

Section 4

Blood Conservation

Aim

- To introduce the learner to the basic concepts of blood conservation

Learning Outcomes

- Identify the principles of blood conservation
- Identify the areas where blood conservation can be undertaken in surgical patients
- Describe the main strategies of blood conservation

Introduction

Allogeneic (donor) blood is a valuable but limited resource and although potentially life-saving, is not without risks e.g. wrong blood incidents, transmission of infection and immunosuppression.

Concerns over a future blood shortage, have resulted in increased efforts to manage the blood supply more effectively.

Reducing the demand (blood conservation) takes many forms and can occur in both medical and/or surgical patients. Blood conservation strategies are a major component of Patient Blood Management, particularly in the surgical setting.

4.1 Patient Blood Management (PBM)

Patient Blood Management is a multidisciplinary, evidence-based approach to optimising the care of patients who might need blood transfusion. Patient Blood Management puts the patient at the heart of decisions made about blood transfusion to ensure they receive the best treatment and avoidable, inappropriate use of blood and blood components is reduced.

In June 2012 a panel of experts and influencers in the field were invited to a one-day conference in order to consider international best practice and what can be done to ensure a Patient Blood Management approach is adopted across England and North Wales.

The aim of the multi-disciplinary conference was to share views on how blood transfusion practice could be improved to:

- Build on the success of previous Better Blood Transfusion initiatives and to further
- promote appropriate use of blood components.
- Improve the use of routinely collected data to influence transfusion practice.
- Provide practical examples of high quality transfusion practice and measures for the avoidance of transfusion, wherever appropriate.
- Consider the resources needed to deliver better transfusion practice including support from NHSBT.
- Understand the patient perspective on transfusion practice.

Following this conference an initial series of recommendations¹ were published by the National Blood Transfusion Committee supported by NHS England and NHS Blood and Transplant in June 2014.

A copy of these recommendations can be found at:

<http://www.transfusionguidelines.org.uk/uk-transfusion-committees/national-blood-transfusion-committee/patient-blood-management>

A toolkit to assist NHS Trusts is being developed and posted on the NBTC website:

<http://www.transfusionguidelines.org.uk/transfusion-practice>

4.2 Reasons for Blood Conservation

Concerns over possible future blood shortages have resulted in increased efforts to manage the blood supply more effectively. This includes efforts to increase the supply and to reduce the demand for blood. Reducing the demand (blood conservation) takes many forms and can occur in both medical and/or surgical patients. This section focuses on surgical patients.



Autologous blood transfusion is one of many blood conservation strategies which should be considered when developing a blood conservation programme.

Emergency Plans for Blood Shortages

Blood services and the hospitals across the UK have made plans to manage the supply of blood in the event of a prolonged shortage. The UK blood services and hospitals have a responsibility to develop an integrated Emergency Blood Management Plan to ensure shortages are handled in a fair way and, once implemented, will invoke a controlled response to a shortage situation. For this reason, efforts at better and more appropriate management of the blood supply are being advocated.

4.3 Autologous Transfusion Techniques

The following techniques involve the collection and reinfusion of the patient's own blood or blood components.

Preoperative Autologous Donation (PAD)

PAD is a form of autologous transfusion where blood is collected from the patient, stored and reinfused at surgery, if appropriate.



Preoperative Autologous Donation (PAD) is currently only recommended in exceptional circumstances.

Preoperative Autologous Donation prior to planned surgery has been used extensively in the USA. In practice the patient goes to theatre with a lower than normal Hb and there is no evidence that these patients receive any less allogeneic (donor) blood, so this technique is no longer recommended as routine. In rare cases of unusual antibody formation or in a situation of blood shortage, it may be considered but it can only be carried out in premises licensed by the Medicines and Healthcare products Regulatory Agency (MHRA) as a blood establishment.

Acute Normovolaemic Haemodilution (ANH)

This is a procedure where the patient donates their own blood in the anaesthetic room with full monitoring in place. At the same time, a plasma expanding fluid is infused to maintain the circulating volume. The patient's whole blood is collected, labelled and kept by the patient's side, then reinfused when surgical bleeding has ceased.



