

Module Six

Part Five – Providing care for the person undergoing haematopoietic stem cell transplantation (HSCT)

Overview

The aim of this module is to develop the ability of the beginning specialist cancer nurse to demonstrate competence across all domains of practice when caring for the person undergoing haematopoietic stem cell transplantation.

Key concepts

The key concepts associated with providing care for the person undergoing haematopoietic stem cell transplantation include:

- Factors influencing selection of haematopoietic stem cell transplantation for the treatment of cancer.
- Experience and impact of haematopoietic stem cell transplantation on various health domains.
- Prevention, detection, and management of common health alterations experienced by people undergoing a haematopoietic stem cell transplantation.

Learning activities

At times, you will have learning activities to complete. The questions will relate to the content you've just read or the video you've just watched.

Resource links

Resource links may be included throughout the module. These links lead to interesting resources, articles or websites, and are designed to encourage you to explore other available information.

Videos

You may be prompted to access EdCaN videos throughout this module.

Estimated time to complete

20 hours

Objectives

On completion of this supporting resource, you should be able to:

1. Perform a comprehensive health assessment on a person prior to, during, and following haematopoietic stem cell transplantation.
2. Analyse clinical, psychological and social data to formulate and implement an individualised plan of care for the person having haematopoietic stem cell transplantation.
3. Demonstrate delivery of effective nursing care to prevent, detect, and manage early and late effects associated with haematopoietic stem cell transplantation.
4. Demonstrate effective educational strategies in providing individualised information to the person having haematopoietic stem cell transplantation.
5. Demonstrate competence in the administration of bone marrow/haematopoietic stem cells.

Principles of transplantation

The key concepts of haematopoiesis and immunology underpin the process of haematopoietic stem cell transplantation.

Resource link

The role of haematopoietic stem cell transplantation in cancer control and a brief overview of the mechanism of action were covered in Module 4: Cancer Treatment Principles. In the sections below, we review specific concepts underpinning the process of haematopoietic stem cell transplantation. Completion of these sections assumes you have successfully completed the relevant learning activities in Module 4. If required, take some time to review the learning activities in Module 4 before completing this module.

Haematopoiesis

Human blood cells are produced, regulated and maintained by the multifaceted, multistep process of haematopoiesis.¹ Organs involved in formation of blood include the bone marrow, spleen, and liver. Haematopoiesis occurs in the flat bones, including the sternum, ribs, skull, pelvis, shoulders, vertebrae, and innominates.¹

Pluripotent stem cells (from which all variants of human cells initiate) are central to the process of haematopoiesis.¹ The earliest identifiable type of stem cell is called a colony-forming unit-blast cell (CFU-blast). It is capable of multilineage differentiation, as well as self-replication.¹

Cells that support immune function are derived from pluripotent stem cells. Cells that have matured through the normal stages of haematopoiesis² have specific functions involving infection control, oxygenation, coagulation, and haemostasis.¹

Resource link

[Haematopoietic Stem Cell Mobilisation and Apheresis: A Practical Guide for Nurses and Other Allied Health Care Professionals.](#)³

Learning activities

Completed

Activities

- 1. Outline the roles of the bone marrow, spleen, and liver in haematopoiesis.
- 2. Review Figure 3. Stem Cell Maturation Cascade in [Haematopoietic Stem Cell Mobilisation and Apheresis: A Practical Guide for Nurses and Other Allied Health Care Professionals](#).³
- 3. Access a current text and identify the normal cell count, lifespan, and function of the following blood cells:
 - neutrophil
 - B lymphocyte
 - T lymphocyte
 - erythrocyte
 - thrombocyte.
- 4. Access a current text and discuss the effects of the following factors on the marrow microenvironment, and their implications on the process of HSCT:
 - ageing
 - antineoplastic agents.

Transplant immunology

An individual's immune system protects their body against foreign substances. The immune system consists of nonspecific (natural) and specific (acquired) immunity, which interact with each other and have overlapping functions. An understanding of immunology is important in transplantation in such key areas as:¹

- human leukocyte antigen testing to appraise donor matching
- immune reconstitution
- considerations associated with donor selection
- sources of stem cells.

Human leukocyte antigen (HLA) typing

Donor tissue typing is based on human leukocyte antigen (HLA) typing, also called the major histocompatibility complex (MHC). There are Class I and Class II HLA / MHC located on human chromosome 6. Class I major antigens include A, B, and C. Class II includes DR, DQ, and DP.

