SUNWAY CANCER CENTRE

SUNWAY Children's HEALTH CENTRE

SUNWAY MEDICAL CENTRE
Sunway City Kuala Lumpur

A Comprehensive Patient Education Guide To

# PAEDIATRIC STEM CELL TRANSPLANTATION

# CONTENTS

# Part 1 Basics of Stem Cell Transplantation

## What is stem cell transplant?

Stem cell transplant is the replacement of recipient stem cells with donor stem cells. Donor stem cells can be from siblings, unrelated donors or even parents.

## Where can we get stem cells from?

Stem cells can be collected from the bone marrow, peripheral blood or from stored umbilical cord blood units.

**Bone Marrow**

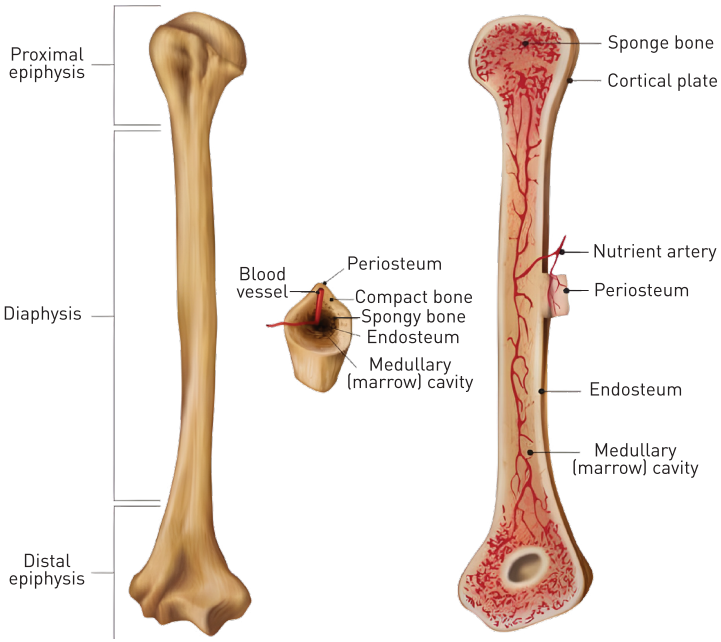
**Peripheral Blood Stem Cells**

**Umbilical Cord Blood**

## What is bone marrow?

Bone marrow is found in the center of most long bones and has many blood vessels. Stem cells in the bone marrow can become red blood cells, white blood cells and platelets.

**Structure of a long bone. Humerus. Tube.**



## Part 2 What are the Types of Transplant?

### 1 Autologous Stem Cell Transplant

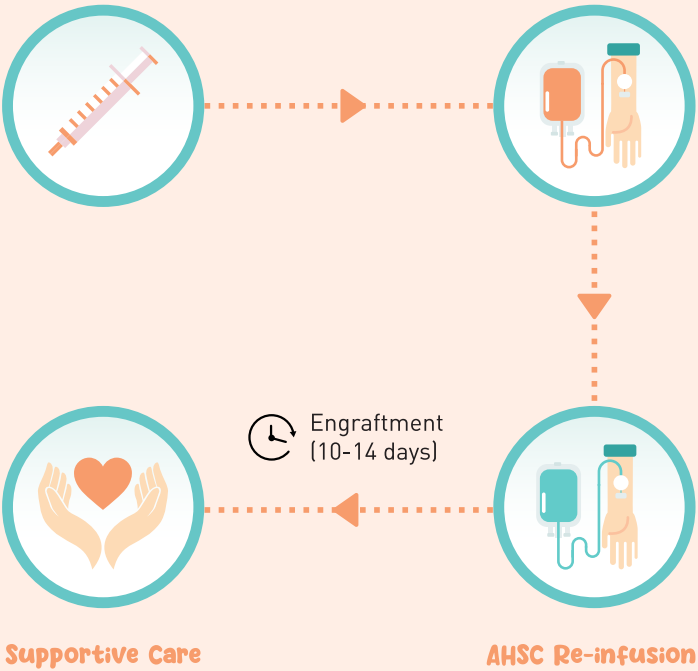
Patient's own stem cells are collected and stored via cryopreservation.
Patient then undergoes chemotherapy (conditioning/megatherapy) followed by reinfusion of the patient's own stem cells.

