

Section 10

Practicalities – Reinfusion

Aim

- To introduce the basic theory and principles of reinfusing Intraoperative Cell Salvage (ICS) blood

Learning Outcomes

- To identify the equipment used for reinfusion and describe the function of each component
- To describe the composition of the final product for reinfusion
- To list the steps and describe the process of preparing for and commencing reinfusion
- To identify the conditions for reinfusion

Introduction

Once the blood collected using ICS has been processed, the next step is reinfusion of the final product to the patient. Many of the principles of reinfusing ICS blood are similar, if not the same, as the principles of transfusing allogeneic (donor) blood.

10.1 ICS (Intraoperative Cell Salvage) End Product

On completion of processing, the ICS machine sends the final product to the reinfusion bag. The final product consists of:

- Red blood cells (RBCs)
- Intravenous (IV) normal saline (0.9% NaCl)

In addition to these, the final product may contain trace amounts of the following:

- Platelets
- Clotting factors
- Anticoagulant
- Microaggregates
- Other cells/proteins aspirated into the system from the surgical field
- Contaminants – if these have been aspirated into the system from the surgical field e.g. betadine

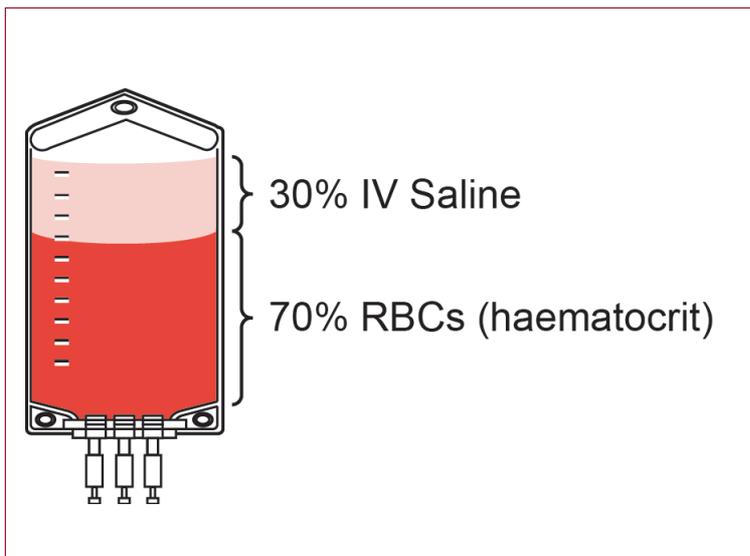
These are present in such small quantities that they are unlikely to cause any adverse effects. However, appropriate precautions should be taken e.g. using an appropriate filter for reinfusion (see 10.4). Information on the clearance rates of different ICS machine can be found on the Machine Specification document on the Better Blood Transfusion Toolkit website www.transfusionguidelines.org.uk.

If contamination of the salvaged blood by substances not intended for IV use has occurred, this should be discussed with the lead clinician taking responsibility for ICS in the procedure, (normally the lead anaesthetist, however, in some cases it may be the lead surgeon). A clinical decision regarding reinfusion should be made by this lead clinician.



The decision to use blood that is potentially contaminated with bacteria, amniotic fluid or malignant cells should be made by the clinicians caring for the patient, taking into account the latest evidence and considering the risks and benefits for the individual patient.

Figure 17. Haematocrit



The haematocrit of the final product can vary, however, providing the manufacturer's guidelines have been followed and the machine has been run in automatic mode, the haematocrit is likely to be around 50-70% (Figure 17).



Coagulopathy - ICS blood contains almost no platelets of coagulation factors. Therefore, in cases of massive haemorrhage it is likely that the patient will require allogeneic (donor) blood components, e.g. platelets, fresh frozen plasma, cryoprecipitate and possibly even allogeneic (donor) RBCs.

10.2 Authorising ICS Blood

The reinfusion of ICS blood should be authorised by the responsible clinician on the documentation approved within your hospital.



Procedural problems - The responsible clinician should be made aware of any problems that have occurred during the process e.g. contamination of the collection reservoir with non-IV substances, so that the decision to reinfuse under these circumstances can be made based on the relative risks and benefits.

10.3 Equipment

The equipment listed in Table 5 is required for the reinfusion of ICS blood.

Table 5. Blood Reinfusion Equipment

Equipment	Function
Reinfusion bag <i>machine specific</i>	The RBCs are sent to the reinfusion bag at the end of processing.
Standard Blood Administration Set	Used to connect the reinfusion bag/filter to the patient's IV access.
Appropriate additional filter <i>(if clinically indicated – see 10.4)</i>	Filters the RBCs as they are being reinfused.

