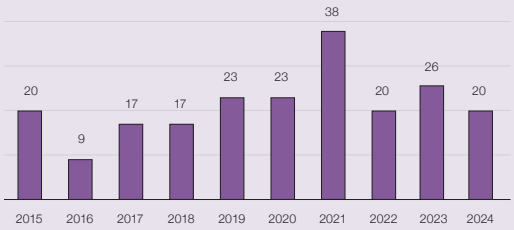
24 Cell Salvage (CS) n=20

Authors: Sarah Haynes and Rebecca Elder

Headline data 2024

Number of reports n=20
Deaths n=0
Major morbidity n=0

CS reports by year



Demographic data

Male n=11
Female n=9
Adults n=18
Paediatric n=2

Blood component data

Red cells n=20
Platelets n=0
Plasma n=0
Multiple components n=0
Other n=0

Key findings:

- There are fewer reports in 2024, suggesting under-reporting
- Avoidable procedural errors were the most reported incidents. Many of these represent themes that recur annually. Of the 20 incidents submitted, only 1 led to a change in practice
- Hypotension represents the most frequently reported adverse reaction, and not always associated with the use of a leucocyte depletion filter (LDF)

Gaps identified:

- Issues with labelling of the cell salvage reinfusion bag with incorrect patient identifiers
- Inadequate training of staff involved in cell salvage
- Lack of foresight and planning for elective cell salvage use in high-risk patients

Good practice:

- One procedural error was managed proactively through a change in practice with a safety briefing and introduction of a second check designed to prevent recurrence
- All machine/disposable malfunctions were recognised early, and the appropriate corrective actions undertaken to minimise impact on the patient
- Hypotensive reactions to salvaged red cells were recognised promptly and dealt with effectively, minimising complications

Next steps:

- Review current training needs and ensure that trained operators are available. Staff members should recognise the limits of their own sphere of competency and ask for help or retraining where there is unfamiliarity with processes and procedures
- Adequate, proactive planning of the use of cell salvage for elective surgeries in high-risk patients should be included early on in the surgical pathway

For all abbreviations and references used, please see the **Glossary** and **Reference list** at the end of the full Annual SHOT Report. Please see the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/annual-shot-report-2024/).

Definition:

Any adverse events or reactions associated with cell salvage (autologous) transfusion methods, including intraoperative and postoperative cell salvage (washed or unwashed).

Introduction

In 2024, 20 cases were included, which is a reduction from previous years, suggesting the possibility of under-reporting. Reports were submitted by 14 different organisations, with one centre submitting 5 reports, 2 reports each from two others; and the rest were single reports from 11 other reporting sites.

Most reports involved patients undergoing elective surgery, 16/20 (80.0%). The greatest number of events were reported from orthopaedics (including one spinal surgery) and vascular surgery, with remaining reports occurring in six different specialities. All incidents were related to the intraoperative use of centrifugal washing devices.

Table 24.1: Cell salvage cases by speciality in 2024 (n=20)

Specialty	Elective	Emergency	Total
Cardiac	1	0	**1**
General	1	0	**1**
Hepatobiliary	1	0	**1**
Neurosurgery	1	0	**1**
Obstetrics	3	1	**4**
Orthopaedic	4	2	**6**
Plastics	1	0	**1**
Vascular	4	1	**5**
Total	**16**	**4**	**20**

There were 17 adverse events, 9 of which were attributable to avoidable errors, and 8 machine/disposable failures. There were 3 adverse reactions, which were reported as hypotension, unrelated to hypovolaemia. Only 1 of these reactions occurred when using a LDF.

Of all incidents, avoidable procedural error was the most reported incident.

Deaths and major morbidity related to transfusion n=0

There were no deaths or major morbidity related to cell salvage.

Cell salvage adverse events n=17

Eight incidents related to machine/disposable failure, with an additional 9 avoidable procedural errors.

Equipment failure n=8

There were 8 reports of equipment failure, 4 of which were reported to the Medicines and Healthcare products Regulatory Agency (MHRA) under the Yellow Card scheme.

There were 4 device malfunctions, with 1 sensor fault and 3 software failures. In all cases, the correct measures were taken to avoid or minimise consequences to the patient by finding an alternative device and continuing the cell salvage process. In 2 cases, the advanced age of the device was thought to be a contributory factor to the machine failure, despite all devices being on preventive maintenance contracts.

There were 4 issues related to cell salvage disposables. In all cases, the correct action was taken to replace the faulty disposable item and minimise any potential impact to the patient.

Procedural errors n=9

There were 9 reports of avoidable errors. Only 1 case identified the error as occurring due to inadequate training.

In 3 incidents, errors in setting up or using the cell salvage device occurred. In 2 cases, incorrect assembly of the disposables or inadequate priming of anticoagulant resulted in clot formation in the collected blood, and replacement of the disposables with a new set. In a 3rd report, interference with the device by an untrained staff member resulted in device failure.

Two incidents involved reinfusion bags incorrectly labelled with previous patient details. One incident included the collection of blood into a kit prelabelled with a previous patient's details who had since died, without requiring cell salvage. The error was noticed after having left theatre, and cell salvaged blood was discarded. The other incident also included an incorrectly labelled reinfusion bag which was noted, and more concerningly, subsequently altered and transfused regardless.

Case 24.1: Incorrectly labelled blood

A different patient's details from a previous day were on the transfusion label attached to the transfusion record. This was identified in theatre recovery, where the details were amended by the anaesthetist and the transfusion subsequently continued.

