GUIDELINE FOR CELL SALVAGE IN OBSTETRICS

Despite initial concerns about its safety, cell salvage has been used in hundreds of cases worldwide with no evidence of an increase in the rate of amniotic fluid embolism, infection or coagulopathy. The use of cell salvage in obstetric haemorrhage has been endorsed by The Confidential Enquiry into Maternal and Child Health in the UK in 2000-2 (1) and 2003-5(2), NICE guidelines (3), the Better Blood Transfusion 3 Health Service Circular, joint AAGBI/OAA Guidelines (4) and RCOG Greentop guidelines. Although its safety has yet to be proven by randomised controlled trials, in vitro work showed that the use of a cell saver (a Haemonetics Cell Saver 5) in combination with a Pall RS Leucocyte depletion filter removed trophoblastic tissue and leucocytes from aspirated blood. Lamellar bodies and fetal squamous cell concentrations were lower in the post-filtration samples than in maternal blood (5). The process also removed alpha-fetoprotein from the red cells of all 14 patients in whom amniotic fluid was removed by separate suction before maternal blood was aspirated. However fetal squames and fetal red cells may still be present and the latter has particular importance in Rhesus incompatibility (6).

The following guidelines apply only to the use of cell salvage in the obstetric setting.

Indications for cell salvage
1) Any patient who is predicted to require a blood transfusion or expected to lose more than 1000 ml blood during elective Caesarean Section may be considered for cell salvage, or whose starting haemoglobin is less than 10g/dL.
2) Any patient who refuses allogeneic blood transfusion (eg. Jehovah’s Witness) should be considered for cell salvage in elective or emergency bleeding situations or in significant anaemia.
3) Any patient with rare blood group or antibodies
4) There is no evidence to contraindicate the cell salvage of blood from the vaginal tract (personal communication, Sue Catling)

Consent and preparation of patients
Patients should be consented verbally for cell salvage by the anaesthetist, and fully informed about the potential complications (of amniotic fluid embolism and Rhesus iso-immunisation). The advantages and risks of ICS and allogeneic blood transfusion should be discussed with the patient prior to surgery. In a pre-planned case this should be done during antenatal care. Patients should receive the Intraoperative Cell Salvage Patient Information leaflet (which can be downloaded from the UK Cell Salvage Action Group, http://www.transfusionguidelines.org.uk/docs/pdfs/Cellsalvagefactsheet
Information for the Public (kept in the orange audit folder in the Obstetric Anaesthetic Office or downloaded from [www.nice.org.uk/IPG144](http://www.nice.org.uk/IPG144)) to read preoperatively. Such detailed consent may not be practicable in an emergency, as for allogeneic transfusion.

1) The consent should be recorded on the anaesthetic chart.

2) Patients should be grouped and antibody screened on admission and cross-matched according to the local agreement (Jehovah’s Witnesses should still be grouped in order to ascertain their Rhesus status).

3) A Kleihauer should be taken irrespective of Rhesus type and alpha-fetoprotein test should be taken pre-operatively (this can be done immediately prior to the procedure) and post-operatively (with the first set of post-operative bloods) to monitor fetal cell transfer and amniotic fluid contamination of the maternal circulation. (If the patient is Rhesus positive this should be indicated on the form requesting the Kleihauer test).

4) A baseline coagulation screen and full blood count should be sent prior to the procedure.

**Organisation of cell salvage cases**

Patients should be referred as early as possible to the Anaesthetic Assessment Clinic, or to the duty Obstetric Anaesthetist if time does not permit.

For use of cell salvage for non-elective work see section on ‘guidance for unplanned and out of hours use of cell salvage in obstetrics’.

1) The Consultant Anaesthetist should inform the following people of an impending case:
   i) The Clinical Midwifery Manager for Delivery Suite, who will then inform the Delivery Suite Co-ordinator and obstetric team. In her absence the Maternity Unit bleep holder should also be informed.
   ii) Operating Department Practitioner
   iii) Blood Transfusion Practitioner, who will inform the blood transfusion department and, for high risk cases or where coagulation support may be needed, the on-call Consultant Haematologist

2) The ODA will ensure that the following sterile disposable items are present:
   - Aspirate collection chamber
   - Suction tubing set x 2
   - Wash chamber set (includes reinfusion bag)
   - Pall leucocyte filter x2
   - Spare reinfusion bag
   The ODA should inform the Co-ordinator when only 3 of any item remain in stock, to ensure timely re-ordering.

