Allogeneic Stem Cell Transplant

This section is for patients who may receive donor stem cells from peripheral blood or bone marrow.

**General Information**

Stem cells are collected from three sources:
- Blood
- Bone marrow (spongy tissue found inside the large bones of the body)
- Newborn baby’s umbilical cord after birth

During an allogeneic transplant, stem cells are collected from a donor and infused into a patient. A special blood test called human leukocyte antigen (HLA) typing checks to make sure the patient and donor are a match. This test requires 2 separate blood draws on 2 different days. The donor may be:
- An identical twin (a syngeneic transplant)
- A relative
- Someone who is not a relative (matched unrelated donor, or MUD transplant)
- A newborn baby (umbilical cord blood transplant)

Before the transplant, you will receive high doses of chemotherapy and/or radiation to destroy the cancer cells. However, this also causes damage to cells in other parts of the body, including the bone marrow and immune system. The immune system is the body’s defense against disease and infection. This process also causes damage to healthy blood cells.

The stem cell transplant allows your body to create new, healthy blood cells from the donor stem cells.

**Graft-Versus-Leukemia Effect**

Graft-versus-leukemia or graft-versus-disease effect (GVL/GVD) is a major benefit of an allogeneic transplant. It occurs when the donor’s cells destroy your cancer cells because it sees them as foreign and different.

**Types of Allogeneic Transplants**

Your doctor will discuss the type of transplant that is best for you.

**Related Donor**

This type of transplant is done if a family member, such as a brother or sister is a HLA match.
**Syngeneic Transplant**
A syngeneic transplant is done when you have an identical twin. Since twins have the same genes, there is less risk of problems. The patient usually tolerates this type of transplant very well.

**Matched Unrelated Donor (MUD) Transplant**
If a family member is not a match, your doctor might recommend a search for a matched unrelated donor (MUD). The search looks at HLA typing from donor volunteer registries to find a possible donor. These lists are updated often.

Finding an exact HLA-matched donor is a challenge. There are many donor registries in the U.S and the world with advances in tissue typing and computer data collection to help find the best HLA donor.

Thousands of new donors register each month with the National Marrow Donor Program. Finding a MUD for African Americans, Hispanics, Asians and other minority and ethnic patients may be a challenge. Awareness and recruitment campaigns aimed at minority donors hope to improve this process.

**Umbilical Cord Blood Transplant**
Many transplants are being done using stem cells from umbilical cord blood due to an increase in public cord blood banks.

If you do not have a donor, you may be a candidate for cord blood transplant. The benefit of using cord blood is that it is likely to be available right away. A drawback is that the number of available stem cells from one umbilical cord donor is a small amount. There may not be enough stem cells to do a transplant.

**Non-myeloablative Transplant**
A non-myeloablative transplant (a mini transplant) is a type of allogeneic transplant. This type of transplant uses low-dose chemotherapy and radiation to prepare you for the transplant. The stem cells from your donor briefly co-exist with your own cells and work together to fight cancer cells. Side effects are usually less severe, and you may have a shorter hospital stay.

**Pre-transplant Phase**
The pre-transplant phase involves a few important steps. We will:
- Confirm financial approval
- Make sure the disease stage will respond to treatment
- Find a HLA-matched donor, which can be a long process

For some patients, the pre-transplant phase is quite short, for others the process can take months. This depends on any problems or delays. There can be problems with disease control, finding a donor match, or with finances. Your transplant coordinator will guide you through this process.
HLA Typing

HLA typing is a special blood test that needs to be done if you are being considered for an allogeneic transplant. The test finds antigens, which are proteins in white blood cells, and compares them to a donor’s. Antigens make each person’s tissue type unique. Both you and your family members should have HLA typing done to help find a HLA-matched donor match.

Finding an HLA-Matched Donor

Finding the most highly matched donor available is very important. There is less risk of problems if you and the donor are HLA-matched.

An HLA sibling is the best donor for an allogeneic transplant. This is because parents pass on one half of their HLA typing to their children. A brother or sister has a 25 percent chance of being a match with the patient.

There is about a 1 percent chance of being matched with a parent, child or distant relative.

MD Anderson must complete the donor HLA typing. If you have siblings that live in the Houston area, they may come to MD Anderson to be HLA typed. If they live outside of the area, we can mail HLA kits directly to them. A local lab facility (e.g. Labcorp®) can take their blood samples. Instructions on how to return the kit to MD Anderson are included. It takes about 2 to 4 weeks to get the HLA typing results.

