Risks of perioperative blood transfusions

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Abstract

Blood transfusions remain common in surgical patients, but despite transfusion being safer then it ever has been, it still poses significant risks. These can be enhanced in the perioperative period where identifying complications can also be more challenging. This article outlines the risks associated with perioperative transfusions and discusses the current recommendations for transfusion and use of alternatives to blood transfusion.

Keywords Blood; perioperative; transfusion

Royal College of Anaesthetists CPD Matrix: 2A05

Learning objectives

After reading this article, you should be able to:

- describe the risks associated with perioperative transfusions
- outline the indications for a blood transfusion including the current transfusion threshold
- discuss the alternatives and adjuncts to blood transfusion

Blood transfusions can be life saving, but despite being safer than it ever has been, transfusions still pose significant risks. A total of 3568 events were reported to the UK Serious Hazards of Transfusion (SHOT) in 2013 with 165 cases of major morbidity or mortality attributable to transfusions.[1] It is essential unnecessary transfusions are minimized and that clinicians are highly vigilant for signs of transfusions reactions.

Serious complications of allogeneic blood transfusion are outlined in Table 1 and are discussed in more detail below. Identifying these adverse reactions can be more challenging in the perioperative setting, as the presentation is often non-specific, especially in anaesthetized patients and can initially mimic conditions that are prevalent in the surgical setting such as haemorrhage. All adverse reactions attributable to transfusions should be reported.

SHOT was established in 1996 as a voluntary haemovigilance system for adverse events affecting recipients. The EU Blood Safety and Quality Directive 2005/61/EC legally mandated haemovigilance for hospital blood banks and blood establishments; in the UK this is facilitated through the MHRA (Medicines and Healthcare products Regulatory Agency) using the SABRE reporting system (Serious Adverse Blood reactions and Events). The transfusion of ABO incompatible blood is also a WHO Never Event.

Antibody-mediated transfusion reactions

A summary of all types of antibody-mediated reactions are found in Table 2. The most serious of these are the haemolytic transfusion reactions. These result from interactions between antibodies in the recipient's plasma and surface antigens on donor red cells. There are numerous red cell antigens but they differ in their potential for immunisation resulting in a spectrum of haemolytic reactions (Figure 1).

Acute haemolytic reactions

The most serious haemolytic reactions are caused by ABO-incompatible red cell transfusions and are associated with major morbidity and mortality, 30% and 5–10%, respectively.[2] They are predominantly caused by human error.[1] Recent estimates suggest that 1:2000 samples received by the laboratory are labelled with the wrong patients information (wrong blood in tube).[3] If an acute haemolytic reaction is suspected the transfusion laboratory should be informed immediately as another patient may be at risk of receiving the wrong blood.

Transfusion-associated circulatory overload (TACO)

TACO is defined as acute or worsening pulmonary oedema within 6 hours of transfusion. Management involves stopping the transfusion and administering oxygen and diuretics/nitrates as appropriate.

This preventable complication of transfusion was the most common cause of transfusion-related major morbidity and mortality reported to SHOT in 2013. Better pre- and post-transfusion assessments could reduce this risk. TACO is much more common in patients who weigh less than 50 kg. Historically it has been assumed that one unit of packed red cells will produce a Hb increment of 10 g/l but this is only accurate if the recipient weighs approximately 70 kg. A dose of 4 ml/kg of red cells will produce a Hb rise of approximately 10 g/l.[2] Patients should be reassessed following each unit of blood with regard to effectiveness of transfusion and side effects.

Transfusion-related acute lung injury (TRALI)

TRALI is characterized by acute respiratory distress within 6 hours of transfusion. Cases commonly present with acute dyspnoea, hypoxia, fever and hypotension. Bilateral pulmonary infiltration is seen on the chest X-ray (CXR). Treatment is supportive and ventilatory support is often required. Most cases recover within 72 hours predominantly without long-term consequences. TRALI is frequently misdiagnosed as cardiogenic pulmonary oedema and treatment with diuretics may worsen outcomes.

The majority of cases of TRALI are caused by antibodies in the donor blood reacting against human leucocyte antigens (HLA) and human neutrophil antigens (HNA) in the recipient. This results in damaged pulmonary endothelial cells due to

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Complications of blood transfusions

Acute (within 24 hours)	Early (within 2 weeks)	Late (after 2 weeks)
Acute haemolytic reactions	Delayed haemolytic reactions	Transmission of infection
Allergic reactions	Post-transfusion purpura	Transfusion-associated graft-versus-host disease
Bacterial contamination of blood unit	Transfusion induced immunomodulation	Transfusional iron overload
Febrile non-haemolytic reactions		Alloimmunization
Transfusion-related acute lung injury		Transfusion induced immunomodulation
Transfusion-associated circulatory overload		

Table 1

sequestration of the inflammatory cells in the lungs, causing capillary leak into the alveolar spaces (non-cardiogenic pulmonary oedema). Patients with raised levels of pro-inflammatory cytokines, such as during the perioperative period, are more susceptible. These antigens needed to be assessed for in suspected TRALI cases.

The incidence of TRALI is approximately 1 in 150,000 units transfused, which is a significant reduction since routine red cell leucodepletion (removal of majority of white cells) was introduced.[1] It is more common with plasma-rich blood components.

Transfusion associated dyspnoea (TAD)

A relatively new term, transfusion associated dyspnoea (TAD) has been used to describe respiratory distress temporally associated with transfusion which does not meet the diagnostic criteria for TACO, TRALI or allergic reaction.

Transfusion-transmitted infections

Bacterial

Bacterial contamination of blood components is a rare complication but can result in septic shock with high mortality rates (25% mortality since 1996 in UK[2]). Contamination commonly

Antibody-mediated transfusion reactions

Reaction	Description	Antibody	Haemolysis	Frequency	Timing	Clinical features	Management
Acute haemolytic reactions	Transfusion of ABO incompatible blood resulting in DIC, haemoglobinuria and acute renal failure	IgM	Intravascular haemolysis of transfused and recipient red cells	1:180,000	Immediate after transfusion 5 ml red cells	DIC, acute kidney injury, haemoglobinuria, shock	Stop transfusion, notify laboratory immediately. Supportive measures including dialysis, inotropes
Delayed haemolytic reactions	Transfusion of red cells expressing antigens to which the donor has pre-formed antibodies (commonly RH, Kidd)	IgG	Extravascular destruction of transfused antigen positive cells only	1:40,000	24 hours—10 days following transfusion	Falling Hb, jaundice, rarely haemoglobinuria	Supportive management
Allergic reactions	Sensitivity to donor plasma proteins	IgE	Non haemolytic	1:100	Usually during or immediately following transfusion	Pruritis, urticaria	Antihistamines
Anaphylaxis	Anaphylaxis, usually in IgA deficient individuals who have anti IgA in their plasma.	IgA	Non haemolytic	1:40,000	Usually during or immediately following transfusion		Management of anaphylaxis as per UK resuscitation council guidelines.
Febrile non haemolytic transfusion reactions	Pyrexia (<38°C but >2°C above baseline)	Cytokine accumulation during cell storage	Non haemolytic	1:100	During transfusion	Pyrexia, chills, myalgia	Slow or stop transfusion, antipyretics

Table 2