Labelling of the cell salvage reinfusion bag with correct patient identifiers should be done at point of contact with the patient. The United Kingdom Cell Salvage Action Group (UKCSAG) has a standardised label that is available from all intraoperative cell salvage (ICS) manufacturers. Unintentional transfusion of ABO-incompatible blood remains a 'Never Event', with significant patient safety ramifications, and safety standards such as checking patient details are accurate are in place to help prevent this. Deviations from correct processes leave patients vulnerable to catastrophic harm.

Two incidents related to the elective care of Jehovah's Witnesses. In 1 case, staff failed to anticipate the need for a LDF until postoperatively, despite the patient having elective surgery for a rectal cancer. This was attributed to the surgery proceeding from laparoscopic to open surgery, which may have necessitated the urgent set up of cell salvage.

In the 2nd incident, cell salvage was requested for a craniotomy. The operating department practitioner and anaesthetists reported they were not proficient or trained in operating cell salvage. They were however encouraged to read some printed instructions and continue setting it up. It was consequently done incorrectly. This was rectified by a trained member of staff but represents unacceptable practice with individuals acting beyond their scope of competency and without adequate training. Of note is the potential morbidity and mortality risks from a lack of planning and preparation in a potentially high-risk elective setting, in a patient who had declined an allogenic blood transfusion.

One case involved the incorrect preparation of swab wash, where saline for irrigation was used instead of intravenous saline and subsequently transfused back to the patient. This represents the only procedural error where a change in practice has been identified. This involved a safety briefing and introduction of a second check of solutions added to the surgical field with the cell salvage operator. This case highlights the importance of set up and preparation, and communication between the scrub staff and cell salvage operators at the World Health Organisation (WHO) team brief (WHO, 2009) as part of the pre-surgery check.

Case 24.2: A distracted operator

A patient underwent elective orthopaedic surgery with cell salvage. The cell salvage operator experienced some difficulty in using the machine, ascribed to unfamiliarity with the software. This resulted in blood not being washed. Upon reflection, the reporter identified several factors that may have also contributed to the error. 'The operation was coming to an end, and they were trying to keep an eye on the patient too. The cell salvage machine had been positioned at the back of the anaesthetic machine, so (that) they could not see the patient and it was difficult to get round…the lines were entangled with other cables. Hence, they were very distracted'.

Despite being in an elective setting, the reporter implies that the cell salvage operator was also a member of the anaesthetic team and was distracted due to additional responsibilities. The 2022 UKCSAG survey highlighted that only 20% of cell salvage procedures are carried out by a supernumerary operator (Kumar, et al., 2024). Whilst utilising an existing member of the theatre team has been deemed to be safe, it should be noted (as for any clinical task) that cell salvage operators must be allowed to prioritise and focus on the job in hand. This incident also highlights the importance of environment design and layout in maintaining vigilance and situational awareness, to uphold patient safety.

Learning points

- Local incident reporting processes should represent an opportunity for shared learning, debriefs, and to strengthen or address current safety policies
- The WHO team brief represents an opportunity for the entire theatre team to communicate, discuss and highlight any concerns regarding cell salvage (WHO, 2009)
- Deviations from recommended processes and suboptimal safety checks pose a risk to patient care. Staff education and training is vital

Cell salvage adverse reactions n=3

There were 3 reports of adverse reactions, all of which comprised marked hypotension, with no other obvious surgical cause. Two out of 3 patients were admitted to the high dependency unit/intensive care unit postoperatively, although these admissions were planned and not attributed to the adverse reactions. A LDF was used in only 1 of the cases, involving the resection of malignant tissue.

Case 24.3: Hypotensive reaction in a patient receiving cell salvaged blood

A patient was undergoing a major vascular procedure. Shortly before finishing, the transfusion of cell salvaged blood was commenced. The patient became profoundly hypotensive, which was compounded by a further bolus of cell salvaged blood. The patient was managed with fluid boluses and an infusion of vasopressors. The patient recovered shortly after and did not require further blood pressure support.

Without further details, it is unclear whether the case represents a reaction to transfusion of cell salvaged blood, hypovolaemia or a cardiac event. A transfusion reaction was initially not suspected by the anaesthetic team either, but it is important to highlight that hypotensive reactions can potentially still occur without the use of a LDF.

Learning points

- Hypotension represents the most frequently reported adverse reaction. It is not always associated with the use of a LDF
- Hypotension should be managed by stopping the infusion, fluid resuscitation and vasopressors as required, whilst all possible other causes are excluded or managed before restarting the transfusion

Conclusion

SHOT has frequently recognised that there have been issues with training in the use of cell salvage and inaccurate labelling of cell salvaged blood. Despite having been flagged in previous Annual SHOT Reports, similar errors continue to occur.

Inadequate training continues to contribute to errors which highlights the need to standardise training across cell salvage practitioners. Refresher training should also be available to staff as appropriate. Practitioners involved in cell salvage should be encouraged to regularly review their training needs and identify areas where retraining or further training is required to ensure competency is achieved/maintained.

The incidents reported also reveal a lack of preparedness, planning and multidisciplinary communication in both emergency high-risk patients and the elective setting, with significant implications for patient safety.

The paucity of incidents reported needs to be addressed to achieve a more accurate picture of incidents occurring during the use of cell salvage. In conjunction with UKCSAG, more needs to be done to address under-reporting and reframe incident reports as learning opportunities.

Recommended resources

SHOT Bite No. 21: Cell Salvage – Insights from SHOT reports
https://www.shotuk.org/resources/shot-bite-no-21/

UK Cell Salvage Action Group - Intraoperative Cell Salvage Education
https://www.transfusionguidelines.org/transfusion-practice/uk-cell-salvage-action-group/intraoperative-cell-salvage-education