HLA typing is generally performed through a search of 10 alleles - HLA A, B, C, DR, and DQ. Debate remains regarding the significance of other minor Class I antigens and HLA DP.⁴

Immune reconstitution

Conditioning regimens prior to HSCT alter an individual's immunity for months to several years post transplantation.¹

In a recipient of an allogeneic HSCT, the establishment of the donor's immune system can provide a therapeutic graft-versus-tumour (GVT) effect. Negatively, it can also cause graft-versus-host disease (GVHD) and prolonged immune dysfunction.⁵

Natural killer (NK) cells and dendritic cells play an important role in activating T cells involved in GVT effect and GVHD.⁴

Resource link

[Emerging immunology of stem cell transplantation](#)⁴

[NCI Understanding cancer series: blood stem cell transplants](#)⁶

Learning activities

Completed

Activities

1. Summarise the processes of non-specific and specific immunity.

2. Describe the roles of the body's nonspecific immune defenses in:

- skin and mucous membranes
- inflammatory response and phagocytosis.

Donor considerations

Donor selection

Choice of donor depends on disease, histocompatibility, availability, informed consent, and medical competence.⁷ Less than 30% of individuals have a HLA-identical sibling. In these circumstances, alternative donors, such as phenotypically matched, unrelated volunteers and partially matched family members, are considered.⁵

Ethnicity

Approximately 75% of Caucasian individuals can locate a suitable matched volunteer donor. Minor ethnic groups have lower rates of success. Such matched unrelated donors (MUD) are associated with significant complications, such as GVHD and prolonged and profound immunodeficiency.⁵

Other considerations

Other factors considered after HLA typing are donor characteristics such as:^{4, 8}

- gender
- weight
- number of pregnancies
- overall health
- age
- Cytomegalovirus (CMV) negative serology (for CMV-negative recipients)
- ABO compatibility
- matched race.

Favourable donor characteristics are male gender, younger age, good size, and good health.⁴ In addition to assessing the donor's physical suitability, the impact of the stem cell collection or harvest on the individual's lifestyle, and the relationship with the recipient should also be discussed. Unrelated donors also receive counseling prior to donation. A social worker or other psychoncology health professional can be involved to deal with stress and anxiety.⁹

Sources of stem cells

The three options for HSCT include use of bone marrow (BM), peripheral blood stem cells (PBSC), and cord blood (CB). The biology of the graft and subsequent immunological effects differ between the sources of stem cells.⁴

Bone marrow (BM)

- The first source of stem cells⁴
- Harvested from the iliac crests of a donor under general anaesthetic⁴
- Disadvantages include:¹⁰
 - requirement for general anaesthetic
 - slower neutrophil and platelet engraftment
 - higher rates of morbidity and mortality
 - potentially more tumour cell contamination of product
- In Australia in 2008 bone marrow was the cell source for:¹¹
 - 18% (70/382) of allogeneic / syngeneic transplants
 - less than 1% (5/744) of autologous transplants.

Peripheral blood stem cells (PBSC)

- Offers the following advantages over BM in collection procedure:⁴
 - no anaesthesia
 - less invasive procedure
 - no hospitalization.
- More chronic GVHD (cGVHD) after PBSC use with unrelated donor transplants for leukaemia⁴
- Survival advantage with PBSC versus BM⁴
- In Australia in 2008 PBSC was the cell source for:¹¹
 - 64% (246/382) of allogeneic/syngeneic transplants
 - 99% (738/744) of autologous transplants.

Cord blood (CB)

- Increasing use in the last decade
- Advantages include:^{1, 4}
 - no apparent risk to donors
 - no prolonged screening process
 - immunologically immature T cells allow for cord blood to be transplanted in mismatched donors without the significant risk of GVHD
- Disadvantages include:^{1, 4}
 - prolonged immune reconstitution
 - low cell dose
 - potential for less GVT
 - limited long term data
 - multiple ethical, legal, and financial considerations remain

- In Australia in 2010:¹²
 - cord blood was the cell source for 8% (34/452) of allogeneic / syngeneic transplants
 - double cord blood was the cell source for 4% (18/452) of allogeneic / syngeneic transplants
 - of the 52 allogeneic cord blood transplants, 34 were in recipients aged 0-15 and 18 were in recipients aged over 16
 - the use of cord blood in the 0-15 age group was approximately five times greater compared with data from 1999.

