



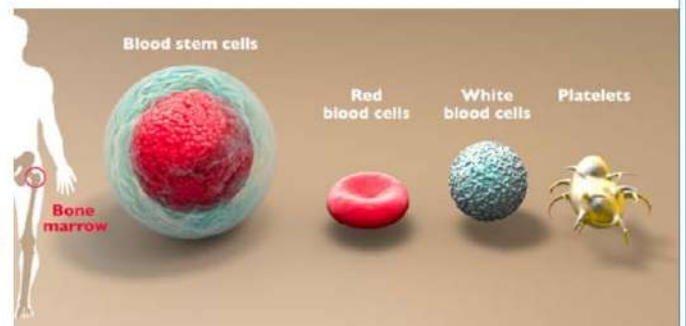
## Bone Marrow Transplant Nursing Guidelines

2023- V1



### Blood stem cells

Bone marrow contains stem cells. A blood stem cell is an immature cell that can develop into a red blood cell, white blood cell, or platelet.



Nursing Research Unit

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## Purpose

- Nursing Guidelines is to provide comprehensive, current, evidence-based nursing care for nursing staff who working in Bone Marrow Transplant Unit.

## Desired Outcome

- Reduce variations in nursing care and promote best practice.
- Develop an evidence-based nursing clinical practice guideline for nursing staff who working in Bone Marrow Transplant Unit.

## Introduction

**Bone marrow** is the soft, spongy tissue found inside large bones. It is responsible for making the blood cells including the red blood cells, white blood cells and platelets. It is also home to immune system. All of these cells are very important, so a change in bone marrow function can have life- threatening effects on body. The blood cells that make other blood cells are called *stem cells*. The most primitive of the stem cells is called the *pluripotent stem cell*.

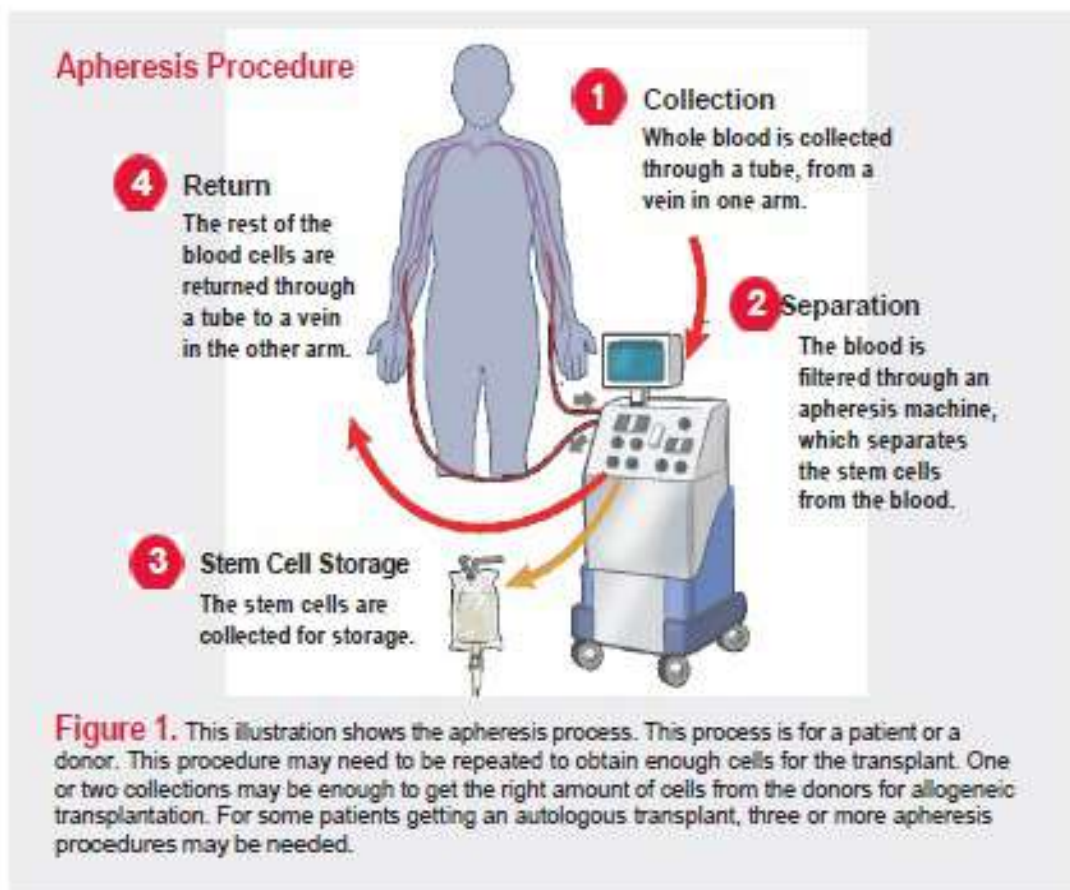
Bone marrow transplant is also called a stem cell transplant or, more specifically, a hematopoietic stem cell transplant (HSCT). Hematopoietic Stem Cell Transplantation (HSCT) is a therapeutic procedure that involves taking cells that are normally found in the bone marrow (stem cells), filtering those cells, and giving them back either to the donor (patient) or to another person. It is A self-renewing and multi-potent cells capable of maturation into any of the hematopoietic lineages, regardless of the source (bone marrow, umbilical cord blood, peripheral blood). The goal of a bone marrow transplant is to cure many diseases and types of cancer, such as leukemia, myeloma, and lymphoma, and other blood and immune system diseases that affect the bone marrow.

## Sources of Stem Cells Transplantation

Stem cells for transplantation can be collected from the Peripheral blood, bone marrow harvest or umbilical cord blood or, rarely, fetal liver.

