



Modified Blood Components

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Blood transfusion is the most common procedure performed in American hospitals.¹ Blood component modification decreases the adverse effects of transfusion, including the transmission of disease, and facilitates the availability of rare units. Modified blood components include leukoreduced, irradiated, frozen, washed, and volume-reduced products.

Leukoreduced Blood Components^{2,3}

The majority of blood products transfused in the United States are leukoreduced, a process by which 99.9% of the white blood cells (WBCs) are removed. Leukoreduction of blood components decreases some of the risks of blood transfusion.

First, leukoreduction of blood components reduces the incidence of febrile nonhemolytic transfusion reactions (FNHTRs). The two possible mechanisms underlying FNHTRs are the accumulation of leukocyte-derived cytokines in stored products and the WBCs within the product reacting with alloantibodies in the recipient. Prestorage leukoreduction reduces the rate of FNHTRs by both of these mechanisms.

Second, leukoreduction decreases the risk of transfusion transmitted cytomegalovirus (CMV) and other infections transmitted by WBCs. Patients requiring CMV-safe (leukoreduced or CMV-negative) blood products include premature neonates, pregnant women, HIV-infected or immunocompromised patients, hematopoietic progenitor cell and solid organ transplant recipients, and fetuses receiving intrauterine transfusions.

Leukoreduction also decreases the incidence of HLA alloimmunization. HLA alloimmunization can be problematic in patients anticipating solid organ transplantation because it makes finding a compatible organ more difficult. HLA alloimmunization can also affect patients requiring frequent platelet transfusions, as it can cause inappropriately low increments in platelet count following transfusion. Thus, leukoreduced products are indicated in both of these patient populations.

Lastly, leukoreduction may decrease the incidence of transfusion related immunomodulation (TRIM), a transient depression of the immune system following transfusion. Research has indicated that leukoreduction is associated with a decreased risk of TRIM-related bacterial infection and multi-organ dysfunction, as well as, in some patients, decreased mortality.

Irradiated Blood Components⁴

Irradiation of cellular blood components prevents transfusion-associated graft-versus-host-disease (TA-GVHD). TA-GVHD occurs when donor lymphocytes engraft in the recipient, resulting in tissue damage and nearly uniform fatality. TA-GVHD is seen in immunocompromised recipients who cannot mount an immunological response against donor lymphocytes or in recipients who do not recognize donor lymphocytes as foreign.

Irradiated cellular blood products are required for patients at risk for TA-GVHD including fetuses receiving intrauterine transfusions; neonates; patients with hematopoietic progenitor cell transplants, congenital immunodeficiencies of cellular immunity, or Hodgkin lymphoma; and patients undergoing treatment for malignancy. More specifically, patients being treated with purine analogues (fludarabine, cladribine and deoxycoformycin) or medications that affect T-cells (alemtuzumab) should also receive irradiated blood products. Lastly, certain products should always be irradiated: granulocytes, HLA-matched products, and blood products donated by relatives.

*Frozen, Washed, or Volume-Reduced Blood Components*⁵

Red blood cell units with rare phenotypes can be frozen for a decade or more for use by patients with alloantibodies to high frequency antigens. Washed cellular blood components are devoid of plasma and supernatant and are indicated for patients who have a history of severe allergic, anaphylactoid, or anaphylactic reactions. Washed components can also be used for patients at risk for transfusion related hyperkalemia. Volume-reduced blood products remove most, but not all, plasma and supernatant and are indicated for patients at risk for volume overload. Volume reduction may also be indicated to remove plasma prior to an ABO incompatible platelet transfusion.

References and Suggested Reading

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