The oncology nurse systematically and regularly evaluates the patient’s and family’s responses to blood component therapy to determine progress towards the achievement of normal blood counts, normalized coagulation profile and depleted immunoglobulin (IgG) levels (Camp-Sorrell, 2015). Blood management is best implemented by using organizational processes and structure (AABB, 2012). Blood and blood product therapy should utilize an interdisciplinary patient-care approach, such as nutrition referrals for patients with anemia to receive dietary instruction and pharmaceutical management of anemia (Ghiglione, 2007). Blood management initiatives incorporate standardized practice, eliminate outlier patterns such as automatic ordering of two units of RBCs rather than one, and enforce evidence-based practice (Camp-Sorrell, 2015).

Normal blood contains large numbers of cells, including:

- red blood cells to carry oxygen
- white blood cells to fight infection
- platelets, tiny cell fragments that have a role in blood clotting

These cells and fragments are made in the bone marrow. Healthy bone marrow makes large numbers of red blood cells, white blood cells, and platelets each day. Myelosuppression is a condition in which bone marrow generates too few of these cells. Myelosuppression is a painless condition, and the consequences vary from mild to life threatening, depending on how low the blood cell numbers fall (Lustberg, 2012).

Myelosuppression is a common concern of cancer treatment

A decrease in the number of red blood cells, called anemia, is very common in cancer patients. A drop in white blood cell numbers is often a problem during chemotherapy. One type of white blood cell, called a neutrophil, is usually affected most severely. A decrease in these cells is called neutropenia. Because neutrophils are responsible for defending the body against bacteria, neutropenia increases the risk of infection. Thrombocytopenia, a significant drop in the number of platelets in the blood can cause problems with clotting and bleeding.

All of the cells that make up the blood are formed in the bone marrow

Anemia is a medical condition in which the red blood cell count or hemoglobin is less than normal. The normal level of hemoglobin is generally different in males and females. For men, anemia is typically defined as hemoglobin level of less than 13.5 gram/100 ml and in women as hemoglobin of less than 12.0 gram/100 ml. Anemia is observed in 30% to 90% of patients with cancer. Anemia in the setting of cancer may be caused by blood loss during surgery, displacement of normal bone marrow by malignant cells, cancer therapies that disrupt bone marrow function or the tumor itself. Risk factors include certain chemotherapy regimens, specific tumor types, and low baseline hemoglobin levels. Anemia can impact the patient’s performance status, quality of life, clinical symptoms, and therapeutic effect of the treatment.
plan as well as survival. Anemia can result in symptoms such as fatigue and angina in patients with coronary artery disease (Gillespie, 2003). It is common for cancer patients to receive transfusions of blood or blood products during their course of treatment (Khorana, Francis, Blumberg, Culakova, Refaai, & Lyman, 2008). Generally, the anemia associated with cancer is considered within the category of anemia of chronic disease. The association of increased hemoglobin levels with increased quality of life has been demonstrated by randomized, controlled trials and large, community-based studies (Caro, Salas, Ward, & Goss, 2001).

**Neutropenia:** Neutrophils are white blood cells, which are the essential first line of defense against infections. Neutropenia is characterized by a significant reduction in neutrophils. The main complication of neutropenia is the increased risk of an infection. The majority of cancer patients develop neutropenia, during their disease course, most often due to chemotherapy. Neutropenia can also be caused by solid tumor malignancies, if they infiltrate the bone marrow, or by liquid tumors such as leukemia and lymphoma in which malignant cells readily impact bone marrow functioning. Radiation, if it is administered to multiple sites of active bone marrow proliferation, can cause neutropenia. Risk factors include older age, co-morbidities, and a prior history of chemotherapy treatment. The type of chemotherapy can also be an important risk factor for neutropenia. Fever related to neutropenia can be very serious. Febrile neutropenia is considered to be an oncologic emergency due to the propensity for the rapid onset of sepsis and septic shock, which is associated with a high risk of mortality. The most serious infections occur with gram-negative bacteria, which can be life-threatening; however, gram-positive bacterial infections, fungal infections, and viral infections always generate significant morbidities and possible mortality in the patient with neutropenia. In patients without fever, neutropenia can lead to chemotherapy dose delays and dose reductions, which can compromise the treatment efficacy and curative potential (Lustberg, 2012).

