



# BLOOD TRANSFUSION AND THE ANAESTHETIST RED CELL TRANSFUSION

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## **Section 1 RECOMMENDATIONS**

1. The decision to transfuse should always be made on an individual patient basis.
2. Patients need not be transfused to achieve a 'normal' haemoglobin concentration.
3. Anaesthetists should play a lead role in good pre-operative assessment and preparation.
4. Departmental guidelines should be drawn up on matters of blood transfusion and be readily available for reference.
5. A permanent record of the administration of each unit of red blood cells is required by European law.
6. Record the reason for pre-operative and postoperative transfusions in the clinical notes.
7. Local surgical blood ordering schedules, once developed, need to be reviewed at regular intervals by auditing red cell use.
8. Every Hospital Transfusion Committee is advised to include a representative from the Department of Anaesthesia.

## Section 2 Introduction

Transfusion medicine is changing rapidly in response to a number of different developments. The increase in blood-borne diseases, many of which have been identified in the recent past, requires anaesthetists to be fully informed of the risks and benefits to patients of red cell transfusion. Blood transfusion can be lifesaving in situations of severe haemorrhage. The aim to restore haemoglobin concentration by the use of allogeneic blood has serious implications and warrants careful consideration.

Blood components currently prepared by the blood transfusion centres are rigorously tested. Blood transfusion is not without risk as has been shown by the report on Serious Hazards Of Transfusion (SHOT) which continues to highlight mistakes in the administration of blood [1]. It would be unwise to believe that new diseases transmitted via blood transfusion will not be discovered.

These factors have required clinicians to examine the use of blood components in a more objective way. It is essential that our practice of blood transfusion is based on current scientific knowledge.

Surgical patients receive approximately 40% of the transfused allogeneic blood in the UK. Anaesthetists are involved in the prescription and administration of much of this blood. This document summarises current evidence and opinion in the practice of transfusion and provides a concise reference to aid rational and appropriate allogeneic red cell use. It defines best practice, which may reduce risk to the patient.

The treatment of massive transfusion is beyond the scope of this booklet. A comprehensive account of the management of this clinical condition is covered in a number of texts [2-5].

## Section 3 Historical Background

The widespread practice of red cell transfusion was essentially a 20th Century phenomenon. Attempts were made to transfuse animal blood into humans as long ago as 1667. Blood was transfused in an attempt to provide a calming effect on the recipient by using docile animals such as sheep as donors. Mortality was high and the practice was discouraged. It was not until the identification of the ABO group blood system by Landsteiner (1900), prompted by the work of Landois, that there was an understanding of incompatible blood transfusion. Following this classification, a reliable system could be developed to ensure the safe practice of allogeneic blood transfusion.

The availability of allogeneic transfusion and the expansion of such practices was slow initially as the storage of blood proved difficult. Blood for transfusion had to be obtained from walking donors known as 'hoof donors' who made themselves available for donation when required. Citrate was used to stop the blood coagulating during the transfusion, but it was not immediately apparent that the blood could be stored once anti-coagulated, provided it was kept at 4°C. It was not until the late 1930s that this technique allowed successful storage. One of the first blood banks was developed at Cook County Hospital, USA. Patients were asked to predonate their own blood before surgery and to deposit it in a blood bank.

These techniques were further developed during the Second World War and helped develop the National Blood Transfusion Service within the National Health Service. It was the provision of a readily available blood supply and parallel developments in anaesthesia and intensive care that led to the explosion in surgical procedures in the latter half of the 20th Century.

In the mid 1970s when it was realised that demand for red cell products was beginning to outstrip supply, in part due to the huge increase in cardiac surgery for coronary artery disease, clinicians became alerted to the need to start using this resource sensibly. It has become apparent over the last 20 years that a number of diseases can be transmitted via blood transfusion, e.g. HIV, Hepatitis B and C and now variant CJD.

## Section 4 Clinical Indications

The purpose of red cell transfusion is to improve the oxygen-carrying capacity of the blood. During the operative and immediate postoperative period, intravascular volume and haemoglobin concentration may change rapidly. Anaesthetists should be prepared to respond to these changes in the most appropriate way. Frequent assessment of changing intravascular volumes, oxygen delivery and patient physiology is required. The surgical patient's anaemia may recover relatively quickly over the ensuing weeks following surgery provided that a good nutritional state is maintained.

The traditional approach of transfusion to achieve a specific haemoglobin concentration should be questioned, in view of the risks associated with allogeneic transfusion.

