



Peripheral blood stem cell (PBSC) harvesting

Information for young people with cancer, and parents of a child or young person with cancer, having a stem cell transplant, and for stem cell donors.

This factsheet is written to help explain what is involved when you undergo a peripheral blood stem cell (PBSC) harvest. It explains what haematopoietic stem cells are; why we need to collect them; and what happens before, during and after the harvest.

Specific details of your planned PBSC harvest will be given to you by your stem cell harvesting team.

Haematopoietic stem cells

Haematopoietic stem cells are the source of all blood cells. Normally before they go into your blood stream your body signals them to become the different blood cells (red cells, white cells or platelets).

Stem cells are normally only found in large numbers in the bone marrow inside your bones. To make the stem cells move (mobilise) from the bone marrow into your blood stream your body needs to produce more of these cells than is normal, so we help it by using a special growth factor called granulocyte-colony stimulating factor (GCSF). This enables the bone marrow to produce more stem cells than you need and they move from your bone marrow into your blood stream.

When stem cells are collected from a patient in preparation for an autologous transplant, this is normally done following a course of your chemotherapy protocol. However, for some protocols and for donors, this is done without chemotherapy and is called a **steady state mobilisation**.

Why do we need to collect stem cells?

For patients undergoing an autologous (from yourself) transplant:

Your consultant will have discussed your treatment protocol with you. We have learnt that in order to have the best chance of getting rid of your cancer and giving you the best chance of a cure, we need to use very high doses of chemotherapy. But we also know that this is a very difficult treatment and, if we only used the high dose chemotherapy, your body may not be able to grow its own blood cells again, and that you would be at risk of infections with low platelets and red blood cells for a very long time.

By having your own stem cells back (known as an autologous stem cell infusion), your body is able to start to grow its own replacement red cells, platelets and white cells. This happens around two to four weeks after the stem cells have been given back.

For related donors undergoing a harvest for an allogeneic (donor) transplant

To be a donor means that your stem cells are healthy and that they are a match for your relative. Collection of your peripheral blood stem cells will normally happen once your relative has started their chemotherapy at the start of their transplant admission.

Before this happens, you will meet with a consultant to discuss if you are happy to be a stem cell donor. You will be asked about what type of cells you would like to give (bone marrow or peripheral blood stem cells).

In the United Kingdom, young people who are 16 years of age or older are now able to donate peripheral blood stem cells. You will meet with the transplant team so that you can be given information about why your cells are needed and ask any questions you may have.

The transplant team members responsible for the harvest will meet you to make plans for the stem cell collection. You will also be seen by your own consultant who will talk to you about your decision to have your stem cells collected. It is important that you have an independent doctor looking after you and that you have made your decision to give your stem cells freely.

Staff who are trained in peripheral blood stem cell harvesting will be responsible for you during this procedure. Local arrangements for the harvest may differ - you may have your stem cells collected at the hospital where you/your relative is being treated or you may have to travel to a different hospital.

What happens before the harvest?

Pre-harvest investigations

Blood tests

It is a legal requirement within the UK that the results of specific blood tests are known before any stem cell harvest. These blood tests look for certain viruses, for example, Hepatitis B, Hepatitis C and HIV. The PBSC team will discuss all of these tests with you. They need to be done within 30 days of the collection day and the results are sent to the stem cell laboratory before the cells are collected.

Consent

The Department of Health Human Tissue Authority (HTA) has strict guidelines that we must follow. Before we take your cells we must get written consent for the testing, storage and discarding of these cells. The PBSC team will go through the form with you (and your parents if you are under 18). If you have any questions please feel free to ask.

Mobilisation of stem cells

Before we can collect the stem cells, you will require daily injections of GCSF to increase the number of stem cells your body produces and to allow them to move from your bone marrow into your circulating blood. GCSF is a hormone naturally produced by the body. It has two major functions: to create replacement stem cells in the bone marrow, and to turn stem cells in the bone marrow into mature blood cells.

Usually between 7-16 days after starting GCSF, following your chemotherapy, or 5 days if you haven't had chemotherapy, your white count will rise and your stem cells will mobilise from the bone marrow into the peripheral blood.

As with all drugs there are possible side effects of GCSF. The most common are listed below:

- Injection site reactions
- Headache
- Tummy upsets such as nausea, vomiting and diarrhoea
- Rash
- Achy flu-like symptoms
- Temperature

Many of these symptoms are common for patients following chemotherapy and if they do occur you may need to be admitted to hospital for treatment as it may indicate an infection. If you are concerned please contact your hospital immediately.

The GCSF is given as a subcutaneous (below the skin) injection in the arm, leg or abdomen. The injections are best given at the same time each day. The first injection will be given in hospital. Some treatment centres will then teach you or your parents to do these injections at home. Nursing staff will show you how to do this. If you are unable to do this at home you may be able to have a local community nurse or hospital do this for you.

You may be offered a very small sub-cutaneous cannula, called an insuflon. The insuflon enables the needle to be inserted into the end of the insuflon instead of the skin. Some people choose to just have a subcutaneous injection and no insuflon. The nursing staff will explain both methods so you can choose which is right for you.