**Thrombocytopenia** is a low platelet count. This condition can range from mild to severe, depending on its underlying cause. For some, the symptoms can include severe bleeding, which can be fatal if not treated. Other patients may experience red, purple, or brown bruises, which are called “purpura”, or a rash with small red or purple dots called “petechiae”. **Thrombocytopenia** is a frequent complication of cancer and its treatment. Systemic chemotherapy is the most common cause. The degree and duration thrombocytopenia depends upon the intensity and duration of the treatment. Significant thrombocytopenia may also be caused by tumor involvement of bone marrow and spleen. Due to the broad differential diagnosis associated with cancer related thrombocytopenia, a careful diagnostic evaluation is indicated. The goal of treatment should be to maintain a safe platelet count to allow effective treatment of the underlying malignancy, prevent bleeding complications, and to minimize the use of platelet product transfusion (Liebman, 2014)

*Blood transfusion therapy can save and enhance patients’ lives but careful consideration must be given to the associated risks*
Blood transfusions are a life-sustaining and life-saving treatment but they aren’t without risk. Conditions that warrant blood transfusions range from acute trauma to intra-operative blood loss to compromised blood-cell production secondary to disease or treatment. Each oncology nurse must have the skills and knowledge required to care for patients receiving blood and blood component therapy (Bielefeldet, 2010). It is important for oncology nurses to comprehensively understand the nursing policies and practice of transfusion therapy, as it is a constant and central component of disease management in oncology health care. At every stage of the transfusion process the nurse is responsible for the part they play in making sure that the correct patient receives the correct blood and also that blood components are used and handled with care (Oldham, Sinclair, & Hendry, 2009).

Types of blood products:

- **Whole blood transfusion:** Generally indicated only for patients who need both increased oxygen-carrying capacity and restoration of blood volume when there is no time to prepare or obtain the specific blood components needed

- **Packed RBCs:** Should be transfused over 2 to 3 hours; if the patient cannot tolerate volume over a maximum of 4 hours, it may be necessary for the blood bank to divide a unit into smaller volumes, providing proper refrigeration of remaining blood until needed. One unit of packed red cells should raise hemoglobin approximately 1%, and the hematocrit about 3%

- **Platelets:** Administer as rapidly as tolerated (usually 4 units every 30 to 60 minutes). Each unit of platelets should raise the recipient’s platelet count by 6000 to 10,000/mm³; however, diminished incremental increases occur with allo-immunization from previous transfusions, bleeding, fever, infection, autoimmune destruction, and hypertension

- **Granulocytes:** May be beneficial in selected population of infected, severely granulocytopenic patients (less than 500/mm³) not responding to antibiotic therapy and who are expected to experienced prolonged suppressed granulocyte production

- **Plasma:** Plasma is the largest component of the blood, making up about 55% of its overall content. The primary purpose of plasma is to transport nutrients, hormones, and proteins to the parts of the body that need it. Human plasma also contains important components including immunoglobulins (IgG), clotting factors, and the proteins albumin and fibrinogen. These components can be isolated from the plasma and concentrated into various products, which are then used as treatments for people suffering from specific medical emergencies

- **Albumin:** Indicated to expand to blood volume of patients in hypovolemic shock and to elevate level of circulating albumin in patients with hypoalbuminemia. The large protein molecule is a major contributor to plasma oncotic pressure

- **Cryoprecipitate:** Indicated for treatment of hemophilia A, Von Willebrand’s disease, disseminated intravascular coagulation (DIC), and uremic bleeding
Guidelines for Planning & Implementation of Blood / Blood Product Transfusion