Learning activities

Completed	Activities
<input type="checkbox"/>	1. Access a current text and <u>National Marrow Donor Program HLA matching guidelines for unrelated adult donor hematopoietic cell transplants</u> , ⁸ and describe the reported potential implications of the following allogeneic donor characteristics: <ul style="list-style-type: none"> • aged over 60 • obesity (BMI greater than 30) • female with a history of three pregnancies.
<input type="checkbox"/>	2. Access a current text or evidence review and outline the components of an education session, including preparation, details of the procedure, and potential risks/effects for an individual undergoing: <ul style="list-style-type: none"> • PBSC collection • BM collection.
<input type="checkbox"/>	3. Review the medical notes of a recipient of an autologous PBSC transplant, and: <ul style="list-style-type: none"> • Identify their disease • Summarise their treatment history • Outline the intent of treatment with HSCT • Review relevant evidence based guidelines to support the use of this treatment approach in this individual.
<input type="checkbox"/>	4. Access the <u>ABMDR cord blood fact sheet</u> ¹³ and identify the key considerations associated with cord blood donation and use.

Harvesting and storage of haematopoietic stem cells

Bone marrow

Bone marrow is generally harvested from the posterior iliac crest, as either an inpatient or outpatient procedure. Marrow can also be aspirated from the anterior iliac crests and sternum if required. The amount required to achieve haematopoiesis is 10-15ml/kg of recipient body weight.¹

Peripheral blood stem cells (PBSC)

Mobilising or enhancing the number of stem cells in blood for peripheral blood stem cell harvest is achieved through use of antineoplastic agents and/or growth factors.¹⁴ Allogeneic donors receive growth factors only.

An apheresis machine collects the stem cells from peripheral blood. Venous access via the antecubital vein may be used. A central venous catheter may be needed if venous access is inadequate.

Effects related to the collection procedure are usually well tolerated. They include¹⁴:

- citrate toxicity
- hypovolaemia
- thrombocytopenia.

Cord blood

Cord blood is harvested via a 16-gauge needle through the umbilical vein once the placenta has been delivered. The median volume harvested is 100ml.¹⁴

Cell manipulation

Prior to storage and administration, stem cells may be manipulated. They may be enriched with CD34+ cells or 'purged' by removing T lymphocytes or malignant cells.¹⁵

Storage

Stem cells are stored using one of two methods of cryopreservation:¹⁴

- controlled-rate freezing and storage in a liquid nitrogen freezer using 10% by volume of dimethylsulfoxide (DMSO)
- storage in a freezer at -80°C and -196°C using 5% DMSO and 6% hydroxyethyl starch (HES).

Allogeneic stem cells are generally transfused into a recipient within 24 to 72 hours of collection and do not require cryopreservation.

Learning activities

Completed



Activities

1. Identify an individual having an autologous peripheral blood stem cell collection. Review their health history and outline:
 - indication for procedure
 - process to mobilise stem cells
 - considerations regarding venous access
 - information and supportive care needs throughout process.

2. Access a current text and outline the aetiology, assessment, and interventions to prevent and manage the following effects of peripheral blood stem cell harvest:
 - citrate toxicity
 - hypovolaemia
 - thrombocytopenia.

Recipient considerations

During the transplant evaluation process, recipients undergo physical and psychological assessments to determine eligibility for transplantation.¹⁴ The transplant physician considers the individual's disease, risk factors, and reported survival data to determine appropriate disease management.

Factors that improve outcomes

Refinements in criteria for performing HSCTs have improved outcomes. Both disease and individual factors have been recognised as significant in minimising the risk of failure from toxicity and improving control of underlying disease.¹⁶

Disease factors associated with improved outcomes include:¹⁶

- transplantation in individuals with treatment-induced remission
- transplantation earlier in the course of the disease.

Australian 10-year survival probability data reinforce this. Recipients aged over 16 who received their first allogeneic related transplant in their first remission have a survival probability of 49%. Recipients with poor risk have a survival probability of 22%.¹¹

Factors that increase risk

Individual factors that increase the risk associated with HSCT include:¹⁶

- advanced age of the individual
- significantly impaired ventilatory function
- abnormal hepatic function
- abnormal renal function
- presence of an active infection.

