

Care of Patients With Neutropenia

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Neutropenia can be a significant problem in the oncology setting. Awareness of potential risks, management of neutropenia, and preventive measures guide nurses in providing comprehensive care that can make the difference between life and death.

Neutropenia is a reduction in the white blood cell (WBC) count (Camp-Sorrell, 2005; Cappozzo, 2004; Hawkins, 1997; Lynch, 2000).

- WBC function is to fight off infection.
- Five types comprise the count: neutrophils, lymphocytes, monocytes, eosinophils, and basophils (see Table 1).
- The five types are reported in percentages that add up to 100%.
- Neutrophils are the first line of defense in infection.
- Neutrophils digest bacterial organisms and debris.
- Neutrophils increase during infection or acute trauma.
- Neutrophils have a half-life of seven to eight hours in circulation.
- Bands, also called “stabs,” are the immature form of neutrophils.
- An increase in band level is called a left shift, which occurs with acute infection.

Neutropenia is caused by problems with neutrophil production, problems with neutrophil distribution, infection, treatment, or drugs (Lynch, 2000). Treatment-related causes include chemotherapy, radiation therapy, immunotherapy, and bone marrow transplant (National Comprehensive Cancer Network [NCCN] & American Cancer Society [ACS], 2002).

Despite the cause or treatment modality, patients with neutropenia are at increased risk for infection. The absolute neutrophil count (ANC) is an essential tool used in oncology to determine poten-

Table 1. Function of the White Blood Cell Components

WHITE BLOOD CELL TYPE	FUNCTION
Neutrophils: also called polymorphonuclear cells (polys) or segmented neutrophils (segs)	Phagocytosis: digestion of bacterial organisms and debris
Lymphocytes: Measurement reflects a combination of the T and B cells.	Combat acute viral infections and chronic bacterial infections
Monocytes: also called monos	Phagocytosis of bacteria; monocytes last longer in circulation than neutrophils.
Eosinophils: also called eos	Allergic reaction and parasitic infections
Basophils: also called mast cells or basos	Involved in inflammatory process and allergic reactions

Note. Based on information from Hawkins, 1997; Pagana & Pagana, 2002.

tial risk (Hawkins, 1997). ANC represents the number of mature WBCs in circulation using a simple, mathematical calculation. See Figure 1 to learn how to calculate the ANC. The ANC is categorized into grades, which reflect the risk for infection. See Table 2 for grading and levels of risk.

The occurrence of neutropenia can lead to life-threatening infections. To decrease the rate of chemotherapy-induced neutropenia, the chemotherapy dose may be reduced or delayed. Reductions or delays diminish the effectiveness of potentially curative treatment (Cappozzo, 2004; Nirenberg, 2003). Prevention of chemotherapy-induced neutropenia is one way to

decrease the potential for dose reductions or delays and is achieved through the use of (Camp-Sorrell, 2005)

- Granulocyte-colony-stimulating factor
- Granulocyte macrophage-colony-stimulating factor.

The use of a colony-stimulating factor is recommended when (Camp-Sorrell, 2005)

- Patients have had a previous episode of febrile neutropenia.
- Chemotherapy is being administered in a dose-dense manner.
- A high risk of febrile neutropenia exists.

Despite dose delays, reductions, or use of colony-stimulating factors, fever still may develop in the presence of neutropenia.

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$$\text{Total WBC count} \times (\% \text{ neutrophils} + \% \text{ bands}) = \text{ANC}$$

Example: Total WBC count is 2.5 = 2,500; neutrophils = 32%; bands = 8%

$$2,500 \times (0.32 + 0.08) = \text{ANC}$$

$$2,500 \times 0.40 = 1,000$$

ANC—absolute neutrophil count; WBC—white blood cell

Figure 1. How to Calculate Absolute Neutrophil Count

Note. Based on information from Pagana & Pagana, 2002.

This is called febrile neutropenia and is defined as one of the following (NCCN, 2005; “NCCN Makes Changes,” 2004).

- One-time temperature of 101°F or higher
- Temperature of 100.4°F or higher for more than one hour

If patients develop fever with neutropenia, the workup should include a history review and testing (NCCN, 2005).

- Review history for
 - Recent travel
 - Pet exposure
 - Infectious disease exposure
 - Timing of last chemotherapy treatment
 - Comorbid diseases
 - Current medications, including recent antibiotic use
 - Prior infections.
- Perform the following tests.
 - Blood cultures: Two sets should be taken from separate sites or the same site, such as a central venous catheter, if a sufficient volume of blood is removed with each sample. The recommended volume is 20–40 ml per sample (“NCCN Makes Changes,” 2004).
 - Complete blood count, electrolytes, and kidney and liver functions

- Urinalysis and urine culture
- Chest x-ray
- Site-specific cultures such as stool, skin, throat, and vascular access device

Once cultures have been obtained, patients are treated with antibiotics. Initial antibiotic monotherapy includes the use of one of the following drugs (NCCN, 2005).

