



AAGBI SAFETY GUIDELINE

Blood Transfusion and the Anaesthetist

Intra-operative Cell Salvage

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Endorsements and/or Support

This guideline has the endorsement and/or support of the following bodies:

- British Orthopaedic Association
- College of Anaesthetists of Ireland
- Royal College of Obstetricians & Gynaecologists
- Royal College of Surgeons in Ireland
- Royal College of Surgeons of Edinburgh
- Royal College of Surgeons of England
- Vascular Anaesthesia Society of Great Britain & Ireland
- Vascular Society of Great Britain & Ireland

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1. Recommendations

- The use of Intra-operative Cell Salvage (ICS) reduces the demand on allogeneic (donor) red cells and is a cost effective measure.
- Trusts should provide the resources required to set up and maintain an ICS service in a safe, appropriate and cost effective manner.
- Each Trust needs to ensure there is a clinical lead for ICS.
- A member of the theatre management team is responsible for ensuring overall management and facilitation of the ICS service.
- All personnel using ICS must be adequately trained and competent in its use.
- Pre-operative assessment clinics should provide information on ICS to patients.
- All ICS cases undertaken require documentation and audit of use to enable future service planning and quality assurance.

2. Introduction

The challenge to ensure a safe and adequate supply of blood components for transfusion continues. It has been recognised that there are morbidities associated with the immunological complications of allogeneic blood transfusion. The cost of allogeneic blood components is increasing as testing and processing to avoid transfusion transmitted infection becomes more sophisticated. An additional concern is that the donor pool is decreasing.

The use of ICS reduces the demand on allogeneic (donor) red cells and is a cost effective measure. The Chief Medical Officer's National Blood Transfusion Committee in England document 'Strategies for Blood Conservation' recommends three main strategies to reduce demand: ICS, better education of practitioners, and better pre-operative patient preparation.

Analysis of a recent survey showed that 53% of UK hospitals now use ICS [1]. The principal aim of this document is to facilitate and promote the safe and competent use of ICS to enhance patient care.

3. Getting organised and competencies

Greater awareness of the need for blood conservation should help influence clinicians to make wider use of autologous blood recovery techniques.

Lead ICS clinician

The lead clinician should ideally be someone working in the theatre setting, i.e. a consultant anaesthetist or surgeon and a member of the Hospital Transfusion Committee. Their role is to provide information, support and direction. This includes:

- Responsibility for the overall ICS programme within an organisation.
- Ensuring that agreed procedures and protocols are adhered to.
- Informing clinical staff about the benefits of the autologous programme.
- Identifying clinical situations where cell salvage can be used.
- Advising on the use of ICS in special circumstances, e.g. malignancy, sepsis, and obstetrics.
- Developing a safe out of hours ICS service where appropriate.

Operational management

Operational manager

A senior member of the theatre management team should be responsible for the organisation and facilitation of the ICS service by:

- Identifying a member of staff who will take on the role of co-ordinating the cell salvage service.
- Being involved in the purchase of equipment and service contracts.
- Liaising with the lead ICS clinician to produce and implement local protocols and guidelines.

ICS co-ordinator

In larger Trusts, there may be a need for a cell salvage co-ordinator. The co-ordinator should be fully trained and competent in the operation of all types of cell salvage machines used in an organisation. The cell salvage co-ordinator is a member of the theatre staff who is responsible for:

- Delivering and recording of training and competency assessment.
- Arranging for cell salvage to be available at the clinician's request. If the service is not available, this should be reported to the lead ICS manager and clinician.
- Maintaining records of all procedures undertaken to ensure accurate auditing and quality assurance.
- Providing information for the Hospital Transfusion Committee (HTC) and national audits as appropriate.

Competencies

Documents supporting competency assessment are available on the Better Blood Transfusion website:

www.transfusionguidelines.org.uk.

Click on *Better Blood Transfusion Toolkit* on the left hand menu, then *Appropriate Use* and then *UK Cell Salvage Action Group*. Alternatively most search engines will take you straight to the relevant section if you insert 'UK Cell Salvage Action Group'.

4. Operative indications

ICS is indicated in surgery with:

- Anticipated blood loss of >1000mls or >20% Estimated Blood Volume.
- Patients with a low Hb or increased risk factors for bleeding.
- Patients with multiple antibodies or rare blood types.
- Patients with objections to receiving allogeneic (donor) blood.

In cases with Jehovah's Witnesses where a decision to use ICS is made, this should be discussed with the patient pre-operatively and informed consent obtained. All blood salvaged will need to be labelled clearly. Use of the standard UK label issued for cell salvage is recommended. It is essential that any adverse events whether clinical or technical are reported to Serious Hazards of Transfusion (SHOT).

