Blood Banking/ Immunohematology

Special Relevance to Pediatric Patients

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KEYWORDS

• Transfusion medicine/blood banking • Immunohematology • Pediatrics

KEY POINTS

- Transfusion is part of the treatment plan of many children and adolescents.
- Pediatric licensed care providers should have a basic understanding of different components, including storage conditions, indications and contraindications, and procedures for administration.
- The rationale and indications for product modifications are necessary to provide appropriate blood and blood components.
- Immunohematological testing is critically important in providing appropriate blood and blood components for children.
- The decision to transfuse should involve careful consideration of the risks versus benefits.

DONOR SELECTION AND COLLECTION

Fig. 1 shows the overall schema and processes involved before and after the transfusion of blood and blood components.[1] In the United States, the Food and Drug Administration (FDA) regulates donor selection, collection, testing, component preparation, storage, and distribution of blood and blood components (Code of Federal Regulation under sections 211 and 606). Facilities that collect or manufacture blood components must register with the FDA and be licensed if the manufactured blood component is transferred across US state lines. In addition, AABB (formerly known as the American Association of Blood

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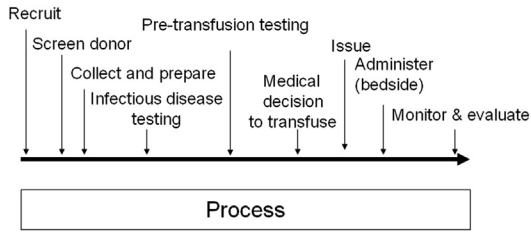

Fig. 1. The process of blood transfusion: from selection to transfusion. The complex process of recruiting, screening, collection, and testing of blood products as well as the decision to transfuse, issuing/administering the product, and performing posttransfusion monitoring are depicted. (*Modified from* Dzik WH. Emily Cooley Lecture 2002: transfusion safety in the hospital. Transfusion 2003;43:1190–9.)

Banks) regularly publishes *Standards for Blood Banks and Transfusion Services*, which are used by accrediting agencies.[2] Countries outside the United States have similar regulatory agencies that oversee manufacturing of their blood products.

Current infectious disease testing in the United States includes serologic testing for human immunodeficiency virus (HIV), hepatitis B and C, human T lymphotropic virus I/II, and syphilis, with nucleic amplification testing for HIV, hepatitis C, West Nile virus, and, in the future, for hepatitis B. Although not currently required by the FDA, testing for Chagas disease is required by the AABB. The FDA and the AABB implemented platelet product bacterial contamination testing because of the risk of bacterial contamination of platelets. This approach to bacterial detection has likely reduced the risk of bacterially contaminated platelets[3]; however, culture bottle detection systems with a minimal culture duration of 24 hours or using other less sensitive methods[4] still potentially allows the release of a product that has clinically significant bacterial growth. Hence, on January 31, 2011, the AABB standard 5.1.5.1.1 became effective, specifying that bacterial detection methods for platelet components use assays either approved by the FDA or validated to provide sensitivity equivalent to FDA-approved methods in order to further minimize the risk of sepsis.

COMPONENT PREPARATION

Whole Blood–Derived Products

Whole blood components, whole blood is collected into bags made of polyvinyl chloride containing di-(2-ethylhexyl) phthalate (DEHP) to make the bags pliable. DEHP is lipophilic and leaches into biologic fluids, including blood. DEHP is metabolized to mono-(2-ethylhexyl) phthalate. Animal in vitro toxicology studies and human epidemiologic studies have linked DEHP and its metabolites to proestrogenic effects. Despite small, long-term follow-up studies showing normal sexual development after early high exposure to DEHP,[5] DEHP-free medical devices, including blood bags, have been recommended for transfusion use in vulnerable patients, including infants and pregnant women, in many countries, including the United States. Most of the red blood cell (RBC) and plasma products (including fresh frozen plasma [FFP], thawed plasma, and so forth) are derived from the donation of whole blood.[6] In Canada and Europe, whole blood–derived platelets are derived using an alternative buffy coat method. **Fig. 2** shows the processes by which whole blood is separated into the various blood components. Depending on the type of processing, one whole blood unit can generate a unit each of packed RBCs, platelet concentrate, and plasma. In addition, subsequent thawing and precipitation of FFP at 1°C to 6°C generates a unit of cryoprecipitate (see **Fig. 2**).