Date: 20 Sep 2017
Sources Searched: Medline, Embase.

Cell Salvage at Vaginal Birth

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1. A novel obstetric medical device designed for autotransfusion of blood in life threatening postpartum haemorrhage

Author(s): Yost G.; Collofello B.; Goba G.; Geller S.; Koch A.; Harrington A.; Esmailbeigi H.; Robinson N.; Kutz-McClain P.; Dobiesz V.

Source: Journal of Medical Engineering and Technology; Aug 2017 ; p. 1-7

Publication Date: Aug 2017

Publication Type(s): Article In Press

Abstract: Postpartum haemorrhage (PPH) is an obstetric emergency caused by excessive blood loss after delivery, which is the leading cause of maternal mortality worldwide. PPH can lead to volume depletion, hypovolemic shock, anaemia and ultimately death. The prevalence of PPH is disproportionately higher in low resource settings where there is limited access to skilled medical care and safe blood supplies. Current management strategies target both prevention and treatment of PPH however no alternatives currently exist to address the lack of safe blood supplies which are considered essential in emergency obstetrical care. Autotransfusion is used to salvage blood loss in a variety of clinical settings but has never been used in the context of vaginal delivery. We describe the development and testing of a novel device for the collection, filtration and autotransfusion of blood lost due to PPH. The prototype device is inexpensive and easily operated so that it may be practically deployed in low resource settings. The device is comprised of a blood collection drape, a pump apparatus, three leukocyte reduction filters and a reservoir for filtered blood. Preliminary testing demonstrates efficacy of microbial load reduction of up to 97.3%. To reduce cost and improve safety, the device is modular in design such that the drape, tubing, filters and transfusion bag may be stored sterile, used once and discarded; while the pump apparatus may be used indefinitely without the need for sterilisation. Preliminary results indicate the device confers a low cost and potentially effective means of collecting, pumping, filtering and returning blood to a patient following PPH in settings that lack safe blood supplies. This device shows promise as a method of stabilising patients suffering of PPH in low resource settings until definitive treatment is rendered with the ultimate goal of reducing maternal mortality globally.

Database: EMBASE

2. Testing of the filter function of a prototype device to eliminate fetal surrogate markers and bacterial load for autotransfusion in postpartum haemorrhage in low-resource settings

Author(s): Collofello B.; Robinson N.; Dobiesz V.; Kutz P.; Koch A.; Harrington A.; Esmailbeigi H.; Geller S.

Source: The Lancet Global Health; Apr 2016; vol. 4 ; p. 26

Publication Date: Apr 2016

Publication Type(s): Conference Abstract

Abstract: Background Postpartum haemorrhage is a leading cause of death in low-income and middle-income countries, but it is also largely preventable. As a potential solution for restoring blood volume in women with life-threatening haemorrhage in low-resource settings, a vaginal blood collection drape with adaptations for autotransfusion has been created. In this study, we aimed to assess the filtration function of the autotransfusion system prototype and to determine the degree to which the filter removes surrogate markers for amniotic fluid, fetal cells, and inhibin A, as well as to quantify the reduction of bacterial contaminants in postpartum blood after vaginal delivery. Methods We collected postpartum blood from four women who had normal spontaneous vaginal delivery of a term pregnancy using an adapted obstetrical blood collection drape. Immediately after the delivery, the research drape was placed under the buttocks of the participant and postpartum blood was collected. The blood entered a sterile system and was filtered through a Pall Leuko Guard BC2 Cardioplegia filter via a negative pressure pump. We tested prefiltration and post-filtration samples for the presence of fetal cells, inhibin A, and surrogate markers for amniotic fluid contamination. Cultures of prefiltered and post-filtered blood underwent qualitative analysis, to identify specific bacterial species present, and quantitative analysis. Findings We identified Escherichia coli, Bacteroides fragilis, Klebsiella pneumoniae, Enterococcus faecalis, Corynebacterium jeikeium, Lactobacillus spp, and Staphylococcus spp in prefiltration blood samples. In samples from three of the four participants, bacterial load decreased after filtration. However, complete elimination of a bacterial species did not occur in two participants' post-filter cultures. Fetal cells were present in one prefiltration sample and decreased but remained present after filtration. Reduction in alpha-fetoprotein and inhibin A varied between the four participants' post-filtration samples. Interpretation The filter tested in the autotransfusion system prototype did not significantly reduce the surrogate markers tested nor eliminate bacteria in the four samples, although selective removal of Staphylococcus spp might have occurred. The system remains a promising solution to improve health outcomes of women who give birth in low-resource settings but improved filter function does need to be addressed. Future studies will test a leucocyte depletion filter, previously shown to successfully remove bacterial contaminants, as well as alter device flow rates for optimum filter function.

