Cell Salvage (CS) Case Studies

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Failure to communicate risks inadequate anti-D immunoglobulin (Ig) prophylaxis

- *A woman in her 20s underwent an elective caesarean section in which cell salvage was to be used*
- *Prior to surgery there was no discussion within the theatre team about the women's blood group, which was D-negative*
- *The patient received a transfusion of 251mL of salvaged red cells whilst in theatre, something not communicated to the midwife at handover*
- *This was later discovered when the patient herself told the midwife she had received her own blood back and the fact verified by review of the anaesthetic chart*
- *No maternal sample had been taken for Kleihauer testing even though over 45 minutes had elapsed since the transfusion*
- *A review of the cell-free fetal deoxyribonucleic acid (cffDNA) result however showed that the baby was also D-negative meaning that no anti-D Ig prophylaxis was required*

Near miss where a patient could have potentially received another patient's blood (1)

- *A woman in her 30s underwent an emergency caesarean section and intraoperative cell salvage (ICS) was facilitated*
- *Blood loss was estimated at 900mL*
- *At the end of the surgical procedure the patient was moved to recovery before the ICS process was completed producing 226mL of salvaged red cells (O D-positive)*
- *An anaesthetist then took the labelled reinfusion bag from theatres to the bedside of what they thought was the correct patient in recovery*
- *The bag was hung on a drip stand and connected to a cannula in the patient's arm, but the infusion was not commenced*

Continued…

Near miss where a patient could have potentially received another patient's blood (2)

- *The doctor was initially questioned by the patient 'is that mine?' and then challenged by the midwife*
- *Checking the patient's details on the labelled blood bag against the wristband revealed that the doctor was in the wrong bay with a different patient (B D-positive)*
- *The infusion was disconnected and removed*
- *The doctor had failed to follow the 4-point patient identity check at the bedside before connecting the transfusion*
- *Timely intervention by the patient and the midwife prevented the transfusion of the wrong blood into the wrong patient*
- *The process was updated following this incident whereby a patient receiving cell salvaged blood must leave theatre with the red cell transfusion connected and running*

Hypotension on reinfusion of salvaged red cells with a leucocyte depletion filter (LDF) (1)

- *A woman in her 20s underwent an elective caesarean section and experienced an intraoperative haemorrhage post-delivery of approximately 4000mL*
- *Intraoperative cell salvage (ICS) was utilised with anticoagulation by acid-citrate-dextrose (ACD) with a collection volume of approximately 800mL*
- *Three units of allogeneic red cells were transfused prior to commencing salvaged red cells*
- *On commencement of the autologous transfusion through a LDF the patient exhibited a sudden drop in blood pressure and became tachycardic*

Continued…

Hypotension on reinfusion of salvaged red cells with a leucocyte depletion filter (LDF) (2)

- *The salvaged red cell infusion was stopped, and the patient received vasopressors and fluids and she quickly recovered*
- *The cell salvage transfusion of approximately 200mL was recommenced slowly without incident*
- *Towards the end of the infusion, the remainder of the volume within the bag was drawn into a 30mL syringe via a 3-way tap downstream of the filter*
- *Infusion of this bolus resulted in a second hypotensive event accompanied with tachycardia*
- *The patient was resuscitated with vasopressors and fluids and made a full recovery*

Massive obstetric haemorrhage patient unable to receive reinfusion of red cells due to suspected machine failure

- *In an emergency caesarean section, 3L of blood was collected and was being processed*
- *The cell salvage operator became concerned that the quality of the reinfusion product was suboptimal as the device was not showing the washing efficiency as it normally would. The machine was swapped for a second device and the same issue occurred*
- *After discussion with the anaesthetist, the cell salvage process was abandoned and a decision to use allogeneic blood made*
- *Subsequent investigation revealed that the cell salvage devices had been serviced by a third-party engineer. The programming was changed to factory default settings with the wash quality settings routinely used in the hospital turned off. This had not been communicated to the cell salvage lead and the devices were assumed to be working as normal after servicing*

Cell salvage used outside of guidelines in massive obstetric haemorrhage with successful outcome

- *A parturient in her 20s, with an abnormally invasive placenta, underwent an emergency caesarean section. Massive blood loss ensued, estimated in the region of 10L, and a hysterectomy was required*
- *Cell salvage was utilised and within the urgency of the situation the surgeons made an on the spot decision to salvage blood lost from the vagina as well as the abdomen*
- *This was not communicated to the cell salvage operator or anaesthetist at the time*
- *Blood salvage from vaginal loss was outside of national guidelines. All blood collected was processed and 2496mL of salvaged red cells reinfused without the use of a leucocyte reduction filter, along with over 30 units of allogeneic blood components*
- *The patient recovered well without the need for intensive care unit admission. There were no signs of transfusion reaction or bacterial contamination*

