

ORIGINAL ARTICLES

The Use of Cell Salvage during Obstetric Procedures: an Audit of Scotland's Maternity Units

M Harkness¹, V Clark²

¹Transfusion Research Nurse/Midwife, Better Blood Transfusion Programme, Scottish National Blood Transfusion Service, Ellen's Glen Road, Edinburgh, EH17 7QT

²Consultant Anaesthetist, Simpson Centre for Reproductive Health, Royal Infirmary of Edinburgh, Little France, Edinburgh, EH16 4SA

Correspondence to

Mairi Harkness, Transfusion Research Nurse/Midwife, Better Blood Transfusion Programme, Scottish National Blood Transfusion Service, Ellen's Glen Road, Edinburgh, EH17 7QT

Email: Mairi.harkness@snbts.csa.scot.nhs.uk

Abstract

Background

Concerns about the safety and supply of donor blood mean that clinicians are increasingly looking for alternatives to allogenic blood transfusion. One such alternative is cell salvage. Theoretical concerns about the safety of giving salvaged blood to obstetric patients have so far limited its use in maternity patients, but its use in obstetrics is now growing.

Aims

To determine how many Scottish maternity units use cell salvage and what barriers anaesthetists see to its use in obstetrics.

Methods

A survey was posted to one consultant anaesthetist at each of Scotland's 18 consultant led maternity units.

Results

Two out of 18 maternity units in Scotland use cell salvage. Perceived barriers to use include lack of machine, insufficient cases and lack of familiarity with the technology. Only 4/15 anaesthetists saw safety concerns as a barrier to using the technology.

Conclusion

It would appear that practical issues such as staff training and maintaining familiarity with the technology are greater barriers to the use of cell salvage during obstetric procedures than concerns over safety or financial costs. Although cell salvage would appear to be safe, its use in obstetrics must be accompanied by ongoing audit and detailed data should be collected for each case.

Introduction

Concerns about the safety and supply of donor blood mean that clinicians are increasingly looking for alternatives to allogenic blood transfusion. One such alternative is cell salvage where shed blood is collected and then filtered and/or washed using a cell salvage machine (Figure 1) in order to produce autologous red blood cells for transfusion.

Figure 1: Haemonetics Cell Saver 5 Cell Salvage Machine

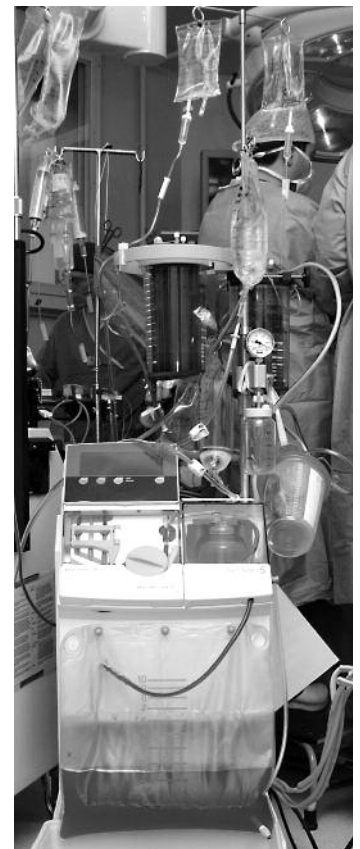
Potential benefits to the patient are a reduction in the incidence of transfusion reactions and transfusion related infection compared with donor blood transfusion. The technology is increasingly used in fields such as cardiac and orthopaedic surgery and its use during obstetric surgery is growing.

At the Simpson Centre for Reproductive Health, Royal Infirmary of Edinburgh (RIE) cell salvage has been used for high-risk elective obstetric surgery such as caesarean section for placenta praevia, particularly in patients who refuse donor blood, since 2002. We planned a Scottish national survey to determine how many other maternity units are using cell salvage in obstetrics. The survey was seen as an opportunity both to collect data on the use of cell salvage in obstetrics, and also to contact interested clinicians with the prospect of developing a network of enthusiasts and the potential to share experiences and data on the use of this technology in obstetrics.

Methods

A short survey questionnaire was developed for this audit. Questions asked included whether or not cell salvage was available for use in obstetrics, the type of equipment used, frequency of use, staff training and perceived barriers to its use. The questions offered fixed answers, but there was also space for 'free text' following each question and at the end of the questionnaire.

There are 18 consultant led maternity units in Scotland and the survey was posted to a named consultant obstetric anaesthetist



in each unit during July 2005. After four weeks non-responders were sent another copy of the questionnaire. After a further three weeks there were only two non-responders, both of whom were contacted by telephoned and interviewed using the survey as a prompt.

Results

Data were available for all 18 consultant led maternity units in Scotland.