1. Educate patient and family about the purpose of the transfusion or blood component therapy
2. Teach patient and family about the signs and symptoms of transfusion reaction that should be reported to the health care team
3. Review institutional protocol for the administration of blood component therapy
4. Review institutional protocol to confirm need for filter and/or irradiation. Review institutional protocol for specific tubing, priming solution and flushing procedure
5. Check blood component type with medical order
6. Check blood component type and identification information with two patient identifiers with another registered nurse.
7. Examine blood product for clots bubbles, particulates and discoloration
8. Ensure that medications are never added to blood products
9. Use 20-gauge or larger needle or angio-cath for infusing blood products
10. Record the patient's vital signs (temperature, pulse, respirations, and blood pressure) shortly before the initiation of the transfusion and after the first 15 minutes, and compare to baseline values.
11. After the transfusion is initiated, the rate of flow, vital signs and assessment should be performed according to the institutional protocol and/or physician's orders.
12. If a particular patient is determined to be at increased risk for a reaction, a "PRN" order, for pre-medications to decrease incidence and severity of side effects (e.g., acetaminophen and/or diphenhydramine) should be available.
13. Assessment of the effect of the transfusion (increment in hemoglobin/hematocrit, platelet count or fibrinogen, or correction of PT/INR or PTT, as applicable) is important post-transfusion (Camp-Sorrell, 2015).

Why transfusion reactions occur

Blood transfusion reactions typically occur when the recipient’s immune system launches a response against blood cells or other components of the transfused product. These reactions may occur within the first few minutes of transfusion (classified as an acute reaction) or may develop hours to days later. If red blood cells are destroyed, the reaction may be further classified as hemolytic, all other types of reactions are broadly classified as non-hemolytic. Some reactions result from infectious, chemical, or physical forces or from human error during blood-product preparation or administration (Bielefeldet, 2010).

Observing for signs and symptoms of a transfusion reaction
Signs and symptoms of a transfusion reaction include fever, chills, shortness of breath, dyspnea, wheezing, hives, flank or back pain, blood in urine, hypotension, tachycardia, chest pain, and headache (Camp-Sorrell, 2015). If a reaction occurs, follow institutional protocol. General guidelines include:

1. Stop the infusion and keep the IV line open with normal saline
2. Report the reaction to the provider and the blood bank
3. Re-check identifying tags and numbers on the blood component with the patient identifiers, at the bedside with another registered nurse
4. Treat symptoms noted, as ordered:
   a) Diphenhydramine 25mg – 50mg IV (have available)
   b) Hydrocortisone 50mg – 100 mg (have available)
   c) Meperidine 25mg-50mg (have available for uncontrolled rigors)
   d) Acetaminophen 650mg – 1000mg by mouth (have available)
   e) Oxygen if indicated
   f) Diuretic if indicated for fluid overload
   g) Epinephrine or Solu-Medrol (have available for allergic or anaphylactic reaction
5. Monitor vital signs every 15 min, or more frequently as clinically indicated
6. Send blood bag and attached administration set and labels to the blood bank
7. Collect urine and blood samples as per institutional protocol or ordered
8. Document transfusion reaction:
   a) Date and time noted
   b) Signs and symptoms observed
   c) Actions taken
   d) Patient monitoring (Camp-Sorrell, 2015).

Minimizing transfusion reactions

Some transfusion reactions cannot be foreseen or avoided as antibody levels rise and fall and may not always be detected during the cross-match process. However, transfusion-associated circulatory overload may be avoided by considering the patient’s risk factors, as well as the volume, rate, and timing of transfusions. For example, in patients who are at risk, practitioners can slow down the rate of infusion while ensuring the blood or blood component is transfused within acceptable time limits, that is, no more than four hours after it was removed from the controlled temperature storage. Clinicians should also consider the administration of prescribed diuretics to prevent fluid overload.

Patient Identification: Failure to identify the patient correctly is often implicated as a root cause of blood / blood component transfusion errors. The identification error can occur at the
time of the blood draw for a Type and Cross-match which results in mislabeling of the specimen and a “downstream” mislabeling of the product in the blood bank. Misidentification of the patient can also occur at the time of the infusion. Numerous policies and process have been implemented along with information technology (IT) systems to help ensure the accuracy of practice at all levels of the blood product processing and the transfusion of blood products process. However, while IT systems can help to alert staff to errors, they do not replace the manual checking process, and nurses should not rely on them to prevent human errors.

