Advanced Oncology Certified Nurse Practitioner

REVIEW COURSE 2024

October 10-12, 2024 | Houston, TX

MDAnderson Cancer Center

Making Cancer History*

Myelosuppression

Ancy Mathews, DNP, FNP-C, BMTCN, RN Nadya Panjwani, DNP, NP-C, RN

Learning Objectives

- 1) Discuss the definition, etiology, risk factors, signs and symptoms of myelosuppression.
- 2) Identify symptoms of myelosuppression-associated, neutropenia, anemia, and thrombocytopenia.
- 3) Recognize the complications of myelosuppression.
- 4) Identify diagnostic tests and workup for myelosuppression.
- 5) Discuss prevention and treatment options for myelosuppression.



What is Myelosuppression?

- Myelo is a Latin term referring to marrow.
- A condition in which bone marrow activity is decreased, resulting in fewer red blood cells, white blood cells, and platelets (National Cancer Institute, 2024).

Causes of Myelosuppression

- Chemotherapy (Fluorouracil, Methotrexate, Carmustine, Oxaliplatin, Irinotecan)
- Hematological Cancers (Leukemia, Lymphoma, Myeloma)
- Radiation
- Viruses (EBV, Parvo, CMV, HIV, Dengue Fever, Hep C)
- Nutritional Deficiencies (from Mucositis, Anorexia, Nausea)
- Rare disorders such as primary myelofibrosis, causing scarring of bone marrow
- Antibiotics (Linezolid, Ganciclovir, prolonged Vancomycin exposure), Steroids, Stem Cell Transplant, CAR-T Therapy
- Other: thiazide diuretics, ethanol, Botrezomib, Aspirin, Tamoxifen

Symptoms of Myelosuppression

- Neutropenia
- Anemia
- Thrombocytopenia
- Pancytopenia

Other symptoms a result of pancytopenia:

- Infections
- Sepsis
- Bleeding
- Fatigue
- Negative impact on quality of life
- Inability to continue treatment
- Usage of supportive care interventions
- Death

Neutropenia

Definition

Neutropenia is an absolute count (ANC) of 1000/mm3.

Degree of Neutropenia

General Mild: ANC 1000-1500/mm3

- □ Moderate: ANC less than 500-1000/mm3
- Severe Neutropenia: ANC less than 500/mm3.
- Profound Neutropenia: ANC less than 100/mm3.

Calculation of ANC

ANC = % of Neutrophils (Polys + Bands) x WBCs

Example: WBC = 1300, Polys: 20, Bands = 2

- **Step 1:** Add (20 + 2 = 22)
- **Given Step 2:** Convert sum to % (22/100 = 0.22)
- **Given Step 3: Multiply 1300 x 0.22 = 286/\text{mm}^3**

Febrile Neutropenia

• Neutropenic fever manifests as a single oral temperature greater than or equal to 101F (38.3C) for at least an hour with ANC of less than 1500 cells/microliter.

Risk Factors of Febrile Neutropenia

- Age greater than 65years
- Persistent neutropenia
- Tumor involvement of the bone marrow/advanced stage
- Poor performance status and nutritional status
- Renal dysfunction (creatinine Clearance less than 50ml/min)
- Liver dysfunction (bilirubin greater than 2 mg/dl)
- Previous chemotherapy or radiation
- Pre-existing Infection, Open wounds, or recent surgery
- Use of Specific Medications (phenothiazines, diuretics, immunosuppressive drugs)
- Types of hematological malignancies such as Leukemia, Lymphoma, Myelodysplastic Syndromes
- Types of solid tumor such as breast, lung, colorectal, ovarian
- Dose of chemotherapy

Symptoms of Infection

- Fever (febrile neutropenia)
- Fatigue
- Sore throat (pharyngitis)
- Swollen lymph nodes
- Mouth ulcers
- Perirectal ulcers
- Diarrhea
- Urinary Urgency, frequency, dysuria

Treatment of Neutropenia

- Antibiotics to treat infection.
- Filgrastim is used to produce more neutrophils in the bone marrow.
- Corticosteroids are effective in an autoimmune disorder.
- Antithymocyte globulin enhances the hematopoietic recovery in patients with aplastic anemia.
- Stem cell transplant is also an option (hematological malignancy, aplastic anemia, or other conditions).

