Stem Cell Transplant Guide

What this leaflet is about: what a stem cell transplant involves, how the cells are collected, and how to care for yourself afterwards.

> Quick emergency advice
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> After a stem cell transplant you are at high risk of infection, bleeding and other problems. If you develop a fever of 38.5 degrees C or above, or if you feel suddenly very unwell, telephone the transplant unit or the clinic immediately - do not wait.
> Follow the self-care checklist at the end of this leaflet every day after you go home. It is short, and every item of it matters.

What are stem cells?

Stem cells are the parent cells in the bone marrow that produce all the blood cells. They are the body's own factory, and the reason a transplant works is that transplanted cells settle into the empty marrow and start making healthy blood cells again.

There are three main sources of these cells.

- Bone marrow, taken directly from the pelvic bones of the hip.
- Peripheral blood, which is the commonest source today, because it can be collected from a vein without any operation.
- Cord blood, collected from the placenta and umbilical cord of a new born baby and then banked.

Autologous or allogeneic?

This is the single most important decision in planning a transplant, and it depends on the disease and on the state of your own marrow.

Autologous - your own cells

The stem cells are taken from you, cleaned and put back. The benefit is that there is no risk of graft-versus-host disease and the recovery is quicker. This is used when the disease is confined to the blood or marrow but the marrow itself is still healthy enough to produce cells - for example in multiple myeloma and in some lymphomas and leukaemias.

Allogeneic - a matched donor's cells

The stem cells come from another person - usually a brother or sister, sometimes an unrelated matched donor. The new immune system attacks any remaining disease cells as well as the new marrow, which is why it is used where the disease is aggressive, or where the patient's own marrow has failed. Because the cells are not your own, there is a risk of graft-versus-host disease, and the recovery is longer.

Why is a transplant done?

Usually for one of two reasons. Either the marrow is diseased and the cancer cells must be cleared out, or the marrow has failed to make enough blood cells - with severe anaemia, infections or bleeding despite treatment. In the first situation the cure comes from the high-dose chemotherapy, with the new cells supporting you through it. In the second, the cure comes from the new cells themselves.

The autologous process - five steps

Step	What happens
1. Collection	The stem cells are collected from you, either from the bone marrow under a general anaesthetic, or from a vein using a machine called apheresis.
2. Processing	The cells are taken to a laboratory, where they are counted, tested and checked for infection, and cleaned of any tumour cells that may be present.
3. Cryopreservation	The cells are frozen in liquid nitrogen at minus 196 degrees C and stored until you are ready for your treatment. They can be kept for many months.
4. High-dose chemotherapy and/or radiotherapy	This is the intensive part. Very strong treatment is given to kill any remaining cancer cells, and it also destroys your own marrow. This is the hardest part of the whole process.
5. Reinfusion	The frozen cells are thawed and given back to you through a drip into a vein, usually the next day or the day after, like a blood transfusion. You then have a period of close monitoring while they settle in.

The allogeneic process - five steps

Step	What happens
1. Collection from the donor	The donor's stem cells are collected, usually from a vein by apheresis, over one to several days. Most donors go home afterwards and are usually back to normal activity within a few days.
2. Processing	The cells are counted, tested, and cleaned in the laboratory, in the same way as your own cells would be.
3. Cryopreservation	The cells are frozen in liquid nitrogen and stored until you have had your conditioning treatment and are ready for them.
4. Conditioning chemotherapy and/or radiotherapy	You receive very strong treatment to destroy your own diseased marrow and to suppress your immune system so that the donor cells can settle. This is given over a few days.
5. Infusion	The donor cells are thawed and given through a drip into a vein. They then home in to the marrow and begin to make new blood cells.

How the cells are collected

Mobilisation

Stem cells normally sit in the marrow. To collect them from the blood, they must first be pushed out into the circulation. This is done with daily injections of a medicine called granulocyte colony stimulating factor, or G-CSF. It is given for about 5 days before the collection, and it also has the effect of speeding up the recovery of your white cell count afterwards.

Some people, particularly those who have had several courses of chemotherapy, do not produce enough cells with G-CSF alone. For them, a single injection of plerixafor is given about 24 hours before the collection, and this releases the cells in one go.