- **Peripheral blood stem cells (PBSCs):** are collected by apheresis (This is a process in which the donor is connected to a special cell separation machine

via a needle inserted in arm veins (through cannula or mahurkar with high flow dual Leumen catheter preferred to be femoral rather than jugular). Blood is taken from one vein and is circulated through the machine which removes the stem cells and returns the remaining blood and plasma back to the donor through another needle inserted into the opposite arm. Several sessions may be needed to collect enough stem cells to ensure a chance of successful engraftment in the recipient. See **Figure 1**.



- **Bone marrow harvest:** harvesting involves collecting stem cells with a needle placed into the soft center of the bone marrow. Most sites used for bone marrow harvesting are located in the hip bones and the sternum. The procedure takes place in the operating room.
- **Umbilical cord blood transplant (UCB).** Stem cells are taken from an umbilical cord immediately after delivery of an infant. These stem cells reproduce into mature, functioning blood cells quicker and more effectively than do stem cells taken from the bone marrow of another child or adult. The stem cells are tested, typed, counted, and frozen until they are needed for a transplant.

### Types of Stem Cell Transplantation

- **Autologous hematopoietic stem cell transplantation (A-HSCT),** Auto means **Self** (the donor is the patient himself or herself). Stem cells are taken from the patient either by bone marrow harvest or apheresis, frozen. After the patient undergoes a conditioning treatment of high doses of chemotherapy, either with or without radiation therapy, the stem cells are then returned to the patient's body, where they move through the blood stream to the bone marrow (**See Figure 2**). This type of transplant is often used to treat blood cancers such as Hodgkin lymphoma, non-Hodgkin lymphoma and myeloma.

Figure 2

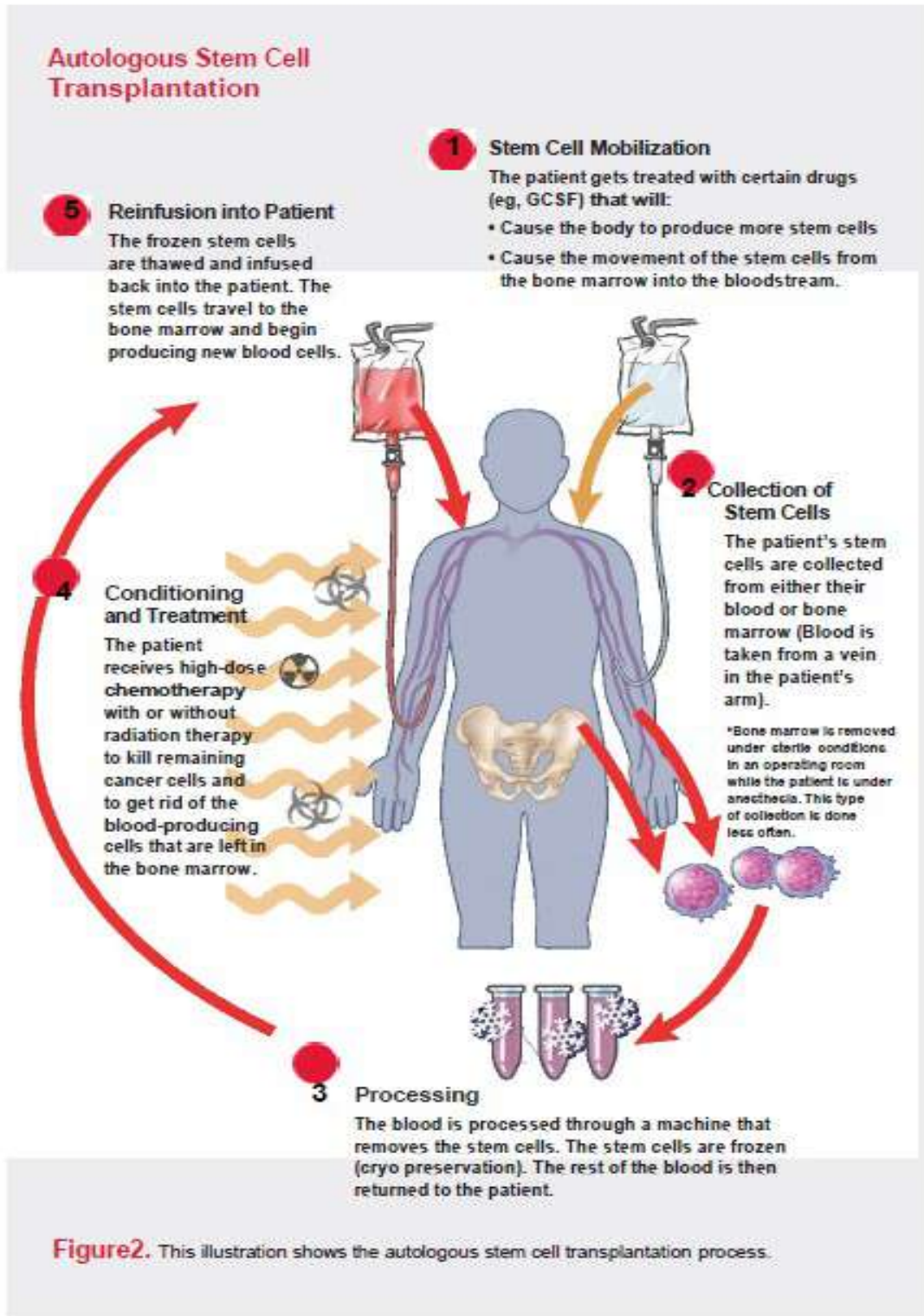
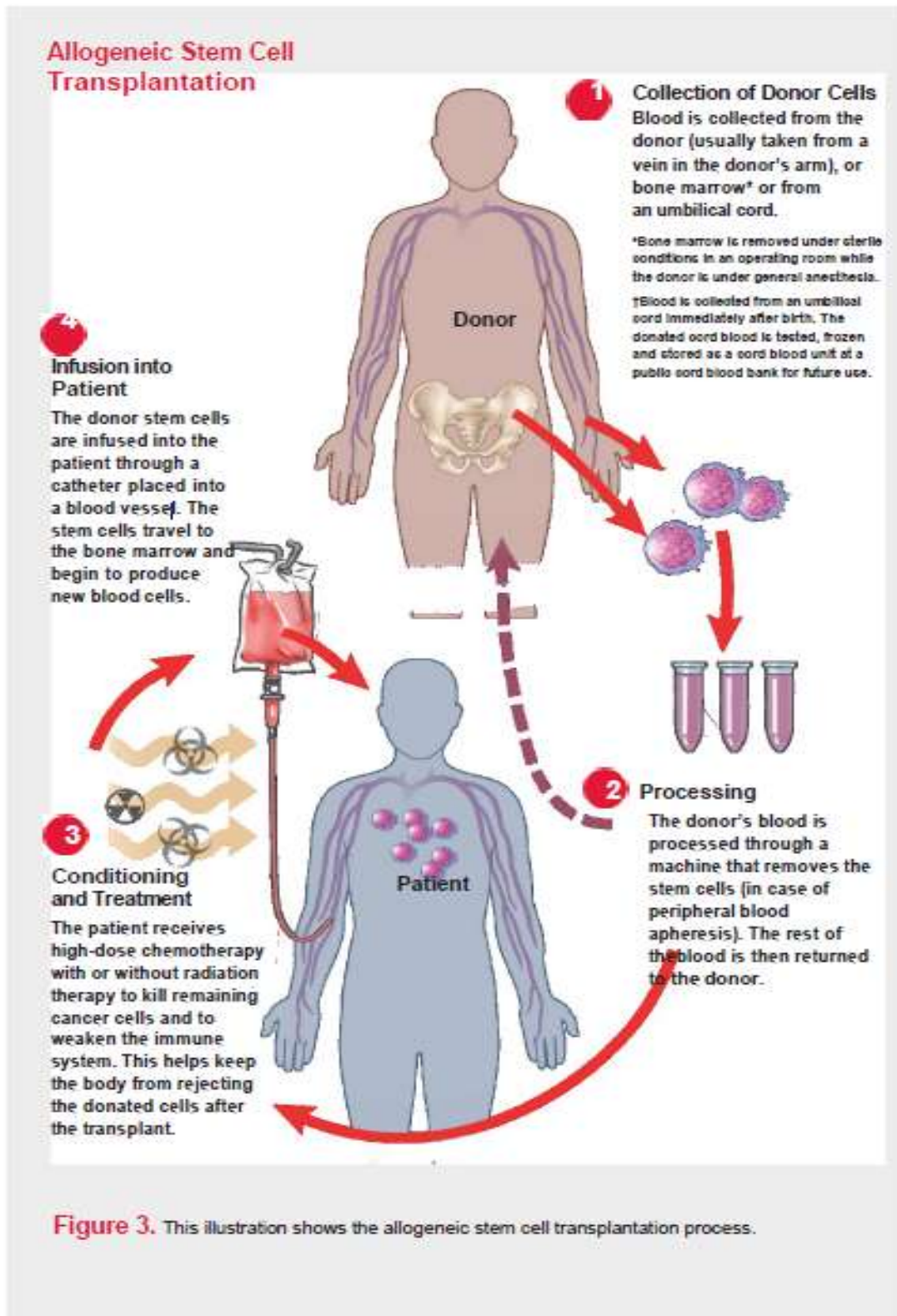


