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An Overview of Cancer Immunotherapy

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Perspective

Cancer immunotherapy (also known as immuno-oncology) is the process of stimulating the immune system in order to treat cancer and improve the immune system's natural ability to combat the illness. It is a burgeoning subspecialty of oncology and an application of cancer immunology's fundamental study. Cancer immunotherapy takes advantage of the fact that cancer cells frequently have tumour antigens, chemicals on their surface that immune system antibody proteins can identify and attach to. Proteins or other macromolecules are frequently found as tumour antigens (e.g., carbohydrates). Normal antibodies bind to external pathogens, but the immunotherapy antibodies are changed to bind to tumour antigens, which flag and identify cancer cells for the immune system to suppress or kill. The clinical success of cancer immunotherapy varies greatly between different types of cancer; for example, certain subtypes of gastric cancer respond well to immunotherapy, whereas other subtypes do not. The Nobel Prize in Physiology or Medicine was awarded to American immunologist James P. Allison and Japanese immunologist Tasuku Honjo in 2018 for their discovery of cancer therapy by inhibition of negative immune regulation.

Various forms of cancer immunotherapy became widely used in the 17th and 18th centuries. Septic dressings encapsulating ulcerative tumours were used to treat cancer in the 18th and 19th centuries. Surgical wounds were left open to allow infection to spread, and purulent sores were purposefully generated. In 1891, an American surgeon named William Coley infected patients with incurable tumours with (*Streptococcus pyogenes*), resulting in one of the most well-known impacts of microorganisms on cancer. Immunotherapies are divided into two types: active and passive. Active immunotherapy uses the immune system to specifically target tumour cells. Therapeutic cancer vaccines (also known as treatment vaccines, which strengthen the body's immune system to combat cancer) and CAR-T cell, as well as targeted antibody treatments, are examples. Passive immunotherapy, on the other hand, does not directly target tumour cells but rather improves the immune system's ability to attack cancer cells. Checkpoint inhibitors and cytokines are two examples. Active cellular treatments work by recognising certain antigens and destroying cancer cells. The purpose of cancer vaccines is to induce an immune response to these antigens *via* a vaccine. Only one vaccination has been licenced so far (sipuleucel-T for prostate cancer). Immune cells are removed from the patient, genetically altered to detect tumour specific antigens, and then reintroduced to the patient *via* cell-mediated therapies like CAR-T cell therapy. Natural killer (NK) cells, lymphokine-activated killer (LAK) cells, cytotoxic T cells, and dendritic cells are all cell types that can be employed in this way. Finally, specialised antibodies that recognise cancer cells and target them for immune system destruction can be produced. The goal of passive antibody therapy is to boost the immune system's activity without particularly targeting cancer cells.

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Cytokines, for example, stimulate the immune system directly and boost immunological activity. Immune checkpoint drugs target proteins that typically moderate the immune response (immune checkpoints). This improves the immune system's ability to combat cancer cells. New potential targets for improving immune function are being identified in current research. Antibodies like Ipilimumab, Nivolumab, and Pembrolizumab have been approved as checkpoint inhibitors. Dendritic cell treatment stimulates anti-tumor responses by forcing dendritic cells to offer tumour antigens to lymphocytes, activating them and priming them to destroy additional antigen-presenting cells. Antigen presentation cells (APCs) in the mammalian immune system are called dendritic cells. They help tumour antigen targeting in cancer treatment. Sipuleucel-T is the only licenced cellular cancer treatment based on dendritic cells. Vaccination with autologous tumour lysates or short peptides is one way to get dendritic cells to present tumour antigens (small parts of protein that correspond to the protein antigens on cancer cells). To boost immunological and anti-tumor responses, these peptides are frequently given in combination with adjuvants (particularly immunogenic chemicals).

Proteins or other substances that attract and/or activate dendritic cells, such as granulocyte macrophage colony-stimulating factor, are examples of adjuvants (GM-CSF). Antibodies are an important part of the adaptive immune response, since they aid in the recognition of foreign antigens as well as the stimulation of an immunological response. Antibodies are Y-shaped proteins produced by B cells that are made up of two parts: an antigen-binding fragment (Fab) that binds to antigens and a fragment crystallizable (Fc) area that interacts with Fc receptors found on the surface of immune cells such as macrophages, neutrophils, and NK cells. Antibodies are used in many immunotherapeutic regimens. Antibodies against specific antigens, such as those found on tumour surfaces, are engineered and generated using monoclonal antibody technology. These antibodies, which are specific to tumour antigens, can then be administered into the tumour [1-5].

Treatment

In cancer treatment, there are two types:

1. Monoclonal antibodies that haven't had any extra parts added to them are known as naked monoclonal antibodies. This antibody type is used in the majority of antibody treatments. Monoclonal antibodies that have been conjugated to another molecule that is either cytotoxic or radioactive are called conjugated monoclonal antibodies. Other toxins can be utilised instead of the harmful substances that are commonly used as chemotherapy medications. The antibody binds to antigens on the surfaces of cancer cells, guiding the treatment to the tumour.
2. Radiolabelled antibodies are those that are coupled to a radioactive substance. Antibodies that have been tagged with chemotherapeutic compounds or toxins are referred to as chemo labelled or immunotoxins antibodies. A TLR agonist has also been found to be conjugated to an anti-tumor monoclonal antibody in studies.

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