Procedures which may be suitable for ICS

(See Appendix 1 on page 18).

5. Technical aspects

The surgical team should be aware of the technical issues relating to the quality of cell salvage.

During surgery, blood loss can be removed from the operative site by a combination of suction and swabs. Depending on the type of surgery, blood loss to swabs during surgery has been estimated at between 30% and 50% of the total surgical blood loss. By washing swabs, the blood that is normally discarded can be collected and the overall efficiency of red cell recovery improved.

ICS should be temporarily discontinued when substances not licensed for intravenous (IV) use are present within the surgical field and could potentially be aspirated into the collection reservoir. The standard theatre suction should be used to aspirate the surgical field and the wound should be irrigated with copious 0.9% sodium chloride before resuming ICS.

Examples of substances that should not be aspirated into the ICS system include:

- Antibiotics not licensed for IV use
- Iodine
- Topical clotting agents
- Orthopaedic cement

To optimise the yield and quality of salvaged blood a large bore suction tip (minimum 4mm, e.g. Yankauer sucker) should be used and surface skimming minimised. Try to avoid aspirating blood mixed with large quantities of air from the surgical field.

To reduce haemolysis the vacuum pressure should always be set as low as practicable.

A standard blood administration set is usually adequate. There are special circumstances where additional filters are recommended (see overleaf).

6. Special circumstances

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 consideration of the risks and benefits for the individual patient.

Malignancy

The manufacturers of ICS devices do not recommend its use in patients undergoing surgery for malignant disease. This is due to concerns about the possibility of malignant cells being reinfused and giving rise to metastases. However, in addition to the many reports in the literature of the use of ICS in cancer surgery without obviously leading to early metastasis, two recent studies have shown no difference in biochemical recurrence or long term survival after radical prostatectomy and cystectomy between patients receiving ICS and those that received no blood [2,3].

A recent prospective study of hepatocarcinoma surgery also showed no difference in recurrence rates between those who did and did not receive cell salvaged blood [4].

In contrast, there is evidence that allogeneic transfusion is independently associated with an increased rate of both postoperative infection and disease recurrence [5-8].

Consequently, in April 2008 the use of ICS in urological malignancies was approved by NICE [9]. ICS can now be used routinely during surgery for urological malignant disease. Aspiration of blood from around the tumour site should be avoided to minimise contamination of salvaged blood with malignant cells. There is in vitro evidence that blood filtration through leucodepletion filters significantly reduce malignant

cell numbers. Some clinicians use a leucodepletion filter (Pall Leukoguard RS) to reduce the reinfusion of malignant cells which may be contaminating the cell salvaged red cells, whilst others reinfuse unfiltered without apparent problems. It is important to remember the manufacturers' guidance on the use of these filters by not pressurising the reinfusion bag.

Obstetrics

The main concern surrounding the use of ICS during obstetric haemorrhage is the risk of reinfusing fetal contaminants with the theoretical risk of causing amniotic fluid embolus (AFE). However, to date there are no proven cases in the literature of AFE caused by reinfusion of salvaged blood, and the use of cell salvage in obstetrics is approved by NICE [10-13].

ICS is being increasingly used in the UK in obstetrics for women at risk from massive obstetric haemorrhage during caesarean section [14]. In the year 2005-2006, 38% of UK maternity units used ICS, and 28% included the use of ICS in their Massive Obstetric Haemorrhage (MOH) protocol [15]. Early theoretical concerns over amniotic fluid embolism have not been borne out in clinical practice, and 80% of maternity units identified lack of training, rather than safety concerns, as the barrier to more frequent use of ICS.

Obstetric use also raises the concern of reinfusion of fetal red cells from the operative field, as the cell saver cannot distinguish fetal from maternal red cells [16]. If the mother is rhesus negative (and the fetus RhD positive) the extent of maternal exposure should be determined by Kleihauer testing as soon as possible and a suitable dose of Anti D given. (N.B. the RhD negative mother would be routinely receiving Anti D after obstetric haemorrhage).

Bowel contamination

The use of ICS in the presence of bowel contents is contraindicated by the manufacturers unless there is catastrophic haemorrhage. However, the evidence indicates that wound infection rates after laparotomy for abdominal injuries is no different for patients receiving allogeneic or cell salvaged blood, with no correlation between organisms grown from the cell saved blood and those causing postoperative pneumonias, bacteraemias or urinary tract infections [17,18].

A recent prospective RCT of laparotomy for abdominal trauma showed that ICS significantly reduced allogeneic blood usage with no effect on postoperative infection or mortality [18]. While salvage from grossly contaminated fields should be avoided, procedures involving bowel resection may use ICS for at least part of the procedure.