Figure2. This illustration shows the autologous stem cell transplantation process.

- **Allogeneic Hematopoietic stem cell transplantation (AHSCT).** Allo means **Other** (the donor shares the same genetic type as the patient). Stem cells are taken either by bone marrow harvest or Peripheral blood stem cells (apheresis) or cord from a genetically matched donor. Other donors for allogeneic bone marrow transplants may include the following:
  - **Matched related donor:** Siblings (brothers or sisters) is most likely to be a match.
  - **Haploidentical (half-match) stem cells:** When the donor is a parent. Parents are always a half-match for children.



(See Figure 3)



**Figure 3.** This illustration shows the allogeneic stem cell transplantation process.

## Criteria for admission and discharge at BMT unit

### **Admission Criteria**

1. Patient is in complete remission.
2. Patient is not neutropenic.
3. Negative for active infections.
4. Free CT chest and abdomen.
5. Normal Echo findings.
6. Normal liver & kidney function tests result.
7. Availability of a matched donor (for ALLO- BMT).

### **Discharge Criteria**

#### **1-Clinical**

- Good general condition Afebrile.
- No signs or symptoms of transplant related complications (as:GVHD).
- Adequate oral intake.

#### **2. Lab**

- Patient engrafted.
- CBC count back to normal.
- Normal blood chemistry.
- Negative blood culture.

## Preparation for the patient who receiving The bone marrow transplant

- A complete medical history and physical exam are performed, including multiple tests to evaluate the patient's blood and organ functions (as heart, kidney, liver, and lungs).
- A patient will be admitted for placement of the central venous line (Hickman), and other preparations. Then will be receive a **conditioning** (Conditioning uses chemotherapy and/or radiation therapy as doctor order (High-dose chemotherapy is used in stem cell transplantation in order to eliminate residual macroscopic or microscopic disease, and/or radiation therapy as total body irradiation or (TBI).
- This therapy is often called ablative, or myeloablative, because of the effect on the bone marrow. The bone marrow produces most of the blood cells in the body. Ablative therapy prevents this process of cell production and the marrow becomes empty. An empty marrow is needed to make room for the new stem cells to grow and establish a new blood cell production system.
- After conditioning (chemotherapy and/or radiation) is administered, the marrow transplant is given through the central venous catheter into the bloodstream. It is not a surgical procedure to place the marrow into the bone, but is similar to receiving a blood transfusion. A transfusion is a slow injection of blood products into a vein. This can take several hours.
- The transplanted Stem cells will travel to bone marrow and grow. New, healthy blood cells will form. This is called **Engraftment**.

