



# CAR-T Cell Therapy

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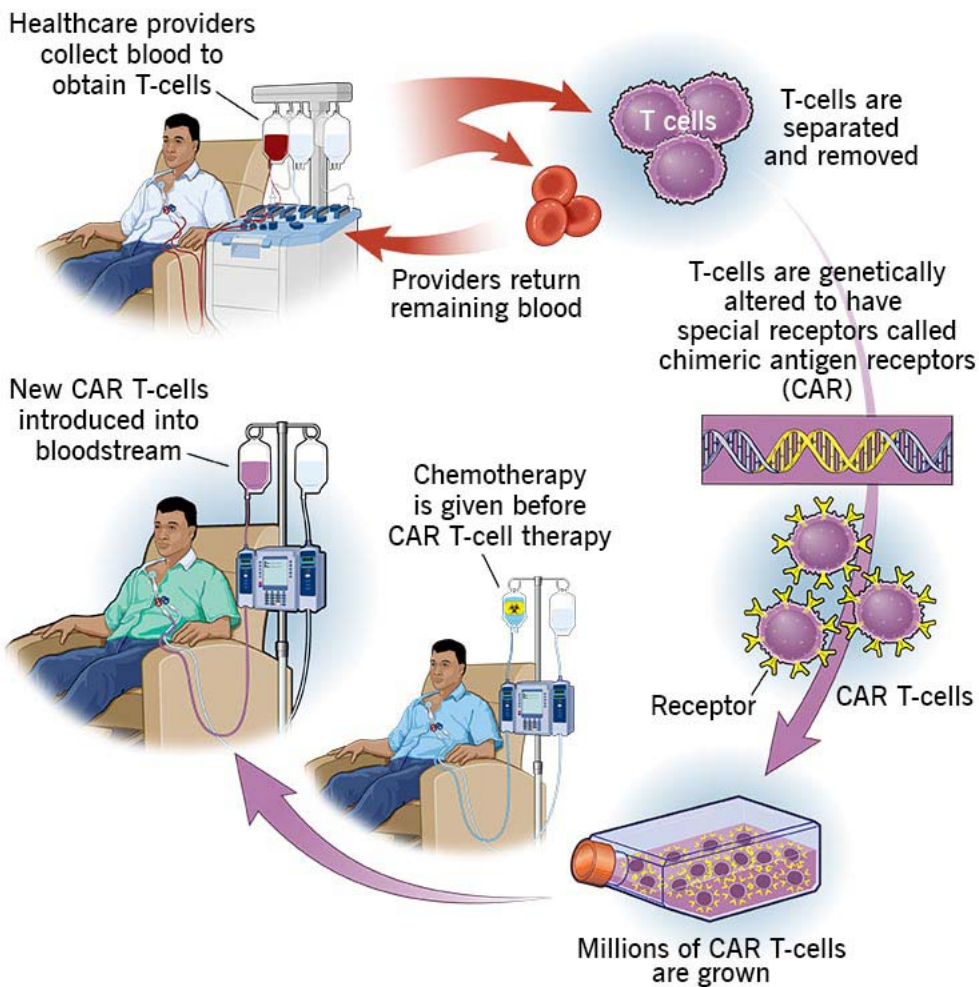
## Why in News?

Following [India's approval of CAR-T cell therapy](#), a pioneering treatment for cancer, a patient recently underwent the procedure, achieving freedom from cancer cells, marking a significant advancement in cancer treatment accessibility in the country.

## What is CAR-T Cell Therapy?

- **About:** CAR-T cell therapy, also known as **chimeric antigen receptor T-cell therapy**, is a type of immunotherapy that uses a patient's own immune system to fight cancer.
  - CAR T-cell therapy has been approved for **leukaemias** (cancers arising from the cells that produce white blood cells) and **lymphomas** (arising from the lymphatic system).
  - CAR-T cell therapies, often referred to as '**living drugs**'.
- **Procedure:** It is a complex and personalised treatment process that involves:
  - **Collecting T cells:** T cells, a type of **white blood cell** that helps fight infection, are extracted from the patient's blood through a process known as **Apheresis**.
  - **Genetic Engineering:** In the laboratory, the T cells are genetically modified to express a special protein called a **chimeric antigen receptor (CAR)** on their surface.
    - This CAR is designed to recognize and bind to a specific **antigen (marker)** found on cancer cells.
  - **Expansion:** The engineered T cells are multiplied in large numbers in the lab.
  - **Infusion:** The expanded **CAR-T cells** are then infused back into the patient's bloodstream, where they can identify and attack cancer cells that express the targeted antigen.

## How CAR T-cell therapy is used to treat cancer



- **Development in India: NexCAR19**, an indigenously developed therapy for **B-cell cancers**, has been collaboratively developed by ImmunoACT, Indian Institute of Technology Bombay (IIT-B), and Tata Memorial Hospital.
  - The commercial use of this therapy to treat certain blood cancers was approved by the [Central Drugs Standard Control Organisation \(CDSCO\)](#) in October 2023.
  - NexCAR19 is the **first CAR-T cell therapy to get CDSCO approval**.

# TREATMENT FOR SPECIFIC B-CELL CANCERS

NexCAR19 is a prescription drug for B-cell lymphomas, lymphoblastic leukaemias when other treatments have been unsuccessful

**PATIENT'S WHITE** blood cells are extracted by a machine through a process called leukapheresis and genetically modified, equipping them with the tools to identify and destroy the cancer cells.



**NEXCAR19 IS** manufactured to an optimal dose for the patient, and typically administered as a single intravenous infusion. Prior to this, the patient is put through chemotherapy to prime the body for the therapy.

## HOW NEXCAR19 WORKS



**T-cells** are naturally made by the body as an advanced defence against viruses and cancer cells.

As T-cells mature, they develop specific connectors (receptors) to target key signals on cancer cells.



**Scientists have** identified certain proteins that are abnormally expressed on the surfaces of specific

types of cancer cells. Specially designed receptors can find and bind to these cells.



**However, cancers** can limit the inbuilt extent and efficiency with which T-cells are able to seek

and fight them. This results in an increase in cancer burden.



**A safe shell** of a virus is used to genetically engineer T-cells so they express Chimeric Antigen

Receptors – connectors that target a protein called CD19 on B-cell cancer.

Source: ImmunoACT

### ▪ Potential Benefits of CAR-T therapy

- **High Remission Rates:** For some patients with advanced cancers who have not responded to other treatments, CAR-T therapy can lead to **high rates of complete remission**.
- **Personalised Approach:** The therapy is tailored to each individual patient's cancer, making it a highly targeted treatment.

### ▪ Potential Risks:

- **Severe Side Effects:** CAR-T therapy can cause serious side effects, including **cytokine release syndrome** (a widespread activation of the immune system and collateral damage to the body's normal cells) and neurological symptoms (severe confusion, seizures, and speech impairment).
- **High Cost:** CAR-T therapy is a very expensive treatment.

## What are the Indian Government's Initiatives Related to Cancer?

- [National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke](#)
- [National Cancer Grid](#)
- Encouraging [Cervical Cancer](#) Vaccination for girls (9-14 years) (Interim Budget 2024-25)

## UPSC Civil Services Examination, Previous Year Question (PYQ)

**Q. Which one of the following statements best describes the role of B cells and T cells in the human body?(2022)**

- (a) They protect the environmental allergens. body
- (b) They alleviate the body's pain and inflammation.
- (c) They act as immunosuppressants in the body.
- (d) They protect the body from diseases caused by pathogens.

**Ans: (d)**

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