Safety considerations and risks of transfusion

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Abstract

Cross-matching of blood components to the patient's blood is mandatory to ensure the safe transfusion of suitable blood components in a timely manner and avoid serious harm to the recipient. This article will outline the validated methods of cross-matching in the laboratory setting. We will also discuss transfusion reactions and consequences of transfusion of inappropriate or mismatched blood components, alongside the principles of patient blood management and pre-operative anaemia.

Keywords Blood; cross-matching; patient blood management; preoperative anaemia; risks of transfusion; transfusion

Royal College of Anaesthetists CPD Matrix: 1E04, 2A03, 2A05

Learning objectives

After reading this article, you should be able to:

- understand haemovigilance and safe transfusion practices
- understand pre-transfusion compatibility procedures and their rationale
- increase knowledge of acute and delayed transfusion reactions
- understand principles of Patient Blood Management

Haemovigilance and safe transfusion

Clinical medicine has long recognized the importance of safety in transfusion of blood components. The transfusion of a blood product is a live transplant, where the donor is freely giving their blood without monetary compensation. Historically, there have been serious complications related to the transfusion of blood components; from development of chronic viral infection, heart failure or lung injury in the recipient, to death.[1] The NHS blood transfusion services rigorously test for clinically significant infections and transmittable conditions to ensure the product is as safe as it possibly can be, but there are inherent risks with transfusion. The United Kingdom has a professionally led independent haemovigilance scheme which was established in 1996. The Serious Hazards of Transfusion (SHOT) Steering Group publish an annual report highlighting errors, near miss and never-events in association with laboratory and patient-facing aspects of transfusion. The SHOT report published in July 2017 shows that the never-event of an ABO incompatible transfusion is the tip of the iceberg and a cascade of failures, including the wrong blood in tube, incorrect laboratory procedures and inadequate identification of the patient at the bedside, have contributed to patient harm. It also comments on many other SHOT-reportable events including transfusion-transmitted infection and transfusion related acute lung injury.

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It is essential to remember that harm can also arise from *not* giving a transfusion; during 2010–2016 it was found that 25 of 115 (21.7%) deaths reported to SHOT were due to delayed transfusions.[2]

Pre-transfusion compatibility procedures

The British Committee for Standards in Haematology published guidelines in 2013 outlining the pre-transfusion compatibility procedures that must be carried out in blood transfusion laboratories.[3] To recap the full guideline is outwith the remit of this article, except to state a few points relevant to the clinician caring for the patient in need of blood components.

Serological testing ('group and save' test) should be performed using blood collected no more than 3 days prior to the proposed transfusion date if the patient has been transfused previously or pregnant in the previous three months.[3] ABO grouping is essential and the safety of this test must not be compromised. The SHOT guidelines recommend that this is fully automated in order to reduce human errors in interpretation and transcription of the test. Each group and save sample received in the transfusion laboratory will have an ABO group established, an Rh group and antibody screen.[3] This can be labour intensive if the laboratory uses manual techniques. Electronic issue (or 'computer cross-matching') is a safe and rapid technique of issuing blood products and compatible products can be issued in around 5 minutes in an emergency situation. Contraindications to electronic issue include a positive antibody screen or for neonates and fetuses if the mother has an IgG red-cell antibody present in her plasma. In addition, it should not be used if the patient has had an ABO-incompatible marrow or haematopoietic stem cell transplant in the past, or had an ABO-incompatible solid organ transplant in the preceding 3 months.[4] In these circumstances provision of blood components may take longer, or a clinical decision to use *least incompatible* blood products may be taken.