Hypotension on reinfusion with a filter and ACE inhibitors

- *A man in his 70s, with known coronary artery disease on angiotensin converting enzyme (ACE) inhibitors, underwent a cystectomy for bladder cancer*
- *Cell salvage was used with citrate as an anticoagulant and a leucocyte depletion filter (LDF) for reinfusion*
- *During heavy bleeding and cell salvage reinfusion the patient became very hypotensive*
- *Following treatment with fluid, inotropes and calcium, this resolved*
- *A second similar hypotensive episode occurred at the end of the procedure when the last bowl from the cell salvage machine was reinfused*
- *The transfusion was stopped and the patient quickly stabilised*
- *The patient went to intensive care intubated and ventilated*
- *He was extubated the following day and went on to make a good recovery*

Leucocyte depletion filter (LDF) not used for reinfusion of red cells in a urological case with malignancy

- *A patient in their 50s undergoing elective open partial nephrectomy with malignancy experienced a major haemorrhage*
- *Intraoperative cell salvage (ICS) was being used and autologous red cells were available for reinfusion*
- *The transfusion was initiated without the use of a LDF as the operator was unaware of the patient's malignancy status*
- *Only 20mL was infused before the error was noted*
- *The transfusion was stopped and a LDF used for the remainder of the infusion*

Sepsis, disseminated intravascular coagulation (DIC) and renal failure following re-infusion cell salvaged blood (imputability: 1, possible)

- *A patient in her 20s, undergoing emergency caesarean section (Category 2) for failure to progress following induction of labour for high blood pressure, received a re-infusion of 450mL of cell salvaged blood in recovery*
- *She went on to become septic, developed DIC and renal failure requiring dialysis*
- *Her renal function did not significantly improve leaving the patient in need of a renal transplant*

Cardiac arrest during re-infusion of cell salvaged blood during nephrectomy (imputability: 0, excluded or unlikely)

- *A patient in their 80s underwent an elective nephrectomy for malignancy and suffered significant blood loss*
- *Cell salvaged blood was re-infused intraoperatively using a LDF with a member of theatre staff applying manual pressure to speed up the rate of transfusion*
- *Having re-infused 50mL over 5 minutes the patient suffered a cardiac arrest from which they were successfully resuscitated*
- *The patient also became bradycardic and required the insertion of a permanent pacemaker*
- *The anticoagulant used for cell salvage was acid-citrate-dextrose solution (ACD)*

Allergic reaction to salvaged red cells (imputability: 2, likely/probable)

- *A patient in her 30s undergoing myomectomy developed red tracking marks proximal to the cannula on reinfusion of salvaged red cells*
- *The reinfusion was stopped and the marks disappeared only to reappear on resumption of the infusion*
- *The reinfusion was therefore discontinued*
- *There were no further complications and the patient made a complete recovery*
- *The anticoagulant used was acid-citrate-dextrose solution (ACD)*

Hypotension on reinfusion of salvaged red cells in an obstetric case with the use of a leucocyte depletion filter (LDF) (imputability: 2, likely/probable)

- *A patient in her 30s underwent an elective caesarean section where cell salvage was used with acid-citrate-dextrose solution (ACD) as the anticoagulant*
- *On reinfusion of the salvaged red cells via a LDF, the patient's pulse increased from 81 to 130 beats per minute (bpm) and blood pressure (BP) dropped from 107/72 to 54/34mmHg*
- *The patient reported feeling light-headed, dizzy and nauseous*
- *The reinfusion was stopped and infusion of clear fluids commenced with continuous patient monitoring*
- *The patient quickly improved and reinfusion of the salvaged red cells was recommenced at a slower rate at the patient's insistence with no further issues*

Hypotension on reinfusion of salvaged red cells in an orthopaedic case without the use of a leucocyte depletion filter (LDF); (imputability: 3, certain)

- *A patient in their 70s underwent revision hip surgery of adverse reaction to metal debris (ARMD)*
- *During reinfusion of 240mL of salvaged red cells over 2-3 minutes, the patient exhibited a profound hypotension with systolic blood pressure (BP) of 60mmHg for approximately 5 minutes*
- *This was corrected with the use of vasopressors and fluid infusion*
- *The anticoagulant used for cell salvage was acid-citrate-dextrose solution (ACD)*