Apheresis

The collection itself is done by apheresis. You lie in a chair or on a bed for about 3 to 5 hours, with a needle in a vein in each arm, or in one arm with a two-way catheter. Blood is drawn out, the machine separates the stem cells, and the rest of the blood is returned to you through the other line. It works in a similar way to dialysis. There is no operation and no cutting, and the feeling is often nothing more than tiredness, coldness and a metallic taste during the collection. Calcium and other fluids are given through the drip to prevent cramps.

Finding a donor

Matching matters a great deal. The most important test is HLA matching, which compares the tissue markers on a person's white cells. A close match makes the graft work better and greatly reduces the risk of graft-versus-host disease.

- A brother or sister has a 1 in 4, or 25 percent, chance of being a full match, because you inherit half of your tissue markers from each parent. If you are the only child in your family, that chance falls.
- Where no suitable relative is found, an unrelated volunteer donor can be searched for.
- The Malaysian Stem Cell Registry holds records of potential donors in Malaysia, which makes a national search much quicker.
- Cord blood banks hold stem cells from new-born babies and may be used if no adult donor is found.

You will have tests to check that your heart, lungs, kidneys, liver and general health can cope with a transplant. These decide whether a transplant is safe for you at the moment, and they are repeated during the search for a donor, which can take several weeks or longer.

Getting ready beforehand

- Dental clearance. Any decay, gum disease or a broken tooth must be treated before the transplant, because infection in the mouth can become very serious once your immunity is low. This is essential and it does take time.
- Cardiac assessment, including an ECG and an echocardiogram, to check your heart can cope with the strain.
- Respiratory assessment, including chest X-ray and lung function tests.
- Counselling, both for you and for your family, about what the treatment involves, the risks, and the practical arrangements for the ward and afterwards.
- A 24-hour urine collection, to check how your kidneys work and to measure your mineral and protein losses.
- Sometimes a lumbar puncture is done, and sometimes a scan of the chest (a thoracic CT scan), to check whether disease is present in the fluid around the brain or in the lungs.
- Adequate rest before you come in. You are asked to keep yourself in as good a condition as you can.
- Stop smoking. Smoking increases the risk of infection and of graft complications, and it slows healing. Stopping before the transplant gives the lungs a chance to recover.
- Maintain an ideal body weight. You will be asked for your height and weight to be measured at each visit, and a sensible weight helps with the transplant.

What happens after the infusion

You will be cared for in a single room, with a door that is kept closed. This protects you from other people's germs while your new marrow is not yet producing enough white cells. The nursing staff will wear protective clothing and take every precaution.

- You will be encouraged to do gentle exercise, and to get up and walk a little each day, as much as you safely can. This prevents the problems that come with lying still.
- Visitors are limited to family members only, and nobody with any infection, rash, or recent vaccination with a live vaccine may come in.
- Plenty of rest is needed. Sleep is often disturbed, and tiredness is extreme, especially in the first fortnight.
- You will have a drip in your arm for fluids and medicines, a central line for blood tests, and regular blood tests to follow your counts.

How long you are likely to be in hospital
About 8 to 10 days before the transplant for the preparation, conditioning and recovery.

About 3 weeks after the transplant infusion itself, for the low point of your blood counts and the highest risk of infection.

An allogeneic transplant usually needs a longer stay than an autologous one. Your own team will give you a more accurate estimate for your particular transplant.

Side effects and complications

During the first few weeks

The main problem is a very low blood count while the new cells are still finding their way in. This means a risk of infection, of bleeding, and of severe tiredness. The high-dose chemotherapy also commonly causes severe diarrhoea, painful mouth ulcers, marked tiredness, nausea and vomiting, poor appetite and rash. Kidney and liver function can also be affected, which is why so much blood is taken each day. The risk of serious infection, bleeding or organ failure in the first few weeks is why the monitoring is so intense, and why the protective isolation is so strict.

Engraftment

Engraftment is the point at which the new cells start to work and your blood counts start to rise again. It usually takes 15 to 21 days. Until then you are at the highest risk. Your team will follow your counts daily and will tell you when engraftment has occurred.

Graft-versus-host disease

When donor cells are used, the new immune system may attack your own tissues. This is called graft-versus-host disease, or GVHD. It is one of the main complications of an allogeneic transplant, and it is also one of the main reasons the transplant can cure the disease, because the new immune system also attacks any remaining cancer cells.

The organs most often affected are the skin, the gut and the liver.