- Engraftment of the stem cells happens when the donated cells make their way to the marrow and begin making new blood cells. Depending on the type of transplant and the disease being treated; engraftment usually occurs about 2 to 4 weeks after the transplant. Blood counts will be checked often during the days following transplant to evaluate initiation and progress of engraftment.
- Engraftment can be delayed because of infection, medicines, low donated stem cell count, or graft failure. Although the new bone marrow may begin making cells in the first 30 days following transplant, it may take months, even years, for the entire immune system to fully recover.
- The days before transplant are counted as **minus days**.
- The day of transplant is considered day zero. Engraftment and recovery following the transplant are counted as **plus days**.
- After the transplant, supportive care is given to prevent and treat side effects, and complications as nausea, vomiting, diarrhea, hair loss, mouth sores, infection, bleeding, anemia or fatigue.

### ABO compatibility

-Maximum allowable mismatched RBC volume 0.2-0.4ml/kg.

-In bone marrow graft: RBCs comprise 25-30% of the product volume so, RBCs reduction is mandatory.

-In mobilized peripheral blood product :usually contain few RBCs(<20 ML)→ RBCs reduction is not required.

- RBCs depletion: manual to separate buffy coat cells (mononuclear &granulocytes)

## Nursing Care Pre, During and Post Stem Cell Infusion

Nurses play a role in preventing or early detection of alarming signs, such as sepsis, fluid overload and organ dysfunction, taking appropriate measures to minimize adverse effects and restoring the clinical balance of the patient.

Nurses also provide a key role in patient education, providing pre- and post-transplant. As the following:

### A. Pre-infusion Assessment

- *Maintain a safe environment:* Ensure that patient is prepared and the room is organized and have access to everything as oxygen and suction.
- *Baseline observations:* Record baseline observations in order to assess the patient's physiological status during and post infusion.
- *IV line care:* Check the IV line for patency. Common lines used for this treatment are PICC lines and Hickman lines. Ensure aseptic non-touch technique is used to prevent the risk of infection.
- *Toileting Discuss:* with the patient and encourage toileting prior to starting the procedure in order to minimize interruption to the stem cell infusion and also ensure safety for the patient.
- *Psychological support:* Day zero can be a momentous occasion for someone who requires a stem cell transplantation. Patients may experience a range of emotions, from elation through to distress, anxiety, vulnerability and helplessness. Nurses using simple techniques such as discussing the procedure, and listening and offering reassurance may help to reduce patient's anxiety.

## **B. During Stem Cell Infusion**

- *IV line care:* Nurses ensure that aseptic non-touch technique is used to prevent the risk of infection.
- *O2 saturations* are monitoring constantly during infusion.
- *Assess for potential side effects:* Patients can have mild to severe reactions to a stem cell infusion. Autologous stem cells tend to be cryopreserved. Patients can experience allergic reactions including nausea, flushing, rash, chest tightness, shortness of breath and chills.
- *Good hydration* and urine output monitoring for any change in color.

## **C. Post Stem Cell Infusion**

- *Assess* for later effects of the cell infusion.
- *Observations* should be performed.
- *Report* any abnormalities to the doctor.
- *Document* the care event in patient assessment sheet.

## Common Complications and Nursing intervention (Table 1)

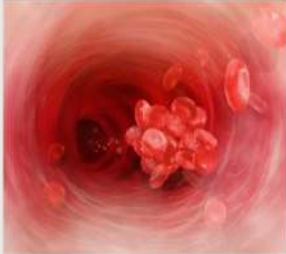
### Note:

- ✓ Any medical side effects should be reported to the doctor.
- ✓ Any medication should be given as doctor recommendations.

Complication	Definition	Nursing intervention
<b>1- Oral Mucositis (OM)</b>	<p>It is inflammation of the mucosal membrane, characterized by ulceration, which may result in pain, swallowing difficulties and impairment of the ability to talk.</p> <p>Generally, makes eating difficult or impossible. Occurring during conditioning chemo or after stem cell infusion.</p>	<ul style="list-style-type: none"> <li>-Monitoring vital signs (temperature, pulse, blood pressure, respirations and pain) as hospital policy and report to the doctor for any abnormality and documentation.</li> <li>-Give patients medication as antifungal and antiviral treatments as doctor order to reduce infections.</li> <li>-Daily assessments should be completed during HSCT and at regular intervals post treatment to monitor for complications and report to the doctor.</li> <li>-Oral hygiene and good nutrition is vital in helping to fight infection, maintain mucosal integrity, enhance mucosal tissue repair and reduce exacerbation of existing mucositis.</li> <li>-Patients may be need to total parenteral nutrition as doctor order until the patients is able to eat again.</li> <li>- Monitor patients weight as doctor order to detect any abnormalities.</li> <li>-Monitor for any swallowing problems, malnutrition and report to the doctor.</li> <li>-Monitor fluid intake and output and document in fluid balance and report to the doctor.</li> <li>- Assess the causes of pain, location, characteristics, onset, duration, frequency and severity and report to</li> </ul>

