cancer cells expressing the specific antigen for which the T cells were customized. It is highly specific to the chosen target. T-Cell Engagers (Bispecific T-Cell Engagers or BiTEs):

Mechanism: T-cell engagers are monoclonal antibodies designed with dual binding specificity. They simultaneously attach to a specific antigen on the surface of cancer cells and T cells. Bridging: T-cell engagers physically bring cancer cells and T cells into close proximity without directly modifying the T cells themselves. Activation: T-cell engagers activate the patient's existing T cells and induce them to attack cancer cells. They work by bringing the immune system's own T cells into contact with cancer cells, promoting their activation and cytotoxic activity. Target: T-cell engagers target a specific antigen present on cancer cells, regardless of the patient's T-cell receptor specificity. They offer a more universal treatment approach for certain antigens. CAR-T Cell Therapy (Chimeric Antigen Receptor T-cell Therapy):

Mechanism: CAR-T cell therapy involves genetic modification of a patient's T cells ex vivo to express a chimeric antigen receptor (CAR) that specifically recognizes a predefined cancer-associated antigen. Customization: CAR-T cells are customized with a specific CAR targeting a predefined antigen, such as CD19 in B-cell malignancies. The CAR combines an antigen recognition domain with T-cell activation domains. Infusion: Modified CAR-T cells are infused back into the patient, where they can recognize and bind to cancer cells expressing the target antigen, leading to T-cell activation and cancer cell destruction. Target: CAR-T cell therapy is highly specific to the chosen target antigen and is mainly used for blood cancers and some solid tumors. T-Cell Receptor (TCR) Therapy:

Mechanism: TCR therapy involves genetic modification of T cells to express T-cell receptors (TCRs) that can recognize specific cancer-associated antigens presented by the major histocompatibility complex (MHC) on cancer cells. Customization: TCR therapy customizes T cells to recognize a particular antigen-MHC complex found on cancer cells. Infusion: Modified T cells are infused back into the patient to target and attack cancer cells expressing the antigen-MHC complex. Target: TCR therapy is highly specific to the chosen antigen-MHC complex and can be used for various types of cancers. Tumor-Infiltrating Lymphocytes (TIL) Therapy:

Mechanism: TIL therapy involves isolating T cells that have naturally infiltrated a patient's tumor tissue. Customization: These T cells are not typically genetically modified or customized in the laboratory. Infusion: Expanded TILs are infused back into the patient, where they can target cancer cells in the tumor. Target: TIL therapy relies on the T cells' inherent ability to recognize and attack

cancer cells within the patient's tumor microenvironment. In summary, these immunotherapies vary in their mechanisms, customization processes, and specificity, making them suitable for different clinical scenarios and cancer types. T-cell transfer therapy, CAR-T cell therapy, and TCR therapy involve customizing T cells ex vivo, T-cell engagers work in vivo to bring the patient's own T cells into proximity with cancer cells, and TIL therapy relies on naturally infiltrating T cells from the tumor microenvironment.