10.4 Filters

There are a number of filters (Table 6 – on following page) available which can be used for ICS blood reinfusion. The type of filter used should comply with local policy as well as national and manufacturer's guidelines. In most cases, a standard 200µm blood

administration set is sufficient. The use of other filters in addition to blood administration set may be advocated in the following specialities:

- **Obstetrics, Malignancy and contaminated fields** – the use of Leukoguard[®] RS filter (Haemonetics Ltd), a leucodepletion filter, is advocated in Obstetrics & Malignancy and has been evaluated contaminated fields (ref). The flow rate is slow and the maximum capacity per filter is around 450ml. This filter however is the only one that has been shown to effectively remove contaminants specific to these settings.



Use of leucodepletion filters and hypotension - there have been reports of patients becoming hypotensive when receiving ICS blood through leucodepletion filters. While this appears to be a rare side effect, all such incidents should be reported to the Serious Hazards of Transfusion (SHOT) Scheme.

- **Orthopaedic surgery** – there is a theoretical concern that fat globules released from bone marrow could result in fat embolism syndrome if reinfused. However, there is currently no evidence to support this. As a precaution, the use of a lipid depleting microaggregate filter is recommended as best practice in operative procedures where there is a high risk of fat embolism. The risk of fat embolism can also be decreased by leaving the last few millimeters of ICS blood in the reinfusion bag.

Table 6. Filters for ICS Blood Reinfusion

Type of filter	Medium	Removes
Standard blood administration set	170-200µm screen	Blood component and non-blood component particulate matter.
Microaggregate blood filter	40µm screen	Blood component microaggregates and non-blood component particulate matter.
Lipid depleting microaggregate filter	40µm screen	Microaggregates, lipids, C3a, some leucocytes.
Leucodepletion filter	Affinity filter	Leucocytes, lipids, microaggregates, some bacteria

Regardless of the type of filter or giving set used for reinfusion of ICS blood, the instructions supplied with the filter/giving set should be followed e.g. if the maximum volume capacity of the filter has been reached and there is blood remaining in the reinfusion bag, the filter should be disconnected and a new filter connected and primed.

Further information on the use of filters can be found in the Technical Factsheets available to download at www.transfusionguidelines.org.uk.

10.5 Reinfusion

“Storage”

ICS blood is untested and intended only for the patient from whom it was collected. Labelling of the reinfusion bag (and collection reservoir if a “collect only” system has been used) is essential and should be carried out near to the patient (to avoid errors) as early on in the procedure as possible (see Sections 8 and 9).

In accordance with recommendations from Serious Hazards of Transfusion (SHOT) for allogeneic (donor) blood, (see Section 5), the following guidelines for the “storage” of ICS blood should be followed:

- The reinfusion bag should **always** be kept beside the patient at all times
- The reinfusion bag **must not** be placed in a refrigerator

Time Limits

The collection, processing and reinfusion of salvaged blood should be completed within the timeframes recommended by the manufacturer. This should be in accordance with guidance from the American Association of Blood Banks (AABB) and the organisation’s transfusion policy.

The AABB Guidelines recommend the reinfusion times for cell salvaged blood as follows:

- Intraoperative Cell Salvage:
 - four hours from the completion of processing
- Postoperative Cell Salvage:
 - six hours from the start of collection (*applicable when Intra-operative Cell Salvage machines are used to salvage blood postoperatively*)

Any blood that has not been transfused within the timeframe specified in the guidelines should be disposed of in accordance with local policy for dealing with liquid biohazardous waste.

The expiry time of the ICS blood should be clearly recorded on the autologous transfusion label (Appendix 3).

Disconnecting the Reinfusion Bag

Reinfusion of ICS blood can occur either while the reinfusion bag is still attached to the processing set or once the reinfusion bag has been disconnected.

- **Attached** – When the reinfusion bag contains ICS blood, the appropriate filter/giving set should be attached to the giving port on the reinfusion bag, primed with the ICS blood and then connected to the patient's IV cannula. This can be done while the reinfusion bag is still attached to the processing set. The same reinfusion bag may fill and empty many times during an operation.



Reinfusion line - The reinfusion line from the processing set should remain open for this set up. Clamping the line will prevent the transfer of further processed RBCs to the reinfusion bag, and could also cause a build up of pressure in the reinfusion line. This could result in spillage from the connector on the reinfusion line/bag or centrifugal system.

- **Disconnected** – When all lines are securely clamped, the reinfusion bag is disconnected from the processing set. An appropriate filter/giving set is subsequently attached to the giving port on the reinfusion bag, primed and attached to the patient's IV cannula. This is normally carried out when the reinfusion bag is full or at the end of the procedure. If there is more blood in the collection reservoir to process, a replacement reinfusion bag is attached to the processing set.



Disconnect in standby - The reinfusion bag should not be disconnected while the machine is processing. The operator should wait until the machine returns to standby, or should pause the process (if applicable on the machine in use) if the reinfusion bag is too full to allow the blood being processed to be transferred to it.

