

Chimeric Antigen Receptor (CAR) T-Cell Therapy

Why in news?

A new development in the field of cancer research called CAR T-cell therapy is currently holding the attention of many researchers worldwide.

What is cancer?

As per the Globocan estimates, the cancer burden worldwide is expected to be 28.4 million cases in 2040, a 47% rise from 2020, due to demographic changes.

- Cancer is a disease in which some of the body's cells grow uncontrollably and spread to other parts of the body.

Types of cancer

- **Carcinoma** - Forms in epithelial tissue that lines most of the organs, internal passageways in the body (like esophagus) and skin.
- **Sarcoma** - Begins in bone or in the soft tissues - cartilage, fat, muscle, blood vessels, fibrous tissue, or other connective or supportive tissue.
- **Leukemia** - Cancer of the body's blood-forming tissues, including the bone marrow and the lymphatic system.
- **Lymphoma** - Cancer of the lymphatic system, which is part of the body's germ-fighting network.

Status of cancer in India

- Based on the cancer registry data it is estimated that there will be about 800,000 new cancers cases in India every year.
- In India, one in nine people are likely to develop cancer in his/her lifetime.
- Lung and breast cancers were the leading sites of cancer in males and females, respectively.

Conventional treatment methods

- **Surgery** (removing the cancer)
- **Radiotherapy** (delivering ionising radiation to the tumour)
- **Systemic therapy** (administering medicines that act on the tumour)