Potential autologous transplant recipients should have limited exposure to myelotoxic agents to avoid compromising stem-cell reserve prior to stem cell harvest.¹⁷

Learning activities

Completed

Activities

1. Access [*Evaluating adult patients prior to hematopoietic cell transplant*](#)¹⁸ and summarise components of the recipient evaluation.

2. Access an individual's health record and describe the evaluation they underwent prior to transplantation.

Bone marrow registries

The major goal of an unrelated donor registry is to create a file of well-informed and well-selected volunteers, with the greatest likelihood of being suitable donors if chosen to donate. Deficiencies in this process may lead to a loss of time and money, impact quality and safety, and may impact on an individual's chances to receive a transplant.⁹

The World Marrow Donor Association (WMDA) has developed recommendations and eligibility criteria for the evaluation of volunteer donor health at recruitment and during later donor selection procedures. These recommendations promote international best practice in this area.^{9, 19}

The WMDA recommendations include:

- sample screening questionnaire
- conditions leading to permanent deferral
- infectious diseases requiring a deferral period
- considerations associated with specific sexual partners
- conditions leading to temporary deferral
- prophylactic immunisations
- conditions requiring individual assessment.

The Australian Bone Marrow Donor Registry (ABMDR)²⁰ is the tenth largest registry in the world. Within Australia, the registry network is comprised of state donor centres, tissue typing centres, marrow collection centres, and transplant centres.²⁰ The Australian Bone Marrow Transplant Recipient Registry (ABMTRR) records details of HSC transplants throughout Australasia. Transplant recipients are followed up annually for incidence of relapse, other major malignancy events, and death up until ten years post-transplant.²¹

Learning activities

Completed

Activities

1. Access and read the [ABMDR donor brochure](#)²² Reflect on your feelings for or against becoming registered as a donor.

2. Identify the donor coordinator in your facility who facilitates the donor search process and develop a summary of the unrelated donor search process for a recipient in your facility. You may wish to access the [Unrelated donor search and transplant webpage](#).²³

Care of the person having HSCT

The care pathway for individuals undergoing HSCT for cancer can be associated with significant information, support and care coordination needs. Nurses work in close collaboration with the multidisciplinary team and the recipient in the planning and coordination of their care. An individualised protocol contains clear documentation of the plan of care and proposed treatment that should be followed throughout the care trajectory.

Prior to admission, it is essential that recipients of HSCT and their carers receive thorough and individualised education. Provision of information and supportive care includes:²⁴

- validating the individual's understanding of the plan and goal of care
- assisting the individual to formulate questions and giving additional information concerning the long term consequences of the planned therapy
- providing a detailed explanation of what the recipient may expect, including care requirements
- outlining the role of the carer.

A number of existing resources are available online for people affected by cancer, providing information on the transplant procedure.

- [Leukaemia Foundation factsheet](#)²⁵
- [American Cancer Society patient information](#)²⁶
- [LymphomaInfo.net](#)²⁷

Learning activities

Completed

Activities

1. Attend a pre-transplant education session with a prospective recipient. Summarise the information provided to the recipient and their carer regarding the following issues prior to admission:
 - dietary restrictions
 - visitor guidelines
 - neutropaenic precautions
 - bleeding precautions
 - roles and responsibilities of the carer.
2. Identify local resources (online and print) available to support the education process for HSCT recipients and their carers.

Conditioning

A complete baseline nursing assessment is required prior to initiation of the conditioning regimen. Assessment is also needed at regular intervals throughout the transplant journey. Risk factors that could trigger or exacerbate effects of the transplant are identified, including:¹⁵

- previous treatment history
- responses to previous treatment
- perception of uncertainty and coping styles
- strategies for managing treatment effects.

Conditioning involves administration of a regimen which includes antineoplastic agents, radiotherapy and immunosuppressive therapy in the days preceding infusion of stem cells. The days of conditioning are designated by negative or 'minus' numbers.¹⁵

Myeloablative conditioning regimens for autologous transplants aim to eradicate malignant disease. Regimens for allogeneic conditioning can be myeloablative or non-myeloablative. The purposes of the conditioning regimen in allogeneic transplantation are:¹⁵

- disease eradication
- host immunosuppression
- creation of space for the donor cells in the recipient marrow.