Anemia

• Anemia is low hemoglobin (Hb) concentration in the blood, measured in whole blood, from the venous or capillary collection, either by automated hematological analyzers or spectrophotometry.

Anemia may be microcytic (due to iron deficiency or thalassemia), normocytic (due to inflammation), or macrocytic (due to vitamin B12/folate deficiency, liver disease, myelodysplasia, or hypothyroidism).

► Diagnose anemia by doing CBC with RBC indices.



свс-complete blood count; G6PD-glucose-6-phosphate dehydrogenase; мсv-mean corpuscle volume; RBC-red blood cell count

Signs and Symptoms of Anemia

- Fatigue > extremely debilitation
- Shortness of breath (dyspnea)
- Dizziness
- Fast or irregular heartbeat (arrhythmia)
- Pounding or "whooshing" sound in your ear (pulsatile tinnitus)
- Headache
- Pallor
- Chest pain

Treatment of Anemia

- Blood Transfusions
- Iron Supplements
- Erythropoietic-Stimulating Agents
- Vitamin B12 or Folic Acid Supplements.

Thrombocytopenia

- Thrombocytopenia is characterized by a platelet count below <150,000/mm3, with severe thrombocytopenia classified as a platelet count below <50,000/mm3.
- Life span of platelets: 7 10 days

Causes of Thrombocytopenia

Decreased production (bone marrow failure syndromes)

Increased destruction (disseminated intravascular coagulation (DIC), thrombotic microangiopathies, and increased antibody-mediated platelet clearance).

Signs and Symptoms

- Bleeding
- Bruising, Purpura, Petechiae
- Severe Headaches
- Muscle/Joint Pain
- Feeling Weak or Dizziness

Treatment

- Platelet transfusions
- Eltrombopag and Romiplastin (N-Plate).

Diagnostic Tests

- History and Physical exam
- Complete Blood Count (CBC).
- Mean Corpuscular Volume (MCV) Test.
- Red Cell Distribution Width (RDW) Test.
- Reticulocyte Count.
- Peripheral Blood Smear.
- Mean Platelet Volume (MPV) Test.
- Bone Marrow Aspiration and Biopsy
- Imaging Studies such as a fluorescent in situ hybridization (FISH) test to look more closely at cell DNA.

Prevention and Treatment

- Practice hand and respiratory hygiene guidelines.
- Avoid undercooked or uncooked poultry food or unwashed fruits and vegetables.
- > Avoid gardening and house renovation (to minimize exposure to mold).
- ➢ HEPA filtration with more than 12 air exchanges per for stem cell transplant patients.
- ➤ Use colony-stimulating factors early in patients at risk for febrile neutropenia to reduce risk of infection.
- > Initiate antimicrobial prophylaxis in high-risk treatment protocols.
- Reduce dose reduction strategies in patient with previous or recurrent neutropenic fevers.

continued

Continued:

- Annual Inactivated Influenza Vaccine: In solid tumors/hematological malignancies
- Do not administer live vaccines
- Pneumococcal, meningococcal, and Human papillomavirus as recommended.
- Recipient of HSCT and cellular therapy should delay vaccine by three months.

Questions

1) All of the following are treatment for anemia except:

- a) erythropoietin-stimulating agents
- b) iron supplements
- c) Filgrastim
- d) blood transfusions

2) Which of the following is *not* the risk factors for febrile neutropenia?