Transfusion incidents

NHS Blood and Transplant report that around 1 in 13,000 blood components are transfused to the wrong patient and up to 1 in 1300 pre-transfusion blood samples are taken from the wrong patient (or 'wrong blood in tube'). Life-threatening or fatal reactions are rare. In 2016 three cases of transfusion of ABO-incompatible blood were reported to SHOT, along with 264 near misses that could have resulted in incompatible transfusions. Two of the three ABO-incompatible transfusions in 2016 resulted in major morbidity but no deaths. Five deaths were

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reported to SHOT as due to transfusion of ABO-incompatible components between 2006 and 2016, which is an improvement on the 15 deaths between 1996 and 2006. However, these events still happen. A nurse was convicted of manslaughter for failing to perform the final bedside check prior to administering an incompatible blood component leading to the death of a patient in 2014. This death was listed in the 2015 SHOT report as a never-event outcome of transfusion and led to the recommendation of using bedside checklists.[2]

Acute transfusion reactions

Acute transfusion reactions encompass febrile, allergic and hypotensive reactions, and are considered 'acute' if they occur within 24 hours of the transfusion even if only a very small volume of component was transfused. These can be graded as mild, moderate or severe as per clinical criteria (see Table 1).

Approximately 75% of cases of febrile-type reactions are reported with red cell transfusions. Plasma and platelets will more commonly cause allergic reactions. Allergic reactions seem to occur more commonly in platelets suspended in plasma; platelets suspended in PAS (platelet additive solution) should be considered in patients with history of allergic reactions that persist despite pre-medication in the patient with recurrent reactions (see Table 2).

Patients must be assessed promptly to identify those who are in need of immediate treatment or resuscitation. Figure 1 can aid in identification and management of a suspected acute transfusion reaction.

Targeted treatment for future transfusion reactions[2]

Reaction	Treatment	Prevention of recurrent reactions
Febrile	Paracetamol	Paracetamol 60 min before anticipated time of reaction
Allergic	Antihistamine (steroid should not be used routinely)	If previous reaction with apheresis platelets try pooled platelets in PAS If recurrent, give antihistamine before transfusion
Severe allergy	If anaphylaxis, adrenaline is essential	If recurrent, consider washed platelets/ red cells; for fresh frozen plasma (FFP) try a pooled component e.g. solvent-detergent treated plasma

Table 2

Transfusion-related acute lung injury

Transfusion-related acute lung injury (TRALI) is caused by antibodies in the donor blood reacting with the patient's neutrophils, monocytes or pulmonary endothelium. Inflammatory cells are sequestered in the lungs, causing leakage of plasma into the alveolar spaces (non-cardiogenic pulmonary oedema). Most cases present within 2 hours of transfusion (maximum 6 hours) with severe breathlessness and cough productive of frothy pink sputum. It is often associated with hypotension (due to loss of plasma volume), fever and rigors and transient peripheral blood neutropenia or monocytopenia. Chest X-ray shows bilateral

Classification of reactions[2]

Type of reaction	1 = Mild	2 = Moderate	3 = Severe
Febrile type reaction	A temperature $\geq$38ºC and a rise between 1 and 2º from pre-transfusion values, but no other symptoms/signs	A rise in temperature of 2ºC or more, or fever 29ºC or over and/or rigors, chills, other inflammatory symptoms/signs such as myalgia or nausea which precipitate stopping the transfusion	A rise in temperature of 2ºC or more, and/or rigors, chills, or fever 39ºC or over, or other inflammatory symptoms/signs such as myalgia or nausea which precipitate stopping the transfusion, prompt medical AND/OR directly results in or prolongs hospital stay
Allergic type reaction	Transient flushing, urticaria or rash	Wheeze or angioedema with or without flushing/urticaria/rash but without respiratory compromise or hypotension	Bronchospasm, stridor, angioedema or circulatory problems which require urgent medical intervention AND/OR directly result in or prolong hospital stay, or Anaphylaxis (severe, life-threatening, generalized or systemic hypersensitivity reaction with rapidly developing airway and/or breathing and/or circulation problems, usually associated with skin and mucosal changes
Reaction with both allergic and febrile features	Features of mild febrile and mild allergic reactions	Features of both allergic and febrile reactions, at least one of which is in the moderate category	Features of both allergic and febrile reactions, at least one of which is in the severe category
Hypotensive reaction		Isolated fall in systolic blood pressure of 30 mm or more occurring during or within one hour of completing transfusion and a systolic blood pressure 80 mm or less in the absence of allergic or anaphylactic symptoms. No/ minor intervention required.	Hypotension, as previously defined, leading to shock (e.g. acidaemia, impairment of vital organ function) without allergic or inflammatory symptoms. Urgent medical intervention required.

Table 1

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