Cell salvage is currently used at two maternity units in Scotland: Ninewells Hospital in Dundee and the Royal Infirmary of Edinburgh (RIE). The experience in both units was very similar. Elective caesarean section was the only obstetric procedure where cell salvage had been used, although consultants at both hospitals expressed an interest in extending its use to emergency procedures. In the RIE cell salvage has been available in obstetrics for four years, while in Dundee it has been used for approximately 18 months. The number of procedures was also similar. At the time of the survey the machine had been set up for use three times at Ninewells and four times at RIE. In all cases insufficient blood had been collected to allow autologous transfusion. The consultant anaesthetists at both maternity units described cases where cell salvage would have been beneficial, but the intervention was not used. It was felt that lack of familiarity with the technology and lack of staff training in its use were significant barriers to more widespread use.

Of the 16 Scottish maternity units where cell salvage is not used in obstetrics, 15 offered data on perceived barriers to its use. There was no access to a cell salvage machine at any of the 15 units. Perceived barriers to the introduction of cell salvage in obstetrics included the feeling that it was not justified due to the small number of suitable cases each year, lack of knowledge and familiarity with the technology, lack of expertise from non-obstetric cases, concerns for patient safety, theatre staffing levels and costs. These are detailed in Table I.

Table I: Barriers to Introducing Cell Salvage for Use during Obstetric Procedures

Barriers to the use of cell salvage in obstetrics	Number of maternity units stating each barrier (n=15*)
No machine available	15 (100%)
Insufficient number of cases	8 (53%)
Lack of familiarity with technology	5 (33%)
Lack of expertise from non-obstetric cases	5 (33%)
Concerns over patient safety	4 (27%)
Theatre staffing levels	1 (6%)
Financial costs	1 (6%)

*Data missing from one maternity unit

Discussion

The use of intra-operative cell salvage is well established in surgical fields such as cardiac and orthopaedic surgery. Its use so far, in obstetrics has been limited and this is borne out with the results of our survey: anaesthetists at just two of Scotland's maternity units reported having used the intervention during obstetric procedures. Theoretical concerns over the safety of salvaged blood are often cited as a barrier to the widespread use of cell salvage during obstetric surgery.¹ However our survey suggests that practical considerations may now present a greater barrier to its use than safety concerns.

A major strength of this survey is that responses were received from all 18 of Scotland's consultant led maternity units and that the factual data, such as whether cell salvage is ever used, is likely to be very accurate. One drawback of the survey is that the sample included only one anaesthetist at each unit, although that consultant was the lead consultant anaesthetist. This was due to resource constraints, and ideally all obstetric anaesthetists at each unit would have been surveyed. The aspect of the survey most likely to be biased by this is the section where anaesthetists were asked what they perceived as barriers to the use of cell salvage in their unit.

Cell salvage is most likely to be of benefit for patients undergoing elective caesarean section who have conditions such as placenta praevia or placenta accreta, where a large volume blood loss is anticipated. The small number of cases means that there is little published evidence about the efficacy of cell salvage during caesarean section. However one study, comparing 139 patients at three centres in the United States, found a median volume of re-infused blood of between 250ml to 450ml per patient.²

In our survey although the machine had been set up for use at a number of procedures where patients were at risk of large blood loss, in each case insufficient blood was collected to allow re-infusion. We did not ask the anaesthetists why they thought that insufficient blood was collected during the procedures, for example whether the blood loss was less than expected or whether there was a technical reason such as failure to collect shed blood. Predicting which patients will lose large volumes of blood at caesarean section is difficult. Those expected to bleed heavily due to a pre-diagnosed condition such as placenta praevia, may in fact lose very little blood. Rarely, others who have no apparent risk factors may go on to have a major haemorrhage. In the Scottish maternity units using cell salvage both anaesthetists described cases where they felt cell salvage may have been beneficial but it was not used, with lack of familiarity with the technology and lack of staff training seen as significant barriers to its use.

Consultant anaesthetists at the units not using cell salvage identified seven perceived barriers to its use in Scotland's maternity units (Table I). At more than half of the units (53%) anaesthetists felt that they would see an insufficient number of cases where cell salvage would be of use and a third felt that lack of familiarity with the technology was an important barrier. The lack of expertise from non-obstetric cases was also flagged as a barrier to use at 5/15 maternity units. For cell salvage to be used safely and effectively a technician must be specially trained in order to operate the equipment correctly; the surgeon must use a suction technique that avoids amniotic fluid and aspirates as much shed blood as possible; and the anaesthetist and other theatre staff must be familiar with the technology in order to allow the safe re-infusion of salvaged blood. Initial training is necessary, but ongoing regular use is also important in order to maintain familiarity with the technology.