Possible allergic reaction to salvaged red cells

- *A patient undergoing emergency caesarean section developed anaphylactic-like symptoms within a few minutes of commencement of reinfusion of salvaged red cells*
- *The patient reported difficulty in breathing and tongue swelling and the infusion was stopped with a prompt resolution of symptoms*
- *When reviewed the following day the patient revealed that the effects of a high epidural had caused numbness in her face and hands, she panicked and this affected her breathing*
- *She also stated this reaction started before the infusion of the salvaged red cells commenced*

Hypotension on reinfusion of salvaged red cells

- *A patient with placenta praevia underwent elective caesarean section with cell salvage*
- *Intraoperative blood loss was approximately 800mL and a reinfusion of 200mL of salvaged red cells was commenced using a leucocyte-depletion filter*
- *The patient experienced a sudden and profound hypotension and the infusion was stopped*
- *The patient's blood pressure was normalised with vasoconstrictors and other obvious causes of hypotension ruled out*
- *The leucocyte-depletion filter was removed and the remainder of the autologous red cells reinfused without further incident*

Hypotension resulting from reinfusion of salvaged red cells confirmed by a secondary challenge (1)

- *A patient with a grade IV placenta praevia underwent elective caesarean section*
- *As the patient was being transferred from theatre, reinfusion of 361mL of autologous red cells via a leucocyte-depletion filter commenced*
- *The patient then complained of nausea and vomiting, looked unwell and became slightly less responsive*
- *Monitoring revealed sinus tachycardia with a heart rate of 165 beats per minute (bpm) with systolic blood pressure (BP) of 78mmHg*
- *The red cell infusion was stopped and the symptoms resolved with a bolus infusion of 60 micrograms of phenylephrine*

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Hypotension resulting from reinfusion of salvaged red cells confirmed by a secondary challenge (2)

- *Having stabilised the patient in the recovery area (heart rate 78bpm, systolic BP 98mmHg), the autologous red cell transfusion was recommenced*
- *This resulted in rapid rise in heart rate to 150bpm with concomitant hypotension*
- *The infusion was stopped immediately with rapid resolution of symptoms*
- *The remaining 150mL of autologous red cells was then discarded*
- *The reporter noted that cell salvage was carried out following standard protocols, however, at the end of the case a partial bowl was washed without using the 'concentrate' function and the saline wash volume was not increased to compensate for this*

Cardiac arrest in a baby during cardiac surgery. Imputability 1

- *During cardiac surgery, red cells were reinfused using a cell saver. This appeared to be associated with profound hypotension and cardiac arrest*
- *Topical haemostatic agents had been used within the surgical field, but there had been no suggestion that these caused any blockage or failure of the cell-salvage equipment or washing process*
- *The baby had a complex past medical and surgical history. Cardiac surgery had been initially undertaken two days previously to try and correct coarctation of the aorta and a hypoplastic aortic arch*
- *The baby also had a complete atrio-ventricular septal defect*
- *The initial operation two days before re-operation reported coagulation problems secondary to heparin and aspirin use and postoperatively hypotension had been a longstanding issue*
- *Following the cardiac procedures the baby remained critically unwell developing renal failure and septicaemia eventually dying just over a month later*

Hypotension during re-infusion; neurosurgery. Imputability 1 (1)

- *Cell-salvage blood was collected and administered during meningioma resection*
- *Sudden cardiovascular collapse (SBP 40mmHg) occurred and the infusion limb became red*
- *The transfusion was stopped and a dose of vasopressor and crystalloid resulted in a rapid restoration of blood pressure (BP) with a short period of tachyarrhythmia and possible atrial fibrillation followed by sinus rhythm*
- *Transfusion of the same bag of salvaged red cells was cautiously restarted through a different cannula and site and completed without incident*

(continued)

Hypotension during re-infusion; neurosurgery. Imputability 1 (2)

- *A second bag of cell-saved blood was commenced approximately one hour later with repetition of cardiovascular collapse and a red limb*
- *The infusion was stopped and the salvaged red cells discarded*
- *Transfusion continued with crossmatched blood and products thereafter*
- *The patient was extubated postoperatively but later admitted to ITU from recovery but then developed disseminated intravascular coagulation (DIC)*
- *Two further operations where required and the patient developed a refractory coagulopathy*
- *The patient unfortunately died and the case is under investigation with clinical teams and transfusion consultant*