3) The Consultant Anaesthetist should ensure that all members of the obstetric, midwifery and anaesthetic team involved in the case are aware of the theoretical and practical implications of obstetric cell salvage.
Setting up the machine
1) The machine should be set up and operated by a fully trained and competent ODP according to standard operating procedure. A list of personnel qualified in its use is held by the Clinical Midwifery Manager for Delivery Suite and also in the rota file on Delivery Suite. Any healthcare professional involved with obstetric cell salvage must be familiar with all relevant guidelines and **only experienced operators should use the machine in obstetrics.**

2) Some Jehovah’s Witnesses require that the entire circuit should be set up in continuity. If this is done the circuit should be primed with saline and the air expelled from the reinfusion bag. During use the bag should never be empty of fluid.

3) In other cases where it is not certain as to the likely extent of the blood loss, it is economical to set up only the aspiration and reservoir kit. The decision to process and re-transfuse is a clinical decision by the anaesthetist and can be taken once the extent of the haemorrhage has become clear.

4) At present two suction systems must be used: one connected to the cell salvage machine and the other for blood contaminated with amniotic fluid. However in vitro work suggests that amniotic fluid contamination (indicated by alphafetoprotein levels) is no higher if one suction is used and red cell retrieval is increased. Further research is needed before the requirement for 2 suction units is revoked (7).

Use of the cell saver
1) The Consultant Anaesthetist is responsible for all clinical decisions regarding the cell salvage machine ie. when and whether to reinfuse blood.

2) Before the case starts an addressograph label printed from the hospital patient address system should be placed on the reinfusion bag. The time at which collection of blood into the cell salvage machine starts should be written on this label, as any blood processed must be reinfused within 6 hours of collection. The reinfusion pack must be kept with the patient and not stored in the blood fridge, to minimise the risk of transfusing the wrong blood.

3) If the patient is having a general anaesthetic, the aspiration reservoir should be fully primed as soon as is practicable, but should not impact upon the anaesthetic to incision time.

4) Blood should be aspirated from the surgical site from ‘pools’ rather than ‘dabbing’ tissue surfaces, which disrupts erythrocytes.

5) **The amount of amniotic fluid aspirated into the cell salvage machine should be kept to a minimum.** It is the obstetrician’s responsibility to determine the point at which amniotic fluid is no longer likely to contaminate blood and hence the cell salvage suction may be used. The basic rule is that only fluid which can be given intravenously should be aspirated into the cell salvage machine.

6) Uncontaminated blood from swabs can be gently washed in a solution of 1000ml normal saline and salvaged from a sterile bowl into the cell saver (see Appendix 1). In order to estimate blood loss, swabs should be weighed before washing by placing a sterile plastic sheet or bag over the scales.
7) Suction pressure should be kept as low as possible – less than 100 mmHg (20Kpa) – to avoid red cell damage, although higher vacuum levels can probably be used if necessary in the presence of rapid bleeding.

8) **Blood should routinely be reinfused through a Pall RS Leucocyte Depletion filter (leucoGuard RS, Pall Biomedical Products Co., East Hills, NY) in the re-infusion circuit.** This is the only filter which can remove the particulate elements of amniotic fluid (fetal squames, lamellar bodies). However, it should be remembered that prior to the year 2000, this filter was not available, but over 250 cases worldwide safely received cell-salvaged blood without a problem (8). The filter will slow down the re-infusion rate of blood, but using a filter in each port will double the flow rate. The use of a pressure cuff is not advised due to the risk of air embolus and the unknown impact of pressure on the retention of amniotic contaminants within the filter. Recently evidence has been received by SHOT suggesting that there may be an incidence of unexpected hypotension following filtration with leucodepletion filters, the cause of which is as yet not known. Although there is no convincing evidence that the leucodepletion filter is the cause of these reactions, this is currently being investigated by SHOT and the UK Cell Salvage Action Group. Routine use of filters is still advocated at present, but they could be removed if necessary, particularly when salvaged blood is required to be re-infused under pressure (9) or if there is unexplained hypotension shortly following re-infusion of salvaged blood. There are a number of obstetric units in the UK that do not use filters routinely without any untoward effects (8).

