PROCEDURE

# Bone marrow transplant

A bone marrow transplant replaces blood-forming stem cells after treatment for certain cancers and blood or immune disorders.

**PURPOSE**
Restore healthy blood and immune cell production

**PROCEDURE TYPE**
Therapeutic, bedside infusion through a central line

**WHERE IT IS DONE**
At the bedside

**ANAESTHESIA**
None

**HOW LONG IT TAKES**
30 minutes to several hours

**PREPARATION**
Health tests, central line, chemotherapy, sometimes radiation

**RECOVERY**
Weeks to months; no driving until your team clears you

**MAIN RISKS**
Infection, bleeding, graft failure, graft-versus-host disease

**RESULTS**
Engraftment blood counts, usually within two to four weeks

## Overview

A bone marrow transplant replaces blood-forming stem cells, which make red blood cells, infection-fighting white blood cells, and platelets. The medical name is a hematopoietic stem cell transplant.

The cells are infused into a vein rather than placed through surgery. They travel to the bone marrow and may begin producing new blood cells, a process called engraftment.

The cells may come from:

Stem cells can be collected from blood or bone marrow. A transplant includes preparation, conditioning treatment, the infusion, and close monitoring during recovery.

- Your own body: An autologous transplant

- A donor: An allogeneic transplant
- Donated umbilical cord blood: A type of allogeneic transplant

## Why the procedure is performed

A bone marrow transplant may treat leukemia, lymphoma, multiple myeloma, myelodysplastic syndromes, severe aplastic anemia, and some inherited blood, immune, or metabolic disorders.

An autologous transplant allows high-dose cancer treatment that would otherwise severely damage bone marrow. Previously collected cells are then returned to restore blood production.

An allogeneic transplant replaces unhealthy cells with donor cells. Donor immune cells may also attack remaining cancer, called the graft-versus-tumour or graft-versus-leukemia effect.

The goal may be to cure the condition, produce a long remission, or control disease when other treatments have not worked.

## Who should and should not have it

A transplant may be offered when its expected benefit outweighs the risks of conditioning and prolonged immune suppression. The decision considers the diagnosis, disease stage, previous treatment, general health, organ function, and your priorities.

For an allogeneic transplant, donors are compared using human leukocyte antigens, or HLA. A closer match may reduce complications, although a fully matched related donor is not always required.

A transplant may be delayed or avoided if:

Age alone does not always rule out transplantation. Lower-intensity conditioning may be possible, but it still carries serious risks. Your team should explain the likely benefits, complications, and alternatives.

- An infection is not controlled
- Heart, lung, liver, or kidney function cannot tolerate conditioning
- The condition is unlikely to benefit
- The disease needs better control first
- Pregnancy makes planned chemotherapy or radiation unsafe

- Intensive monitoring and follow-up cannot be completed safely

## How to prepare

Follow your treating facility's instructions about medicines, eating, drinking, admission, and infection precautions.

Preparation usually includes blood tests, infection screening, and checks of heart, lung, liver, and kidney function. You may also need bone marrow tests, scans, or pregnancy testing.

Tell the team about every medicine, vitamin, and supplement you take. Do not stop blood thinners or other medicines unless instructed.

Before transplantation, conditioning with chemotherapy and sometimes radiation treats the disease, makes space in the marrow, and may suppress your immune system so donor cells can grow.

A central line is usually placed in a large vein for treatment, stem cells, blood tests, fluids, and transfusions.

Conditioning can affect fertility. Before treatment, ask about preserving sperm, eggs, embryos, or ovarian tissue if biological children matter to you. You may also need a caregiver, transport, and accommodation near the transplant centre after discharge.

## What happens during the procedure

The stem cells arrive in a collection bag and may be fresh or frozen. Staff carefully confirm your identity and the cell product.

You usually remain awake while the cells are given through your central line. Staff monitor your temperature, blood pressure, breathing, and heart rate. You may receive medicine to reduce nausea, fever, or an allergic-type reaction.

Frozen cells often contain dimethyl sulfoxide, or DMSO, which may cause an unusual taste or garlic-like breath. Flushing, nausea, chills, or blood pressure changes can occur. Staff can pause or slow the infusion and treat reactions.

The infusion usually takes 30 minutes to several hours. The cells then travel through the bloodstream to the bone marrow.

## Recovery and what to expect afterward

The infusion is usually painless, but conditioning may cause mouth or throat sores, headaches, body aches, abdominal discomfort, or nerve pain. Tell your team about pain.

