

# Maintenance of Venous Access Devices in Patients With Neutropenia

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Most patients undergoing chemotherapy treatment will have some level of neutropenia. Neutrophils are the body's primary mechanism to fight bacterial infection. In a healthy host, neutrophils eliminate most bacteria adequately through phagocytosis. Chemotherapy destroys neutrophils, therefore weakening the body's ability to defend itself against bacteria. The National Cancer Institute classifies neutropenia into grades 1–4. Mild neutropenia (grade 1) is present in patients with an absolute neutrophil count (ANC) of less than 2,000/mm<sup>3</sup>. Profound neutropenia (grade 4) is an ANC of less than 500/mm<sup>3</sup>. The type of malignancy (solid versus hematologic), type of chemotherapy (including duration and timing), and general immune status prior to chemotherapy will determine the extent of neutropenia that patients will experience during treatment (Greene, 1996).

Neutropenia is a major risk factor for increased morbidity from infection in patients with cancer, so preventing infection is a priority. Because of the frequency of IV medication administration, the use of vesicants, and venipuncture discomfort, many patients have venous access devices (VADs). Although VADs are common, they give microorganisms easy entry into the bloodstream and can cause serious infection. Approximately 400,000 patients experience bloodstream infection from VADs each year (Viot, 2000). Of those patients, approximately 80,000 will die, and one-third of those deaths are directly attributed to the use of VADs (Viot). The rate is even higher in patients with neutropenia. A study by Elishoov, Or, Strauss, and

Neutropenia is a common complication in patients with cancer who are undergoing chemotherapy. Because of treatment frequency, potential chemotherapy damage to peripheral veins and tissues, and pain from multiple venipunctures, venous access devices (VADs) often are used in the oncology setting. Although VADs have been used for 30 years, no sufficient scientific data exist to support the best care and maintenance strategies for their use in patients with neutropenia. Understanding the etiology and pathogenesis of VAD-related infections (VAD-RI) and the proper steps to prevent or quickly treat it can decrease the likelihood that patients with neutropenia will have a fatal response. This article describes the differences between VADs, the most common sources of VAD-RI, and the treatment of such infections and suggests nursing interventions to help prevent VAD-RI.

Engelhard (1998) of patients undergoing bone marrow transplants found that 65% of VAD-related infections (VAD-RI) occurred during periods of neutropenia. The incidence of VAD-RI in neutropenic periods versus non-neutropenic periods was found to be almost two to one. Furthermore, 88% of infections occurring during neutropenia progressed to septicemia, whereas less than 10% progressed during non-neutropenic periods. Because treating VAD-RI costs more than \$10,000, this is not only a dangerous complication for patients but also a costly one (Jackson, 2001). Despite early diagnosis and aggressive treatment, the mortality rate from nosocomial bloodstream infections related to VAD use remains significant (Viot). Nurses caring for patients with VADs must understand catheter type, correct use and maintenance of VADs, and prevention and early detection of VAD-RI.

## Overview of Venous Access Devices

VADs have been used for more than three decades to administer IV medications, nutrition, and blood products and to draw blood specimens. Three types of long-term VADs often are used in oncology: tunneled catheters, peripherally inserted central catheters (PICCs), and implanted ports. Although each device has distinguishable differences, they can be used similarly. The majority of VADs are made of silicone polyurethane material, and a variety of internal and external diameters are available. All devices are available with single or double lumens, and tunneled catheters are available with three lumens. Each device is available

with an open distal tip or with a three-way valve creating a closed distal tip.

Each VAD has characteristics that help to decrease the risk of infection. Most PICCs are inserted in the antecubital fossa of the arm and threaded through the cephalic or basilic veins. The risk of infection is decreased because fewer organisms live on the arm than on the chest and the area is far away from the nose and mouth. Therefore, the chance of introducing organisms into the bloodstream through the VAD is diminished (Pearson, 1996). Tunneled catheters have a cuff to secure the catheter in a subcutaneous tunnel away from the insertion site. Both tunneling and the cuff help to prevent the migration of microorganisms into the bloodstream.

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