While there are standard existing protocols, selecting the appropriate conditioning regimen is a complex decision for the transplant physician. Factors that to be considered include:¹⁵

- ablative potency of the conditioning regimen
- immunosuppressive therapy
- disease-related factors
- recipient factors
- source or manipulation of stem cells
- pharmacologic and radiobiologic factors
- inpatient versus outpatient/ambulatory setting.

Learning activities

Completed	Activities
<input type="checkbox"/>	<p>1. Complete a comprehensive health assessment on an individual prior to an autologous HSCT and complete the following:</p> <ul style="list-style-type: none">• Identify the indications for treatment.• Access relevant clinical practice guidelines and outline the evidence supporting this treatment approach.• Describe other individual and disease related factors which influenced the individual's treatment decision making process.• Outline the information and supportive care provided to recipient related to their conditioning regimen.• Discuss interventions to prevent and manage potential and immediate effects of the conditioning regimen.
<input type="checkbox"/>	<p>2. Complete a comprehensive health assessment on an individual prior to an allogeneic HSCT and complete the following:</p> <ul style="list-style-type: none">• Identify the indications for treatment.• Access relevant clinical practice guidelines and outline the evidence supporting this treatment approach.• Describe other individual and disease related factors which influenced the individual's treatment decision making process.• Outline the information and supportive care provided to recipient related to their conditioning regimen.• Discuss interventions to prevent and manage potential and immediate effects of the conditioning regimen.

Transfusion of BM/PBSC

Stem cell infusion occurs on day 0. The recipient receives hydration and premedication according to their protocol, which may include:¹⁴

- lorazepam
- diphenhydramine hydrochloride
- hydrocortisone
- paracetamol
- frusemide
- methylprednisolone.

Frozen stem cells are thawed and quickly infused via a central venous access device. The recipient may experience a number of effects of the stem cell infusion related to the DMSO, lysis of red blood cells, volume of infusate and the coldness of the thawed cells:¹⁴

- nausea and vomiting
- haemoglobinuria
- elevated serum creatinine
- elevated serum bilirubin
- cardiovascular effects
- chills and fever
- anaphylactic reaction.

Learning activities

Completed

Activities

- 1. Access a current text and local policy and procedures for the administration of cellular products. For the person you assessed, receiving the **autologous** transplant, review their transplant protocol and explain the rationale for processes on day 0.
- 2. Outline how you would prepare the recipient and your work environment prior to administration of autologous BM or PBSC.
- 3. Explain how you would educate an individual and their carer/s on the side effects of DMSO reaction and discuss the management of same.
- 4. Demonstrate safe administration of autologous BM or PBSC as per local policy and procedures.
- 5. Access a current text and local policy and procedures for the administration of cellular products. For the person you assessed, receiving the **allogeneic** transplant, review their transplant protocol, and explain the rationale for processes on day 0
- 6. Demonstrate safe administration of allogeneic BM or PBSC as per local policy and procedures.
- 7. Identify the signs and symptoms of anaphylactic reaction during stem cell infusion.
- 8. Access a current text and outline the implications of a blood type incompatibility between the donor and recipient and interventions to reduce adverse effects in:
 - minor ABO mismatch
 - major ABO mismatch.
- 9. Outline your response to a recipient who complains of 'black urine' six hours post stem cell infusion.

Management of responses to HSCT

Engraftment and recovery

HSC engraftment and production of normal blood cells occur approximately 7-20 days post transplantation.^{10,28} During this period the recipient requires comprehensive assessment and monitoring, physical care, and psychosocial and spiritual support.

Successful engraftment of transplanted stem cells depends on the quality and quantity of stem cells and the integrity of the marrow's microenvironment.¹

Haematopoietic and immunological recovery occur at variable speeds and are influenced by a number of factors:¹⁴

- the nature and status of the primary disease
- previously administered antineoplastic agents and radiation
- the type of preparative regimen
- the type of GVHD prophylaxis
- viral complications
- the use of antiviral agents.

Lack of initial engraftment of donor cells, or loss of donor cells after initial engraftment, is termed graft failure or graft rejection.²⁹ These conditions occur in less than 5% of recipients and are rare after matched-sibling transplants.²⁹

Learning activities

Completed

Activities

- 1. For each of the following drugs commonly used in the acute transplant period:
 - cyclosporine
 - tacrolimus
 - fluconazole
 - acyclovir
 - methotrexate
 - cotrimoxazole
 - intragam
 - G-CSF.
 - Identify the classification of the drug.
 - Describe the indication for the drug.
 - Discuss potential short and long term effects associated with the drug.
 - Explain the nursing interventions to prevent, detect early, and manage these effects.
 - Identify other nursing considerations associated with administering these drugs.