- Cefepime
- Ceftazidime
- Imipenem/cilastatin
- Meropenem
- Piperacillin/tazobactam

Oncology nurses play a vital role in the education of patients and caregivers concerning neutropenia precautions. Patients will need to know how to avoid infection, what the signs of infection are, and when to seek medical care. They should be instructed to (Loerzel, 2005; NCCN & ACS, 2002; Wilson, 2002)

- Wash hands frequently, especially before eating and after using the bathroom.
- Avoid crowds or anyone who is sick with a cold or flu.
- Avoid cleaning up pet excrement.
- Bathe daily.
- Brush teeth twice a day using a soft toothbrush.
- Floss teeth once a day, as long as platelet count is not low.
- Avoid constipation by regularly taking a stool softener.
- Avoid use of suppositories or enemas.
- Eat only fruits and vegetables that can be washed or cooked.
- Eat only meat that is fully cooked.
- Avoid drinking unpasteurized milk or other unpasteurized beverages.

When a patient is neutropenic, the usual signs of infection may not be present because of a lack of sufficient number of neutrophils needed to produce common infectious signs such as pus or productive cough. Patients should be monitored for

signs of infection that may include (Loerzel, 2005; NCCN, 2002)

- Fever or chills, which may be the only indication of infection
- Change in cough or new cough
- Sore throat or new mouth sore
- Burning or pain with urination
- Redness or swelling in any area
- Catheter site that is painful or sore
- Diarrhea
- Pain in abdomen or rectum
- Change in mental status.

Patients and caregivers should seek medical care if patients have (Loerzel, 2005; NCCN & ACS, 2002)

- Fever of 100.4°F for more than one hour or 101°F one time
- Any signs of infection.

If not properly managed, neutropenia in the oncology setting can have a devastating effect on quality of life. The development of an infection in the presence of neutropenia can be fatal in a matter of hours. Nursing makes an important impact on the outcome of care through interventions that help to prevent, monitor, and educate. These interventions may save the life of patients with neutropenia.

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References

- Camp-Sorrell, D. (2005). Myelosuppression. In J. Itano & K. Taoka (Eds.), *Core curriculum for oncology nursing* (pp. 259–274). St. Louis, MO: Elsevier Saunders.
- Cappozzo, C. (2004). Optimal use of granulocyte-colony-stimulating factor in patients with cancer who are at risk for chemotherapy-induced neutropenia. *Oncology Nursing Forum*, 31, 569–574.
- Hawkins, R. (1997). Patient evaluation. In R. Gates & R. Fink (Eds.), *Oncology nursing secrets* (pp. 389–394). Philadelphia: Hanley and Belfus.
- Loerzel, V. (2005). Fever with neutropenia. In M. Hickey & S. Newton (Eds.), *Telephone triage for oncology nurses* (pp. 125–127). Pittsburgh, PA: Oncology Nursing Society.
- Lynch, M. (2000). Neutropenia. In D. Camp-Sorrell & R. Hawkins (Eds.), *Clinical manual for the oncology advanced practice nurse* (pp. 693–698). Pittsburgh, PA: Oncology Nursing Society.
- National Cancer Institute. (1999). *Common*

Table 2. Absolute Neutrophil Count Grading and Risk for Infection

GRADE	ABSOLUTE NEUTROPHIL COUNT	RISK FOR INFECTION
1	1,500/mm ³ or less to more than 2,000/mm ³	No increased risk
2	1,000/mm ³ or less to more than 1,500/mm ³	Slight increase in risk
3	500/mm ³ or less to more than 1,000/mm ³	Moderate risk
4	Less than 500/mm ³	High risk

Note. Based on information from National Cancer Institute, 1999; National Comprehensive Cancer Network & American Cancer Society, 2002.

toxicity criteria, version 2.0. Retrieved December 1, 2005, from http://ctep.cancer.gov/forms/CTCv20_4-30-992.pdf

National Comprehensive Cancer Network. (2005). *Fever and neutropenia: Practice guidelines in oncology—v.1.2005.* Retrieved December 5, 2005, from http://www.nccn.org/professionals/physician_gls/PDF/fever.pdf

National Comprehensive Cancer Network & American Cancer Society. (2002). *Fever*

and neutropenia: Treatment guidelines for patients with cancer. Retrieved December 5, 2005, from http://www.cancer.org/downloads/CRI/NCCN_Fever_2002.pdf

NCCN makes changes to its guidelines for treating fever and neutropenia. (2004). *Supportive Oncology*, 2, 319. Retrieved December 1, 2005, from <http://www.supportiveoncology.net/journal/articles/0204319b.pdf>

Nirenberg, A. (2003). Managing hematologic toxicities: Novel therapies. *Cancer Nursing*, 26(6, Suppl.), 32S-37S.

Pagana, K., & Pagana, T. (2002). White blood cell count and differential count. In *Mosby's manual of diagnostic and laboratory tests*. (2nd ed., pp 477-483). St. Louis, MO: Mosby.

Wilson, B.J. (2002). Dietary recommendations for neutropenic patients. *Seminars in Oncology Nursing*, 18, 44-49.