



Great Ormond Street Hospital for Children NHS Foundation Trust: Information for Families

## Peripheral blood stem cell harvest: information for families

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**This leaflet explains what is involved when your child undergoes peripheral blood stem cell harvest. It explains what happens before the harvest takes place and how the cells are harvested.**

### What are peripheral blood stem cells?

There are many types of stem cells in the body. In this document when stem cells are described it relates to peripheral blood stem cells.

Peripheral blood stem cells are the source of all blood cells. They are formed in the bone marrow and receive signals that direct them to become the different blood cells (red cells, white cells or platelets) before entering the blood stream. Stem cells that have not received the signal to mature into blood cells normally remain in the bone marrow.

Before the peripheral blood stem cell harvest takes place, these stem cells will be prompted to move into the blood stream. This prompting is called mobilisation and usually occurs after a course of chemotherapy.

### What happens before harvesting?

A member of the bone marrow transplant team (BMT) such as a nurse specialist or nurse practitioner will meet you and your child. He or she will discuss the procedure with you and answer any questions you may have. The topics discussed will include:

- Pre-harvest investigations
- Chemotherapy given prior to the harvest
- G-CSF injections
- Blood tests required during the mobilisation
- Admission to hospital before the harvest
- Confirming that stem cells have been mobilised
- Inserting an apheresis catheter
- Harvesting stem cells

You will also be given a timetable of the planned treatment including the mobilisation and harvesting of stem cells. He or she will then ask you to consent to the planned treatment, storage/disposal of the harvested cells and/or virology testing.

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### Pre-harvest investigations

Your child will undergo various tests and investigations to ensure he or she is fit enough to undergo this part of their treatment. There are also specific blood tests that need to be completed before the peripheral blood stem cell harvest. These blood tests look for the infections Hepatitis B, Hepatitis C, HTLV, HIV, and Syphilis. It is a legal requirement in the UK that these tests results are known before the laboratory stores the stem cells. By carrying out these tests, we are not implying your child has these viruses.

### G-CSF Injections

Following the completion of the course of chemotherapy, your child will be given daily injections of G-CSF (Granulocyte Colony Stimulating Factor). G-CSF is a hormone produced by the body and is involved in two major functions:

- To turn stem cells in the bone marrow into mature blood cells.
- To create replacement stem cells in the bone marrow.

#### What will giving G-CSF do?

By giving your child injections of G-CSF we will be increasing the amount of G-CSF available to carry out these functions. After a number of days of G-CSF injections, your child's white blood cell count will rise and at this time the mobilisation of peripheral blood stem cells from the bone marrow into the peripheral blood will take place. The timetable given to you will indicate on which days this is expected to happen.

#### Are there any side effects?

Side effects of G-CSF include pain in the bones, abdomen or shoulder. Some people get redness and soreness at the site of injection.

There are a number of other side effects including: swelling of the mouth, fever, diarrhoea, rash, abdominal pain, vomiting, hair loss and infection. However, such side effects may be caused by other medicines taken during the treatment, rather than G-CSF.

While taking G-CSF, your child may also experience coughing, fever and may easily become out of breath. If these side effects occur, you should tell your team immediately.

If you notice any unusual signs or your child feels unwell while being treated with G-CSF please tell your community or hospital team immediately.

#### How is the G-CSF given?

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These injections will be given by the nursing staff. If your child is in hospital one of the ward nurses will give it. If you are at home your community nursing team will give it. If you wish you could be taught how to give the G-CSF to your child yourself, please discuss further with the team. The G-CSF is given as an injection into the arm or leg.

### Blood tests

Regular blood tests will be taken throughout the mobilisation. By looking at these it will be possible to identify when the stem cells are likely to have been mobilised into the peripheral blood stream. This is usually when the white blood cell count increases rapidly. The day of this increase can usually be predicted and will be included in the timetable given to you.

### Admission to hospital

A planned admission date (if your child is at home during the mobilisation) will be given to you on the timetable. This is usually planned to be two days before the planned first peripheral blood stem cell harvest. This is done because we need to confirm that stem cells have been mobilised into the peripheral blood stream before the peripheral blood stem cell harvest is done. A member of the team who will be performing the peripheral blood stem cell harvest will also come to see you and your child to discuss the procedure and to seek your/your child's consent to the procedure.

### Confirming that stem cells have been mobilised

Very early in the morning before the planned first peripheral blood stem cell harvest, a blood test will be taken from your child. This will be collected and sent to the bone marrow/stem cell laboratory, where a specific test to measure the number of stem cells in the sample will be done. From this result, it is possible to work out if the mobilisation has taken place and that it is the right time to harvest the stem cells.

### Inserting an apheresis catheter

#### Why is an apheresis catheter inserted?

The harvesting of your child's stem cells is done using a procedure called leukopheresis. A constant flow of blood is taken from the bloodstream, passed through a machine called a 'cell separator', and then put back into your child's bloodstream. The speed of the blood passing through the cell separator will vary depending on the size of your child. The speed of the blood in small children (less than 10kg in weight) will be around 10mls per minute, and in bigger children (more than 30kg) up to 30-40mls per minute.

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Commonly, a new catheter will be inserted into a large vein at the top of your child's leg to enable this to happen. This will be inserted only when confirmation that stem cells have been mobilised has been obtained.

