

# Diagnosing Disseminated Intravascular Coagulopathy in Acute Promyelocytic Leukemia

Beth McCraw, ARNP, ACNS-BC, OCN®

Disseminated intravascular coagulopathy (DIC) (see Figure 1) is a complex, life-threatening condition that causes a hypercoagulative state, resulting in inappropriate activation of the coagulation cascade (see Figure 2). Activation of the coagulation cascade is triggered by the release of tissue factor (TF), a transmembrane glycoprotein (McCance & Huether, 2006). On release of TF, the coagulation cascade is initiated, causing an excess of thrombin to be released. With the unregulated release of thrombin, plasminogen is converted to plasmin, resulting in fibrinolysis. Fibrinolysis causes an excess of fibrin degradation products (FDPs), which initiates excessive bleeding (Holmes-Gobel, 2002), leading to a condition of simultaneous hemorrhages and clot formation. In acute promyelocytic leukemia (APL), TF is secreted directly into the bloodstream by the membranes of the promyelocyte blast cells, which initiates the coagulation cascade causing DIC (McCance & Huether). An estimated 85% of patients diagnosed with APL will develop DIC (Ezzone, 2000; Holmes-Gobel, 2000). Although DIC is common in APL, APL itself is a rare form of acute myelogenous leukemia (AML), subtype M3. APL accounts for approximately 10%–15% of adult patients diagnosed with AML (National Cancer Institute, 1999). Cytogenetically, APL is identified by a translocation between chromosomes 15 and 17 (t[15, 17]), which results in the formation of promyelocytic leukemia gene and retinoic acid receptor  $\alpha$  (Wang & Chen, 2008).

## Diagnosis

### Physical Assessment

Clinical manifestations of DIC are highly variable and complex. Vital signs may

demonstrate a normal or increased temperature, tachycardia, hypotension, or tachypnea (Murphy-Ende & Chernecky, 2002). Initial signs and symptoms often are subtle and may go unnoticed until a catastrophic event occurs, such as a cerebral vascular accident, myocardial infarction, massive hemorrhage, or acute renal failure. The mortality rate in a patient with DIC is greater than 75% (Ferri, 2007). For this reason, a thorough assessment of the patient with APL is essential for early recognition of DIC. Generally, the initial sign of acute DIC presents in hemorrhagic form. Often, the DIC patient will have bleeding from three unrelated sites (McCance & Huether, 2006). Symptoms may present as hemorrhagic or embolic events, but microvascular and macrovascular clotting cause irreversible damage (Holmes-Gobel, 2002). Signs and symptoms of DIC are presented by system.

**Integumentary:** Patients may exhibit oozing from previous venipuncture sites, IV or arterial lines, or from surgical wounds. Bleeding mucous membranes, such as epistaxis may be noted, along with bleeding from the sclera and conjunctiva. Often ecchymotic lesions such as petechiae and purpura will occur. Microvascular thrombosis may be manifested by symmetrical cyanosis of the fingers and toes, which can lead to gangrene and subsequent amputation (Geiter, 2003; McCance & Huether, 2006). Jaundice also may occur because of hemorrhage related to excessive release of bilirubin (Holmes-Gobel, 2002).

**Neurologic:** Manifestations may include an altered level of consciousness and changes in behavior or mental status (Geiter, 2003). An excruciating headache, often described as the worst headache the patient has ever experienced, is sometimes reported (Murphy-Ende & Chernecky, 2002). Patients may exhibit onset of new seizure activity or confusion (McCance & Huether, 2006). Because of microembolisms, patients may experience a cerebral vascular accident, exhibiting signs and symptoms of a stroke such as aphasia, facial droop, or motor weakness.

**Cardiovascular:** Signs and symptoms of hemodynamic instability may ensue because of a decrease of intravascular volume related to hemorrhage. If the patient becomes acidotic, the shift in electrolytes may lead to cardiac arrhythmias (Teal, 2007). The patient may have tachycardia, hypotension, and hypoxia. Patients may complain of chest pain or experience myocardial infarction.

**Pulmonary:** Pulmonary embolus or acute respiratory distress syndrome may result from hypoxia (Geiter, 2003). Patients may exhibit dyspnea, tachypnea, and desaturation of oxygen levels, as well as extreme anxiety. Hemorrhagic signs of the pulmonary system such as cough and hemoptysis may occur.

**Gastrointestinal:** Gastrointestinal (GI) bleeding may occur, resulting in signs and symptoms of shock. Physical examination may reveal abdominal tenderness and rigidity, hematemesis, rectal bleeding,

Beth McCraw, ARNP, ACNS-BC, OCN®, is an adult clinical nurse specialist at Jennie Stuart Medical Center in Hopkinsville, KY.

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