Several factors need to be taken into account before considering transfusion in the surgical patient:

- Clinical experience has shown that blood loss of 30% can be treated with crystalloid or colloid solutions alone. A large, retrospective, observational study showed there was no increase in mortality provided the haemoglobin concentration was kept  $>8 \text{ g.dl}^{-1}$ , even in an elderly population [6].
- It has been suggested that a haemoglobin concentration  $>8 \text{ g.dl}^{-1}$  is sufficient even in patients with severe cardiorespiratory disease [7].
- Postoperative patients who are limited in their activity are unlikely to have oxygen demands that exceed supply.
- It is only in the most critically ill patients that demand exceeds supply. Studies in young volunteers have shown that oxygen delivery is not compromised even when the haemoglobin concentration is as low as  $5 \text{ g.dl}^{-1}$  [8].
- It has been shown that wound healing is not affected unless oxygen tension decreases to  $<6.5 \text{ kPa}$  or haematocrit is  $<18\%$  [9].

- The transfusion of allogeneic blood may lead to an increase in postoperative infections due to an immunosuppressive effect [10, 11].
- In a large, randomised, controlled trial of intensive care patients, both adult and paediatric, there was no detriment in restricting transfusion at haemoglobin concentrations of 7-9 g.dl<sup>-1</sup> compared to a liberal transfusion policy [12, 13].
- Elderly patients and those with severe cardiac and respiratory disease have less physiological reserve and may experience symptoms from a low haemoglobin concentration such as shortness of breath, angina, and poor exercise tolerance.

## Section 5 Current considerations

- *Transfusion of red blood cells continues to carry a significant risk.*
- *These considerations should encourage clinicians to question the need for transfusion before administering red blood cells.*

### Risks of Infection

Blood can be regarded as a drug with risks inherent in its use. The public expects to be offered 'zero' risk, but it is highly unlikely that this can ever be achieved. The anaesthetist should ensure that patients are aware of the current risks associated with allogeneic transfusion. NBS leaflets are available and can help patients with this information\*.

HIV infection continues to concern the public and health care workers. Procedures now in place to minimise HIV transmission have lowered the risk considerably. In the UK the probability of a unit of blood being contaminated with HIV is now estimated at 1 in 5,000,000. The risk for Hepatitis C is 1 in 32,000,000. There is now evidence that vCJD can be transmitted by blood transfusion in humans [Appendix 1].

### Serious Hazards Of Transfusion (SHOT) – UK haemovigilance system

This annual publication summarises the complications arising from the transfusion of blood components [1]. The SHOT scheme relies on confidential reports of transfusion incidents occurring at UK hospitals. The reports are likely to be an underestimate because of the voluntary nature of the reporting.

Public concern is focused on virus and prion transmission. However, other risks are of greater importance. In the last 15 years, there have been many more deaths from bacterial contamination or the administration of the wrong blood to the patient than from HIV infection. The correct process of blood administration to minimise this risk is outlined in Section 6.

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\* This leaflet is intended for UK use. Hospitals can obtain copies from their supplying blood service if supplied within the National Blood Service, Those hospitals supplied by Scottish Blood Service, Welsh Blood Service or Northern Ireland Blood Service can order copies from John Chisholm of Phoenix Print Management Limited. Telephone: 01844 354779.

## **Patient Identification**

Incorrect patient identification at any stage of the process from initial blood sampling through to compatibility testing and administration, increases the risk of receiving the wrong blood.

## **Supply and Demand**

Red blood cells have a finite shelf life and cannot be stockpiled despite advances in storage techniques. The changing demographics within the general population have resulted in a more elderly population presenting for surgery. Patients are being offered elaborate and extensive surgery. This increases demand for blood.

## Section 6 The appropriate use of red blood cells

### Pre-operative considerations

- A planned surgical transfusion checklist may be helpful in guiding transfusion and avoiding inappropriate red cell transfusion [Appendix 2].
- Patients should have a full blood count and group and antibody screen performed when placed on the waiting list for an elective surgical procedure that is likely to require red cell transfusion. The use of surgical blood ordering schedules can help decide which operations are likely to lead to red cell transfusion.
- An antibody screen will alert the operative team to possible problems in obtaining compatible blood.
- Iron deficiency anaemia should be investigated and corrected during the pre-operative period.

### Alternatives to allogeneic blood

#### *Autologous Transfusion*

- The use of autologous blood transfusion may be an option depending upon the patient, the surgical procedure that is planned, and local organisation.
- The use of red cell salvage autotransfusion currently seems the easiest and most widely available method.
- Acute normovolaemic haemodilution is another option. The benefits of this technique in terms of red cell saving only become apparent at significant levels of haemodilution.
- Pre-deposit programmes may reduce the need for allogeneic blood. The need for testing and storage combined with the 50% wastage of such collected blood makes it a less cost-effective measure. The clerical errors and chances of transfusing the wrong blood remain.

### ***Pharmacological Methods***

- Aprotinin has been used as high dose prophylactic therapy, with success, when trying to decrease allogeneic blood requirements particularly during cardiothoracic surgery [14]. Due to recent developments aprotinin no longer has a license for use in the UK.
- The use of recombinant erythropoietin in the peri-operative setting is still under investigation.
- Desmopressin may be used to reduce bleeding times in patients with mild forms of Haemophilia A or von Willebrand disease [15]. It promotes the release of von Willebrand Factor (vWF). It may also be successful in improving platelet function in uraemic patients [16].