- 2. Access [Graft failure after allogeneic hematopoietic cell transplantation](#)²⁹ and:
 - Summarise the risk factors for graft failure.
 - Outline methods to prevent and manage graft failure.

- 3. Complete a supportive care screening assessment on one of the individuals you assessed in the pre-transplant period and:
 - Identify their psychosocial concerns in the pre-engraftment period.
 - Complete a focused assessment on a need identified in the screening process.
 - Discuss strategies you can use to support this patient to meet this need.
 - If a referral to the MDT is required to meet this need, outline the process you use to access other services.

Acute effects of HSCT

Potential early effects of HSCT, requiring astute nursing assessment and management, include:^{8, 14}

- mucositis
- neutropenia
- thrombocytopaenia
- anaemia
- infection
- veno-occlusive disease
- ongoing effects of the conditioning regimen (nausea, vomiting, diarrhoea, haemorrhagic cystitis).

There are significant risks to day 100 post transplant. The cumulative incidence of transplant related mortality (i.e. deaths other than those from relapse or persistent disease) for allogeneic transplant recipients in Australia and New Zealand in 2007 was 14.7% at 100 days post-transplant.¹¹ In autologous transplant recipients, this figure was 3% mortality at 100 days post-transplant.¹¹ Complications that may occur up to 100 days post allogeneic transplant include:¹⁴

- acute GVHD
- interstitial pneumonia (CMV and idiopathic)
- varicella zoster virus
- bacteraemia
- herpes simplex virus
- restrictive lung disease
- disseminated fungal infection.

Acute GVHD is a significant complication of allogeneic transplantation, occurring in up to 70% of recipients. The primary organs affected include the skin, gastrointestinal tract and liver. The median reported onset of aGVHD is at Day 17.³⁰ Clinical grading of acute GVHD is determined by the site and severity of the manifestation.

Resource links

A table outlining the organ staging of acute GVHD can be accessed in the following article:

Ball LM, Egeler RM. [*Acute GvHD: pathogenesis and classification*](#). Bone Marrow Transplant. 2008;41:S58-S64³¹

Care requirements of the recipient during the acute phase include:¹⁴

- thorough assessments
- blood tests
- blood product transfusion
- nutritional, antibiotic, immunoglobulin, and intravenous fluid support
- symptom management
- skin biopsies
- close monitoring of medication administration and drug levels
- care of the central venous access device
- psychosocial support.

Resource links

[*Nausea and vomiting with high-dose chemotherapy and stem cell rescue therapy: a review of antiemetic regimens*](#)³²

[*Palifermin reduces incidence and severity of oral mucositis in allogeneic stem-cell transplant recipients*](#)³³

[*Hepatic veno-occlusive disease after hematopoietic stem cell transplantation: update on defibrotide and other current investigational therapies*](#)³⁴

[*GVHD: a continuing barrier to the safety of allogeneic transplantation*](#)³⁵

[*Pain syndromes in the setting of haematopoietic stem cell transplantation for haematological malignancies*](#)³⁶

Learning activities

Completed	Activities
<input type="checkbox"/>	1. Complete a comprehensive needs assessment on one of the individuals you have previously assessed, between days 7 and 21 post-transplant and: <ul style="list-style-type: none">• Identify the acute effects they are at risk of or experience.• Summarise current evidence based strategies to prevent and manage these effects.• Document a nursing care plan to meet the needs of this person.
<input type="checkbox"/>	2. Access a current text and <u><i>Nausea and vomiting with high-dose chemotherapy and stem cell rescue therapy: a review of antiemetic regimens</i></u> ³² and summarise the assessment and management of nausea and vomiting in people during HSCT. Do not repeat if this was completed in LA1.
<input type="checkbox"/>	3. Access a current text and <u><i>Palifermin reduces incidence and severity of oral mucositis in allogeneic stem-cell transplant recipients</i></u> ³³ and summarise the assessment and management of oral mucositis in people following HSCT. Do not repeat if this was completed in LA1.
<input type="checkbox"/>	4. Access a current text <u><i>Hepatic veno-occlusive disease after hematopoietic stem cell transplantation: update on defibrotide and other current investigational therapies</i></u> ³⁴ and: <ul style="list-style-type: none">• Define hepatic veno-occlusive disease.• Identify risk factors for VOD.• Identify signs and symptoms of VOD.• Identify nursing and medical interventions to prevent and manage VOD.

