Q6

# Stem cell therapy is gaining popularity in India to treat a wide variety of medical conditions including leukaemia, Thallessemia, damaged sornea and several burns. Describe briefly what stem cell therapy is and what advantages it has over other treatments?

UPSC Civil Services Mains 2017 · GS III · 10 marks · Indian Economy

Indian Economy and issues relating to planning, mobilization of resources, growth, development and employment.

## Core demand of the question

- Describe briefly what stem cell therapy is
- State its advantages over other treatments for conditions such as leukaemia, thalassemia, damaged cornea and burns

## Revision summary

Stem cells self-renew and become specialised tissue; therapy transplants or grafts them to repair damage.

Adult haematopoietic cells treat leukaemia and can cure matched thalassemia; limbal cells treat some corneal surface failure; cultured skin treats severe burns.

Autologous grafts reduce rejection compared with many organ transplants.

ICMR-DBT 2017 guidelines distinguish approved use from experimental and commercial misuse.

Unproven injections for many other diseases are not the same as these established indications.

## Introduction

**Stem cells** can divide and become specialised tissues. **Stem cell therapy** uses that property to repair or replace damaged blood, eye surface or skin. In India it is already standard in some **bone-marrow transplants** and **limbal** eye procedures, while many private clinics oversell unproven injections. The science is real for a defined set of conditions. It is not a cure-all.

## Body

### What stem cell therapy is

- A stem cell is **unspecialised** and can self-renew; under signals it **differentiates** into blood, nerve, muscle or other lines.
- **Embryonic** stem cells are pluripotent but raise ethical and tumour-risk issues; **adult** (somatic) stem cells, such as haematopoietic cells in bone marrow and cord blood, are the workhorses of current therapy.
- **Induced pluripotent stem cells** are adult cells reprogrammed in the lab; they are a research tool more than a routine Indian hospital treatment in 2017.

• Delivery may be **autologous** (the patient's own cells) or **allogeneic** (a donor, including matched family or unrelated registries).

• For **leukaemia**, high-dose therapy wipes diseased marrow; transplanted haematopoietic stem cells rebuild the blood system.

• For **thalassemia major**, a matched allogeneic transplant can replace the defective blood-forming system, which transfusions and iron chelation only manage.

• For a **damaged cornea**, **limbal stem cell** grafts restore the eye surface when the limbus is injured; this is not the same as a simple corneal button transplant when the stem-cell niche is gone.

• For **burns**, cultured **keratinocytes** and skin substitutes grown from the patient's cells can cover large areas when donor skin is scarce.

• **Indian Council of Medical Research** and **Department of Biotechnology** guidelines (updated 2017) separate approved clinical use from experimental research and warn against unregulated commercial stem-cell tourism.

## Advantages over other treatments

• **Regeneration rather than only suppression:** unlike lifelong immunosuppressants or repeated transfusions, a successful graft can restore function.

• **Autologous** use cuts **rejection** and some infection risk compared with a foreign organ transplant.

• In blood cancers, transplant can be **curative** where chemotherapy alone leaves residual disease.

• In thalassemia, it can end **monthly transfusion** dependence if a donor match exists.

• Limbal therapy can succeed where a cornea graft **fails** because the surface cannot maintain itself.

• Skin culture can treat **extent of burn** that cadaver grafts cannot cover in time.

• **Limits remain:** graft-versus-host disease in allogeneic transplants, cost, donor shortage, tumour risk if cells are poorly controlled, and **no proven benefit** for many advertised neurological claims.

## Flow diagram

Stem cells self-renew -> Blood marrow leukaemia thalassemia

Stem cells self-renew -> Limbal cornea

Stem cells self-renew -> Skin burns

Blood marrow leukaemia thalassemia -> Advantage rebuild not only suppress

Limbal cornea -> Advantage rebuild not only suppress

Skin burns -> Advantage rebuild not only suppress

ICMR-DBT guidelines -> Approved vs unproven clinics

## Conclusion

Stem cell therapy uses self-renewing cells to rebuild blood, ocular surface or skin. For leukaemia, thalassemia, limbal damage and extensive burns it can outperform repeated drugs, transfusion or simple grafts when protocols are followed. ICMR-DBT rules must keep hospital practice inside evidence, so patients are not sold unproven injections in the name of the same science.

## Facts & figures

### Haematopoietic stem cell transplant

Standard treatment that rebuilds bone marrow after leukaemia therapy or for some inherited blood diseases including thalassemia when a match exists.

### Limbal stem cells

Cells at the corneal limbus that renew the eye surface; grafts can restore vision when chemical injury destroys that niche.

### Autologous vs allogeneic

Own-cell grafts avoid immune rejection; donor grafts can cure but risk graft-versus-host disease.

### ICMR-DBT 2017

National guidelines on stem cell research and therapy that restrict commercial unproven treatments and set ethics and trial rules.

### Cord blood

A source of haematopoietic stem cells stored in public or private banks; public registries matter more for matched unrelated transplants.