		<p>the doctor.</p> <ul style="list-style-type: none"> <li>-Give patients adequate pain medication in case of pain as doctor order.</li> <li>-Teach patients as doctor order about diet that may be lead to damage the oral mucosa; as rough, sharp and hard foods.</li> <li>-Education should also include potential oral complications to enable patients to identify and report these early.</li> </ul>
<p><b>2- Sepsis and Septic shock</b></p>	<p><b>-Sepsis:</b>  <b>It is a</b> Systemic inflammatory response caused by infection that manifested with:</p> <ul style="list-style-type: none"> <li>-Fever (<math>&gt;38\text{ }^{\circ}\text{C}</math>) or hypothermia (<math>&lt;36\text{ }^{\circ}\text{C}</math>)</li> <li>-Pulse rate <math>&gt; 90</math> beats/min</li> <li>-Respiratory rate <math>&gt; 20</math>/min</li> </ul> <p><b>Severe sepsis</b></p> <p><b>It is a</b> Sepsis with hypoperfusion or acute organ dysfunction or hypotension that manifested with signs of sepsis with</p> <ul style="list-style-type: none"> <li>-Increased lactate level</li> <li>-Mental changes,</li> <li>-Saturation <math>&lt; 90\%</math></li> <li>-Decreased urine output</li> <li>-Increased liver function tests levels</li> </ul>	<ul style="list-style-type: none"> <li>-Good hand hygiene performed correctly as hospital policy to prevent infection.</li> <li>-Monitor vital signs (temperature, pulse, blood pressure, respirations and pain) and report to the doctor for any abnormality and documentation.</li> <li>-Cultures should be taken if patient has a temperature <math>\geq 38.0\text{ }^{\circ}\text{C}</math> as doctor order.</li> <li>-Assess any signs of sepsis to prevent progress to septic shock and report to the doctor</li> <li>-Assess any sites of infection (mouth, skin, all indwelling catheters, central line site, rectum, or any surgical sites) and report to the doctor.</li> <li>-Change intravenous accesses according to hospital policy.</li> <li>-Start or increased IV fluids and oxygen therapy as doctor order.</li> <li>- Give patients medication as antibiotics, anti-fungal medications and anti-viral medications to prevent or treat serious infections as doctor order.</li> <li>-Assess any signs of bleeding, pain and report to the doctor any abnormality with documentation.</li> </ul>



	<p>-Abnormal coagulation parameters</p> <p><b>Septic shock</b></p> <p><b>It is</b> a subset of severe sepsis with hypotension despite adequate fluid resuscitation and with presence of perfusion abnormalities that may include lactic acidosis, oliguria or alteration of mental status that manifested with signs of severe sepsis with: Vasopressor requirement</p> <p>-Serum lactate level &gt; 2 mmol/L (&gt;18 mg/dL)</p> <p>-Increased respiratory and heart rate.</p> <p>-Altered mental status</p>	<p>- Use protective isolation during the neutropenic as hospital policy.</p> <p>-Monitor laboratory tests (CSF, urine, sputum, chest X-ray and Urinalysis) to detect and to treat infections as doctor order.</p> <p>-Assess intake and output and report to the doctor any abnormality with document in fluid balance.</p>
<p><b>3. Hemorrhagic cystitis (HC)</b></p> 	<p><b>Hemorrhagic cystitis</b></p> <p><b>It is a</b> condition in which the lining of the bladder becomes inflamed and starts to bleed.</p> <p><b>Symptoms</b></p> <p>-Hematuria (blood in the urine), pain and a burning feeling while urinating, feeling a need to urinate often, and being unable to control the flow of urine.</p> <p><b>Cystitis</b> is the term used to describe inflammation of the bladder. The inflammation can be caused by an infection</p>	<p>-Provide adequate daily fluid intake to avoid hemorrhagic cystitis.</p> <p>-Measure intake and output and report to the doctor.</p> <p>-Encourage child during cyclophosphamide infusion to go to bathroom and ask mother to observe any changes in urine color and reported.</p> <p>-Encourage patient to urinate before going to bed for the night to empty the bladder.</p> <p>-Urinalysis is also a recommendation to evaluate for the presence of hematuria, proteinuria, or bacterial infections as order.</p> <p>-Monitor for kidney function as order (Cyclophosphamide is excreted through kidneys.)</p>

	<p>or as a reaction to certain drugs or radiation therapy.</p>	<p>-Forced fluid IV and Mesna (during the cyclophosphamide treatment period) should be administered as close to on time as possible to decrease the incidence and severity of hemorrhagic cystitis.</p> <p>-Report urinary symptoms immediately to doctor (Blood in the urine, pink or red urine, frequent urination or urge to urinate, trouble urinating, incomplete emptying of bladder, pain during urination).</p>
<p><b>4. Engraftment Syndrome (ES)</b></p>	<p><b>Engraftment</b> is defined as when the number of neutrophils in the patient's blood rises to an absolute neutrophil count</p> <p><b>Per-engraftment</b> defined as the period within 5 days of neutrophil engraftment.</p> <p><b>The clinical manifestations</b> are divided into:</p> <p><b>-Major Criteria:</b></p> <ul style="list-style-type: none"> <li>-Non-infectious fever</li> <li>-Skin rash</li> <li>-Pulmonary edema that Confirmed by X-ray or CT, Without signs of infection, cardiac failure or pulmonary embolism.</li> </ul> <p><b>-Minor Criteria</b></p> <ul style="list-style-type: none"> <li>- Weight gain</li> </ul>	<p>-Monitor vital signs (temperature, pulse, blood pressure, respirations and pain), in cases of fever <math>\geq 38^{\circ}\text{C}</math>, obtain cultures as doctor order.</p> <p>- Monitor respirations and Saturation and if symptoms of pulmonary dysfunction as (dyspnoea, tachypnoea, change in breathing pattern, chest pain or cough) as order.</p> <p>-Administration of oxygen therapy may be necessary as doctor order.</p> <p>-Give patients medication as doctor order.</p> <p>- Assess the patient's weight and in case of edema, ascites or other symptoms of fluid retention occurs report to the doctor.</p> <p>-Assess any signs and symptoms of jaundice and yellow sclera are signs of liver dysfunction and bilirubin levels should be checked as order and report to the doctor.</p> <p>- Assess any signs and symptoms as confusion, lethargy, headache, visual disturbances, aphasia and report to the doctor.</p> <p>-Monitor blood glucose levels when give corticosteroids medication and report to the doctor.</p>