### ***Oxygen Carrying Solutions***

There are no commercial oxygen carrying solutions currently available. It is likely that a polymerised bovine haemoglobin solution may be available in the UK in the near future. It is unlikely that these solutions will be suitable for widespread use and it will be prudent to assess their use in clearly defined areas.

'Better Blood Transfusion initiatives' [17] supported by all four UK Chief Medical Officers and by the NHS Executive are an attempt to improve the use of blood components.

## Section 7 Guidelines for transfusion of red cells

### *Red cell transfusion*

- Patients should not normally be transfused if the haemoglobin concentration is  $>10 \text{ g.dl}^{-1}$
- A strong indication for transfusion is a haemoglobin concentration  $<7 \text{ g.dl}^{-1}$
- Transfusion will become essential when the haemoglobin concentration decreases to  $5 \text{ g.dl}^{-1}$ .
- A haemoglobin concentration of  $8\text{-}10 \text{ g.dl}^{-1}$  is a safe level even for those patients with significant cardiorespiratory disease.
- Symptomatic patients should be transfused.

### **Estimation of haemoglobin concentration**

Haemoglobin concentration or haematocrit should be monitored peri-operatively and should guide red cell transfusion. This may be achieved by formal laboratory investigation if time allows or by the use of near-patient monitoring devices that can provide guidance, e.g. blood gas analysers or Haemocue<sup>®</sup> devices.

## Section 8 The process for red cell transfusion

The Blood Transfusion Task Force has issued guidelines on the process of red cell transfusion [18]. A summary of these recommendations follows.

Once the decision to transfuse has been made, the following procedures should be followed to minimise the incorrect administration of red cells to the patient:

- The identity of the patient must be confirmed.
- The blood compatibility label must be checked to ensure that the blood is correct for the patient.
- The expiry date should be checked.
- The bag should be inspected to ensure integrity of the plastic casing.
- Removed patient identification bands must be replaced or re-attached.
- Blood left out of a blood fridge for longer than 30 minutes should be transfused within 4 hours or discarded.
- The details of the unit of blood transfused should be recorded on the anaesthetic chart or as an entry in the contemporaneous clinical notes. Tear-off sticky labels may facilitate this data recording.
- The volume of blood transfused should be recorded once administered.
- 100% traceability of all allogeneic blood transfused is a legal requirement following the European Blood Directive. [19].

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#### **Relevant UK Internet resources**

SHOT:

The National Blood Service:

British Blood Transfusion Society:

Better Blood Transfusion

[www.shot.demon.co.uk](http://www.shot.demon.co.uk)

[www.bloodnet.nbs.uk](http://www.bloodnet.nbs.uk)

[www.blood.co.uk](http://www.blood.co.uk)

[www.transfusionguidelines.org.uk](http://www.transfusionguidelines.org.uk)

# Appendix 1

## Risks of Red Cell Transfusion

<b>Risk Factor</b>	<b>Estimated frequency per unit transfused</b>	<b>Deaths per million units</b>
Acute Haemolytic Reactions	1 in 250,000 to 1 in 1,000,000	0.67
Hepatitis B	1 in 450,000*	<0.5
Hepatitis C	1 in 32,000,000*	<0.5
HIV	1 in 5,000,000*	<0.5
HTLV	1 in 12,500,000*	
<b><i>Bacterial Contamination of</i></b>		
Red Cell Concentrates	1 in 500,000	<0.25

Adapted from British Committee for Standards in Haematology, Blood Transfusion Task Force, Guidelines for the Clinical Use of Red Cell Transfusions: 2001 In Press. British Journal of Haematology [18]

\*Data on viral markers are for the UK during 2004-2005 from Katy Davison, National Blood Service/ Health Protection Agency Centre for Infections

## Appendix 2

### Planned Surgical Transfusion Checklist

<b>PATIENT IDENTITY:</b> Hospital Number: Name: Address: Date of Birth:	
<b>Diagnosis:</b>	
<b>Procedure:</b>	Explained: Yes / No
<b>Components Required:</b>	Info Leaflet: Yes / No
<b>RELEVANT MEDICAL DETAILS:</b>	
<b>Hb</b>	
<b>If anaemic – Diagnosis?</b>	Action to remedy: Yes / No
<b>Anticoagulants / antiplatelet agents</b>	Action to remedy: Yes / No
<b>Procoagulants</b>	Action to remedy: Yes / No
<b>Respiratory Status</b>	
<b>Cardiac Status</b>	
<b>Under normal circumstances trigger Hb</b>	
<b>AUTOLOGOUS TRANSFUSION:</b>	
<b>Discussed: Yes / No</b>	Info Leaflet: Yes / No
<b>Date Procedure:</b>	
<b>Plan Collection:</b>	
<b>OUTCOME</b>	
<b>Components Used:</b>	
<b>Discharge Hb:</b>	
<b>COMMENT:</b>	





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