Regular blood tests will be taken throughout the mobilisation. By looking at the results of these closely we can determine the best day for your harvest. This will usually be when the white blood cells increase rapidly.

Red blood cells (haemoglobin)

Your red blood cell count will be kept over 10 prior to the harvest. This may mean you need to have a blood transfusion during your mobilisation.

Platelets

During the blood tests some of your platelets will be collected into the collection bag. Your platelets will be checked so that a minimum can be maintained.

Venous access: Apheresis/central line or canulae

For patients: At the start of your treatment, when we know that you are likely to need PBSC harvesting, you may have had a double lumen apheresis line put in to prepare for your harvest. However, if you don't have a line like this you can also have this procedure using a permanent Hickman line and a cannula, or have a temporary apheresis line put in.

For donors: You will normally have two cannulae (one in each arm) put in for the collection.

Your PBSC team will discuss the best options for you.

In the days leading up to the harvest when blood samples are being taken we will also check your apheresis/central line is sampling and flushing easily. This helps us to ensure we can get a good flow rate during the PBSC harvest. If the apheresis/central line is not sampling or flushing easily you may have a drug put into the line for several hours to dissolve any blockage. The team will discuss this with you should it need to happen.

When your white cells reach a certain level the laboratory will be able to perform a specific test called a CD34 level which will tell us how well your

stem cells have mobilised. This test will tell us when it is the right time to harvest the stem cells.

Beginning the PBSC harvest

Two lines are needed so that a constant flow of blood is taken from your blood stream, passed through a machine called a 'cell separator' and constantly returned back into your blood stream through the other line once the cells have been collected.

A sterile single use kit will be fitted into the cell separator. You will be connected to the lines from the single use kit. One line will take blood from you and the other will return your blood. Staff trained to do this procedure will stay with you throughout. The separator will be filled with fluid and the staff will enter information about you such as height, weight, sex, and information from your blood count taken earlier that day. Once this information has been put into the machine, the PBSC harvest can start. The amount of blood in the machine at any one time is around 200mls (about the equivalent of a mug full).

To stop the blood from clotting in the machine a drug called ACDA (acid-citrate dextrose solution) is given. A small amount is added constantly and this happens in the cell separator. The nurse operating the machine will show you where this happens if you want.

The most common side effect during this procedure is caused by the ACDA. The ACDA works by attaching itself to the calcium in your blood to stop your blood clotting in the tubing. This goes back to normal when the machine is finished and the ACDA stops. However, you may develop side effects during the PBSC harvest due to having low calcium levels in your blood.

Side effects in children and young people are rare but may include:

- Pins and needles in the fingertips/feet or lips
- Cramping in the face or hands
- Just not feeling well.

During the procedure your nurse will ask you to drink milk or have yoghurt, ice cream or eat some cheese. These all have calcium in them and help to prevent possible side effects. Sometimes we may ask you to chew a calcium tablet or have a drink with calcium dissolved in it.

The machine needs the blood to flow freely from your line/cannula and also back in to you through the other line. Sometimes your lines can be very sensitive and the machine may have a pressure alarm if the blood is not able to flow freely. You may need to have your lines flushed during the procedure and you may also need to move your position to get a better blood flow to and from the machine.

What can you do during the PBSC harvest?

The harvest can last between four and five hours. You will have to remain on the bed/chair during the harvest. You can read, do school work, watch TV or play video games as normal. You might like to have a picnic with your family as this will help to pass the time. If you need the toilet you can use a commode.

What happens when the PBSC harvest has completed?

When the harvest has been completed, you will be taken off the machine and some blood samples will be taken. You can then go home. The stem cells will be taken down to the stem cell laboratory.

The scientists in the laboratory take a small sample of the stem cells so that they can test it to tell us how

many cells have been collected. Depending on when the PBSC harvest finished this may happen on the same day or early the next morning. If enough stem cells have been collected we will not have to do a second day of PBSC harvesting. However if we have not collected enough cells, you will need to continue on GCSF and we will need to do a second day of PBSC harvesting.

What happens to the stem cells?

The staff in the stem cell laboratory will store the peripheral blood stem cells by freezing them in a special way called cryopreservation. The cells are mixed with a preservative (DMSO) to protect them while they are frozen. They will be stored until you need them as part of your treatment.

If you are a donor, you may have your stem cells stored for future use, but it is more common that the cells will go to the stem cell laboratory and be used fresh for your relative's transplant.

The storage of the cells will be discussed with you when you sign the consent for collections forms.

If you have any questions please ask the PBSC harvesting team.



Children's Cancer and Leukaemia Group (CCLG) is a leading national charity and expert voice for all childhood cancers.

Each week in the UK and Ireland, more than 30 children are diagnosed with cancer. Our network of dedicated professional members work together in treatment, care and research to help shape a future where all children with cancer survive and live happy, healthy and independent lives.

We fund and support innovative world-class research and collaborate, both nationally and internationally, to drive forward improvements in childhood cancer. Our award-winning information resources help lessen the anxiety, stress and loneliness commonly felt by families, giving support throughout the cancer journey.

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