

Information for clinicians

Intraoperative cell salvage

Intraoperative cell salvage (ICS) is a blood conservation technique that collects surgical blood loss and processes it through centrifugation and produces washed concentrated filtered red cells in saline. This autologous product can be reinfused during or immediately after surgery.

Who is eligible for ICS?¹

ICS should be considered for all surgical patients where blood loss is anticipated to exceed 500mls or 10% of the circulating blood volume. It should be immediately available in situations where large volumes of blood may be lost in a short period of time.

In some situations, cell salvaged blood may be the only viable transfusion option - such as patients who refuse allogeneic blood transfusion, have multiple red cell antibodies or when blood stocks are compromised.

Patient selection for ICS is at the discretion of the surgeon and anaesthetist caring for the patient. They will consider the type of surgery and the availability of the ICS service and equipment. Patients must be fully informed of all treatment and transfusion options prior to surgery and must provide informed consent.

ICS can be used in major haemorrhage events with the component being available for reinfusion within minutes of collection.

ICS is also commonly used in

- Cardiac surgery
- Obstetrics, including caesarean section, and surgery for ruptured ectopic pregnancy
- Emergency trauma surgery (orthopaedic, general, vascular)
- Revision or complex joint replacement surgery
- Complex spinal surgery
- Vascular surgery

Benefits of ICS²

- Provides an immediate available source of viable, normal functioning red cells
- May reduce the need for allogeneic blood transfusion and its associated risks
 - reduces the risk of acute transfusion reactions associated with allogeneic blood
 - reduces the risk of developing red cell antibodies
 - supports wound healing
 - reduces reliance on other supporting treatments
 - improves length of stay
- Beneficial for patients with preoperative anaemia, as they have less haemoglobin reserve

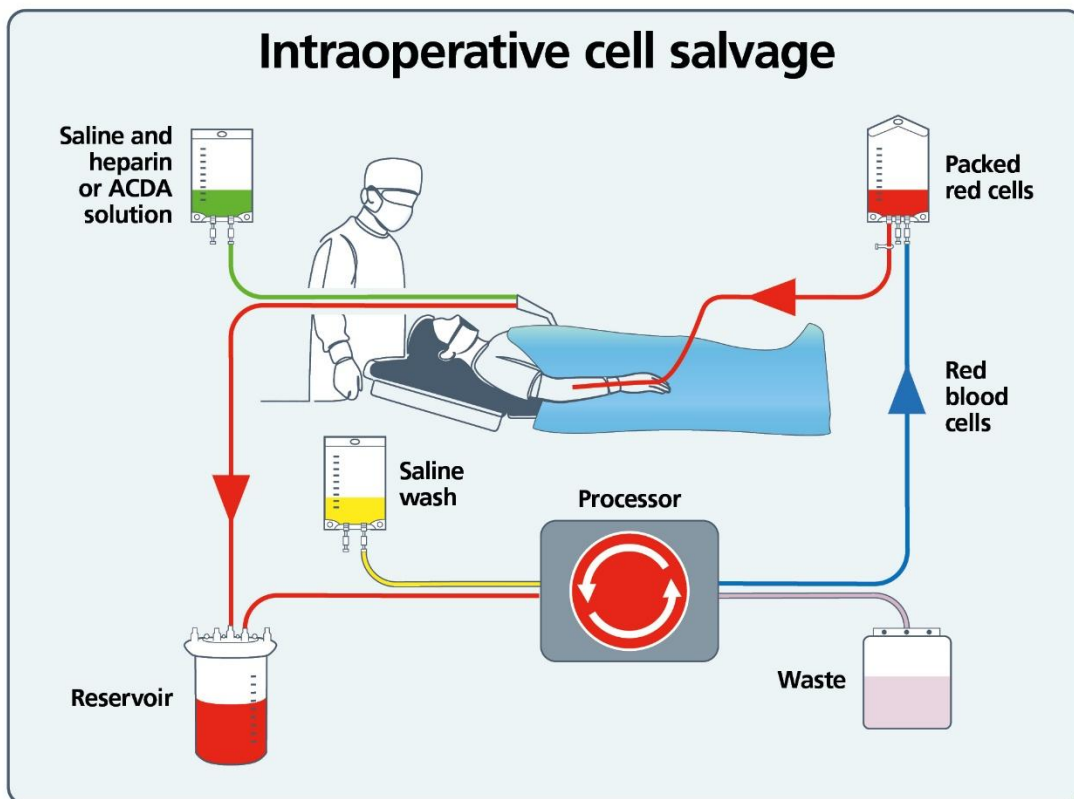
- Reduces the immune-modulatory effect of donor blood which may influence peri-operative infection risks and outcomes including cancer surgery.
- May be the only available source of red cells in situations such as blood stock shortages or complex antibody compatibilities
- Patients who receive only cell salvage blood and no allogeneic blood transfusion can continue to donate blood

Contraindications and considerations

Contra-indications to ICS are few and include patient refusal, heavy contamination of the surgical field with bacteria-rich material, the presence of substances that cause red cell haemolysis, and substances that should not be administered intravenously. There is currently not enough supporting evidence to recommend ICS in patients with sickle cell disease, however it can be used in selected cancer surgeries; a risk versus benefit discussion on a case-by-case basis with the patient and the multidisciplinary team must be applied.

