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)

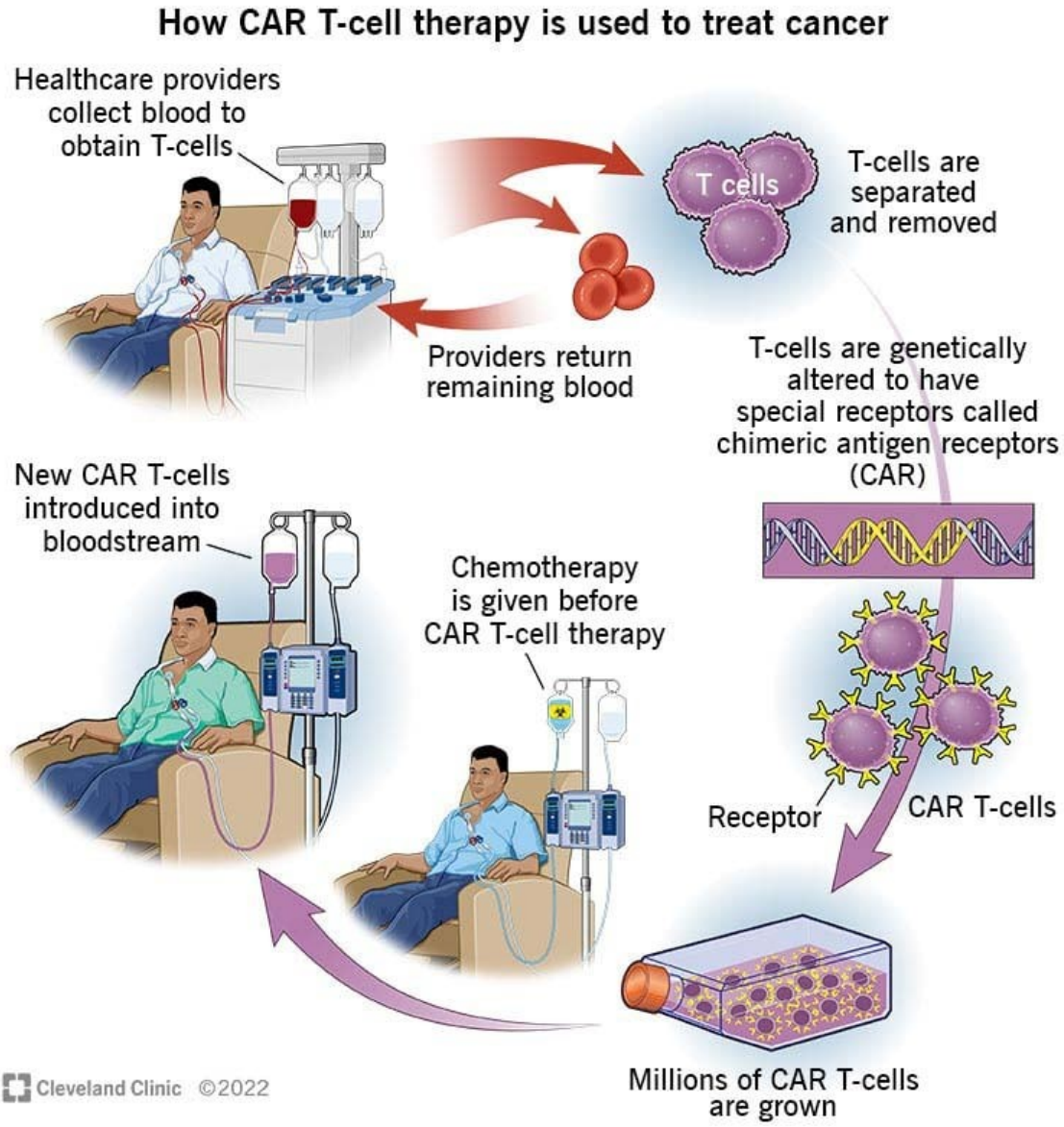
Other technologies related to cancers

- 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.



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