

Aprotinin is recommended in Sections 6.2.1 and 7.2.2 of this guideline, despite concerns about potential side effects. Since the guideline was published the marketing licence for aprotinin has been suspended due to increased concern about side effects. Full reasons for the suspension are given in a safety warning issued by the Medicines and Healthcare products Regulatory Agency ([www.mhra.gov.uk/Safetyinformation/Safetywarningsalertsandrecalls/Safetywarningsandmessagesformedicines/CON2033201](http://www.mhra.gov.uk/Safetyinformation/Safetywarningsalertsandrecalls/Safetywarningsandmessagesformedicines/CON2033201)) In view of this withdrawal, these recommendations for aprotinin no longer hold good and should be ignored.

- B**
- **The use of aprotinin or tranexamic acid is recommended for patients undergoing cardiac surgery which carries a high risk of transfusion**  
(e.g. repeat cardiac operations, multiple valve replacements, thoracic aortic operations, patients on preoperative aspirin therapy and procedures with anticipated long bypass times).
  - **Aprotinin may be considered to reduce blood loss in hip and knee arthroplasties but its use should be restricted to:**
    - procedures with an increased risk of high blood loss  
(e.g. bilateral and revision)
    - circumstances when other blood conservation techniques are not appropriate  
(e.g. treatment of Jehovah's Witnesses).
  - **Tranexamic acid can be used to reduce blood loss and transfusion requirements in patients undergoing knee replacement surgery, when other blood conservation techniques are inappropriate and where major blood loss is anticipated.**

## CELL SALVAGE

- C** Reinfusion of washed shed mediastinal blood may be used to reduce allogeneic transfusion in cardiac surgery.
- D** In orthopaedic surgery, unwashed postoperative salvage using drains should be considered in patients in whom a postoperative blood loss of between 750 ml and 1,500 ml is expected (e.g. bilateral joint replacement).
- B** In orthopaedic surgery, washed intraoperative salvage should be considered in patients in whom an intraoperative blood loss of more than 1,500 ml is anticipated (e.g. major pelvic, spinal or uninfected revision surgery).
- B** Cell salvage using either unwashed or washed red blood cells may be considered as a means of significantly reducing the risk of exposure to allogeneic blood in orthopaedic surgery.

The Scottish Intercollegiate Guidelines Network (SIGN) supports improvement in the quality of health care for patients in Scotland by developing and disseminating national clinical guidelines and facilitating their implementation into practice. SIGN guidelines provide recommendations for effective healthcare based on current evidence.

The recommendations are graded **A B C D** to indicate the strength of the supporting evidence.

Good practice points  are provided where the guideline development group wish to highlight specific aspects of accepted clinical practice.

Details of the evidence supporting these recommendations and their application in practice can be found in the full guideline, available on the SIGN website: [www.sign.ac.uk](http://www.sign.ac.uk).

This guideline was issued in October 2001 and will be considered for review in 2004.

For more information about the SIGN programme, contact the SIGN executive or see the website.

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## DECIDING WHETHER OR NOT TO TRANSFUSE

The decision to transfuse any patient for a given indication must balance the risks of not transfusing, influenced for example by disease prognosis, against the risks of transfusion, influenced for example by the probable duration of patient survival and the incubation time of known infective agents.

- D** Given the potential risks, however small, each allogeneic transfusion must have a valid, defined and justifiable indication.
- The indication for each transfusion should be documented in the patient's records.
- In a haemodynamically stable patient, one unit of concentrated red cells should be transfused at a time, allowing the benefit of each to be assessed at 24 hourly intervals.
- B** Transfusion of leucodepleted allogeneic blood should not be limited by concerns over increased cancer recurrence or perioperative infection.
- D** All surgical and anaesthetic units should have protocols:
- to prepare anticoagulated patients for all types of surgery
  - for deep vein thrombosis prophylaxis in the preoperative period.

## AVOIDING PROCEDURAL ERROR

- D** The British Committee for Standards in Haematology collaborative guideline for the administration of blood and blood components and management of transfused patients should be implemented in all Scottish hospitals where transfusion takes place.
- A final check of the patient's wrist identity band against the identity given on the blood component to be transfused is essential for safe practice.

## HAEMOGLOBIN TRANSFUSION THRESHOLDS

The transfusion threshold is the haemoglobin value at which transfusion will normally be indicated, under stable conditions, and in the absence of other clinical signs or symptoms of anaemia.

- A transfusion threshold should be defined as part of an overall strategy to provide optimal patient management.
- The transfusion threshold should be viewed as the haemoglobin value below which the patient should not fall during the perioperative period, particularly in the context of ongoing or anticipated blood loss.

### PREOPERATIVE THRESHOLDS

- All patients undergoing major elective surgery should have a full blood count performed prior to surgery, to avoid short term cancellation and to allow those patients presenting with anaemia to be investigated and treated appropriately (e.g. iron therapy).