10.6 Administration of ICS Blood

Clean/aseptic technique should be used as appropriate and protective clothing should be worn in accordance with local policy.

Pre-transfusion Checks

- Reinfusion of the salvaged blood should follow standard blood transfusion practice. The responsible clinician should authorise salvaged blood for reinfusion in the same manner as for allogeneic blood.
- Baseline observations should be recorded in the patient's clinical record prior to commencing the reinfusion of ICS blood. This is usually carried out by the anaesthetist as part of the anaesthetic record that is routinely completed in theatre.
- The patient details (full name, date of birth and unique identification number) on the autologous label attached to the reinfusion bag should always be carefully checked against the details on the identification band attached to the patient prior to commencing reinfusion of the ICS blood. If the identification band is inaccessible during surgery, due to surgical drapes, patient identification should be undertaken as per local protocol for these circumstances.
- The expiry time on the autologous transfusion label attached to the reinfusion bag should be checked prior to commencing reinfusion of ICS blood. Expired blood should be disposed of according to hospital policy.
- Check the reinfusion bag for any signs of leakage, clots or abnormal colour.

Administration of ICS Blood	<ul style="list-style-type: none"> • A giving set/filter, appropriate to the type of surgery, should be used for reinfusion (see 10.4). • The rate at which the red cells are reinfused can be adjusted using a clamp on the administration set and by adjusting the height of the reinfusion bag. • Observations should be carried out and recorded in the patient's clinical record at least 15 minutes from the start of reinfusion and on completion of the reinfusion.
Documentation	<ul style="list-style-type: none"> • Reinfusion of salvaged blood should be documented in the appropriate section of the patient's clinical record as specified in the organisation's transfusion policy. The autologous transfusion label contains a peel out section, which should be completed at the time of reinfusion and can be used for this purpose.



Pressure Cuffs - Manufacturers advise NOT to use a pressure cuff as there is a risk of air embolus from the air in the reinfusion bag. Some devices may also detect a back pressure if the reinfusion line is open.



Patients with religious requirements - the set up of ICS equipment for patients with religious requirement may differ. The requirements should be discussed with the patient prior to use and all relevant staff should be made aware of these requirements. Further information can be found in Appendix 2.

10.7 Transfusion Reactions

If a transfusion reaction is suspected, STOP the transfusion and seek immediate advice from the lead surgeon and/or anaesthetist. Complete an adverse event form and report the incident to the individual specified in the organisation's transfusion/ICS Policy.

10.8 Documentation

The documentation required during blood reinfusion is the same as outlined in Sections 8 and 9:

- Autologous transfusion label (Appendix 3)
- ICS data form (Appendix 4)
- Prescription (as per local policy)
- The volume of blood reinfused should be documented in the patient's clinical record in accordance with local policy

Key Points

- ICS blood for reinfusion consists mainly of RBCs suspended in IV normal saline (0.9% NaCl). Other components, such as platelets, may be present in extremely small quantities. The reinfusion of ICS blood should be prescribed by the responsible clinician and should follow local policy and national guidelines.
- Care should be taken to:
 - identify the correct patient
 - ensure the ICS blood is suitable for reinfusion (i.e. not expired or damaged)
 - select the correct giving set/filter to use
 - record the procedure accurately on the documentation approved by the organisation

References

1. Waters JH, Tuohy MJ, Hobson DF, Procop G (2003). Bacterial reduction by cell salvage washing and leukocyte depletion filtration. *Anesthesiology*;99:652–5

Further Reading

UK Cell Salvage Action Group Publications

The following publications are available to download at:

www.transfusionguidelines.org.uk

- Policy for the provision of Intraoperative Cell Salvage
- Technical Factsheets
 - 4 Reinfusion of Red Cells
 - 5 Administration of Reinfused Red Cells
 - 6 Use of ICS in Jehovah's Witness Patients
 - 7 Use of Filters
 - 8 Use in Obstetrics
 - 9 Contraindications

Other

- American Association of Blood Banks – Standards for Perioperative Autologous Blood Collection and Administration 3rd Edition
- Manufacturers' ICS Machine Specific Guidance
- National Institute for Health & Clinical Excellence (NICE) (2008) Intraoperative red blood cell salvage during radical prostatectomy or radical cystectomy – Guidance
<http://www.nice.org.uk/nicemedia/pdf/IPG258Guidance.pdf>
- National Institute for Health & Clinical Excellence (NICE) (2005) Intraoperative Blood Cell Salvage in Obstetrics – Guidance
<http://www.nice.org.uk/nicemedia/pdf/ip/IPG144guidance.pdf>

Self-Directed Learning



List the procedures (if any) in your department for which a leucodepletion filter is used to reinfuse ICS blood.



Where are leucodepletion filters stored in your hospital?



On what documentation within the patient's clinical record is transfusion recorded within your organisation?