- 5. Access a current text and [GVHD: a continuing barrier to the safety of allogeneic transplantation](#)³⁵, and:
 - Describe the pathology of acute graft-versus-host disease.
 - Identify the clinical manifestations of acute graft-versus-host disease.
 - Summarise approaches to prevent and manage acute GVHD.

- 6. Access [Pain syndromes in the setting of haematopoietic stem cell transplantation for haematological malignancies](#)³⁶, and:
 - Summarise the pain syndromes experienced by the people following HSCT.
 - Discuss implications of HSCT on pain management.

- 7. Summarise the indications for blood product support in the post transplant period.

- 8. Access the [Australian Red Cross website's section on modified blood products](#). Outline the rationale for the following associated with blood product administration following HSCT:
 - irradiation
 - leukocyte reduction
 - CMV assessment.

- 9. Demonstrate safe administration of a blood product to a transplant recipient.

Discharge and follow up care

The period of hospitalisation for recipients of transplantation varies according to their condition, the type of transplant, and protocol. Individual transplant centres vary in their criteria for discharge from the acute care setting.¹⁴

Critical verbal and written discharge instructions to the recipient and their carers prior to discharge should include:¹⁴

- signs and symptoms to report to the transplant centre
- bleeding precautions
- infection control practices
- central venous access device care
- dietary restrictions
- medical instructions
- follow up care and appointments
- what to do in an emergency.

Transplant recipients still have special health care needs following discharge. A treatment and communication plan is required to ensure appropriate short and long term monitoring.

Recommended screening and preventive practices for transplant recipients have been developed by a consensus panel formed by members of:

- the Center for International Blood and Marrow Transplant Research (CIBMTR)
- the European Group for Blood and Marrow Transplantation (EBMT)
- the American Society for Blood and Marrow Transplantation (ASBMT).

The National Marrow Donor Program (NMDP) – in partnership with these organisations– has developed [Recommended post-transplant care guidelines](#).³⁸ Recipients and health care professionals can use these guidelines to schedule long term follow up care after a marrow, peripheral blood stem cell, or cord blood transplant.³⁹

Resource link

National Marrow Donor Program. [Recommended post-transplant care](#).³⁸

Learning activities

Completed

Activities

- 1. Outline common criteria for discharge following transplantation in your practice setting.
- 2. Summarise the education and information resources you would provide to a recipient and carer regarding the following possible scenarios post discharge:
 - feeling unwell
 - presence of a temperature greater than 38°C
 - three episodes of diarrhoea in 24hours
 - redness and pain at central venous access device site.
- 3. Demonstrate effective principles of information provision in a discharge education session with a patient. Include at a minimum information regarding the four issues in the previous learning activity.
- 4. Identify the recommended tests and procedures for recipients' six-month, one-year, and annual post-transplant check-ups in your facility and compare these to the [*Recommended post-transplant care guidelines*](#)³⁸ for:
 - autologous recipients
 - allogeneic recipients.
- 5. Discuss the local community and health care facility resources that support the transplant recipient and their carer following discharge.

Chronic effects of HSCT

Chronic effects may loosely be termed those that occur after day +100. Recipients are at risk of complications related to:

- organ damage from the conditioning regimen
- chronic GVHD
- immune dysfunction and effects of immunosuppressive therapy.

While many HSCT recipients have a good quality of life at one year and have resumed part or full time employment, a significant proportion of survivors experience persistent anxiety and depressive symptoms, fatigue, sexual dysfunction, and fertility concerns.⁴⁰

Chronic graft-versus-host disease

Chronic GVHD (cGVHD) is a syndrome of immune dysfunction that results in immunodeficiency and autoimmunity. cGVHD has been reported in at least 30-50% of recipients of transplants from HLA-matched siblings, and at least 60-70% of recipients from unrelated donors.⁴¹ Any organ can be involved and many symptoms resemble those of spontaneously occurring autoimmune disorders. The skin, liver, and mouth are the most frequent targets. Opportunistic infections are common, including invasive fungal infections and *Pneumocystis jiroveci* pneumonia. Decreased quality of life and depression have also been associated with cGVHD.⁴¹

Infections

Transplant recipients— especially allogeneic recipients with cGVHD— have an increased risk of infection for up to five years after transplantation.²⁸

- Recurrent sinopulmonary infections (sinusitis, pneumonia, bronchitis) are common in the first two years.
- Reactivation of latent varicella zoster virus occurs in almost 50% of survivors.
- Reactivation of cytomegalovirus (CMV) is most common in allogeneic recipients who are taking corticosteroids for GVHD.