Acute Normovolaemic Haemodilution (ANH) is not currently recommended

Adverse events include myocardial ischaemia, pulmonary oedema and mis-identification of blood. A meta-analysis² suggested only modest benefits and therefore this technique has limited benefit.

Intraoperative Cell Salvage (ICS)

ICS is used during surgery to collect whole blood which would otherwise be lost. Most systems then concentrate and wash the red cell component before reinfusion back to the patient.

Post-operative Cell Salvage (PCS)

Generally used in orthopaedic surgery, blood that is lost from the wound post-operatively is collected into special autologous wound drains where it is filtered before being reinfused to the patient. There are also machines available that extend the intraoperative cell salvage process into the post-operative period providing washed red blood cells for reinfusion.

4.4 Strategies for Blood Conservation in surgical patients

Figure 4. Strategies for Blood Conservation

Strategies for Blood Conservation		
Pre-operative	Intraoperative	Post-operative
Maximum Surgical Blood Order schedule Assessment clinics Iron Erythropoetin	Cell salvage Anaesthetic technique Normothermia Tranexamic acid Surgical technique Haemostats and sealants Point of care tests	Minimize blood loss Cell salvage Transfusion thresholds Review requirement for transfusion Iron Erythropoetin

4.4.1 Preoperative Strategies

Maximum Surgical Blood Order Schedule:

A maximum surgical blood order schedule (MSBOS) is an agreed number of units of blood (red cells) that will be cross-matched for a patient undergoing a specific surgical procedure. MSBOS reduces excessive requesting of blood. These days many surgical procedures have no units listed in an MSBOS and rely simply on a valid group and save sample which may be used to issue group-specific or cross-matched units on request.

Assessment Clinics (Preoperative Planning)

- Manage Hb (correct anaemia)
- Manage haemostasis (detect and manage coagulation disorders, stop anti-coagulants and anti-platelet drugs if safe to do so)
- Cell salvage (arrange for blood salvage to be available if it is appropriate for the planned surgery, ensuring availability of kit and operator)
- Discuss potential need for transfusion and possible alternatives with the patient.

Iron:

Iron supplements are usually used to treat iron-deficiency anaemia. It is also common to administer supplements to individuals who are not anaemic but who have evidence of absent body iron stores. Iron can be an oral or intravenous preparation.

Oral Iron

Oral iron is available in a variety of preparations and is the recommended treatment for mild to moderate iron deficiency anaemia. The recommended dose is 80-100mg elemental iron per day but compliance is often poor because of gastrointestinal side effects. Oral iron therapy may fail in the presence of chronic diseases, e.g. Crohn's, ulcerative colitis, coeliac disease, renal failure, parasitic disease, and drugs that inhibit erythropoiesis (red blood cell production).

NICE guidance on blood transfusion (2015) recommended that oral iron be offered before and after surgery to patients with iron deficiency anaemia.

Intravenous (IV) Iron

This is an alternative to oral iron and may be required if there is insufficient or no response to oral iron, intolerance of oral iron, severe anaemia or a need for a rapid response. IV iron should only be administered if the patient's iron status is known, to prevent iron overload.

NICE guidance recommends:

Consider intravenous iron before or after surgery for patients who:

- Have iron deficiency anaemia and cannot tolerate or absorb oral iron or are unable to adhere to oral iron treatment
- Are diagnosed as having functional iron deficiency, or, are diagnosed as having iron deficiency anaemia and the interval between the diagnosis of anaemia and surgery is predicted to be too short for oral iron to be effective.

Erythropoietin (EPO):

Erythropoietin (EPO) is a glycoprotein hormone produced primarily by cells of the endothelium of the kidney and is responsible for regulating red cell production and stimulating red cell production where necessary. A recombinant form of this hormone, given as an injection, is available to boost manufacture of red cells and is acceptable to Jehovah's Witness patients. However, NICE recommendations state that recombinant erythropoietin should not be offered to reduce the need for blood transfusion in patients having surgery, unless: the patient has anaemia and meets the criteria for blood transfusion, but declines it because of religious beliefs or other reasons; or, the appropriate blood type is not available because of the patient's red cell antibodies.