- a) Age less than 65 years
- b) previous chemotherapy
- c) renal and liver dysfunction
- d) dose of chemotherapy
- 3) Moderate Neutropenia is defined as:
 - a) ANC less than 500-1000/mm³
 - b) ANC 1000-1500/mm³
 - c) ANC less than 100/mm³
 - d) ANC greater than 500-1000/mm³



American Cancer Society (2024). Anemia (low red blood cell counts). https://www.cancer.org/cancer/managing-cancer/side-effects/low-blood-counts/anemia.html

- Benjamin, L. S. (2020). Holistic nursing upon the knowledge of care during myelosuppression among cancer patients. *Asian Pacific Journal of Cancer Prevention : APJCP, 21*(4), 1089 -1096. <u>https://doi.org/10.31557/APJCP.2020.21.4.1089</u>
- Crawford, J., Herndon, D., Gmitter, K., & Weiss, J. (2024). The impact of myelosuppression on quality of life of patients treated with chemotherapy. *Future Oncology*, 1–16. https://doi.org/10.2217/fon-2023-0513
- Epstein, R. S., Aapro, M. S., Basu Roy, U. K., Salimi, T., Krenitsky, J., Leone-Perkins, M. L., Girman, C., Schlusser, C., Crawford, J. (2020). Patient burden and real-world management of chemotherapy-induced myelosuppression: Results from an online survey of patients with solid tumors. *Adv Ther* 37, 3606–3618. <u>https://doi.org/10.1007/s12325-020-01419-6</u>
- Hart, L., Ogbonnaya, A., Boykin, K., Deyoung, K., Bailey, R., Heritage, T., Lopez-Gonzalez, L., Huang, H., & Gordan, L. (2023). Burden of chemotherapy-induced myelosuppression among patients with extensive-stage small cell lung cancer: A retrospective study from community oncology practices. *Cancer medicine*, 12(8), 10020–10030. <u>https://doi.org/10.1002/cam4.5738</u>
- Ishizu, Y., Ishigami, M., Hayashi, K., Honda, T., Kuzuya, T., Ito, T., & Fujishiro, M. (2020). Rapid increase of platelet counts during antiviral therapy in patients with hepatitis C virus infection. *Hepatology Research*, 50(1), 47–56. <u>https://doi.org/10.1111/hepr.13426</u>

National Cancer Institute (2024). *Myelosuppression*. <u>https://www.cancer.gov/publications/dictionaries/cancer-terms/def/myelosuppression</u>

National Cancer Institute (2024). Pancytopenia. https://www.cancer.gov/publications/dictionaries/cancer-terms/def/pancytopenia

Olsen, M. (2023). Chemotherapy and Immunotherapy Guidelines and Recommendations for Practice (Second Edition). Oncology Nursing Society.

- Ramanathan, S., Narula, G., Prasad, M., Vora, T., Chinnaswamy, G., & Banavali, S. (2018). Parvoviral disease in childhood cancer: Clinical outcomes and impact on therapy at a tertiary cancer center in India. *Pediatric Blood & Cancer*, 65(11), e27357-n/a. https://doi.org/10.1002/pbc.27357
- Renzaho, A., Podlech, J., Kühnapfel, B., Blaum, F., Reddehase, M. J., & Lemmermann, N. A. W. (2020). Cytomegalovirus-associated inhibition of hematopoiesis Is preventable by cytoimmunotherapy with antiviral CD8 T Cells. *Frontiers in Cellular and Infection Microbiology*, *10*, 138–138. <u>https://doi.org/10.3389/fcimb.2020.00138</u>

Saria, M. G., Baldwin, C. M., & Coleman, C. M. (2023). Advanced oncology nursing certification: Review and resource manual (Third Edition). Oncology Nursing Society.

Williams, A. M., Brown, K. H., Allen, L. H., Dary, O., Moorthy, D., Suchdev, P. S. (2023). Improving anemia assessment in clinical and public health settings. *The Journal of Nutrition*, S29- S41. <u>https://doi.org/10.1016/j.tjnut.2023.05.032</u>

Thank you!

Ancy Mathews (<u>amathews2@mdanderson.org</u>) Nadya Panjwani (<u>nhpanjwa@mdanderson.org</u>)

REVIEW COURSE 2024

October 10-12, 2024 | Houston, TX

MDAnderson Cancer Center

Making Cancer History*