Contributing factors include persistent hypogammaglobinaemia, impaired cellular immunity, and splenic hypofunction.²⁸ Antibody titres to vaccine-preventable diseases decline during the first four years after transplantation, requiring revaccination.²⁸

Learning activities

Completed

Activities

- 1. Access a current text and watch the [Coping with chronic graft-versus-host disease presentation](#)⁴², and:
 - Distinguish between acute and chronic graft-versus-host disease.
 - Describe the pathology of chronic graft-versus-host disease.
 - Identify the clinical manifestations of chronic graft-versus-host disease.
 - Outline the treatment options for chronic graft-versus-host disease.
 - Identify common psychosocial experiences for the individual with graft-versus-host disease.
 - Discuss the role of the nurse in the functional and psychosocial support of the individual with graft-versus-host disease.

- 2. Identify approaches used to reduce infection risk in transplant recipients post discharge and explain the rationale for the use of the drug/strategy.

- 3. Discuss the implications of a diagnosis of herpes zoster (shingles) in a transplant recipient considering:
 - symptom management
 - occupational health and safety.

- 4. Access a recipient's treatment protocol, current Australian guidelines and, [Hematopoietic stem cell transplantation: a primer for the primary care physician](#)⁴³ and:
 - Discuss the role of vaccination in recipients after allogeneic and autologous HSCT.
 - Outline the suggested schedule of vaccinations.

Late effects

With the increased use of HSCT there is a rising population of survivors worldwide. Lifetime surveillance and management of transplant recipients is necessary to ensure ongoing quality of life and longevity.

There are numerous models of survivorship care. Essential features of high quality services include: ⁴⁴

- comprehensiveness
- a coordinated approach
- individualised, holistic care provision.

Potential late effects

The late effects summarised in this section are those experienced five or more years after HSCT. ⁴⁵

Ophthalmologic late effects

- dry eyes
- cataracts are a common late effect, often related to total body irradiation or steroid use.

Pulmonary late effects

- ongoing restrictive or obstructive changes related to infections and pulmonary complications within two years of HSCT
- conditions include chronic bronchitis, hepatopulmonary syndrome, bronchiolitis obliterans, pulmonary fibrosis, and idiopathic pneumonia syndrome.

Endocrine late effects

- gonadal dysfunction
- ovarian failure
- thyroid dysfunction
- growth hormone deficiency.

Gastrointestinal late effects

- dry mucous membranes.

Musculoskeletal late effects

- avascular necrosis
- diminished bone mineral density
- osteochondromas.

Neurocognitive late effects

- cognitive dysfunction.

A devastating late effect of HSCT is the development of a secondary malignant neoplasm (SMN). In the first decade after HSCT, the recipient is at risk of:

- post-transplant lymphoproliferative disorders (PTLD)
- myelodysplasia (MDS)
- acute myeloid leukaemia (AML).

Learning activities

Completed

Activities

- 1. Access [What constitutes ideal survivorship care?](#)⁴⁶ and summarise the principles of optimal survivorship care.
- 2. Access [NMDP Patient care post transplant](#)⁴⁷, and:
 - Identify the yearly assessments and tests required of the recipient of an allogeneic transplant at five years post-transplant.
 - Discuss the potential psychosocial impact of long term follow up.
- 3. Access a current text and [Late effects in survivors of Hodgkin and Non-Hodgkin Lymphoma treated with autologous hematopoietic cell transplantation: a report from the bone marrow transplant survivor study](#)⁴⁸, and:
 - Identify the late effects (excluding graft-versus-host disease) experienced by individuals post autologous HSCT.
 - Discuss the potential role of the nurse pre- and post- HSCT in the counseling, education, early identification, and management of these late effects.

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