Financial approval for the test is needed before testing can occur.

If a Family Member Is a Match

If a family member is a match, the related stem cell transplant coordinator will be your main contact. This coordinator reviews your family member’s health history to confirm that he or she is in good health to be your donor. Conditions such as high blood pressure, diabetes or high cholesterol need to be assessed, but seldom keep someone from being a donor.

Your transplant process and the donor’s stem cell collection is coordinated by the transplant coordinator. Donors must come to MD Anderson for the stem cell collection procedure. It can take up to 2 weeks to complete the collection process.

Any recent history of cancer or an autoimmune disease, like rheumatoid arthritis or multiple sclerosis, needs further assessment by the treatment team. This may prevent your family member from being a donor.

If more than one sibling is a match, your treatment team will decide which donor is best based on age, gender, health and other criteria

If You Do Not Have a Family Member Match

If no family member is a match, the unrelated stem cell transplant coordinator will start the process of finding an unrelated donor.
Unrelated Donor Search

Initial Search for an Unrelated Donor
Possible donor matches can be found quickly using a worldwide donor database. This only gives initial information. HLA testing is required to find a donor match.

Formal Search for an Unrelated Donor
The transplant coordinator and your transplant doctor work together to find the best donor for you. The search starts after you give consent and financial clearance is complete.

The donor search can be costly. Your insurance company will review your request. If your insurance does not cover a donor search, the transplant coordinator will give you a quote for the cost of the search, and a financial counselor will review it with you.

Once a search begins, the transplant coordinator will help with the following:
- Review the list of possible donors and choose the most suitable ones for further testing. Donor registries provide results from the HLA typing as early as 2 weeks. This process can take longer.
- Ask the donors to send a blood sample to MD Anderson for HLA typing. Once the blood arrives to MD Anderson, it may take 7 to 10 business days to confirm the donor’s HLA typing.
- Review the test results and work with your care team to decide if the donor is a good match.

When a Donor Is Found
Once a donor is found, you and your care team will decide the best time for the transplant. This depends on many factors, such as:
- Your disease status
- The date of your last chemo treatment
- Whether you have an infection
- Donor availability

If there is a special event in your life, such as a wedding, birth of a child or holiday, we will try to plan your transplant around it. Talk with your doctor about events that you would like to plan around.

Stem Cell Collection

Related Patient and Donor Transplant
For donors who are relatives, the related stem cell transplant coordinator will schedule the stem cell collection as close to the transplant date as possible. If needed, the team may allow the collection to happen weeks to months before the transplant.
Unrelated Patient and Donor Transplant
For unrelated transplant patients, the unrelated stem cell transplant coordinator will file a request with the National Marrow Donor Program to request stem cell donation dates. During this same time, you will start testing and chemotherapy. Your transplant coordinator will discuss details with you so you can prepare for your stay in Houston. See the steps below about the process.

Step 1 – Contact the Donor
- The donor is contacted and told that he or she is a match. If the donor is interested in donating, he or she attends an information session about the donation process.

Step 2 – Donor Consent and Exam
- If the donor gives consent to donate, a doctor from the donor center will do a complete physical exam.
- Once donation dates are set, you will prepare for the transplant. This includes having required tests and signing the transplant consent forms.
- If the donor is unable to donate or decides not to donate, your doctor and transplant coordinator will talk about other options (i.e. search for another donor).

Step 3 – Transplant Approval
- Once the doctors approve the transplant for you and the donor, you will start chemotherapy and the admission process.

Step 4 – Transplant Day
- A certified collection center will collect the stem cells on the day of transplant and send them to MD Anderson for the lab to process.
- You will receive the donor’s stem cells on the transplant day.

Some patients may want to contact their donor. Guidelines vary with each donor center. Talk with your transplant coordinator about this once you proceed with the transplant.

Peripheral Blood Stem Cells or Bone Marrow Collection

Stem cell collection is a procedure that involves separating and collecting stem cells from the blood or bone marrow and storing them for transplant. There are 2 main ways to collect stem cells:
- Apheresis is a process that collects peripheral blood stem cells (PBSC) from the bloodstream.
- Bone marrow collection (harvest) is a process that collects cells directly from the bone marrow.

