

Nursing Considerations for Transplant-Related Drugs: Mobilization and Conditioning

Drug/Indication/Route	Common Side Effects	Nursing Considerations
G-CSF, filgrastim (Neupogen®) - stem cell mobilization (SQ)	Most often very well tolerated. May cause generalized bone pain including sternal pain, fatigue, nausea, and low-grade fever.	<ul style="list-style-type: none"> Routinely managed as an outpatient Side effects associated with stem cell mobilization compared to post-transplant vary (normal WBC being escalated versus low WBC returning to near normal): <ul style="list-style-type: none"> Generalized bone pain and splenic rupture associated with stem cell mobilization Peri-engraftment syndrome and thrombocytopenia associated with post-transplant use Educate patients that pain at site of previous bone involvement is not an indication of active disease Sternal pain may mimic cardiac chest pain but should still be evaluated to r/o cardiac source. Educate patient on risk of splenic rupture including symptoms: left upper abdominal and/or shoulder pain. Educate patients on side effects; provide anti-emetics and anti-diarrhea medications as needed (i.e. loperamide). Provide contact phone numbers in case of adverse symptoms or emergency.
Plerixafor (Mozobil®) – stem cell mobilization in combination with filgrastim (G-CSF) (SQ)	Most often very well tolerated. May cause nausea/diarrhea, injection site reaction.	
Cyclophosphamide (Cytoxan®) – stem cell mobilization and MM treatment (IV)	Tolerated well if side effects are managed. Early: nausea, vomiting, diarrhea Delayed: alopecia, myelosuppression, ridging of nail beds.	<ul style="list-style-type: none"> Provides dual benefit of Myeloma treatment and stem cell mobilization: <ul style="list-style-type: none"> Premedicate with anti-emetics and corticosteroids. Anticipate neutropenia approximately 7 days following administration. Educate and monitor for fevers; antibiotic prophylaxis may be used (ie, levofloxacin, acyclovir). Hemorrhagic cystitis prevention: <ul style="list-style-type: none"> Pre-med with adjunct hydration Encourage oral hydration, especially in the first 72 hours Educate on symptoms and signs of hematuria.

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Melphalan (Alkeran®) – chemotherapy drug, alkylating agent (IV)	<p>Early: nausea, vomiting, diarrhea</p> <p>Delayed: alopecia, myelosuppression, mucositis/stomatitis, ridging of nail beds</p>	<ul style="list-style-type: none"> Inpatient versus outpatient management varies between medical centers. For outpatient management, a 24-hour caregiver is required. Provide contact phone numbers in case of adverse symptoms or emergency. Monitor for nausea and vomiting; use antiemetics, antidiarrheals, intravenous (IV) fluids. Mucositis prevention & management: <ul style="list-style-type: none"> Cryotherapy (sucking on ice chips) before, during, and for at least 30 minutes after Melphalan infusion Frequent oral care, avoid alcohol-based preparations Manage oral pain with opioids in conjunction with lidocaine containing topicals Mucositis-related diarrhea is common. Assess bowel pattern, abdominal pain and rule out infection (clostridium difficile) before adding anti-diarrheal agents. Bowel perforation is rare, but possible during neutropenic phase. Manage myelosuppression with transfusions (red cells and platelets) as needed and prophylactic antibiotics Neutropenic fever is considered a medical emergency – Immediate action is needed <ul style="list-style-type: none"> Educate patients on importance of monitoring for fever and symptoms of infection; be alert to signs of sepsis In case of neutropenic fever, draw blood cultures followed by broad spectrum IV antibiotics Survivorship Considerations: <ul style="list-style-type: none"> Monitor for secondary malignancies Potential for late side effect of interstitial pneumonitis and fibrosis Discuss potential for infertility following transplant
Dimethyl sulfoxide (DMSO) – combined with stem cell at time of process for cryopreservation	Flushing, arrhythmia, chest tightness, shortness of breath, nausea	<ul style="list-style-type: none"> Remain at bedside throughout the infusion and take frequent vital signs. Aggressive IV hydration and furosemide as needed. Hemolysis can occur, leading to renal failure. Monitor urine output (volume and color)
G-CSF, filgrastim (Neupogen®) Used post-transplant to promote white blood cell engraftment	Generalized bone pain including sternal pain, fatigue, nausea, thrombocytopenia and fever	<ul style="list-style-type: none"> Use post-transplant is not universal Can be associated with peri-engraftment syndrome (fever, rash, diffuse alveolar hemorrhage) Monitor for cough, bloody sputum, fever, or respiratory distress Promotion of WBC growth may hinder platelet recovery Side effects associated with stem cell mobilization compared to post-transplant vary (normal WBC being escalated versus low WBC returning to near normal): <ul style="list-style-type: none"> Generalized bone pain and splenic rupture associated with stem cell mobilization Peri-engraftment syndrome and thrombocytopenia associated with post-transplant use