- Skin: a widespread red, blotchy or peeling rash. It may look like a sunburn, and often starts on the palms of the hands, the soles of the feet, the face and the ears.
- Gut: watery diarrhoea, sometimes very profuse, and abdominal cramps and pain, sometimes with nausea and vomiting.
- Liver: jaundice, dark urine, pale stools and itching, from a rise in the liver enzymes in the blood.

The liver problem is usually the least obvious to you but the most important for your team, because it is detected in the blood tests before you feel unwell. GVHD is treated with steroids and other immunosuppressants, and it is why you will stay on medicines for a long time and why you must never stop them without being told to.

Grapefruit and cyclosporin

Grapefruit interacts with cyclosporin. Grapefruit, grapefruit juice, and also Seville oranges and star fruit, can raise the level of cyclosporin in your blood to a dangerous level, which can damage the kidney. Do not eat grapefruit, drink grapefruit juice, or take any product containing grapefruit while you are taking cyclosporin, and tell us if you have had any in the days before a blood test. Always ask us before you start any new food supplement, herbal product or over-the-counter medicine.

Self-care after you go home

Your daily checklist after discharge

Shower every day, and keep the skin clean. Use a mild, unperfumed soap, and dry yourself thoroughly, especially in the folds of the skin and between the toes.

Watch for new rashes or bruises. Check your skin regularly in good light, and report anything new to us straight away - it may be a sign of graft-versus-host disease or of a low platelet count.

Use a soft toothbrush, and watch your mouth for thrush. Thrush appears as white patches on the tongue or inside the cheeks, or as soreness of the mouth corners, and it is very common after a transplant. Tell us, because it is easily treated.

Avoid people with infections, and avoid crowds. Practise good hand hygiene with everyone you meet, including at home.

Stop smoking permanently. This is the single most useful thing you can do for your long-term health, and it is especially important for your lungs and for your risk of infection.

Avoid direct sunlight. Do not sit in the sun, and use a high factor sunscreen, a hat and a cover, because the new immune system makes sun damage far more likely and severe.

Take all medicines exactly as directed. Do not stop, reduce or skip a medicine, and do not start anything new - including vitamins and herbal products - without asking us.

Avoid cleaning pet litter, and avoid animal faeces. If you have pets, ask someone else to do this job.

Check with your doctor before you drive. Concentration and reaction can be affected for a long time after a transplant, and you must judge when you are ready.

Attend every follow-up appointment. The blood tests at follow-up are how we detect problems while they are still small enough to treat easily, and it is not safe to skip them because you feel well.

Recovery after a transplant is a long process measured in months and sometimes years, and it is not a straight line. Tiredness and cough that improve slowly are common, as are small fluctuations in your blood counts. Set your expectations realistically, keep your appointments, and contact us early if something changes. If you are ever unsure, it is always better to ask.

When to contact us

If you are worried about yourself, or about the person you are caring for, please get in touch. We would always much rather hear from you early than late. If you have read something in this leaflet that worries you, that is a good reason to telephone us, even if you feel well.

Visit us
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If you cannot reach us, or you are very unwell

Please go to the emergency department of KPJ Ampang Puteri Specialist Hospital, or call the emergency ambulance service. Do not wait for a routine appointment, and do not wait for a reply to an email.

Important medical disclaimer

This leaflet is written for patients and their families and carers. It is general patient education only. It is not a substitute for medical advice, and it is not a substitute for the diagnosis and treatment that your own haematologist, nurse, pharmacist or doctor will give you.

Nothing in this leaflet should be used to change, stop or start a medicine, a test or a treatment. If anything you read here is different from what your healthcare team has told you, follow your healthcare team and ask us about the difference.

Information about medicines names, strengths, test turnaround times and supportive care is current at the time this leaflet was prepared. It may be updated from time to time, and the version printed here may therefore not be the newest one. Please ask reception for the current copy.

If you think that you or someone you care for is seriously unwell, do not wait for an appointment and do not wait for this leaflet to be read. Contact the clinic, or go to the emergency department of KPJ Ampang Puteri Specialist Hospital, straight away.

We Listen. We Care. Evidence-based Medicine.

Dr K Y Goh Haematology & Internal Medicine Clinic | KPJ Ampang Puteri Specialist Hospital | Tel: +60 3 4289 5000

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