	<ul style="list-style-type: none"> <li>- Hepatic dysfunction</li> <li>- Renal dysfunction</li> </ul> <p>Transient</p> <ul style="list-style-type: none"> <li>-Encephalopathy</li> </ul>	
<p><b>5. Idiopathic Pneumonia Syndrome (IPS)</b></p> <p>It is a serious condition that can occur after a stem cell transplant (<b>Rare</b>)</p>	<p>It is a set of pneumonia-like symptoms that occur with no sign of infection in the lung.</p> <p><b>Signs and Symptoms</b></p> <ul style="list-style-type: none"> <li>-Fever</li> <li>-Non-productive cough</li> <li>-Rales (It is a fine, high-pitched crackling or rattling sound that can occur during inhale).</li> <li>-Dyspnea</li> <li>-tachypnoea</li> <li>-low saturation with an increasing need for oxygen support.</li> </ul>	<ul style="list-style-type: none"> <li>-Monitor patient's vital signs (temperature, pulse, blood pressure, respirations and pain) and report to the doctor for any abnormality.</li> <li>-Administration of medication as doctor order.</li> <li>- Monitor sputum cultures and laboratory tests as doctor order.</li> <li>-administer oxygen therapy as doctor order.</li> <li>-Teach the patients about breathing techniques and exercises to decrease level of anxiety as doctor order.</li> </ul>
<p><b>6. Diffuse alveolar haemorrhage (DAH)</b></p>	<p>It is a non-infectious pulmonary complication associated with hematopoietic stem cell transplant (HSCT) and other causes</p> <p><b>Symptoms</b></p> <ul style="list-style-type: none"> <li>-Dyspnea, dry cough and fever.</li> </ul> <p><b>Signs</b></p> <ul style="list-style-type: none"> <li>-Hemoptysis</li> <li>-Hypoxemia</li> <li>-Diffuse or focal interstitial or alveolar infiltrates</li> </ul>	<ul style="list-style-type: none"> <li>-Frequent monitoring for vital signs (temperature, pulse, blood pressure, respirations and pain) as hospital policy and report to the doctor for any abnormality.</li> <li>-Administration of oxygen therapy as order.</li> <li>-Using as order appropriate breathing technique in anxiety patient that may decrease some discomfort.</li> <li>- Monitor blood glucose level during high-dose corticosteroid treatment, it is important to be alert to steroid-related changes in the patient's mental status.</li> </ul>

<p><b>7. Sinusoidal Obstruction Syndrome /Veno-Occlusive Disease (SOS/VOD).</b></p>	<p>Occur when the small blood vessels leading into the liver and that are found inside the liver become swollen, damaged and/or blocked.</p> <p><b>Signs and Symptoms</b></p> <ul style="list-style-type: none"> <li>-Bloated abdomen</li> <li>-Pain in the top right quarter of abdomen</li> <li>-Dark urine.</li> <li>-Weight gain</li> <li>-Yellow eyes and skin</li> </ul>	<ul style="list-style-type: none"> <li>-Good examinations to assess all sites for bleeding or pain source and level and report to the doctor.</li> <li>-Monitoring fluid intake and output, blood tests as urea and electrolytes, liver function, patients weight and abdominal girth and report to the doctor.</li> <li>-Give patient medication as doctor order.</li> <li>-Teach patients that VOD can occur while in hospital or after being discharged from hospital, it is important to look out for any signs and symptoms.</li> </ul>
<p><b>8. Transplant-associated microangiopathy (TAM)</b></p>	<p><b>Symptoms</b></p> <ul style="list-style-type: none"> <li>-Microangiopathic hemolytic anemia with schistocytes (fragmented red blood cells).</li> <li>-Thrombocytopenia from platelet consumption.</li> </ul>	<ul style="list-style-type: none"> <li>- Frequent monitoring for vital signs (temperature, pulse, blood pressure, respirations and pain) as hospital policy and report to the doctor for any abnormality.</li> <li>-Keeping track of fluid balance and weight is equally important.</li> <li>-Monitor the patient's urine for proteinuria and hemoglobinuria and report to the doctor for any abnormality.</li> <li>- Monitor as doctor order CBC, kidney function test and hemolytic workup as lactate dehydrogenase (LDH), fragmented RBCs, reticulocytes and c5b9).</li> <li>-Assess any signs of gastrointestinal bleeding and report to the doctor.</li> </ul>
<p><b>Graft versus host disease (GVHD)</b></p>	<p>-It is an immune reaction of the donor's cells against the body tissues.</p>	<ul style="list-style-type: none"> <li>-Monitored closely for signs and symptoms and report to the doctor.</li> <li>-Give patients medication as doctor order.</li> </ul>