The two maternity units that do use cell salvage are situated within large teaching hospitals and at both hospitals cell salvage is widely used in other surgical fields. In particular anaesthetists and other theatre staff regularly use cell salvage during elective orthopaedic surgery. The number of cases where cell salvage had actually been used in obstetrics was small, three and four procedures in a 12 month period, and it may be that without the additional experience gained through working in other disciplines, clinicians would be unable to maintain the skills required to offer safe cell salvage during obstetric procedures. In our unit at the RIE, we have now adopted a policy whereby cell salvage is used during all elective caesarean sections for placenta praevia in order to increase staff familiarity with the technology. Familiarity with the technology is particularly pertinent in a situation where a patient is experiencing sudden and heavy blood loss. It is vital that the use of cell salvage technology does not detract from other aspects of patient care in an emergency situation.

When cell salvage is used during caesarean section, blood and amniotic fluid aspirated before delivery is discarded. Thereafter, shed blood is suctioned from the wound site via a catheter, mixed with anti-coagulant, usually acid citrate dextrose, and then processed in the cell salvage machine. Here it is filtered and washed before being re-infused to the patient. The aspirate may include amniotic fluid and fetal cells and a leucodepletion filter is mandatory to reduce the amount of amniotic cells in the salvaged blood. Safety concerns have been raised about both the theoretical risk of re-infused salvaged blood causing amniotic fluid embolism and, in women with an RhD negative blood type, an increased risk of maternal sensitisation due to exposure to fetal red blood cells.

Again, due to the small number of cases, published clinical evidence to support the safe use of cell salvage in obstetrics is limited. However leucocyte depletion filtering has been shown to significantly reduce particulate contaminants to a concentration equivalent to maternal venous blood.³ There are three published clinical studies concerning the use of cell salvage during caesarean section.^{2,4,5} These include a total of 177 obstetric patients who received salvaged blood, and no cases of acute respiratory distress syndrome or amniotic fluid embolism were reported. However, the reported clinical incidence of amniotic fluid embolism varies greatly, but may be as low as 1:120,000.⁶ With such a rare incidence, the use of cell salvage during obstetrics would have to become far more prevalent, and many more cases reported, for any increase in risk of amniotic fluid embolism associated with re-infusion of salvaged blood to become apparent. This makes it vitally important that the use of cell salvage in obstetrics is audited on an ongoing basis and that accurate and detailed data is collected for each case.

There is also a theoretical safety concern that re-infusing salvaged blood to obstetric patients may increase the risk of sensitisation with red cell antibodies for women with an RhD negative blood type. A Kleihauer or equivalent test should be taken after re-infusion of salvaged blood and must be followed by an appropriate dose of anti-D immunoglobulin.

The financial cost of using cell salvage was considered a barrier to its use by only one of the anaesthetists we surveyed. Cell salvage is not an inexpensive technology. A cell salvage machine may cost in the region of £10,000 and the disposable equipment used for each patient will cost between around £40 (for partial set up) to around £100 (when blood is collected and processed for re-infusion). This compares with an estimated cost of £132⁷ for one unit of donor red cells.

The benefit to a patient, particularly a young woman who may go on to have further pregnancies, of avoiding exposure to donor blood is incalculable. Many NHS trusts now aim to provide blood conservation technologies and the effective use of blood is promoted by government documents such as *Better Blood Transfusion*.⁸ Further, we anticipate more uptake of cell salvage following recommendations by both the latest Confidential Enquiry into Maternal and Child Health⁹ and the Royal College of Obstetricians and Gynaecologists Green Top Guidelines¹⁰ that cell salvage should be considered in cases where there is high risk of massive haemorrhage, particularly for patients who refuse allogenic blood transfusion for religious or other reasons. However, despite growing support for the technology, the provision of cell salvage equipment for use in obstetrics may be very dependent on local budgetary and health care priorities.

Conclusion

Although cell salvage was in use at only 2/18 maternity units, the anaesthetists we surveyed showed widespread support for the use of this technology in obstetrics. It would appear that practical issues such as staff training and maintaining familiarity with the technology were greater barriers to its use than concerns over safety or financial costs. Even at Scotland's largest teaching hospitals the small number of cases each year where cell salvage would be of benefit during obstetric procedures mean that unless staff are also using the technology in other surgical areas, they are unlikely to be able to maintain the knowledge and skills required to salvage blood safely and effectively in an emergency situation. Unfortunately the potential benefit to Scotland's geographically remote maternity units of having immediately available, fully compatible blood for transfusion in a situation where there is sudden and torrential haemorrhage may be negated by the need for ongoing and regular use of the technology by staff to ensure its safe use.

Although cell salvage would appear to be safe there is, as yet, very little published evidence. It is important that when cell salvage is used in obstetrics that it is accompanied by ongoing audit and detailed data is collected for each case.

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