Intraoperative Blood Cell Salvage for Obstetrics

Introduction
Intraoperative blood cell salvage is an efficacious technique for blood replacement and its use is well established in areas of medicine other than obstetrics. There is a strong case for its widespread introduction in surgery to avoid the well recognised risks, costs and increasing scarcity of homologous blood for transfusion.

Theoretical safety concerns have slowed the introduction of Intraoperative blood cell salvage in Obstetric settings, despite the endorsement of the AAGBI and the OAA. The National Institute for Health and Clinical Excellence reviewed the evidence in 2005 and supported its use in Obstetrics subject to:

1. Data collection
2. Reporting of complications to the Medicine and Healthcare products Regulatory Agency
3. Patients should be fully informed ‘whenever possible’ of the potential complications
4. Performed by multidisciplinary teams who develop regular experience of intraoperative blood cell salvage

The collection of blood at the time of Elective Caesarean section is now routine at The Royal Cornwall Hospital.

Benefits of Obstetric Cell Salvage (OCS)

1. To avoid the risks associated with conventional homologous or allogeneic/donor blood transfusion
   a. infection (viruses, bacteria and prions)
   b. acute incompatibility / allergic reactions
   c. hypothermia
   d. cost
   e. increasing scarcity

2. To enhance the safety of Caesarean Section (CS) for patients who decline blood products from donors

Theoretical risks

1. Amniotic Fluid Embolism (AFE)

There have been no reported cases to date of AFE associated with the use of cell salvage in obstetrics. Amniotic fluid embolism is now considered to be a type of anaphylactic reaction rather than an embolic reaction.
disease. Furthermore, the washing and filter processes used in cell salvage have now been shown to effectively remove amniotic fluid contaminants, fetal squames and other debris.\textsuperscript{4-6}

2. Sensitisation to Fetal Red Cells

The cell salvage machine is unable to distinguish between maternal and fetal red cells so, if the salvaged blood is transfused back to the mother, fetal red cells may be present in higher concentration than in the maternal circulation (than often occurs naturally at delivery). Maternal sensitisation to fetal red cell antigens may then occur. Rh(D) incompatibility is relatively common but sensitisation can be prevented with adequate anti-D administration after delivery. The development of antibodies to other antigens however can occur and these may pose a risk of fetal anaemia and haemolytic disease of the newborn in future pregnancies. With modern management good outcomes are usually achieved in such cases but treatment is invasive and poses significant risks to the mother and baby. Studies have shown fetal red cells still present in cell-salvaged blood during caesarean section.\textsuperscript{6-8}

**Indications for OCS**

All elective CS are consented for the collection of blood and this should be achieved whenever possible subject to staffing competencies. Procedures for which cell salvage is specifically indicated are:

1. Elective CS procedures at increased risk of bleeding. e.g:
   a. Placenta praevia
   b. Suspected placenta accreta
   c. Classical incision
   d. Past history of uterine atony
   e. Maternal bleeding disorders

2. Emergency CS at increased risk of bleeding. e.g:
   a. Placental abruption
   b. Placenta praevia
   c. Prolonged or obstructed labour associated with atony, head impaction or oedematous lower segment
   d. Women on anticoagulants
   e. Maternal bleeding disorders

3. CS for women who have declined blood products (An advance directive filed in the front of the hospital notes and copied into the hand held notes will identify which women have consented to the use of cell salvage )

4. CS when there is difficulty with cross-matching due to antibodies or anaemia

5. Laparotomy following postpartum haemorrhage
**Procedure**

**Anaesthetic assistant**

*Never delay the start of emergency surgery to set up the cell saver. Only perform cell salvage if you are trained and competent to do so.*

Prepare heparinised saline for collection and connect to cell saver (Cell saver 5+—usually in obstetrics). Set to automatic mode. Use one large bore suction device and pass to scrub nurse when ready.

Assist anaesthetist during induction.

*Record the time the collection commences. To reduce haemolysis the vacuum pressure should be set to as low as practicable.*

If possible the surgeon should attempt to minimise fetal red cell contamination of the collection by cutting the umbilical cord close to the clamp.

Even though blood can be collected from blood-soiled swabs following gentle irrigation with intravenous 0.9% Saline, the aim should be to minimise the number of swabs used.