**Mobilisation and Harvesting**

AHSC (AHCS) are mobilised from the bone marrow, collected by leukapheresis and cryopreserved

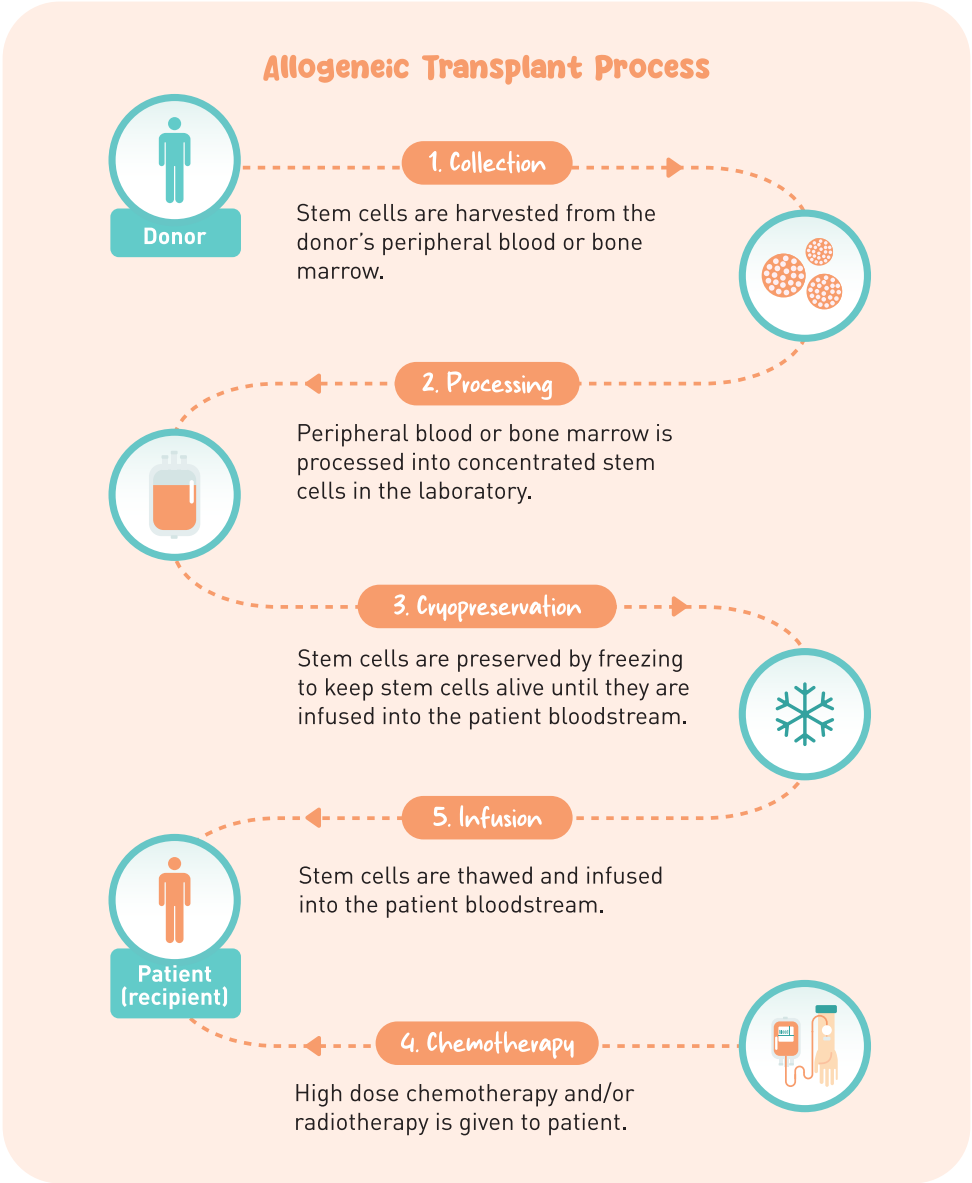
**Conditioning Regimen**

High dose chemotherapy is administered for ablation of the cancer cells and haematopoietic system



## 2 Allogeneic Stem Cell Transplant

Patient undergoes conditioning chemotherapy and following then gets a stem cell infusion from a donor.
Donor can be a sibling, an unrelated donor or stem cells from an umbilical cord blood unit.
Parents can also be donors to their child.