Peripheral Blood Stem Cell Collection (PBSC) Using Apheresis
Apheresis is the most common method used at MD Anderson for stem cell collection. It is usually done on an outpatient basis in 3 phases: mobilization, monitoring and collection.
Mobilization Phase
During the mobilization process, stem cells are prepared for collection. The donor receives growth factor injections, such as G-CSF (Zarxio®) or G-CSF with Mozobil™, under the skin. This medicine helps the body make stem cells and increases the number of stem cells in the blood. A stem cell transplant clinic nurse will teach the donor or a member of his or her family about how to give the medicine.

Growth factor injections may cause bone pain because the bone marrow is making more stem cells. The pain goes away once the injections stop.

Monitoring Phase
When donors receive the growth factor prescription, they also get an appointment for a lab visit a few days after starting the shots. During the lab visit, the clinic staff takes a blood sample and tests it to see how many stem cells have moved from the bone marrow out into the bloodstream. The test takes a few hours to run. The results show if the donor is ready to start the donation. If there are not enough stem cells, the donor will come to the lab each day for tests. Once the tests show that there are enough stem cells in the bloodstream, the clinic team will schedule an apheresis appointment to collect the stem cells.

Collection Phase
Related donors usually donate cells through an intravenous catheter (IV) in each arm. One arm is used to draw the blood out of the body and into the aspheresis machine. The machine filters out the stem cells. The other arm is used to return the blood to the body. See Figure 1.

Some donors may need a central venous catheter (CVC) for the procedure. Your health care team will discuss this with the donor before the procedure. Patients will have a central venous catheter (CVC) inserted for the transplant procedure.

The donation procedure normally takes about 4 hours. It may take longer depending on how quickly the stem cells are removed from the blood. After the procedure, the apheresis nurse will give the donor an instruction sheet about self-care.

Bone Marrow Collection (Harvest)
Doctors usually do bone marrow collections while the donor is asleep, using sedation. In an operating room, the doctor uses a special needle to remove marrow from the back of the hip bone. The process usually takes about 1 hour to collect all the bone marrow needed for the transplant. The stem cell transplant coordinator and clinic nurse will help prepare the donor for the procedure and answer any questions.
Admission for Stem Cell Transplant

Pre-admission Testing
You will need a series of tests before being admitted for the stem cell transplant. The tests assess your condition and health. Some may be tests you have already had, but they need to be done again within 30 days of your transplant.

The test results help your health care team make sure that it is the best time for you to have a transplant. The results also tell the team if you have any health conditions that may need more assessment.

Common tests include:
- Echocardiogram. This test checks blood flow through the heart.
- Pulmonary function test. This test checks the health and strength of the lungs.
- CAT/PET scan. This test checks location and activity of some cancers.
- Bone marrow aspiration. This test checks for cancer in the bone marrow.
- Blood and urine tests. This test checks blood counts and levels.
- Dental exam. This exam checks for dental concerns or problems, like gum or tooth infection.

The dental exam can be done with your dentist before your transplant appointment.

Your stem cell transplant coordinator and treatment team will talk with you about the tests needed and will help coordinate your tests before the transplant.

Conditioning Phase
Chemotherapy with or without radiation is given during the conditioning phase. This helps to:
- Wipe out the existing bone marrow cells to allow the donor’s new, healthy stem cells to grow
- Destroy any existing tumor cells if there is cancer or a tumor

Stem Cell Infusion
You will be ready to receive your transplant once the chemotherapy and radiation is done. During the transplant, the stem cells are infused through a tube called a central venous catheter (CVC). The stem cells go into your blood and travel to the bone marrow. These stem cells produce new blood cells in the bone marrow. The day of the transplant is called Day 0. The infusion lasts from 30 minutes to several hours.

