

Allogenic Stem Cell Transplant

Stem cell transplants treat several forms of blood cancer, including leukemia and multiple myeloma. They are also a treatment for serious diseases that are not cancer such as aplastic anemia.

Problems in the bone marrow cause all these diseases. To understand stem cell transplants, it is important to know how bone marrow works in your body.

What is bone marrow and what does it do?

Bone marrow is spongy material inside bones. Stem cells in the bone marrow develop into different types of blood cells. Each cell type has a function:

- Platelets help blood clot to control bleeding.
- Red blood cells carry oxygen throughout the body.
- White blood cells help fight infection.

Bone marrow makes new cells and sends them into the blood as old cells die. This process is always happening so the blood has fresh cells whenever it needs them.

What is an allogeneic transplant?

In an allogeneic stem cell transplant, healthy cells from a donor replace unhealthy cells in the bone marrow. Before the transplant, the patient receives high-dose chemotherapy and sometimes radiation to treat the disease. After this treatment, the patient receives donated stem cells. The donor may be related to the patient or unrelated. All donors go through testing to make sure donated stem cells are the right match for the patient.

Who can be a stem cell donor?

Finding the best donor

Finding the best donor lowers your chances of getting graft-versus-host disease (GVHD). GVHD happens when the immune system of the donor's cells (graft) attacks your body's own tissues (host). The cells from the donor do not recognize the tissues and organs of your body.

Human leukocyte antigen (HLA) typing helps match transplant patients with donors. HLAs are proteins on the surface of most cells in the body. Antigens help the body notice the difference between healthy cells and unhealthy cells, such as cancer. HLA typing is done with

the potential donor's saliva or blood sample. The goal is to find a donor with 10 specific antigens that are the same as the patient's. A close match between the HLA antigens of the donor and patient lowers the risk of the body rejecting the new stem cells and causing GVHD.

Once the donor is chosen, they go through a screening process to make sure they are the best donor for you. The donor has blood tests, a pregnancy test if appropriate, and a vein assessment. Vein assessment makes sure their veins are large enough for the stem cell collection. Donors 50 years and older also have a chest x-ray and an electrocardiogram. After these tests, the potential donor sees a transplant doctor to have a physical exam and be cleared for donation.

Types of transplant donors

- Matched related donor (MRD): Biological siblings have a 25% chance of being a full match.
- Matched unrelated donor (MUD): Unrelated donors can be identified through worldwide registries such as the National Marrow Donor Program (NMDP).
- Haploidentical donor: Siblings, parents, or biological children who are half-matched can be donors.
- Mismatched donor: This can be a related or unrelated donor who is not a full match.
- Cord blood donor: Stem cells are collected from a newborn infant's placenta or umbilical cord. A blood bank keeps the cells frozen until needed. Worldwide registries help track these donors.

What are the types of stem cell donation?

Your transplant doctor will determine the best source of stem cells from your donor, either peripheral blood stem cell (PBSC) or bone marrow.

PBSC donation

PBSC are stem cells in the bloodstream collected through a non-surgical procedure called apheresis. During apheresis, blood goes from an IV line in the donor's vein to a machine that collects the stem cells. The rest of the donor's blood is returned to the donor through a second IV line into a different vein. The stem cells are either used the same day or frozen and used

later, depending on your treatment plan and your donor's availability.

For five days prior to the PBSC donation, the donor will get daily shots of a drug called filgrastim. This drug increases the number of stem cells in the blood. After the donation, the body naturally replaces the stem cells within 24 hours and the donor can return to normal activities the next day. Depending on the type of donor, the shots and apheresis will take place at the Blood and Marrow Transplant (BMT) clinic or as arranged through the NMDP registry.

Bone marrow donation

Depending on the type of donor, the collection takes place at the cancer hospital or as arranged through the NMDP registry. The donor receives medicine to make sure they feel no pain. The doctor uses a large needle to take bone marrow from the donor's hip bone. Usually, the donor goes home the same day and recovers from the procedure in about a week. The stem cells from the fresh bone marrow are processed and either used the same day or frozen and infused later.