## Diseases that can be treated with Stem Cell Transplant

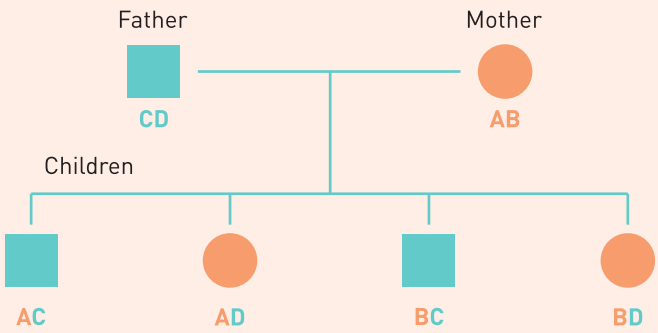
- Acute Lymphoblastic Leukemia
- Acute Myeloid Leukemia
- Chronic Myeloid Leukemia
- Severe Aplastic Anemia
- Thalassaemia Major
- Primary Immunodeficiencies
- Inherited Metabolic Diseases
  *only certain diseases*

## Part 3 What is HLA Typing?

HLA stands for Human Leukocyte Antigens and they are proteins (or markers) on most cells in your body. Our immune system uses HLA to see which cells belong in your body and which don't. We have many HLA markers but doctors use HLA typing to look at specific HLA markers.

HLA typing involves having your blood drawn or the inside of your cheek swabbed and the samples are then sent to the lab for processing. Results may take about 2 weeks to be ready.

In a family, siblings who share the same parents have a 25% chance of being a full HLA match. Unfortunately, 70% of patients who need a transplant will not have a fully matched donor in their immediate family. As children inherit half of their HLA from their mother and half from their father, parents and children share half of the same HLA. Parents can be a donor for their child for a haploidentical transplant.



# Part 4 Overview of Transplant Process

Patient fulfills indication for stem cell transplant

HLA Typing for donor and receipient

Donor identified

Pre transplant counseling for patient, donor and family

Receipient workup

Donor workup

Central line (Hickman's line) insertion

Stem cell mobilisation and collection

**STEM CELL TRANSPLANT**

# Part 5 Pre-transplant Evaluation

## Recipient work up

All patients who will be undergoing stem cell transplantation will need to undergo a series of blood investigations, radiological investigations and in some cases, bone marrow aspiration.

### Blood Investigations

Patients will need to undergo some basic blood investigations including infective disease screening such as for Hepatitis B, Hepatitis C, HIV, VDRL and for some other viruses.

### Radiological Investigations

Patients will need to undergo an **echocardiography** to ensure their heart function and contractility is normal. They will also need a **chest x-ray** to ensure their lungs are free of infection. Some patients will need an **ultrasound of their kidneys** to ensure their kidneys are normal prior to transplant. There may be other radiological investigations that the treating doctor may order based on case-by-case basis.

### Bone Marrow Aspiration

Patients with hematological malignancy planned for transplant will need a bone marrow aspirate to ensure that the disease is in remission prior to transplant.

### Dental clearance

Patients scheduled for transplant require a dental check-up. Any teeth with carries must be treated prior to transplant as it can be a source of infection during transplant if left untreated.

## Donor work up

Identified stem cell donors need to undergo an evaluation to ensure that they are fit to donate stem cells. The evaluation involves:

