6.1: Autologous blood transfusion (collection and reinfusion of the patient’s own red blood cells)

6.1.1: Predeposit autologous donation (PAD)

This is the banking of red cell units from the patient before planned surgery. PAD was stimulated by concerns about viral transmission by donor blood, especially during the HIV epidemic of the early 1980s. With a red cell storage-life of 35 days at 4°C, most healthy adult patients can donate up to three red cell units before elective surgery. Patients may be given iron supplements, sometimes with erythropoietin, to prevent anaemia or allow more donations to be collected. The Blood Safety and Quality Regulations (BSQR, 2005) require that donations for PAD must be performed in a licensed blood establishment, rather than a routine hospital setting. The donations must be processed and tested in the same way as donor blood and are subject to the same requirements for traceability.

Given the current remote risk of viral transfusion-transmitted infection by donor blood in developed countries, the rationale, safety and cost-effectiveness of routine PAD has been severely questioned (see 2007 British Committee for Standards in Haematology (BCSH) Guidelines for Policies on Alternatives to Allogeneic Blood Transfusion. 1. Predeposit Autologous Blood Donation and Transfusion – https://b-s-h.org.uk) and the procedure is now rarely performed in the UK. Although PAD may reduce exposure to donor blood, it does not reduce overall exposure to transfusion procedures or protect against wrong blood into patient episodes due to identification errors at collection from the blood bank or at the bedside. Indeed, the availability of autologous blood may increase the risk of unnecessary transfusion. Most Jehovah’s Witnesses will decline PAD (see Chapter 12). Clinical trials of PAD are mainly small and of low quality and do not provide strong evidence that the risks outweigh the benefits. The BCSH guideline on PAD only recommends its use in ‘exceptional circumstances’, and lists the following indications for PAD:

- Patients with rare blood groups or multiple blood group antibodies where compatible allogeneic (donor) blood is difficult to obtain.
- Patients at serious psychiatric risk because of anxiety about exposure to donor blood.
- Patients who refuse to consent to donor blood transfusion but will accept PAD.
- Children undergoing scoliosis surgery (in practice, most specialist units now use other blood conservation measures).

PAD should only be considered in surgery with a significant likelihood of requiring transfusion, operation dates must be guaranteed and the patient’s ability to donate safely must be assessed by a ‘competent clinician’, usually a transfusion medicine specialist. Adverse events and reactions associated with PAD (or other autologous transfusion systems) should be reported to the Serious Hazards of Transfusion (SHOT) haemovigilance scheme and the Medicines and Healthcare Products Regulatory Agency (MHRA).

6.1.2: Intraoperative cell salvage (ICS)
This is the collection and reinfusion of blood spilled during surgery.

Commercially available, largely automated devices are available for ICS and are now widely used in hospitals for both elective and emergency surgery with significant blood loss and in the management of major traumatic or obstetric haemorrhage. The machines must always be used and maintained according to the manufacturer’s instructions by appropriately trained staff. A 2010 Cochrane Collaboration review of randomised trials of ICS, mainly in cardiac and orthopaedic surgery, showed a 20% reduction in donor blood exposure (an average saving of 0.7 units per patient). Much useful information about clinical indications and use of ICS, policies for implementation, staff training/competency assessment and patient information has been prepared by the UK Cell Salvage Action Group (UKCSAG) (http://www.transfusionguidelines.org.uk/Index.aspx?Publication=BBT&Section=22&pageid=7507).

Blood lost into the surgical field is filtered to remove particulate matter and aspirated into a collection reservoir where it is anticoagulated with heparin or citrate. If sufficient blood is collected and the patient loses sufficient blood to require transfusion, the salvaged blood can be centrifuged and washed in a closed, automated system. Red cells suspended in sterile saline solution are produced, which must be transfused to the patient within 4 hours of processing. The reinfusion bag should be labelled in the operating theatre with the minimum patient identifiers derived from the patient’s ID band (UKCSAG has developed a suitable label for this purpose). The red cells are transfused through a 200 µm screen filter, as in a standard blood administration set, except in those instances where a leucodepletion filter is indicated (see below). The transfusion should be prescribed, documented and the patient monitored in the same way as for any transfusion. Patients undergoing elective procedures where ICS may be used should give informed consent after provision of relevant information.

Indications for ICS in adults and children (for whom low-volume processing bowls are available) are as follows:

- Surgery where the anticipated blood loss is >20% of the patient’s estimated blood volume.
- Elective or emergency surgery in patients with risk factors for bleeding (including high-risk Caesarean section) or low preoperative Hb concentration.
- Major haemorrhage.
- Patients with rare blood groups or multiple blood group antibodies for whom it may be difficult to provide donor blood.
- Patients who do not accept donor blood transfusions but are prepared to accept, and consent to, ICS (this includes most Jehovah’s Witnesses).

ICS should not be used when bowel contents contaminate the operation site and blood should not be aspirated from bacterially infected surgical fields.

Because of concerns about cancer cell reinfusion and spread, manufacturers do not recommend ICS in patients having surgery for malignant disease. However, extensive clinical experience suggests this is not a significant risk although it is recommended to reinfuse the red cells through a leucodepletion filter.

ICS is now widely used in women at high risk of postpartum haemorrhage during Caesarean section and in the management of major obstetric haemorrhage and is supported by many specialist and national guideline groups (http://guidance.nice.org.uk/IPG144/). Theoretical concerns about amniotic fluid embolism have not been borne out in practice, although gross fluid contamination should be aspirated before blood collection and the harvested red cells should be reinfused through a leucodepletion filter.

**6.1.3: Postoperative cell salvage (PCS)**
PCS is mainly used in orthopaedic procedures, especially after knee or hip replacement and in correction of scoliosis. Blood is collected from wound drains and then either filtered or washed in an automated system before reinfusion to the patient.

The simple filtration systems for reinfusion of unwashed red cells are mainly used when expected blood losses are between 500 and 1000 mL. With these infusion volumes concerns about adverse effects on blood coagulation have not been confirmed in routine practice. Clinical staff must be trained and competency assessed to use the device, accurately document the collection and label the pack at the bedside. Collection of salvaged blood must be completed within the manufacturer’s specified time (usually 6 hours) and the reinfusion must be monitored and documented in the same way as donor transfusions.

PCS is relatively cheap, has the potential to reduce exposure to donor blood and is acceptable to most Jehovah’s Witnesses. It remains unclear whether it adds significantly to a comprehensive blood conservation programme which includes preoperative optimisation of Hb, haemostatic/antifibrinolytic measures during surgery and strict postoperative transfusion thresholds.

6.1.4: Acute normovolaemic haemodilution (ANH)

In ANH several units of blood are collected into standard blood donation packs immediately before surgery (usually in the operating room) and the patient’s blood volume is maintained by the simultaneous infusion of crystalloid or colloid fluids. The blood is stored in the operating theatre at room temperature and reinfused at the end of surgery or if significant bleeding occurs. ANH is most often used in cardiac bypass surgery where the immediate postoperative transfusion of ‘fresh whole blood’ containing platelets and clotting factors is seen as an advantage. Reported hazards of ANH include fluid overload, cardiac ischemia and wrong blood into patient errors. Mathematical modelling suggests ANH is most effective as a blood conservation measure in surgery with major blood loss – now uncommon in elective cardiac surgery. Systematic reviews of published trials have found no significant reduction in exposure to donor transfusions compared to standard care or other blood conservation techniques and the safety of ANH remains unclear.