What happens during the transplant?

Testing

Before your transplant, your transplant team will arrange for diagnostic testing. This testing is to check the status of your disease and to ensure it is safe for you to proceed with transplant. Testing could include, but not be limited to, blood work, imaging, pathology testing, heart and lung testing, and dental exam.

Conditioning

To prepare you for the stem cell transplant, you will receive high doses of chemotherapy. This is called pre-transplant conditioning or preparative regimen.

Depending on your treatment plan, you may also get radiation treatment to your entire body. This is called total body irradiation (TBI).

You will also get medication to help prevent GVHD and other side effects.

Most patients will come to the hospital for pre-transplant conditioning and stay until they are well

enough to go home or to local housing after the transplant.

Pre-transplant conditioning treatment destroys any remaining disease and prepares your marrow for new stem cells. The conditioning can also harm other healthy cells in your bone marrow. Your transplant team will tell you about the possible risks.

Transplant

The day you receive your new stem cells is called your transplant day. This is also called Day 0. All days before the transplant are counted with "minus" numbers. All days after the transplant are counted with "plus" numbers. For example, you may have chemotherapy from Day -4 through Day -1. The day after your transplant is Day +1.

On Day 0, the technician prepares the stem cells for infusion. The transplant nurse will give the stem cells to you through your IV line.

The transplanted stem cells will move from your bloodstream to the bone marrow. They will begin to create new blood cells. The transplant team will test your blood often to keep track of this process.

Your immune system will be very weak and you will get several medicines to prevent infection. A nurse will check your temperature often because fever is a sign of infection.

In the days after your transplant, you are likely to have side effects from chemotherapy and radiation, including:

- Nausea and/or vomiting
- Fatigue
- Fever
- Rashes
- Mouth sores
- Constipation
- Diarrhea

Your transplant team will tell you ways to prevent and ease these side effects.

Engraftment

Engraftment means that the transplanted stem cells have started producing white blood cells, red blood cells, and platelets. After your transplant, your team will perform an absolute neutrophil count (ANC). The ANC tells them how many neutrophils, a type of white blood cell, are present. When your ANC is more than 500 for three days in a row, engraftment has happened.

Engraftment can happen as soon as 10 days after transplant, but it is normal for it to take longer. It can take up to 28 days after a peripheral blood or bone marrow transplant. It can take up to 42 days after a cord blood transplant. Once you have engrafted, your immune system will get stronger again and your transplant team can stop some of the medicines that prevent infection.

Recovery

For inpatient transplants, you can leave the hospital once engraftment happens and you are well enough. If you live within 40 miles (a 60-minute drive) of Huntsman Cancer Institute, you can go home. If you live farther away, you will need to stay locally for at least 100 days after Day 0.

For outpatient transplants, you must live within 20 miles (a 30-minute drive) for at least 100 days after your transplant date (Day 0).

During recovery, you will still have a high risk of infection. Some patients have infections, nausea, or diarrhea after leaving the hospital.

You will need a caregiver to help you at home 24 hours a day after you leave the hospital for at least 100 days after your transplant (Day 0).

You must come for follow-up visits at the BMT clinic 1 to 3 times a week. At these visits, the transplant team will check your health and you will have blood tests. You may get IV fluids or blood transfusions. The transplant team will adjust your medicine as needed and monitor you for infection and GVHD.

The transplant team works with a home health care agency that can give IV medicines and fluids if you need them between visits. Some problems may require you to go to the BMT clinic more often and you may need to stay in the hospital again.

About 100 days after your transplant, you and your caregiver will meet with a BMT staff member to review best practices for your safety after your clinic visits end. You will also receive a survivorship care plan that includes the following:

- Details of your transplant therapy.
- Signs and symptoms to watch for.
- Your schedule for follow-up visits.

If you have been staying in temporary lodgings, you can return to your home for the rest of your recovery.