	<p><b><u>Types:</u></b></p> <p>1-<u>Acute graft versus host disease</u>: affecting skin, gastrointestinal tract, and liver</p> <p>-Occurs within the first 100 days of transplant.</p> <p>2-<u>Chronic graft versus host disease</u>. Occurs within the first two years after transplant.</p>	<p>-Strict intake and output as doctor order.</p> <p>-Administer immune suppressing medications as doctor order to prevent graft versus host disease, but these immune suppressing medications increase the risk of infections.</p> <p>-Encourage patient's nutrition with a low-fiber, low-fat, and low-sugar diet as order in case of diarrhea.</p> <p>-Encourage daily stretching exercises and deep muscle/fascial massages at home to improve range of motion.</p> <p>-Teach children and parents to avoid direct sun exposure (especially between 10 am and 4 pm) and wear a long-sleeved shirt, full-length pants, and hat also use Sunscreen cream as doctor order to protect the face, neck, and all uncovered skin.</p> <p>-For dry skin, teach children and parents to use oil in the bath water, as order.</p>
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## Administration Notes of Chemotherapy and Nursing Intervention (Table 2)

**Note:**

- ✓ Any medical side effects should be reported to the doctor.
- ✓ Any medication should be given as doctor recommendations.

Medication	Common side effects	Nursing Intervention
<b>Busulfan</b> (Busulfex, Myleran)	<ul style="list-style-type: none"> <li>-Low blood counts (may cause increased risk of infection, bleeding, anemia, and/or fatigue).</li> <li>-Oral Mucositis</li> <li>-Seizures</li> <li>-Change in skin color (darkening of skin)</li> <li>-Liver problems that called veno-occlusive disease(VOD)</li> </ul>	<ul style="list-style-type: none"> <li>- Flush the line with 10ml n/saline in order to ensure patency as hospital policy.</li> <li>-Regular blood draws to check blood counts as order.</li> <li>-Assess any signs and symptoms as (change in skin color, cloudy or pink urine, dark or black stools, unusual fatigue, blurred vision, flank or joint pain, swelling of lower legs and feet; yellowing white of eye, abdominal discomfort, or itching and report to the doctor.</li> <li>-Monitor liver function (Busulfan is extensively metabolizes in the hepatic) as order.</li> <li>-Give to the patient medication according doctor order as: <ul style="list-style-type: none"> <li>- antiemetic to prevent nausea and vomiting.</li> <li>- anti-convulsant to prevent seizures.</li> </ul> </li> <li>-Assess oral cavity for any sore mouth or throat, and promote mouth care as hospital policy.</li> <li>-Weight all patients according to hospital policy.</li> <li>-Monitor intake&amp; output and increase fluid intake to assure adequate urinary output as doctor order.</li> </ul>
<b>Fludarabine</b> (Fludara)	<ul style="list-style-type: none"> <li>-Low blood counts (may cause increased risk of infection, bleeding, anemia, and/or fatigue).</li> <li>-Oral Mucositis.</li> <li>-Nausea and vomiting</li> </ul>	<ul style="list-style-type: none"> <li>-Regular blood draws to check blood counts as doctor order.</li> <li>-Monitor liver and kidney function as doctor order.</li> <li>-Monitor signs of CNS toxicity, including confusion, agitation, severe headache, hearing loss, visual</li> </ul>

	<ul style="list-style-type: none"> <li>-Fever</li> <li>-Chills</li> <li>-Infections</li> <li>-Fatigue</li> </ul>	<p>disturbances, and decreased consciousness. Notify physician, especially if patient becomes unresponsive or difficult to arouse.</p> <ul style="list-style-type: none"> <li>-Assess any signs of skin rash, itchiness or signs of numbness, tingling, or weakness that might indicate peripheral neuropathy and report to the doctor.</li> <li>- Monitor neuromuscular signs of electrolyte imbalances that may be indicate tumor lysis syndrome with signs of severe muscle weakness or paralysis due to increased plasma potassium (hyperkalemia) or muscle hyperexcitability and tetany due to phosphate and calcium imbalances (hyperphosphatemia and hypocalcemia) and report to the doctor.</li> <li>-Assess kidneys and liver are functioning as order (Fludarabine can affect the kidneys and liver).</li> <li>-Administer antiemetic drugs to patients as order to help prevent or control nausea or vomiting.</li> <li>-Give to patient's small frequent meals as order.</li> <li>-Oral care to prevent or cure sore mouth or mouth ulcers as hospital policy.</li> <li>-Encourage patients to drink water in case of diarrhea</li> </ul>
<p><b>- Carboplatin</b> (Paraplatin, CBDCA)</p>	<ul style="list-style-type: none"> <li>-Hypersensitivity Reaction.</li> <li>-Anaphylaxis.</li> <li>-Ototoxicity.</li> <li>- Electrolyte Abnormality.</li> <li>-Low blood counts</li> <li>-Oral Mucositis.</li> </ul>	<ul style="list-style-type: none"> <li>- Maintain adequate nutrition and adequate hydration as doctor order.</li> <li>-Monitor signs of nephrotoxicity as decreased urination, swelling from fluid retention and high blood pressure and report to the doctor</li> <li>-Monitor intake&amp; output and assess any signs/symptoms of fluid overload and report to the doctor for any abnormality.</li> <li>-Regular blood draws to check blood counts as doctor</li> </ul>