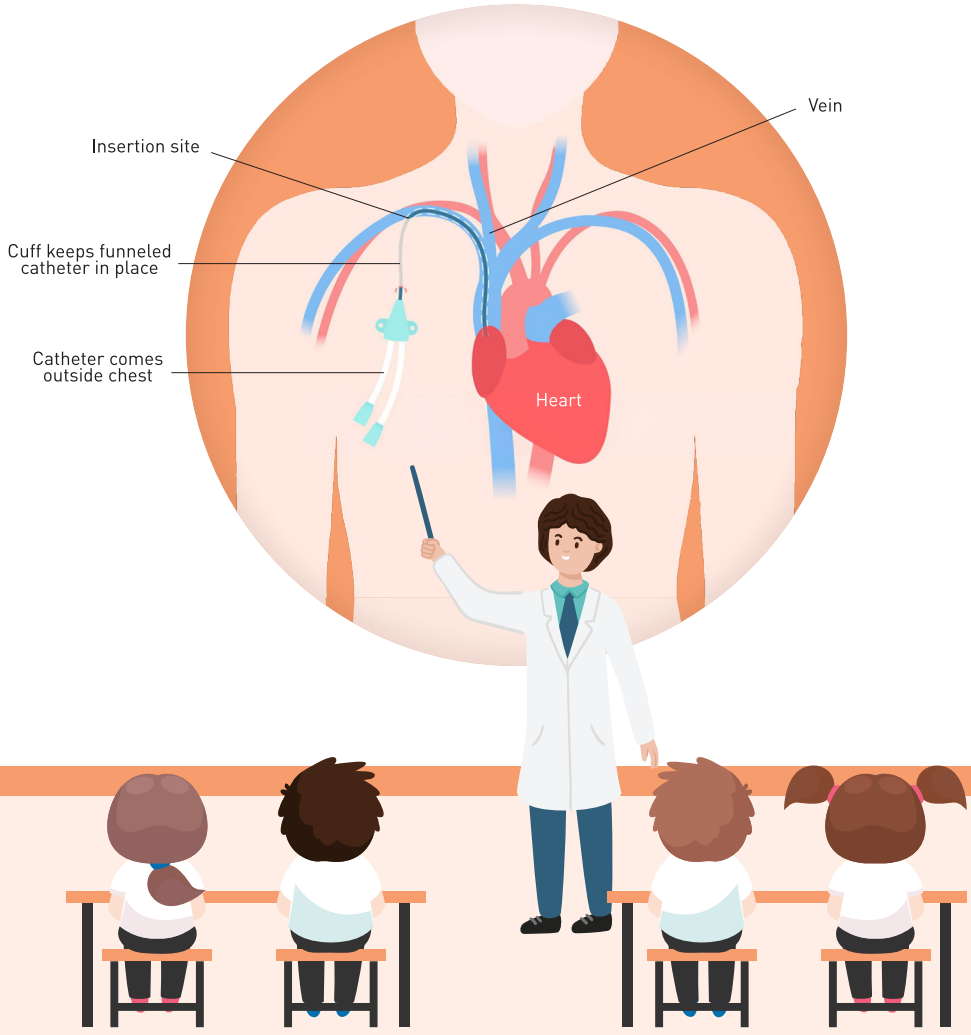
- Complete history taking and physical examination
- Blood investigations including screening for infective diseases such as Hepatitis B, Hepatitis C, HIV and venereal disease
- Other investigations deemed necessary based on case-by-case basis

# Part 6 Central Line - Hickman's Line Insertion

A central line is a catheter that is placed into a big blood vessel that drains into the heart. It will be used to administer medications and also for blood taking so that we don't have to prick your child.

The procedure of central line insertion is usually done by the Paediatric Surgeon or Interventional Radiologist and is done in the operation theatre under general anaesthesia. The central venous lines can be used for months.

## Hickman's Line after insertion



# Part 7 Conditioning Regimens

Conditioning treatment is a preparative regimen that is given to patients prior to stem cell transplant. Role of conditioning therapy is to:

- Destroy any residual disease
- Suppress patient's immune system prior to transplant
- Create a space in the bone marrow for donor cells

Conditioning treatment can consist of **chemotherapy** alone or a **combination of chemotherapy drugs** with **total body irradiation (TBI)**. Types of conditioning treatment that is used will depend on patient's disease and clinical condition.

## Chemotherapy

Chemotherapy is a cancer treatment that uses drugs to stop the growth of cancer cells, either by killing the cells or by stopping them from dividing.

### Side effects of chemotherapy

Weight loss


Hair loss


Loss of appetite


Nausea


Fatigue


Diarrhoea


Oral ulcers


Effects to organs such as heart, lungs, liver

## Total Body Irradiation (TBI)

Total Body Irradiation (TBI) is a form of radiotherapy that is given to patients. 2 weeks prior to the start of conditioning, patients will need to be seen in the radiotherapy unit for radiotherapy simulation and planning. This process will take a few hours.

During the actual TBI treatment, patients will be given total body irradiation twice a day for 3 days. It is not a painful procedure.

