Intraoperative Cell Salvage and Patient Blood Management

Mr John Faulds
Patient Blood Management, Manager
Royal Cornwall Hospital
Outcomes from today's Presentation

- Define PBM
- Understanding ICS
- Implementing Intra Operative Cell Salvage
- Future of Intraoperative Cell Salvage
The planned surgical intervention is often ephemeral, with the intended surgery dealing with the presenting problem. Therefore anything that we can employ to support the patient through this major surgical insult, is beneficial to both the patient and provider.

Employing a patient centered, evidence gathering approach, allows information to be collated following intervention, utilizing the knowledge to further enhance understanding and treatment plans.

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What is Patient Blood Management?

Patient blood management (PBM) views a patient’s own blood as a valuable and unique natural resource that should be conserved and managed appropriately. PBM is a multidisciplinary, multimodal, evidence based, patient centred approach to optimising, conserving and managing the patient’s own blood. PBM puts the patient at the centre of decisions made about transfusion.
PBM goes beyond just the decision whether to transfuse. PBM includes considering the patient’s entire (projected) course to determine whether the reason for transfusion could be avoided in the first place and/or possibly treated in another manner.

The intent of PBM is to apply transfusion as a therapeutic modality only when it is in the patient’s best interest to do so.
The Three Pillars of Multidisciplinary Multimodal Patient Blood Management

1st Pillar
Optimise red cell mass
- Detect, diagnose and treat reversible anaemia (e.g., iron deficiency)
- Identify underlying cause for the anaemia (e.g., NSAIDs or occult GIT malignancy)
- Refer for further evaluation if necessary
- Note: Reversible anaemia is generally a contraindication for elective surgery

2nd Pillar
Minimise blood loss
- Identify and manage bleeding risk
- Minimising iatrogenic blood loss
- Procedure planning and rehearsal
- Preoperative autologous blood donations in selected case
- Other

- Meticulous haemostasis and surgical techniques
- Blood-sparing surgical techniques
- Anaesthetic blood conserving strategies
- Autologous blood options
- Pharmacological haemostatic agents

3rd Pillar
Harness & optimise physiological tolerance of anaemia
- Assess/optimise patient’s physiological reserve and risk factors
- Compare estimated blood loss with patient-specific tolerable blood loss
- Formulate patient-specific management plan using appropriate blood conservation modalities to minimise blood loss, optimise red cell mass and manage anaemia
- Restrictive transfusion strategies
- Optimise cardiac output
- Optimise ventilation and oxygenation
- Restrictive transfusion strategies
- Harness physiological tolerance of anaemia
- Maximise oxygen delivery
- Minimise oxygen consumption
- Avoid/treat infections promptly
- Restrictive transfusion strategies

Preoperative Phase
Intraoperative Phase
Postoperative Phase
Key benefits of a surgical patient blood management service

- Reduced risk for patients and improved patient care
- Reduced demand on blood banks and associated costs
- Reduction in last minute cancelled operations
- Reduced risk of peri-operative operative complications leading to reduced length of stay
Intra Operative Cell Salvage
“Washed” Cell Salvage

The collection of intraoperative/postoperative surgical blood loss, using a dedicated suction device, that collects filters, centrifuges, and washes salvaged blood blood, producing a unique end product of Red Cells suspended in saline individualised to the patient.
Cell salvage and tranexamic acid

Offer tranexamic acid to adults undergoing surgery who are expected to have at least moderate blood loss (greater than 500 ml).

Consider tranexamic acid for children undergoing surgery who are expected to have at least moderate blood loss (greater than 10% blood volume).

Do not routinely use cell salvage without tranexamic acid.

Consider intra-operative cell salvage with tranexamic acid for patients who are expected to lose a very high volume of blood (for example in cardiac and complex vascular surgery, major obstetric surgery, and trauma surgery).
ICS and Surgical Specialities

Cardiac
Orthopaedics
Trauma
Urology
Neurosurgery
Vascular
Gynaecology
Principles of Cell Salvage
Drip rate should be set at 1-2 drops per second.
Fill Cycle
Washing Cycle
Salvaged Blood

Red Cells suspended in Saline
What are the Contradictions to Cell Salvage?

Pharmacological Agents – Clotting agents, betadine
Contaminants – Bowel contents, infection, (amniotic fluid)
Malignancy
Haematological Disorders – Sickle cell
Others – diathermy smoke
Obstetrics

Amniotic Fluid Embolus

Also known as anaphylactoid syndrome of pregnancy possibly caused by Amniotic Fluid (AF) entering the maternal circulation and so could be initiated by re-infusing any AF aspirated by the cell salvage machine.