4.4.2 Intraoperative strategies

Intraoperative cell salvage (ICS) - blood lost during the operation can be collected, washed and given back to the patient.

Anaesthetic techniques - this could include deliberate hypotension e.g. with regional anaesthesia, commonly spinal or epidural anaesthesia, which lowers the patient's blood pressure during surgery and therefore reducing blood loss from the surgical site.

Normothermia - if patients get cold their clotting system is impaired

Tranexamic acid acts against breakdown of clots (by inhibiting or stopping plasminogen activation and fibrinolysis), and so it is useful in stopping severe blood loss as it increases clot formation. NICE has recommended that it be offered to adults undergoing surgery who are expected to have at least moderate blood loss. It can also be used in children undergoing surgery who are expected to have a blood loss greater than 10% of their blood volume.

Surgical techniques - this could include meticulous surgical techniques during dissection, use of minimally invasive technique, use of harmonic scalpel.

Haemostats and sealants— e.g. Haemostatic products containing gelatin, collagen, cellulose or polysaccharide spheres that form a barrier to stop the flow of blood and create a surface on which blood may rapidly clot. Also products containing thrombin +/- exogenous plasma derived fibrin which may be applied to tissues to activate clot formation.

POCT (Point of Care Testing) - Blood samples are drawn from the patient and tested for Hb concentration and coagulation abnormalities. The tests are performed close to the patient, often in the operating theatre. During large blood loss and transfusion the patient's haemoglobin and coagulation status can change considerably. POCT rapidly provides the clinician with information that permits targeted, appropriate treatment of low Hb and rapid correction of a coagulopathy.

4.4.3 Postoperative strategies

Minimise blood loss - this could include adequate oxygenation, management of drugs that impair clotting and postoperative cell salvage. Minimising blood sampling is also important.

Cell salvage - PCS blood is collected from wound drains, filtered and/or washed and given back to the patient.

Transfusion threshold - A lower Hb level is accepted before an allogeneic (donor) red cell transfusion is considered. The acceptable Hb level varies between patient groups and often between individual patients. NICE recommends the use of restrictive transfusion thresholds for patients who do not have major haemorrhage, acute coronary syndrome, or need regular blood transfusions for chronic anaemia. The recommended threshold is 70g/l and an haemoglobin (Hb) target of 70-90g/l after transfusion. In patients with acute coronary syndrome, this is increased to 80g/l and an Hb concentration target of 80-100g/l after transfusion.

Review requirement for transfusion – i.e. check Hb / other signs and symptoms of anaemia. Unless the patient is actively bleeding: after each single-unit red blood cell transfusion (or equivalent volumes calculated based on body weight for children or adults with low body weight), the patient should be clinically reassessed and their haemoglobin levels checked, and further transfusions given if needed.

Key Points

- Blood conservation requires a team approach if it is to be successful.
- Safe and appropriate use of allogeneic (donor) blood should be a priority for all staff.
- Developing a blood conservation policy for each organisation is essential.

References

1. JE Martin (2014) on behalf of the National Blood Transfusion Committee. Patient Blood Management: An evidence-based approach to patient care.
<http://www.transfusionguidelines.org.uk/uk-transfusion-committees/national-blood-transfusion-committee/patient-blood-management>
2. Segal, J. B., Blasco-Colmenares, E., Norris, E.J., Guallar, E. (2004) Preoperative acute normovolaemic haemodilution: A meta-analysis. *Transfusion*, 44(5) 632-644

Further Reading

- All Blood Counts: A manual for blood conservation and patient blood management (2016) ed Thomas, Thompson and Ridler (ISBN: 978-1-903378-95-3)
- Gombotz H. Patient Blood Management: A Patient-Orientated Approach to Blood Replacement with the Goal of Reducing Anemia, Blood Loss and the Need for Blood Transfusion in Elective Surgery. *Transfus Med Hemother*. 2012 Apr;39(2):67-72
- Blood transfusion; NICE guideline, Published: 18 November 2015
nice.org.uk/guidance/ng24

Self-Directed Learning



What pre-operative assessment clinics are run in your organisation?



What methods of blood conservation are you aware of in your theatre / department