**C** Where possible, anaemia should be corrected prior to major surgery, to reduce exposure to allogeneic transfusion.

### INTRAOPERATIVE THRESHOLDS

There is no indication that thresholds should differ during this period but the use of intraoperative transfusion must reflect the ongoing rate of surgical blood loss, continued haemodynamic instability, and anticipated postoperative bleeding.

### POSTOPERATIVE THRESHOLDS

- D**  Transfusion is required at haemoglobin values < 70 g/l.
- C**  Patients with cardiovascular disease, or those expected to have a high incidence of covert cardiovascular disease (e.g. elderly patients or those with peripheral vascular disease) are likely to benefit from transfusion when their haemoglobin level falls below 90 g/l.
- D**  Transfusion is unjustified at haemoglobin values > 100 g/l.

## PREDICTING THE NEED FOR TRANSFUSION

Nine risk factors which predict the need for allogeneic transfusion have been defined:

- low preoperative haemoglobin/haematocrit, either before intervention or on day of surgery
- low weight
- small height
- female sex
- age over 65 years
- availability of preoperative autologous blood donation (PABD)
- estimated surgical blood loss
- type of surgery
- primary or revision surgery.

## BLOOD SPARING STRATEGIES

Blood sparing strategies should be considered for all patients who may require a transfusion (Mercuriali's formula may be used to identify these patients) and who have consented to transfusion.

- All patients undergoing major blood losing surgery, and who have consented to transfusion, must have as a minimum provision a blood specimen grouped and screened by their hospital bank.

### PREOPERATIVE AUTOLOGOUS BLOOD DONATION (PABD)

**B** Preoperative autologous blood donation (PABD) can be used to reduce allogeneic blood exposure although it does increase the total number of transfusion episodes.

**D** PABD should be offered only when it is possible to guarantee admission and operative dates.

**C** PABD should be targeted to:-

- men who present with haemoglobin 110-145 g/l
- women who present with haemoglobin 130-145 g/l.

**C** PABD can be used safely in elderly populations with diverse comorbidities.

Any patient undergoing surgical procedures currently served by a Group and Screen policy is unsuitable for preoperative donation.

Patients undergoing primary hip and knee surgery with a presenting haemoglobin > 145 g/l should be discouraged from autologous donation.

### ERYTHROPOIETIN

**B** Erythropoietin use should be targeted to patients aged under 70 years who are scheduled for major blood losing surgery and who have a presenting haemoglobin < 130 g/l.

**D** Erythropoietin can be used to prepare patients with objections to allogeneic transfusion for surgery that involves major blood loss.

If erythropoietin brings about a >0.50 rise in the patient's haematocrit, a 500 ml venesection should be undertaken.

### COMBINING PABD & ERYTHROPOIETIN

**B** In fit patients undergoing major surgery, erythropoietin can be used:

- in combination with autologous blood collection to reduce allogeneic transfusion
- to obtain multiple autologous red cell donations while maintaining an adequate day of surgery haemoglobin.

### ACUTE NORMOVOLAEMIC HAEMODILUTION (ANH)

ANH is potentially most useful for a patient meeting all of the following criteria:

- a substantial anticipated blood loss
- a relatively low target haemoglobin (intraoperatively and postoperatively)
- a relatively high initial haemoglobin.

**D** ANH should be limited to patients with a haemoglobin level sufficiently high to allow 1,000 ml of blood to be removed, and in whom a relatively low target haemoglobin is deemed appropriate.

- ANH should only be implemented where the logistics of blood removal and replacement can be undertaken without detracting from patient care.
- Hospitals considering ANH must address organisational issues, including the provision of appropriate support to the anaesthetist.
- Autologous blood should be labelled and stored according to the British Committee for Standards in Haematology blood transfusion guideline, with particular care being taken where autologous blood transfusion is initiated postoperatively.

## BLOOD ORDERING EQUATIONS

Blood ordering schedules relate the ordering of blood to the likelihood that a transfusion will be required, taking into account the type of operation and an individual patient's risk factors.

- C**  All hospitals should use a maximum surgical blood ordering schedule to provide concentrated red cells.
- When ordering blood, all nine factors determining the risk and degree of transfusion should be taken into account, for example by using Mercuriali's formula.

### MERCURIALI'S FORMULA

Expected blood loss = Preoperative red cell volume - Postoperative red cell volume + Red cells transfused

- preoperative red cell volume is influenced by: preoperative haemoglobin, weight, height, sex
- postoperative red cell volume is influenced by: postoperative target haemoglobin, weight, height, sex, age, medical history
- red cells transfused is partly determined by the potential use of blood sparing strategies such as salvage, PABD, ANH