Other technologies related to cancers

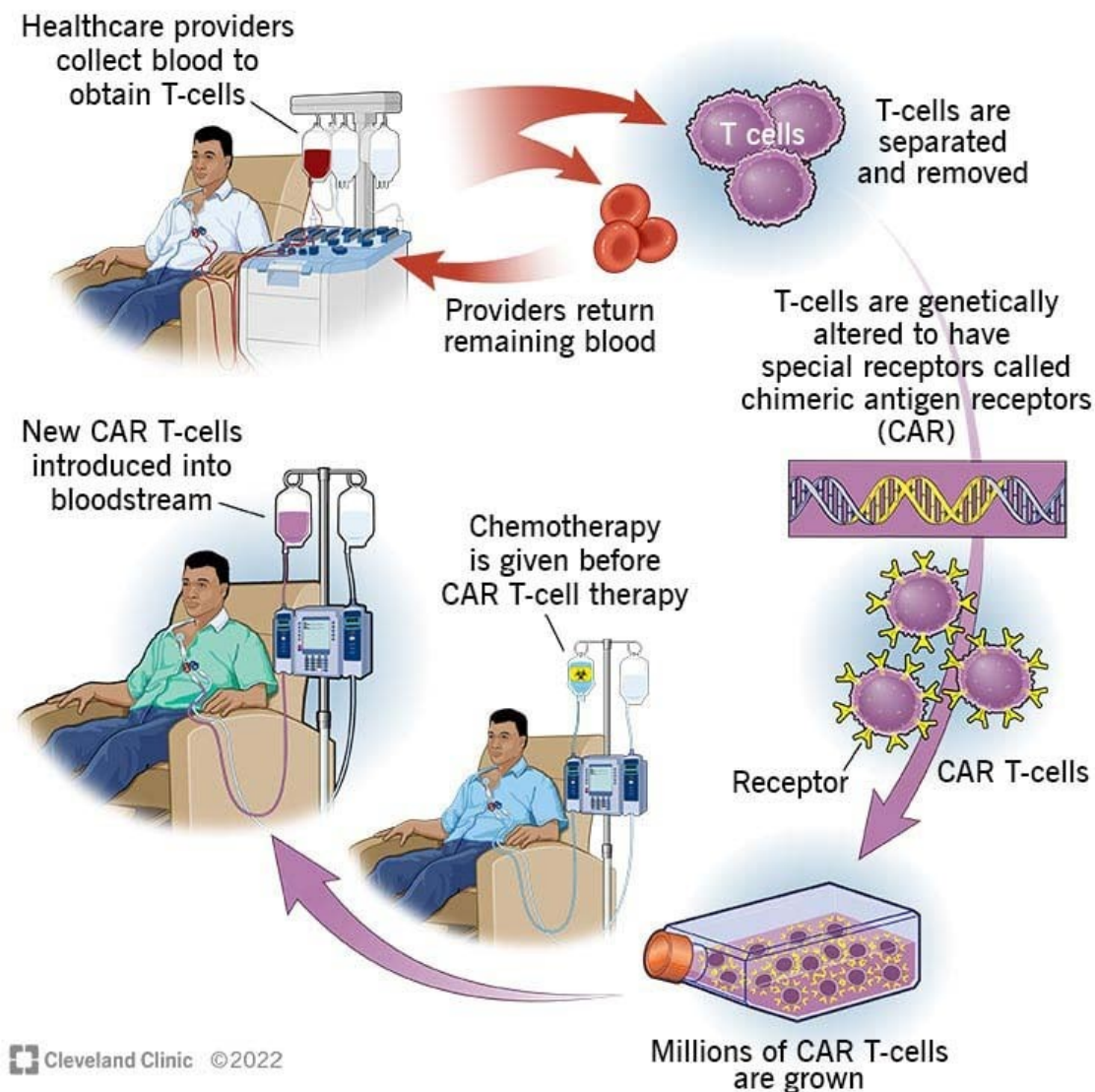
- CAR T-cell therapy

- Use of genomic profiling
- Evolution of gene editing technologies
- Next generation of immunotherapies

What is Chimeric Antigen Receptor (CAR) T-cell therapy?

- **CAR T-cell therapy** - CAR T-cell therapies use a patient's own cells.
- They are modified in the laboratory to activate T-cells (a component of immune cells) to attack tumours.
- These modified cells are then infused back into the patient's bloodstream after conditioning them to multiply more effectively.
- This modification in the cellular structure allows CAR T-cells to effectively bind to the tumour and destroy it.

How CAR T-cell therapy is used to treat cancer



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What is the significance?

- Unlike chemotherapy or immunotherapy, which require mass-produced injectable or oral medication, CAR T-cell therapies use a **patient's own cells**.

- The cells are even more specific than targeted agents and directly activate the patient's immune system against cancer, making the treatment more clinically **effective**
- Chemotherapy or immunotherapy comprises molecules that bind to the tumour or block chemical pathways that allow the tumour to grow or multiply but **don't directly affect the immune system**.
- In CAR T-cell therapy, the immune system is activated when the modified T-cells are reintroduced into the body so the **immune system can't resist** such drugs as like in old treatment methods.

What are pros of cell therapy?

- **Evading Unregulated Cells** - Cell therapy can regulate the unregulated cells by strengthening the immune system.
- **Accomplish Conventional Methods** - CAR t-cell therapy is used where patients with cancers that have returned after an initial successful treatment or haven't responded to previous combinations of chemotherapy or immunotherapy.
- **Success rate is high** - In certain kinds of leukaemias and lymphomas, the efficacy is as high as 90%.
- **For solid tumours** - For prostate, lung, colon, and some other organs, CAR T-cell therapy has been shown to be able to cure patients who have evaded multiple lines of treatment.
- **Understanding complexities** - Cancer constantly evolves to evade treatment so we need to develop more therapies with few-side effects, the solution now is Cell therapies

What are the cons of cell therapy?

- **Cost and Value** - Introducing any new therapy faces the twin challenges of cost and value as CAR T-cell therapy will be unaffordable to most Indians.
- **Insurance coverage** - Having access to the global standard of care is every patient's right but the treatment incurs out-of-pocket expenses for their treatment since insurance coverage is minimal.

References

1. [The Hindu | CAR T-cell therapy is cancer treatment's next moonshot](#)
2. [The Hindu | India to face 'tsunami' of chronic diseases like cancer](#)