Adverse Reactions to Transfusion of Blood Products and Best Practices for Prevention

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KEYWORDS

• Blood components • Transfusion • Adverse transfusion reactions • TACO • TRALI • Restrictive transfusion strategy

KEY POINTS

- Acute adverse reactions to transfusion occur within 24 hours and may be immune or non-immune in origin; most occur within 4 hours of transfusion. Delayed reactions occur 48 hours or more after transfusion and are primarily immune in origin.
- Strategies currently used to reduce adverse transfusion reactions include donor and donated blood screening, leukoreduction, irradiation, premedication with acetaminophen, diphenhydramine, and furosemide, restrictive transfusion protocols, cell salvage and autotransfusion, and devices and practices to reduce iatrogenic anemia, although research evidence is not supportive of several of these strategies.
- The use of restrictive transfusion protocols with a transfusion trigger hemoglobin of 8 g/dL for orthopedic and cardiac surgery patients is supported with high-quality evidence.

INTRODUCTION

Annually, nearly 14 million units of whole blood and packed red cells (PRC) are transfused worldwide; in the United States, approximately 36,000 units of PRC, 7000 units of platelets, and 10,000 units of fresh frozen plasma (FFP) are transfused each year.[1]

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Transfusion of blood products in critical care is common; scientists estimated that 15% to 53% of critically ill patients are transfused during their critical care stay.[2] Blood transfusion in the intensive care unit is primarily used to increase oxygen-carrying capacity reduced by anemia. Anemia in the critical care unit is multifactorial and may be associated with nutritional deficiencies of iron, folate or vitamin B, cell hemolysis, coagulopathies, erythropoietin deficiencies, and blood loss due to trauma, surgery, hemorrhage, or iatrogenic reason.[3,4] Although transfusion is a common practice in the critical care unit, it is not without complication.

Recently, scientists analyzed 125 data sets representing 25 countries from the International Haemovigilance Network Database and determined the rate of adverse reactions to transfusion of blood products was 660 per 100,000 individuals; nearly 3% of these were categorized as severe.[5] The mortality associated with transfusion was 0.26 deaths per 100,000; nearly 60% of deaths were due to transfusion-associated circulatory overload (TACO), transfusion-related lung injury (TRALI), and transfusion-associated dyspnea (TAD). Harvey and colleagues[6] analyzed transfusion data from 77 facilities in the United States and found that there were 239.5 adverse reactions per 100,000 units transfused. Allergic reactions were the most common type with 112.2 reactions per 100,000 units transfused. Severe adverse reactions occurred at a rate of 17.5 per 100,000 units transfused. Platelet transfusion had the highest rate at 421.7 per 100,000 units; rates for PRC, plasma, and cryoprecipitate were 205.5, 127.7, and 5.6 per 100,000 units, respectively. Although transfusion of blood components is common, adverse reactions to those transfusions may produce mild to severe adverse reactions.

HISTORICAL CONTEXT

Although references to blood transfusion can be found as early as 32 BC in early Greek and Roman myths, these likely referred to drinking blood rather than actual transfusion as we understand it. In 1612, William Harvey described the circulatory system, and subsequently, a variety of scientists described and attempted transfusions, primarily in animals. In the early 1800s, Dr James Blundell performed the first reported human to human transfusions; the first successful transfusion was from his assistant to a woman with postpartum hemorrhage.[7,8] However, some early attempts transfused blood from cadavers to live patients for treatment of various illnesses.[9]

In 1900, Landsteiner and other scientists described 4 blood types and subsequently proposed a classification system for international use; this system was universally adopted in the 1950s.[10] With the need for treatment of patients after war trauma during World War II, direct whole blood transfusions was replaced with component transfusion once science developed techniques for separation of whole blood and storage of components.[9] However, reports of recipient hepatitis after transfusion eventually led to the initiation of screening donor blood for infectious diseases.[11] In addition to infectious transmission, multiple adverse reactions were observed and described over the past 200 years; in fact, Dr Blundell reported several adverse reactions with his initial person-to-person transfusions.[7] Researchers and clinicians are now aware of multiple adverse reactions that may occur; recent data demonstrated that TRALI and TACO accounted for 38% and 24%, respectively, of transfusion-associated fatalities from 2011 to 2015.[12]

ADVERSE REACTIONS TO TRANSFUSION OF BLOOD PRODUCTS

Acute Reactions

Acute adverse reactions to transfusion are those that occur within 24 hours; however, most occur within 4 hours of transfusion[13] (**Table 1**). Acute reactions may be immune