Alloimmunisation

Fetal RBCs cannot be distinguished from maternal RBCs by cell salvage machines. Could theoretically cause haemolytic disease of the newborn and fetal hyperbilirubinemia and anaemia.
Infection

salvage as part of a blood conservation strategy in anaesthesia

A. Ashworth and A. A. Klein*

Studies of autologous transfusion of microbiologically contaminated salvaged blood have demonstrated no adverse outcomes or increase in postoperative infectious complications. Therefore, enteric content contamination or systemic sepsis should no longer be considered an absolute contraindication to the use of intraoperative cell salvage. In cases where there is gastrointestinal content contamination, the surgeons should avoid suctioning faecal matter, broad-spectrum antibiotics should be administered, and the volume of saline wash can be increased.

Intraoperative cell salvage: a fresh look at the indications and contraindications

Stephen A. Esper and Jonathan H. Waters

It should be remembered that there is a known risk that exists with allogeneic blood, whereas administration of salvaged blood is associated with only a theoretical risk. Until data are generated demonstrating a risk from salvaged blood in these circumstances, it seems reasonable to avoid the known risk of allogeneic blood through the use of cell salvage.
Malignancy

Intraoperative cell salvage: a fresh look at the indications and contraindications

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Surgical procedures involving resection of cancerous tumours are a source of major controversy. As mentioned earlier, immunomodulation occurs with allogeneic transfusion. The issue of whether this immunomodulation affects tumour growth is unresolved. At the same time, there is evidence to suggest that there is a worse outcome for patients who receive allogeneic blood in the setting of cancer surgery.

https://www.nice.org.uk/guidance/ipg258

Intraoperative red blood cell salvage is an efficacious technique for blood replacement and its use is well established in other areas of surgery. The evidence on safety is adequate. The procedure may be used during radical prostatectomy or radical cystectomy provided normal arrangements are in place for clinical governance and audit.

Clinicians wishing to undertake intraoperative red blood cell salvage during radical prostatectomy or radical cystectomy should ensure that patients understand the possible risks and benefits of the procedure compared with those of allogeneic blood transfusion, and provide them with clear, written information. In addition, use of the Institute's information for patients ('Understanding NICE guidance') is recommended.
## Adverse Event Reporting

Visit [www.shotuk.org](http://www.shotuk.org)

<table>
<thead>
<tr>
<th>Category</th>
<th>What to report</th>
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<tbody>
<tr>
<td><strong>Operator error</strong></td>
<td>Patient identification error - incorrect blood component transfused (IBCT)</td>
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<tr>
<td></td>
<td>Equipment not assembled correctly to include both collection and processing equipment</td>
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<tr>
<td></td>
<td>Incorrect dilution of heparinised saline</td>
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<td></td>
<td>Inadequate anticoagulation - clotting in reservoir</td>
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<td></td>
<td>Non IV Saline used for the wash</td>
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<td></td>
<td>Contraindicated substances aspirated into the collection</td>
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<td>Reinfusion bag not labelled for the patient - either IGS or operative cell salvage (PCS)</td>
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<td>Time exceeded for collection and/or Reinfusion for either IGS or PCS</td>
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<td></td>
<td>PCS system not assembled correctly</td>
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<td>Contraindicated procedure e.g. infected Hb</td>
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<td><strong>Machine/System failure</strong></td>
<td>Any stoppage of the machine where the operator has not made the decision to halt the procedure</td>
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<td>Reinfusion bag falls off (PCS)</td>
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<td><strong>Clinical events</strong></td>
<td>Air embolism</td>
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<td>Fat embolism</td>
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<td></td>
<td>Signs of acute haemolytic transfusion reaction - jaundice</td>
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<td>Hypotensive episode on reinfusion of processed red cells related to hypovolaemia</td>
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<td>Bacterial contamination</td>
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<td></td>
<td>Anaphylaxis or other allergic reaction</td>
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<td>Other - please state</td>
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Implementing a Cell Salvage Programme

Prescribing/Labelling Responsibilities — who prescribes the blood? Partial or full bowels? What labels? Checking of blood

Individual Responsibilities — User records? Maintaining competency

Training — Competency based training? Maintaining training records? Staff training — What grade

Indications and Patient Selection — What groups of patients will receive ICS? How will they be flagged up
Things to Consider

Patient Information — What, how and where do you tell patients about ICS?

Quality Assurance — How, when and why?

Clinical Coding - OPCS-4 (The classification is mandatory for use by healthcare providers to support various forms of data collections for operational and secondary uses.)
• X36.4 Autologous blood salvage – use if ICS is set up for the patient
• X33.7 Autologous transfusion of red blood cells – use if blood is actually returned to the patient.

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.
So what’s the Future for Cell Salvage?
Laparoscopic Cell Salvage -
Currently undertaken by some hospitals, no standardised set up

Cancer surgery -

**TICTOC** - Feasibility study in ovarian surgery

Vaginal Cell Salvage -

Study proposal currently under way