If deemed clinically necessary the following practical tips may help:

- Initial evacuation of the soiled abdominal contents.
- Additional washing (increasing the volume of IV normal saline [0.9% NaCl] which the machine uses to wash the salvaged blood).
- Ensure use of broad spectrum antibiotics.

It is unlikely that bowel contamination in such traumatised individuals will lead to problems in decision making about the use of ICS, but hopefully the points raised can enable all concerned to make an informed management choice.

N.B. SHOT has received a few recent reports of hypotension that appear to be temporally related to reinfusion of cell salvaged blood. The clinical/equipment details of each case are currently being investigated to establish whether there are any common features. The web version of this document will be updated accordingly.

7. Financial considerations

To keep the cost argument simple, it becomes self evident that if there is a machine available and a competent operator, then the direct and recurring costs can be quite easily calculated. Each 250 ml of salvaged and washed red cells is equivalent to a unit of concentrated red cells, e.g. SAGM. Both have a similar volume and haematocrit and therefore could be regarded as therapeutically equal, if time is allowed for the stored red cells to become biochemically active.

The current red cell unit cost in the UK is approximately £140 (although the price has been intentionally held steady for some years). The disposable costs vary depending on which cell salvage machine is being used, but range from approximately £100 to £170. One can see that at this level saving an average of 1 to 1.5 units of red cell equivalent per case salvaged will cover the disposable costs. As prices will inevitably change it is recommended that readers bear in mind the date of publication of this booklet.

If the hardware for cell salvage is not available within the Trust where you work you may find a generic business case helpful. Readers requiring a generic business case, which can be adapted to their own circumstances can obtain this by going straight to the UK Cell Action Salvage Group area of the Better Blood Transfusion Website as explained on page 6 or by placing 'UK Cell Salvage Action Group' in a search engine.

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Websites

www.transfusionguidelines.org.uk
www.aagbi.org
www.nataonline.com
www.bbts.org.uk

Appendix 1

Procedures and situations which may be suitable for ICS

Vascular Surgery, Trauma & Orthopaedics	Open aortic aneurysm repair - (elective and emergency) Splenic/liver trauma Spinal surgery Revision hip replacement Pelvic and femoral fractures (In primary hip and knee replacement it may be better to consider post operative drainage systems)
Urology	Radical cystectomy Radical prostatectomy Nephrectomy Pelvic clearance
General Surgery	Hepatectomy Abdominal/thoracic trauma Emergency laparotomy
Cardiac	All major procedures (post-op drainage may be of use if mediastinal drainage is of high volume)

Obstetric

Emergency use: major obstetric haemorrhage at caesarean section, laparotomy for postpartum haemorrhage genital tract trauma, etc.

Elective use: anticipated haemorrhage at caesarean section, e.g. placenta praevia/ accreta, large fibroid uterus, etc.

Gynaecology

All major procedures, e.g. pelvic clearance

Head and Neck

Major procedures

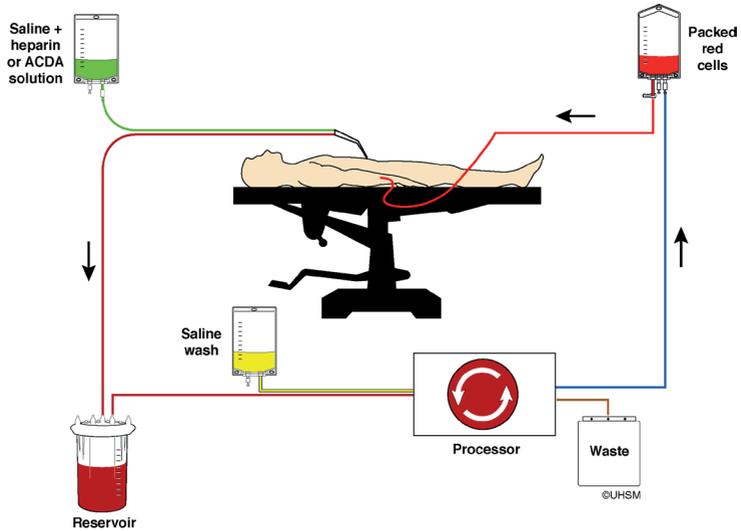
Jehovah's Witnesses or any patient refusing a blood transfusion

Consideration should also be given to post-op drainage and reinfusion where indicated
All surgical procedures where blood loss is expected to have an impact

Maximum benefit of cell salvage can be gained by capture of emergency cases which often require large volume blood component support.

Appendix 2

Diagram of ICS set-up



Drawn for the UK ICS Action Group by Medical Illustration Department - University Hospital of South Manchester NHS Foundation Trust.



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