### Side effects of TBI


Dry skin


Dry mouth


Infertility


Organ specific toxicity
*heart, lungs*

## Part 8 Stem Cell Infusion

Stem cells are infused on Day 0 of the transplant protocol. Stem cells are infused to the patient thru the central venous line. It is just like a blood transfusion. The cells can be a fresh infusion or from a cryopreserved collection.

For a cryopreserved collection, cells will be thawed and then infused. Patients may experience side effects of Dimethyl Sulfoxide (DMSO) which is a cryopreservative used to preserve stem cells.

### Side effects of DMSO


Hypertension


Nausea


Vomiting


Anaphylaxis

## Post Transplant Period

This is the period where patient's blood counts will be the lowest. Patients are prone to infection, bleeding as well as oral ulcers and poor appetite. Patients will require red blood cell or periodic platelet transfusion during this period.

Patients who have very poor oral intake will need either nasogastric tube feeding or total parenteral nutrition. It is very important to maintain good hygiene during the entire transplant process.

If the transplant is successful, blood counts will slowly start to improve from the 2nd to 3rd week post transplant. Patients will then slowly start to feel better. The first sign of a successful transplant is **engraftment which is defined as absolute neutrophil count more than 0.5 for 3 consecutive days**. The first of the 3 days is termed day of neutrophil engraftment.

## Graft Failure

Graft failure is a serious and fatal complication of allogeneic stem cell transplantation.

| | |
|---|---|
| Primary Graft Failure | lack of initial engraftment of donor cells |
| Secondary Graft Failure | loss of donor cells after initial engraftment |

Successful transplantation depends on the formation of engraftment, in which donor cells are integrated into the recipient's cell population.

# Part 9 Routine in Paediatric Stem Cell Transplant Ward

Transplant is a complicated process and involves a lot of planning. It is also important to ensure medications are delivered on time. Patients and caregivers are advised to adhere to ward regulations and the guidelines to ensure best possible outcome for patients.

1. Nurses will access the central line for blood taking at 6am and the line will be flushed off.

2. Frequency of blood taking from central line will depend on doctor's instructions.

3. Patient and caregivers are advised to wake up by 9am and to take a shower and clean their mouth before doctors do their morning ward rounds.

4. It is **VERY IMPORTANT** to maintain good personal hygiene to reduce risk of infection.

5. Nurses will re-connect patient to their central line and administer medications from 9.30 am onwards unless indicated earlier.

6. Vital signs monitoring (blood pressure, heart rate, oxygen saturation and respiratory rate monitoring) will be done every 4 hours.

7. Patients are also weighed on a daily basis to enable doctors to make adjustments to the fluids regimen.

8. Patients will also need to chart their urine output to enable doctors to adjust the fluid regimens.

9. Post-transplant: patients will get mucositis which is inflammation of the oral mucosa. There may be oral ulcers and it will be painful to swallow.

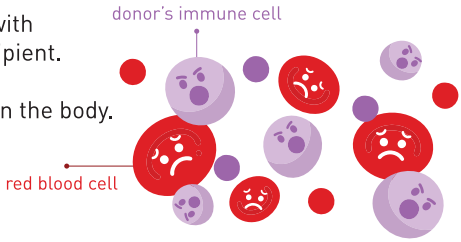
10. It is important to maintain good oral hygiene during this period. Doctors will give medication to control pain.

# Part 10 Graft-Versus-Host Disease

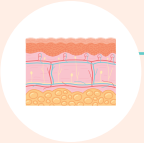
Graft-versus-host disease (GVHD) occurs when donated bone marrow or stem cells view the recipient's body as foreign and attack the body. Graft-versus-host disease can be divided into acute graft-versus-host disease and chronic graft-versus-host disease.

Acute graft-versus-host disease can occur anytime during the 1st 100 days after allogeneic stem cell transplant while chronic graft-versus-host disease can occur any time after 100 days of allogeneic stem cell transplant. The risk of graft-versus-host disease is higher in cases with higher HLA mismatches between donor and recipient.

Graft-versus-host disease can affect any organ in the body.