Nausea, diarrhoea, appetite loss, and taste changes may make eating difficult. Medicines, nutritional drinks, tube feeding, or nutrition through a vein may be needed. Follow your centre's food-safety instructions while your immune system is weak.

Fatigue is common. Gentle activity may be encouraged, but avoid strenuous activity, contact sports, crowds, sick contacts, soil, and other infection exposures as directed.

Do not drive after discharge until your transplant team says it is safe. Weakness, poor concentration, and medicines can impair driving. Returning to work often takes weeks to months and may take longer after an allogeneic transplant.

## Risks and possible complications

Conditioning causes very low blood counts, increasing the risk of infection, anemia, and bleeding until engraftment. You may need antimicrobial medicines and blood or platelet transfusions.

Other risks include:

After an allogeneic transplant, donor immune cells may attack your tissues. This is graft-versus-host disease, or GVHD. It can affect the skin, digestive system, liver, mouth, eyes, lungs, or other organs and may develop early or later.

Complications can be life-threatening, and treatment-related death is possible. Individual risk depends on the disease, transplant type, donor match, conditioning plan, and general health.

- Mouth and digestive tract inflammation
- Nausea, diarrhoea, dehydration, and poor nutrition
- Liver, kidney, lung, or heart injury
- Graft failure
- Infertility or early menopause
- Cataracts, hormone problems, or later secondary cancers

## Results and follow up

Frequent blood tests check for engraftment. White blood cells often recover first, followed by platelets and red blood cells. This commonly begins within a few weeks but varies by

transplant type and cell source.

After an allogeneic transplant, chimerism testing may show how much blood formation comes from the donor. Other tests check the underlying disease.

Follow-up also monitors infection, GVHD, nutrition, organ function, and medicine side effects. Take immune-suppressing medicines exactly as prescribed and never stop them suddenly.

Protection from earlier vaccinations may be lost. Your team will provide a new vaccination schedule when your immune system has recovered enough.

## Alternatives

Alternatives depend on the condition, previous treatment, and goals of care. They may include:

For some conditions, autologous transplantation may be an alternative to allogeneic transplantation. It avoids GVHD but lacks a donor immune effect and may return hidden abnormal cells.

- Standard-dose chemotherapy: Less intensive, but sometimes provides less disease control
- Targeted therapy: Treats specific cancer features when a suitable target exists
- Immunotherapy: Redirects the immune system and has different risks
- CAR T-cell therapy: May treat certain blood cancers, but eligibility and availability vary
- Supportive treatment: Manages anemia, bleeding, infection, and symptoms
- Observation: May suit stable or slow-growing conditions
- A clinical trial: Provides access to newer treatments with uncertain benefits and risks

## When to call your healthcare team

During recovery, contact your transplant team promptly for any fever at or above the threshold they gave you. Call the same day for a new rash, worsening diarrhoea, persistent vomiting, yellow skin or eyes, painful urination, unusual bruising, line redness, or difficulty taking medicines or fluids.

Seek emergency help for severe trouble breathing, chest pain, uncontrolled bleeding, a seizure, fainting, sudden confusion, or difficulty waking.

Do not wait for a routine appointment. Your transplant centre may want you to call before attending an emergency department so staff can prepare for your infection risk.

## Common questions

Will I be asleep?

Usually not. The infusion is given through a central line while you are awake. Anaesthesia used to collect a donor's marrow is a separate procedure.

Can I drive home?

Not unless your transplant team clears you. Arrange for someone else to drive.

How painful is it?

The infusion is usually painless. Conditioning and recovery can cause mouth sores, digestive discomfort, headaches, and body aches. Supportive treatment is available.

When will I know if it worked?

Blood tests may show engraftment within a few weeks. Disease response and long-term success are assessed over months or years.

How long will I be in hospital?

Some autologous transplants are managed partly as outpatient treatment. Many people stay in hospital for several weeks, especially after an allogeneic transplant or if complications occur.

Will I need a perfectly matched donor?

Not always. Options may include matched unrelated donors, partially matched family donors, and cord blood. The best source depends on your condition and treatment plan.

## Sources

- National Cancer Institute: Stem Cell Transplants in Cancer Treatment
- National Heart, Lung, and Blood Institute: Blood and Bone Marrow Transplant
- NMDP: The Blood and Marrow Transplant Process
- American Cancer Society: Getting a Stem Cell or Bone Marrow Transplant
- Carreras E, Dufour C, Mohty M, Kröger N, editors: The EBMT Handbook-Hematopoietic Stem Cell Transplantation and Cellular Therapies, Springer