Initial Recovery Period
After the stem cells are infused:
- You will stay in the hospital for about 3 to 4 weeks while your blood counts recover.
- Your treatment team will monitor your blood counts daily and help manage any side effects.
- Several IV medicines and fluids may be given.
- You will be discharged from the hospital once you have engrafted, meaning that your white blood cells have recovered, and you are eating and drinking well.
- Each patient will be assessed on an individual basis. For example, you may need to stay in the hospital longer if you have a fever or other conditions that require medical care.
Follow-up and Recovery After Discharge

After your discharge:

- You must have a caregiver with you 24 hours a day.
- You will come to the Ambulatory Treatment Center (ATC) for up to 100 days (or longer for some patients) after the transplant. Follow-up visits are usually every day, or may be every other day or twice a week depending on your health and needs.
- Our goal is for you to go home after the first 100 days. This may vary depending on your condition. Once you are cleared to leave the Houston area, you will continue to have follow-up visits with your cancer or primary care doctor in your home area. Some patients may need continued monitoring and symptom management. If this is the case, you will need to stay within 30 minutes of MD Anderson until your doctor tells you it is OK.
- You will also need to attend a survivorship class before leaving the Houston area.

After the first 100 days, you will continue to have regular lab tests done. Results will need to be sent to MD Anderson for review. You will need to come back for tests and exams every 3 to 6 months for the first year and then every 6 to 12 months. This can be different for each patient and depends on your condition. Your doctor will make a follow-up plan for you.

Potential Problems

When having an allogeneic transplant, problems could occur. These include the following:

Graft Failure
Graft failure is when the immune system rejects the transplant. This is not common because the chemotherapy and radiation that is given before the transplant destroys (suppresses) the patient’s immune system.

Graft-Versus-Host Disease
Bone marrow cells are unique to each person. When bone marrow stem cells (the graft) are transplanted in the recipient’s body (the host), the stem cells recognize the host as foreign. The cells may attack the cells in the body. This process can cause a reaction in your body called Graft-Versus-Host Disease (GVHD). There are 2 types of GVHD: short-term (acute) and long-term (chronic).

Acute GVHD
Acute GVHD can occur in the first 100 days after a transplant. It can vary from mild to serious and could threaten your life.

Watch for these signs and symptoms:
- Skin rashes (red, flat, thick or bumpy) or blisters on the body
- Redness in the palms of the hands and soles of the feet
- Yellowing of the skin and eyes
- Changes in liver function tests
- Stomach cramps, or bloody or watery diarrhea
- Fever
We will give you GVHD medicines, such as Tacrolimus, before, during and after the transplant to help prevent or treat this condition. The prescribed medicine depends on your diagnosis and treatment type. Your physician will review this with you and discuss common side effects of these drugs.

While on GVHD medicines, your blood levels will be checked 2 times a week to determine if the dose is right for you. If you develop GVHD symptoms, we may give you a steroid medicine to treat it. Other medicines may be added based on your response.

**Chronic GVHD**

Chronic GVHD can develop from 3 months to several years after the transplant. It can affect multiple body areas.

Watch for these signs and symptoms:
- Skin color changes
- Hard and thick patches of skin
- Skin or joint tightness
- Changes in liver function tests
- Dry mouth
- Dry eyes
- Hair loss
- Diarrhea
- Weight loss
- Changes in breathing or lung function, such as wheezing, coughing, shortness of breath or lips turning blue

The most common medicines used to prevent and treat chronic GVHD are tacrolimus, methotrexate, corticosteroids, antithymocyte globulin (ATG) and cyclosporine. Other medicines used include infliximab (Remicade®), daclizumab (Zenapax®), rapamycin (Rapamune®, Sirolimus®) and pentostatin. Your medicines will depend on your diagnosis and transplant type. You may need more than one type of medicine.

**Weakened Immune System**

Your immune system will be very weak for several months after an allogeneic transplant. It takes over a year for the immune system to recover. The first 3 months after a transplant are the most serious. Doctors usually prescribe antibiotics during this period and monitor patients closely for infections.

**Survivorship**

The term the new normal is often used to describe life after an allogeneic transplant. A stem cell transplant survivorship program and clinic is offered for patients and caregivers. This program teaches you about your continued recovery at home, life after transplant, and how to maintain your health as you recover from the early transplant effects. This program is a life-long resource available to you for information and management of late side effects.
For more information about survivorship, visit [www.mdanderson.org/topics/survivorship](http://www.mdanderson.org/topics/survivorship).

Talk to your care team if you have any questions.

**Resources**

**The Learning Center**
The Learning Center is a patient education library. We provide current and reliable information on cancer prevention, treatment, coping and general health.

Theodore N. Law Learning Center, Main Building, Floor 4, 713-745-8063.

**Be The Match (National Marrow Donor Program)**
800-627-7692