

Allogeneic Stem Cell Transplant

Utah Blood and Marrow Transplant Program

Stem cell transplant is treatment for several forms of blood cancer including leukemia and multiple myeloma. It is 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 how a stem cell transplant works, 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. Prior to the transplant, the patient receives a treatment of high-dose chemotherapy and sometimes radiation to treat the disease. After this treatment, the patient receives donated stem cells. The donor can be related to the patient or unrelated. To make sure the donor's stem cells are the right match for the patient, the donor will go through testing.

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 stem cell 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 patients. The closest match between the HLA markers of the donor and patient lowers the risk of the body rejecting the new stem cells (graft versus host disease).

Once the donor is chosen, they will go through a screening process. This process ensures they are the best donor for you. The screening process involves donor work-up and a physical exam. During the work-up, the donor will have tests done including blood tests, a pregnancy test if appropriate, and vein assessment. Vein assessment ensures the veins are large enough for the stem cell collection. Donors 50 years and older will have an electrocardiogram and chest x-ray. After the workup, the potential donor will see a transplant doctor to be cleared for donation.

Types of Transplant Donors

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: These can be first degree relatives or an unrelated donor who is not a full match.
- Cord blood donor: Stem cells are collected and stored from a newborn infant's placenta or umbilical cord. A blood bank keeps these cells frozen until needed and worldwide registries help find donors.

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 (BM).

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 donor 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, shots and apheresis takes 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 in an operating room at the HCI's 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.

Pre-Transplant Workup Tests

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's 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.

Preparation for the Transplant

To prepare you for the stem cell transplant, you will receive high doses of chemotherapy known as pre-transplant conditioning or preparative regimen. Depending on your treatment plan, you may also get

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 the pre-transplant conditioning and stay until they are well enough to go home or to local lodgings. The pre-transplant conditioning treatments destroy any remaining disease and prepare your marrow for new stem cells however they harm healthy cells in your bone marrow. Your transplant team will tell you about the possible risks.

Transplant

Day 0 is your transplant day. This is the day you receive your stem cells. All days before the transplant have "minus" (-) numbers. All days after it have "plus" (+) numbers. For example, if you have chemotherapy on Day -4 through Day -1, and then have your transplant, the day after your transplant is Day +1.

On Day 0, the technician prepares the stem cells for infusion and the transplant nurse gives you the stem cells through your IV line. These transplanted stem cells will move from your bloodstream to the bone marrow and begin to create new blood cells. The transplant team will do lab tests on your blood often to keep track of this progress.

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:

- 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 working, producing white blood cells, red blood cells, and platelets. After your transplant, we perform an absolute neutrophil count (ANC). This tests your blood often to see how many neutrophils, a type of white blood cell, are present. When your ANC is more than 500 three days in a row, engraftment has happened.

The engraftment date varies from person to person. Once you have grafted, your immune system will get stronger again and your transplant team can stop some of the medicine preventing infection.

Leaving the Hospital and Recovery

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

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

You will be in recovery. You will still have a high risk of infections. Some patients have a hard time with infections, nausea, or diarrhea after leaving the hospital.

After you leave the hospital, you will need a caregiver to help you at home 24 hours for at least 100 days after your transplant (Day 0). You must come for follow-up outpatient visits at the BMT Clinic 1-3 times a week. At these visits, the transplant team will check your health. You will have blood tests and may get IV fluids or blood transfusions. The transplant team will adjust your medicines as needed. At these visits, your transplant team will also help you if infection or GVHD happen.

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

About 100 days after you leave the hospital, 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
- What to watch for
- Schedule for follow-up visits with your transplant doctor at the clinic

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