Blood Product Transfusions and Reactions

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KEYWORDS

• Blood products • Transfusion • Packed red blood cells • Fresh frozen plasma

KEY POINTS

- Blood product transfusions are an essential component of the practice of emergency medicine.
- From acute traumatic hemorrhage to chronic blood loss necessitating transfusion for symptomatic anemia, familiarity with individual blood products and their indications for transfusion is an essential tool for every emergency physician (EP).
- The advances made in transfusion medicine over the past few decades have ensured that administration of blood products has become safer than ever before, but significant risks still exist, and will continue to present EPs with diagnostic and treatment challenges.

Blood product transfusions are an essential component of the practice of emergency medicine. From acute traumatic hemorrhage to chronic blood loss necessitating transfusion for symptomatic anemia, familiarity with individual blood products and their indications for transfusion is an essential tool for every emergency physician (EP). Although the focus of this article is primarily on the transfusion of red blood cells, many of the concepts are applicable to the transfusion of all blood products, including platelets, cryoprecipitate, and (supernatant) fresh frozen plasma (FFP).

The history of blood transfusions dates back to the 1600s when British physician William Harvey first discovered the circulation of blood, followed closely by the first successful blood transfusion in 1665.[1] Over the past several decades, advances in blood transfusion medicine have made the practice of administering these transfusions safer and more accessible to the EP. According to the Red Cross, more than 30 million blood components are transfused per year in the United States.[2] EPs must be fully familiar with both the individual blood components and the potential reactions and complications of these transfusions.

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BLOOD PRODUCTS

Packed Red Blood Cells

Packed red blood cells (PRBCs) are used clinically to increase the hemoglobin and oxygen-carrying capacity in an anemic patient. PRBCs are procured from whole blood samples. From a single donation unit of whole blood, approximately 2 transfusable units of PRBCs are collected.[3] PRBCs are stored between 1° and 6°C in a solution containing citrate, phosphate, dextrose, and adenine as well as nutrient additives, which confers a shelf life of approximately 42 days for each unit.[3] One unit of PRBCs given to an average adult will elevate the hemoglobin by about 1 g/dL and the hematocrit by about 3% (**Table 1**).[7] Transfusion guidelines for PRBCs are controversial, and recommendations vary between professional societies. In 2012 the American Association of Blood Banks (AABB) released a clinical practice guideline for transfusion of PRBCs based on a systematic review of multiple randomized clinical trials. The AABB recommends that in hospitalized, stable patients a threshold of 7 to 8 g/dL should be used to guide transfusion based on high-quality evidence.[4] For individuals with preexisting cardiovascular disease, the threshold should be 8 g/dL or less, although this is a weak recommendation by the AABB based on moderate-quality evidence.[4] Ultimately, transfusion decisions should be based on the clinical presentation of the patient in conjunction with the clinical gestalt of the physician.

Platelets

Platelets can be isolated for transfusion either from whole blood donations, which often require multiple or pooled donors to produce a unit, or from platelet apheresis procedures, in which a single donor can provide sufficient platelets for a transfusion unit.[8] Platelets are stored at 22°C, which does increase the risk for bacterial contamination in comparison with PRBCs, which are stored at much lower temperatures.[8] Platelets can be stored safely for 7 days.[8] Platelet transfusions tend to be dosed as a "6-pack" of platelets, which contains 6 units of platelet concentrate from multiple donors or a single apheresis unit, and can be expected to raise the platelet count by 40,000 to 60,000/μL (see **Table 1**).[3] Although there is no definitive trigger for platelet transfusion, current data support the transfusion of platelets for counts less than or equal to 10,000.[8]

Fresh frozen plasma

FFP can also be prepared from whole blood or be collected by apheresis, and contains normal levels of stable clotting factors, albumin, and immunoglobulins.[5] One unit of FFP is usually about 200 to 250 mL in volume.[3] It is stored frozen at −18° to −30°C and then thawed between 30° and 37°C in a water bath under continuous agitation.[5] After thawing, the FFP should be administered as soon as possible,

Table 1
Recommendations for dosing of blood products

Packed red blood cells	10 mL/kg (children) 1 unit per 1 g/dL increase desired (adults)
Platelets	5–10 mL/kg (children) 1 "6-pack" or 1 aphresis unit per 40–60,000/μL increase (adults)
Fresh frozen plasma	10–15 mL FFP/kg (all patients)
Cryoprecipitate	1 cryo unit per 5 kg for 100 mg/dL fibrinogen increase (all patients)

Data from Refs.[3–6]