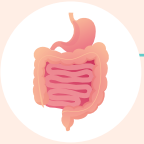



## Signs and symptoms of Acute GVHD



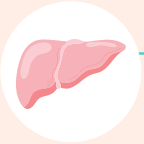
### Skin

- Rashes (very faint to severe sunburn-like rashes)
- Blisters



### Gastrointestinal Tract

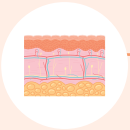
- Nausea
- Vomiting
- Stomach discomfort and pain
- Diarrhea
- Belly pain that does not go away
- Bloated or full of gas
- Blood in stool



### Liver

- Jaundice (yellowish skin or eye)
- Dark urine (tea colour)

## Signs and symptoms of Chronic GVHD



### Skin and Nails

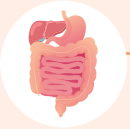
- Rashes
- Nail and skin texture changes

### Joint and Muscles

- Pain and stiffness
- Muscle pain and cramps

### Lungs

- Shortness of breath
- Cough that doesn't go away
- Trouble breathing



### Digestive System

- Diarrhea
- Nausea and vomiting
- Stomach cramp

### Genitals

- Irritation or dryness
- Painful intercourse

## Treatment for GVHD

Treatment for graft-versus-host disease will involve drugs that suppress the immune system such as methylprednisolone, tacrolimus, mycophenolate mofetil, cyclosporin or ruxolitinib. Patients who do not respond to medication to treat graft-versus-host disease may require extracorporeal photopheresis (ECP) to treat their graft-versus-host disease.

## Part 11 Discharge from Hospital

You are advised to stay in nearby amenity for **AT LEAST** 1 month post autologous transplant; 3 months post allogeneic transplant. You will be reviewed by the transplant team to ensure your health status is good.

Follow up appointment, in general, depends on patient's condition:

| | |
|---|---|
| Autologous stem cell transplant | every 2 weeks for the 1st month |
| Allogenic stem cell transplant | every week for the 1st month |

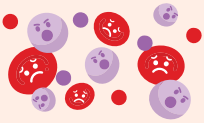
The frequency of follow up appointment will reduce according to your body's health status.

### You need to contact the transplant team IMMEDIATELY if you have:

Fever with temperature above 38°C

Blood in urine or stool

Coughing out blood



Suspected graft-vs-host disease

Persisting diarrhea, vomiting

Bleeding

Change in the skin around the central line catheter

Painful in urination, tea colour urine

## Dietary Advice

After the stem cell transplant, your child is encouraged to have adequate calories and protein in order to achieve and maintain your targeted body weight. You will need to practice **Neutropenic diet**, which is a low bacterial diet to reduce the risk of food-borne illness or food poisoning. You may refer to Neutropenic Diet Booklet for more information on dietary recommendation and meal plan. Please also follow dietary advice given by your dietitian.

## Mouth Care

Your white cell count may still be lower than normal, thus oral hygiene is important to protect the mouth from infections. You should let your doctor know if you notice any bleeding or ulcer in your mouth.

### Good practice for mouth care

Brush teeth
at least twice a day
and when necessary

Gargle with
mouthwash after each
meal and before bed

Clean the dentures
after each meal and
keep in a container
before going to bed
*if applicable*

## Hand Hygiene

### Wash your hands often

Before eating
or cooking

After going to
the toilet

After going outdoors
and every time you
return home

# HOW TO HANDWASH?

**Wash hands when visibly soiled! Otherwise, use handrub**

Duration of the entire procedure: 40 - 60 seconds


Wet hands with water


Apply enough soap to cover all hand surfaces


Rub hands palm to palm


Right palm over left dorsum with interlaced fingers and vice versa


Palm to palm with fingers interlaced


Backs of fingers to opposing palms with fingers interlocked


Rotational rubbing of left thumb clasped in right palm and vice versa


Rotating rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa


Rinse hands with water


Dry hands thoroughly with a single use towel


Use towel to turn off faucet


Your hands are now safe

# Part 12 Central Venous Line / Hickman Catheter Care

**Redness, swelling, pain, fever and discharge** from the Hickman Catheter insertion site are the indications of infection. These photos below are infected Hickman Catheter.

### Photos of the infected Hickman Catheter

Contact the transplant team immediately if you suspect your Hickman line is infected. Do not apply cream or medication on the Hickman line insertion site without doctor's instruction.

## Hickman Line Care

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