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Anti-emetics *5-HT ₃ receptor antagonist (i.e. ondansetron) * [§] Dopamine receptor antagonist (i.e. prochlorperazine) **Antihistamine (i.e. diphenhydramine) ^#Psychotropics/Anxiolytics (i.e. lorazepam) #Anti-Cholinergic (Scopolamine®) &Steroids (i.e. dexamethasone)	^Drowsiness #Dry mouth §Extrapyramidal, Parkinsonian-like side effects *Headache &Restless leg & hyperactivity *Urinary retention in men	<ul style="list-style-type: none"> Transplant is associated with significant GI disturbance. GI protection and antiemetics are essential. Understanding the source of nausea (i.e. treatment, motion, anxiety) is essential to choosing an effective anti-emetic Adjust antiemetics to optimal benefit with least side effects, this can vary between patients. Query patient for previous effective combinations. Alternate route of administration should be considered (IV versus PO) Educate patients on pre-empting nausea rather than gaining control <ul style="list-style-type: none"> Create a schedule for anti emetic use Encourage use of non-sedating antiemetics during the day and more sedating options before bed
Antibiotics Antiviral (i.e. acyclovir) Antifungal (i.e. fluconazole) Antibacterial (i.e. levofloxacin, penicillin, sulfamethoxazole-trimethoprim)	Rash, allergic reaction, diarrhea, elevated renal function	<ul style="list-style-type: none"> Review allergy profile, use alternates as needed (i.e. penicillin versus doxycycline) Prophylactic oral antibiotic use during neutropenic phase and up to one year post-transplant; IV use for neutropenic fever or culture positive infection
Electrolytes Potassium Magnesium Phosphorus	Potassium should be taken with food to prevent GI upset. Magnesium can contribute to diarrhea	<ul style="list-style-type: none"> May be administered orally or IV Hypokalemia can be seen during stem cell mobilization and engraftment due to cellular proliferation Electrolyte imbalance is common, often associated with GI side effects of anorexia, nausea, vomiting and diarrhea Side effects related to lack of electrolytes (fatigue, muscle weakness/cramping)

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Previously prescribed medications <ul style="list-style-type: none"> Anti-hypertensives Diuretics Blood thinners or anti-platelet agents Cholesterol lowering agents 		<ul style="list-style-type: none"> Side effects and interactions with transplant medications may require placing previously prescribed medications “on hold” <ul style="list-style-type: none"> Anti-hypertensives and diuretics - Dehydration and hypotension are common Blood thinners and anti-platelet agents – invasive procedures such as central line placement and thrombocytopenia are expected Cholesterol lowering agents – interaction with anti-fungal medications Restarting “on hold” medications may be decided by Transplant Center or local provider
Post-transplant maintenance <ul style="list-style-type: none"> Lenalidomide Bortezomib Thalidomide 		<ul style="list-style-type: none"> Commonly accepted practice post-transplant (IMWG Consensus Statement) Recovery post-transplant is needed before starting maintenance therapy, often Day +60 to Day +100 Choice of maintenance therapy is based upon previous therapy and disease risk stratification Consider clinical trial participation
General		<ul style="list-style-type: none"> Many side effects overlap and can be multifactorial. IV hydration is a common need; IV nutrition less common and reserved for prolonged anorexia. Polypharmacy and frequent medication adjustments are common and can be confusing for patient/caregiver. Provide education, current medication schedule, and daily review.

References:
 Nurse Leadership Board. [Hematopoietic Stem Cell Transplantation and Multiple Myeloma](#). *CJON*. 2013; 17(6):7-47.
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