In some cases, especially with bigger children, it may be possible to perform the harvest using either one peripheral needle/cannula and an existing line (such as a Hickman line) or two peripheral cannulas, one in each arm. This depends entirely on the quality of your child's veins, and also their ability to tolerate needles and to sit quite still, as the arm containing the cannula must be kept as still as possible during the procedure.

### What is an apheresis catheter?

An apheresis catheter looks like a central venous catheter line/Hickman Line but is more rigid to allow a constant flow of blood to be taken from, and returned to, your child's bloodstream. It is made specifically for this job. It will be inserted in the operating theatre under general anaesthetic, so that your child is deeply asleep.

### How long will it stay in place?

The apheresis catheter will only remain in place as long as peripheral blood stem cell harvests are being done. As soon as enough stem cells have been harvested the nursing staff on the ward will remove it. One hour after the procedure is complete the nurse looking after your child will repeat the full blood count (FBC) and the results are checked to make sure your child's platelet count is adequate. Some children may need a platelet transfusion before the catheter is taken out.

## Peripheral blood stem cell harvest

The day after the insertion of the apheresis catheter the first peripheral blood stem cell harvest will take place. An early morning FBC will be taken, as this data is required for programming the Cell Separator machine.

### Preparing the cell separator machine

An experienced apheresis nurse will bring the cell separator to your child's ward and prepare the machine for the procedure. He or she will stay with your child throughout the procedure. A sterile, single use kit will be fitted into the cell separator. This means your child's blood is not exposed to outside infections during the harvest. The operator will prepare the cell separator for the harvest.

### How much blood will be in the cell separator?

The amount of blood in the machine at any time is 160mls.

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If this results in more than 10 per cent of your child's blood being in the kit, a blood prime of the machine is carried out before your child is connected to it.

### What is a blood prime?

A blood prime uses a unit of blood that has been cross-matched as compatible for your child. Immediately before your child is connected, this unit of blood will fill the kit on the cell separator. As soon as your child is connected to the cell separator and blood starts to be removed, it will be replaced with this cross-matched blood from the blood prime. This procedure carries the same risks as for any blood transfusion, these can be discussed further with your apheresis nurse prior to the procedure.

### Beginning the peripheral blood stem cell harvest

Two lines from the kit will be attached to your child's apheresis catheter, one to take blood from the bloodstream and the other to return blood to the bloodstream. As the blood enters the cell separator, a drug is added to it. This drug is called ACD-A (citrate), and is given to stop the blood from clotting while it is going through the cell separator, which could otherwise block the kit.

A constant flow of blood is passed through the cell separator over three to four hours. Inside is a centrifuge that separates the blood into the different types of blood cells. The white blood cells are collected in this centrifuge and at regular intervals transferred to a bag attached to the cell separator.

### Are there any side effects that can occur during the harvest?

The most common side effects during a peripheral blood stem cell harvest are caused by the drug ACD-A given to stop the blood clotting.

### Why does ACD-A cause side effects?

ACD-A works by attaching itself to the calcium in your child's blood. Calcium is required by the blood to form a clot, and so no clots will be made while the peripheral blood stem cell harvest is taking place. Your child may develop side effects due to having a low Calcium level in his or her blood. He or she may feel sick, may develop pins and needles in his or her fingertips or lips, or may just feel poorly. The member of staff carrying out the harvest is experienced in recognising these side effects and will take appropriate action if they occur. Side effects due to ACD-A are rare in children.

### What other side effects or problems can occur?

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- Sometimes children may feel lightheaded during the harvest, particularly at the beginning of the procedure. This can be rectified by slowing the rate the blood is taken from your child, or by giving your child an intravenous infusion of fluid.
- Sometimes it is difficult to get enough blood to flow through the apheresis catheter or cannula. The member of staff carrying out the harvest may make adjustments to the position your child is in to allow a better flow.

### What can my child do during the harvest?

As your child is attached to the cell separator, he or she will need to remain in bed for the time the harvest takes. Your child will be able to do most of the things that they normally do. He or she will be able to read, watch TV and play games. Parents and visitors are able to stay throughout the harvest.

### What happens when the harvest has finished?

After three to four hours, the cell separator will indicate that the harvest is finished. The member of staff looking after your child will disconnect your child, dispose of the kit, and take the stem cells to the bone marrow/stem cell laboratory. He or she is then free get out of bed and to move around normally.

### How many stem cells are there?

A small sample is taken from the collection bag and a measurement is done on this sample on the same day. That result will indicate whether enough stem cells have been harvested.

### What happens if enough stem cells have been harvested?

If enough stem cells have been harvested, your child can have the apheresis catheter removed and go onto the next part of his or her treatment.

### What happens if not enough stem cells have been harvested?

If insufficient stem cells have been harvested, a dose of G-CSF will be given and a further peripheral blood stem cell harvest will take place the next day.

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### What happens to the stem cells?

The bone marrow/stem cell laboratory will store the stem cells until your child requires them back. Normally this means they are frozen and stored for use at a later stage. Sometimes the stem cells are kept in the laboratory and then given to your child following the next part of their treatment.

If you have any questions about peripheral blood stem cell harvesting, please ask your doctor or nurse.

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Compiled by the Apheresis team in collaboration with the Child and Family Information Group

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