If clinically indicated or a sufficient volume of blood is collected then the anaesthetist will instruct to process the blood.

*The processing unit can then be set up.*

It is not necessary to wash the collection twice but with a bowl size of 125mls, 1500 ml wash should be used and set to wash at a speed of 300mls/min. A complete bowl takes 5 minutes to wash.

*Complete documentation as per proforma for every case and file in ring binder folder attached to cell saver (appendix 1).*

Label the final product with maternal clinical details and time collected. The product must be used within 6 hours of the start of the collection. Keep the blood with the patient either until it is re-infused or discarded. **Do not refrigerate.**

**Administering re-infusion**

Always re-infuse the final washed product through a leucodepletion filter (Pall LeukoGuard ® RS Filter).

The decision to re-infuse cell saved blood is a multidisciplinary medical decision which will be influenced by the clinical case and, if appropriate, maternal consent.

*The blood must be prescribed and the time and amount of blood re-infused should be clearly documented in the patient notes.*

Cell saved blood has a haematocrit of approx 50% when operated in the automatic mode. Active 2, 3-DPG (Diphosphoglycerate) is found in the end product allowing for better delivery of oxygen to the tissues. It does not require warming.

- **Emergency cases with significant blood loss.**

  If possible obtain verbal consent from mother to re-infuse and a full blood count sample prior to starting the re-infusion. Consideration should be given to the risks and benefits of allogeneic blood, versus cell saved blood. If the patient is under general anaesthesia the decision to re-infuse is a medical one. In cases of rapid blood loss there will be a limit to the rapidity of the re-infusion through the filter. The re-infusion bag can not be pressurised.
Manage cases of massive obstetric haemorrhage according to local guidelines. It will sometimes be necessary to give allogeneic blood simultaneously to the re-infusion.

- Non-emergency cases.

Obtain informed consent for the re-infusion. The decision to re-infuse should be taken jointly by the clinician and the woman and is informed by an estimate of blood loss, a HemoCue result (taken in recovery) and the clinical situation. If the woman consents to the re-infusion, take a sample of her blood for a full blood count and for all women request a Kleihauer test on this same sample (not just Rh D negative women). Do this before the re-infusion. Explain to the woman she will need a follow up blood sample at 3 and 6 months, post delivery, to check for antibody formation. Re-infuse blood through a leucodepletion filter. Perform regular observations as for allogeneic blood transfusion. The blood must be re-infused within 6 hours of the start of the collection.

Follow up

Fetal red blood cells are not washed or filtered from the final product and can therefore be re-infused into the maternal circulation. The amount of fetal red cell contamination varies. The risk of maternal immunisation and the formation of a clinically significant antibody, is currently unknown although it is uncertain if a re-infusion increases the inherent risk from pregnancy itself or from a donor blood transfusion. It is important to understand there are clinically significant antibodies other than Rh D.

By looking at the fetal red cell contamination prior to re-infusion and the incidence of antibody formation post delivery, the risk may be quantified. It is recommended all women have a 3 and 6 month follow up blood sample for test of antibody formation.

References

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<thead>
<tr>
<th><strong>PATIENT LABEL</strong></th>
<th>**Date.…./.../…. Theatre...<strong>Delivery</strong></th>
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</thead>
<tbody>
<tr>
<td>Operation.................</td>
<td></td>
</tr>
<tr>
<td>Surgeon......................</td>
<td></td>
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<tr>
<td>Anaesthetist...............</td>
<td></td>
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<tr>
<td>Machine Operator............</td>
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<tr>
<td>Consumable Batch No</td>
<td>Batch no</td>
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Collection Start Time: ..................

On Pre-Delivery Iron?   Yes ☐   No ☐   Pre-Op HB……..g/dl.(date… /…)  

Processing unit opened? Yes ☐   No ☐

**If collection only, collected volume:**.........mls

**Estimated Blood loss:**..........mls

Post surgery HB.........g/dl (HemoCue)  

Re-infuse before ..........o’clock

**IF PROCESSED, PLEASE FILL IN THIS BOX**

Bowl size…….ml

Processed volume ............ml

Red Cell volume out............ml

Re-transfused volume..........ml   Signature.................

Leucodepletion filter used? Yes ☐   No ☐