		<p>order.</p> <ul style="list-style-type: none"> <li>-Monitor signs of hypersensitivity reactions, including anaphylaxis reactions as pulmonary symptoms (tightness in the throat and chest, wheezing, cough, dyspnea) and skin reactions (rash, pruritus, urticaria, burning skin) and report to the doctor.</li> <li>- Monitor signs of ototoxicity such as hearing loss, tinnitus, disturbed balance, and report these signs to the doctor.</li> <li>- Monitor neuromuscular signs of electrolyte imbalances as (hypocalcemia, hypokalemia, hyponatremia, hypomagnesemia) and report to the doctor.</li> <li>-Give patients education about avoid contact with patient body fluids, which can contain the drug for 48 hours after it is given.</li> </ul>
<p><b>- Melphalan (Alkeran)</b></p>	<ul style="list-style-type: none"> <li>-Low Blood Counts</li> <li>-Oral Mucositis.</li> <li>-Nausea and vomiting.</li> <li>-Loss of appetite.</li> <li>-Changes in taste.</li> <li>-Dizziness.</li> <li>-Mouth sores</li> <li>-Fatigue or weakness</li> </ul>	<ul style="list-style-type: none"> <li>-Monitor signs of allergic reactions or anaphylaxis, including pulmonary symptoms (tightness in the throat and chest, wheezing, cough, dyspnea) or skin reactions (rash, pruritus, urticaria) and report to the doctor.</li> <li>-Assess any signs of leukopenia (fever, sore throat, signs of infection), thrombocytopenia (bruising, nose bleeds, bleeding gums), or unusual weakness and fatigue that might be due to anemia and report to the doctor.</li> <li>- Regular blood draws to check blood counts as doctor order.</li> <li>- Frequent hand washing to prevent infection and avoid crowds and contact with persons with contagious diseases.</li> </ul>
<p><b>-Antithymocyte globulin (Thymoglobulin, ATG )</b></p>	<ul style="list-style-type: none"> <li>-Allergic reaction</li> <li>-Low Blood Counts</li> <li>-Oral Mucositis</li> </ul>	<ul style="list-style-type: none"> <li>-Assess any symptoms of allergic reaction as fever, chills, itching, swelling, hives, trouble breathing, low blood pressure, nausea/vomiting and report to the doctor.</li> </ul>



		<ul style="list-style-type: none"> <li>-Monitoring liver and kidney function as order.</li> <li>-Assess any signs of abdominal pain and report to the doctor.</li> <li>-Frequent monitoring for vital signs (temperature, pulse, blood pressure, respirations and pain) as hospital policy and report to the doctor for any abnormality as hypertension, headache.</li> <li>-Give patient medication in case of any abnormality as hypertension, headache, pain or fever as doctor order.</li> <li>-Monitoring levels of potassium in the blood, and counts of platelets and white blood cells as doctor order.</li> </ul>
<b>Cyclophosphamide (Cytosan)</b>	<ul style="list-style-type: none"> <li>-Low Blood Counts</li> <li>-Oral Mucositis.</li> <li>-Hemorrhagic Cystitis</li> </ul>	<ul style="list-style-type: none"> <li>- Closely monitor infusion site for extravasation.</li> <li>-If extravasation occurs, follow Prevention and Treatment of Drug Extravasation hospital policy.</li> <li><b>-See above (Hemorrhagic cystitis) table 1.</b></li> </ul>
<b>Cytarabine (Ara-C) (Cytosar)</b>	<ul style="list-style-type: none"> <li>-liver dysfunction.</li> <li>-Conjunctivitis with HD</li> <li>-Flu like syndrome (Fever).</li> <li>-Low Blood Counts</li> <li>-Oral Mucositis.</li> </ul>	<ul style="list-style-type: none"> <li>- Administer pre-medications as ordered</li> <li>-Assess AST, ALT, and bilirubin as order.</li> <li>-Mouth care as hospital policy.</li> <li>- Assess sign and symptom of skin rash and report to the doctor.</li> <li>-Assess any CNS toxicity (confusion, mood changes, numbness, tingling, severe muscle weakness, or stiff neck) and report to the doctor.</li> <li>- Assess any GI toxicity (severe nausea, vomiting, or diarrhea and report to the doctor.</li> <li>-Administer Dexamethasone eye drops /6 hours with HD ARA-C.</li> <li>- Assess any visual changes and report to the doctor.</li> <li>-Frequent monitoring for vital signs (temperature, pulse,</li> </ul>

		<p>blood pressure, respirations and pain) as hospital policy and report to the doctor for any abnormality and in case of fever ask doctor before blood culture with <b>HD ARA-C</b></p> <p>-Assess for any focus of infection after administration.</p>
<p><b>Bendamustine</b> (Belrapzo, Bendeka, Treanda, Vivimusta Cytostasan)</p>	<p>-Low blood counts (may cause increased risk of infection, bleeding, anemia and fatigue)</p> <p>-Fatigue or weakness</p> <p>-Headache</p> <p>-Skin rash, redness, or dryness</p> <p>-Diarrhea</p> <p>-Constipation</p>	<p>-Regular blood draws to check blood counts and liver and kidney function as order.</p> <p>-Clear instructions to patients and encouraged to maintain good oral hygiene.</p> <p>-Good hand hygiene performed correctly as hospital policy to prevent infection.</p> <p>-Assess any symptoms as confusion, memory loss, headache, vision or speech changes, loss of balance or coordination, weakness on one side of the body, or changes in mood or behavior.</p> <p>-Give patient medication to reduce nausea and vomiting as doctor order.</p>
<p><b>Etoposide</b> (Toposar, VP-16, VePesid)</p>	<p>-Stored at room temperature.</p> <p><b>Signs and symptoms</b></p> <p>-Hypotension.</p> <p>-Diarrhea.</p> <p>-Myelosuppression</p>	<p>-Measure vital signs and blood pressure before starting the Etoposide infusion and report to the doctor.</p> <p>- Monitor patient closely for anaphylactic reaction as (chills, fever, tachycardia, bronchospasm, dyspnea, hypotension) and report to the doctor.</p> <p>-Check IV site before, during and after infusion as doctor order.</p> <p>- Regular blood draws to check blood counts as doctor order.</p> <p>- Changes patient position slowly, from lying to upright position because transient hypotension after therapy is possible as order.</p>

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