How does it work?

In many cases the cell salvage machine can be set up to 'collect only' until sufficient blood has been collected, where there is likely to be high blood loss the machine can be set up to 'collect and process'.



Collection

Intra operative cell salvage (ICS) aspirates blood lost within the surgical field and collects it in a reservoir, where it is immediately mixed with an anticoagulant to prevent clotting. This is achieved using a dual lumen 'aspiration and anticoagulation' line which delivers anticoagulant to the tip of the suction line at the same point where blood is being aspirated.

Processing

The collected blood is then filtered to remove large particles, centrifuged to separate the red cells, and washed to produce filtered red cells suspended in saline for reinfusion. The final product contains no clotting factors, platelets, or plasma proteins as these components are removed during the washing process and discarded. The anticoagulant and any other waste material is also removed during processing.

Reinfusion

Reinfusing the patient's own red cells offers advantages over donor transfusion: these cells have superior oxygen-carrying capacity, retain normal deformability, and do not suppress the patient's immune system. ICS washes and concentrates viable red cells with intact membranes and preserves 2,3-DPG levels, (a natural molecule found inside red blood cells that regulates how tightly haemoglobin holds onto oxygen), enabling more effective oxygen release to tissues when needed.

Once complete, and enough washed red cells have been collected they are transferred into a correctly labelled reinfusion bag to support safe reinfusion practice. The label must include the patient's full name, date of birth, NHS/ hospital number, the words **'For Autologous Use Only'**, the date and time of processing, and the signature or the identification of the responsible practitioner. This ensures the component is traceable and is reinfused back to the correct patient, in the operating theatre or in recovery. If reinfused when the patient is in recovery the autologous blood must be connected to the patient before they leave the operating theatre

Tranexamic acid is recommended for all patients undergoing ICS unless a specific contraindication is present.

Training

Effectiveness of ICS is a whole theatre team approach, all staff involved in the process must be trained and competency-assessed in a manner appropriate to their role and the task undertaken.

Audit³

Each ICS episode should be recorded in a central system to enable effective ongoing audit, quality monitoring, and analysis of service activity, including the reinfused volume. Audit and governance processes should include input from Anaesthesia, Surgery, Theatres, and the Hospital Transfusion Team along with ongoing data collection and audit.

Reporting of adverse events

Adverse incidents and reactions related to ICS must be reported locally through the organisation's local incident-reporting system. The Hospital Transfusion Committee must also be informed, as these incidents may be required to be reported to the Serious Hazards of Transfusion (SHOT) UK Haemovigilance scheme.

A list of adverse events and reactions relating to ICS can be found on the SHOT webpage here: [Reporting-adverse-events-and-reactions-relating-to-Cell-Salvage-to-SHOT-Oct-2017.pdf](https://www.shotuk.org/resources/cell-salvage-cs-cumulative-data/)

Further information

UK Cell Salvage Action Group

<https://www.jpac.org.uk/transfusion-practice/uk-cell-salvage-action-group/>

National Institute for Health and Care Excellence (NICE) {NG24} (2015)

<https://www.nice.org.uk/guidance/ng24/chapter/Recommendations#alternatives-to-blood-transfusionfor-patients-having-surgery-2>

UK Cell Salvage Action Group Patient Information Factsheet

<https://www.jpac.org.uk/transfusion-practice/uk-cell-salvage-action-group/patient-factsheets/>

Association of Anaesthetists

<https://anaesthetists.org/>

Serious Hazards of Transfusion (SHOT) cell salvage cumulative data

<https://www.shotuk.org/resources/cell-salvage-cs-cumulative-data/>

References

1. Klein AA, Bailey CR, Charlton AJ, Evans E, Guckian-Fisher M, McCrossan R et al. Association of Anaesthetists Guidelines: cell salvage for peri-operative blood conservation 2018. *Anaesthesia* 2018;73(9):1141-50
2. Ashworth, A. & Klein, A.A. (2010) 'Cell salvage as part of a blood conservation strategy in anaesthesia', *British Journal of Anaesthesia*, 105(4), pp. 401–416
3. Kumar, M.M., Choksey, F., Jones, A., Chambers, M., Haynes, S., Gormley, S. et al. (2024) 'Intraoperative cell salvage: a survey of UK practice', *British Journal of Anaesthesia*, 132(5), pp. 995–997. Doi: 10.1016/j.bja.2024.01.042

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