**Reporting transfusion reactions**

All suspected transfusion reactions must be reported immediately to the blood bank so laboratory investigation and follow-up can begin. It may also be necessary to recall other blood components from the same donor. All adverse events and reactions must be documented in the patient’s medical record and formally reported via the institutions risk management system (RISQ).

**Special Considerations for oncology patients receiving blood products**

**Leukocyte Removal:** Removing white blood cells (leukocytes) from the blood products which are to be transfused into the cancer patient (or any individual who is immune-compromised) may help prevent some serious complications. Many adverse events associated with the transfusion of blood products have been shown to be related to the presence of leukocytes in the blood product transfused. Over the past two decades it has been shown that the removal of such leukocytes is associated with improved outcomes. These include:

- Reduction in the incidence and severity of febrile transfusion reactions
- Reducing the CMV transfusion transmission risk
- Reducing the risk of platelet refractoriness (not responsive to treatment)
- The possible avoidance of v CJD transmission
- Reducing the risk of mortality and organ dysfunction in cardiac patients (Blajchman, 2006).

Leukocyte reduction of blood products is performed by the blood bank. **Oncology patients should only receive blood products which are leuko-depleted.** The nurse must assure that the blood product to be transfused is labeled that it has been leuko-depleted.

**Using CMV negative blood products:** CMV infection is relatively harmless in a person whose immune system is normal, but can cause serious complications in the immune-compromised patient. Considerable data suggest that primary infection and reactivation or re-infection with CMV occur frequently after transfusion. The incidence of these infections appears related both to the number of donors and to the volume of blood received by a patient. For the person who has been exposed to the virus before, the virus can reactivate. It is important to transfuse the individual who has never been exposed to the virus with blood products that are CMV negative. Removal of leukocytes from the unit also helps prevent CMV transmission, as CMV usually lives within the white blood cell. For severely immune-
suppressed oncology patients the use of CMV negative blood products is both appropriate and likely to prevent post-transfusion CMV infection. For most oncology patients the use of leukocyte depleted blood products is sufficient to prevent primary CMV infection (Ljungman, 2014).

**Irradiating blood products:** The immune-compromised individual is at risk for developing graft-versus-host disease (GVHD) from a transfused blood product. The T-lymphocytes in the healthy donors’ blood product attack the body tissues of the immune-suppressed host after the transfusion. The lymphocytes may attack the liver, skin, gut, or bone marrow. This is a potentially fatal complication. The population at risk usually includes profoundly immune-suppressed individuals such as bone marrow transplant patients, and individuals with leukemia. Irradiating the blood product before it is transfused into the patient “deactivates” the T-lymphocytes and makes them incapable of proliferating. For severely immune-suppressed oncology patients, or patients who will be receiving numerous blood products, irradiation of the blood product to be transfused is both appropriate and likely to prevent transfusion related GVHD (Leitman & Holland, 1995).

**Conclusion:**

Transfusion therapy in cancer patients is multi-factorial in etiology and may be necessitated by either a direct effect of the cancer, as a result of the cancer treatment itself, or due to chemical factors produced by the cancer. The clinical symptoms of the need for transfusion therapy vary according to the individual’s capacity to respond to blood loss or reduced cell production. Clinical and laboratory evaluation, and examination of the bone marrow can provide important diagnostic information in many cases. Transfusion therapy involves many hazards, some of which may be reduced or avoided. In advanced cancer patients the use of blood transfusion should be evaluated on an individual basis, according to the presence of distressing symptoms and life expectancy. Transfusion therapy has made it possible to treat the individual with cancer aggressively, controlling symptoms and sometimes preventing bleeding. Early detection of clinical symptoms and monitoring of laboratory data is important to diagnose and to intervene with treatment of the disorder before further complications arise. Control of bleeding, and the management or prevention of complications associated with transfusion therapy decreases the morbidity and mortality in those with cancer and improves overall quality of life.
References:


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