9) Blood not immediately re-infused should be either discarded, or used within 6 hours of collection, and should not be refrigerated.

10) As with any major haemorrhage, the patient should be carefully monitored for 24 hours, preferably on Maternity HDU.

11) The cell salvage machine filters out coagulation factors and platelets: only red cells are reinfused, so a dilutional coagulopathy or thrombocytopenia may ensue. Coagulation tests and FBC for platelet count should be sent and repeated if abnormal or if clinically indicated. The contact number for urgent haematology results is 8737. When sending urgent samples, phone 8737 (Haematology) and 2479/2564 (Transfusion) and indicate the clinical urgency and mode of transport (POD or Porter).

12) If the patient is Rhesus negative a Kleihauer test should be performed and Anti-D given as appropriate within 48-72 hours. The cell salvage machine does not remove fetal red cells, which are reinfused with the salvaged blood. The Kleihauer will establish the amount of fetal red cell exposure and ensure recipients receive an appropriate dose of anti-D.

13) An audit form documenting how much was collected and reinfused should be completed for each patient. An audit form must also be completed for cases where blood was collected but not reinfused. Four copies should be made and placed: in the folder with the machine; in the orange cell salvage audit folder in the obstetric anaesthetic office; in the patient’s notes; one copy should be sent to the transfusion practitioner.
14) Data collection is important and clinicians should report all complications to the Medicines and Healthcare products Regulatory Agency (www.mhra.gov.uk).

GUIDELINES FOR UNPLANNED OR OUT OF HOURS USE OF CELL SALVAGE IN OBSTETRICS

The out of hours service for ICS is currently suspended due to lack of availability of trained staff to operate it. However, development of a training programme is currently under way and we hope to resolve this issue as soon as possible.

References:
1) CEMACH 2000-2002 Why Mothers Die: Ch 4 p91-2, Ch 9 p132
2) CEMACH 2003-2005 Saving Mother’s Lives: Section 1:80
3) NICE Guidelines Nov 2005

Additional information:

Addendum
The following is a list of useful contacts related to cell salvage in obstetrics:

Elaine Peachy, Clinical Midwifery Manager, Delivery Suite (ext 2308)
Cheryl Tyler (Fresenius Representative) 07866496469
Craig Dean (ODP, Main Theatres) ext 2411
Richard Perry (ODP, Main Theatres) ext 2411
Sharon Gale/ Sue Redfearn (Transfusion Practitioner and Manager) Ext 8727
Appendix 1

SWAB WASHING

**AREA of APPLICATION**
Theatre staff

**STAFF**
A.McCormick
Consultant Anaesthetist, Chair Hospital Transfusion Committee
May 2010
(Date for revision May 2012)

**PROCEDURE:**
1. Set up a sterile bowl with 1000ml sterile IV grade 0.9% saline*.
2. Soak blood soiled swabs† for a few minutes in the saline to extract red cells. Gently compress the swabs to express any residual solution before discarding.
3. At the end of the procedure # aspirate the swab wash solution into the cell salvage reservoir using the suction line. The swab wash should not be left for more than 6 hours without processing.

**Notes**
If blood loss is to be calculated by weight of blood in the swabs, the swabs will need to be weighed aseptically in the sterile field prior to washing. This can be achieved by placing digital scales within a sterile transparent plastic bag.

* Some centres use anticoagulant in the swab wash e.g. 10,000 IU heparin per litre saline.
† Avoid washing swabs contaminated with betadine or other substances contraindicated in cell salvage.
# In a long procedure consider evacuating the swab wash every two hours to avoid stagnation. In cases with high blood loss, consider retrieving the blood in the swab wash earlier.

**ICS Technical Factsheet Number 1**
The efficiency of red cell recovery by cell salvage is very much dependent on the ability to recover the blood lost in a useable form. During surgery, blood loss can be removed from the operative site by a combination of suction and swabs. Blood loss to swabs during surgery has been estimated at between 30%1 and 50%2 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.3

**REFERENCES:**

washing swabs increase the efficiency of red cell recovery by cell salvage in aortic surgery? Vox Sanguinis 2005; 88: 244–248