TECHNOLOGY
NETWORKS

WHAT IS CANCER IMMUNOTHERAPY?

Immunotherapy is a form of treatment that uses parts of a patient's immune system to fight a disease, including cancer. This can be achieved in two main ways:

1. **By stimulating a patient's own immune system to work harder or smarter to attack cancer cells**
2. **By giving a patient 'immune system components' such as man-made immune system proteins**

This infographic summarises the main types of cancer immunotherapy, outlines the pro's and con's of this kind of treatment versus chemotherapy and radiotherapy, and highlights some recent immunotherapy success stories.

CURRENT TYPES OF IMMUNOTHERAPY

MONOCLONAL ANTIBODIES[1]

Naked monoclonal antibodies[3]

The most common cancer immunotherapy

Tell the immune system to attack cancer cells or block cancer growth

Conjugated monoclonal antibodies

Have a chemotherapy drug or radioactive particle attached to them

Attach directly to cancer cells

Bispecific monoclonal antibodies

Bind to cancer cells and activate immune cells simultaneously

Have a low effective dose

Help avoid resistance to treatment

IMMUNE CHECKPOINT MODULATORS[2]

PD-1 or PD-L1 inhibitors and CTLA-4 inhibitors

Target immune checkpoints on T cells

Boost the immune response by activating T-cells

The mAb, Ipilimumab, is the only FDA approved CTLA-4 inhibitor

CANCER VACCINES[3]

Traditional vaccines protect against oncoviruses

Tumour cell vaccines help provoke a stronger immune response

Antigen vaccines boost a patient's immune response and can be mass produced easily.

Dendritic cell vaccines help the body recognise cancer cells

DNA vaccines encode cancer antigens and other immunomodulatory molecules which manipulate the immune response.

ADOPTIVE CELL TRANSFER[4]

CAR T-cell therapy – Chimeric antigen receptors (CARs) are artificially added to the surface of T cells which helps them to attach to the surface of cancer cells.

TCR therapy – T cell receptors (TCRs) recognise tumour-specific proteins from the inside of cancer cells and are engineered to recognise a tumour-specific protein fragment/MHC combination.

GENERAL IMMUNOTHERAPIES

Cytokines – Molecules broadly expressed by immune cells which control the growth and activity of cells in the immune system.[5]

Colony stimulating factors - Boost the production of white bloods cells in a patient's bone marrow.[6]

+ PROS / CONS -

+ PROS	CONS -
Highly Specific	More expensive than chemotherapy
Fewer side effects	Most exciting immunotherapies are not yet in clinic
Powerful, dramatic cures in certain cancers	Cancers can still become resistant

RECENT IMMUNOTHERAPY SUCCESSES

2017 May

In May 2017 the US FDA granted accelerated approval of pembrolizumab as a second-line treatment for all metastatic solid tumour types classified as MSI-hi or dMMR.[10]

2017 Sep

In September 2017 The FDA granted approval of Pembrolizumab to treat advanced, recurrent cancer of the stomach and gastroesophageal junction.[11]

2017 Oct

In October 2017 the FDA approved the CART-cell therapy YESCARTA™ for the treatment of non-Hodgkin lymphoma.[12]

References

1. Markets and Markets. Cancer Immunotherapy Market. Available at https://www.marketsandmarkets.com/PressReleases/cancer-immunotherapy.asp (Accessed December 19 2017)

2. ASCO. Advance of the Year: Immunotherapy 2.0. Available at https://www.asco.org/research-progress/reports-studies/clinical-cancer-advances/advance-year-immunotherapy-20 (Accessed December 19 2017)

3. Weiner, G. J. (2015). Building better monoclonal antibody-based therapeutics. Nature Reviews Cancer, 15(6), 361-370.

4. Haanen, J. B., & Robert, C. (2015). Immune checkpoint inhibitors. In Immuno-Oncology (Vol. 42, pp. 55-66). Karger Publishers.

5. Melief, C. J., van Hall, T., Arens, R., Ossendorp, F., & van der Burg, S. H. (2015). Therapeutic cancer vaccines. The Journal of clinical investigation, 125(9), 3401.

6. Rosenberg, S. A., & Restifo, N. P. (2015). Adoptive cell transfer as personalized immunotherapy for human cancer. Science, 348(6230), 62-68.

7. Lee, S., & Margolin, K. (2011). Cytokines in cancer immunotherapy. Cancers, 3(4), 3856-3893.

8. Metcalf, D. (2013). The colony-stimulating factors and cancer. Cancer immunology research, 1(6), 351-356.

9. Couzin-Frankel, J. (2013). Cancer Immunotherapy-Breakthrough of the year 2013. Science, 342, 1432-3.

10. U.S. FDA. Pembrolizumab (Keytruda) 5-10-2017. Available at https://www.fda.gov/Drugs/InformationOnDrugs/ApprovedDrugs/ucm558048.htm (Accessed December 19 2017)

11. U.S. FDA. FDA grants accelerated approval to pembrolizumab for advanced gastric cancer. Available at https://www.fda.gov/Drugs/InformationOnDrugs/ApprovedDrugs/ucm577093.htm (Accessed December 19 2017)

12. NCI. With FDA Approval for Advanced Lymphoma, Second CAR T-Cell Therapy Moves to the Clinic Available at https://www.cancer.gov/news-events/cancer-currents-blog/2017/yescarta-fda-lymphoma (Accessed December 19 2017)