Database: EMBASE

3. Cell salvage for vaginal delivery - is it time we considered it?

Author(s): Wilson, M J A; Wrench, I J

Source: International journal of obstetric anesthesia; May 2015; vol. 24 (no. 2); p. 97-99

Publication Date: May 2015

Publication Type(s): Editorial

PubMedID: 25840853

Database: Medline

4. Is cell salvaged vaginal blood loss suitable for re-infusion?

Author(s): Teare, K M; Sullivan, I J; Ralph, C J

Source: International journal of obstetric anesthesia; May 2015; vol. 24 (no. 2); p. 103-110

Publication Date: May 2015

Publication Type(s): Research Support, Non-u.s. Gov't Journal Article

PubMedID: 25659518

Abstract:BACKGROUNDHaemorrhage is one of the commonest causes of maternal critical care admission. Cell salvage used during caesarean section can contribute to a reduction in allogeneic blood consumption. This study sought to provide a practical method to salvage blood lost after vaginal delivery and a description of the constituents before and after washing.METHODSBlood lost after vaginal delivery was collected from 50 women and washed in a cell salvage machine. No blood was re-infused to any patient in this study. The following measurements were made pre- and post-wash: haemoglobin (haematocrit), alpha-fetoprotein, albumin, lactate dehydrogenase, plasma free haemoglobin, heparin concentration, fetal red cells and identification of bacterial species and colony-forming units (cfu).RESULTSMedian haemoglobin concentration post-wash was 15.4 g/dL. Alpha-fetoprotein, lactate dehydrogenase and albumin concentrations were significantly reduced post-wash (<1 KU/L, 183 IU/L, 0.011 g/L, respectively; P <0.001). Median fetal red cell level post-wash was 0.15 mL [range 0-19 mL]. Median bacterial contamination concentration post-wash was 2 cfu/mL, with a median total count of 303 cfu.CONCLUSIONSVaginal blood can be collected efficiently with little disruption to patient management. The amounts of haemolysis and washout of non-red cell blood components are consistent with results in our cell salvage quality assurance programme for caesarean section and non-obstetric surgery. Although bacteria are detectable in all the post-wash and post-filter samples, the median residual contamination is similar to that found with cell salvage in caesarean section, and if re-infused would result in a circulating bacteraemia of <1 cfu/mL; this is similar to that seen with dental procedures (0.3-4.0 cfu/mL) and is thought to be clinically insignificant.

Database: Medline

5. Red blood cell salvage during obstetric hemorrhage.

Author(s): Milne, Megan E; Yazer, Mark H; Waters, Jonathan H

Source: Obstetrics and gynecology; Apr 2015; vol. 125 (no. 4); p. 919-923

Publication Date: Apr 2015

Publication Type(s): Journal Article

PubMedID: 25751212

Available in full text at Obstetrics and Gynecology - from Ovid

Abstract:OBJECTIVETo describe which obstetric patients lose enough blood during postpartum hemorrhage to receive a reinfusion of intraoperative blood salvage.METHODSEight years of intraoperative blood salvage data from a regional tertiary care maternity hospital were analyzed. The volume of blood returned through intraoperative blood salvage was standardized to the volume of red blood cells in an allogeneic red blood cell unit from the blood bank.RESULTSThere were 884 obstetric hemorrhage cases in which intraoperative blood salvage was utilized. Sufficient blood was collected by intraoperative blood salvage to permit reinfusion in 189 of 884 (21%) patients. For patients in whom intraoperative blood salvage blood was reinfused, the mean ± standard deviation number of reinfused shed blood units was 1.2 ± 1.1 units. Although intraoperative blood salvage was most commonly performed on patients who underwent routine cesarean delivery (748/884 patients), only 13% of these patients received an intraoperative blood salvage reinfusion; 73% of the

patients undergoing cesarean hysterectomy, 69% of those who had bleeding after cesarean delivery, and 53% of the patients who bled after vaginal delivery received an intraoperative blood salvage reinfusion (P<.001).CONCLUSIONAlthough intraoperative blood salvage was attempted on many patients, on only 21% of the women was a sufficient amount of intraoperative shed blood collected to proceed with reinfusion. Patients who experienced bleeding or who underwent a cesarean hysterectomy were the most likely to receive a reinfusion of intraoperative blood salvage-processed blood.

Database: Medline

6. Obstetric cell salvage at vaginal delivery: A pilot study to evaluate safety and infection risks

Author(s): Leach D.J.; Hammersley B.; Unsworth P.F.; Rowland J.S.

Source: BJOG: An International Journal of Obstetrics and Gynaecology; Jun 2013; vol. 120 ; p. 437

Publication Date: Jun 2013

Publication Type(s): Conference Abstract

Available in full text at BJOG: An International Journal of Obstetrics and Gynaecology - from John Wiley and Sons

Abstract: Objectives Postpartum haemorrhage (PPH) is a leading cause of maternal mortality. The majority of PPH cases occur in women following a vaginal delivery. With cell salvage now supported by a substantial base of evidence for intraoperative use, this pilot study aimed to evaluate the capacity of conventional cell salvage techniques to remove microbiological contamination from blood lost at vaginal delivery to a level that would allow safe autologous transfusion of this blood. Methods Women for whom a normal delivery was expected were recruited on admission for induction of labour. Blood was collected at the delivery with a sterile under-buttock drape filled with anticoagulant. This was processed with a Cell Saver 5+. Samples for culturing were taken prior to processing, immediately afterwards, and 6 hour post-processing. Results Waste was collected from 11 women, of whom 10 had vaginal deliveries and one had an emergency caesarean section. All the pre- and post-processing samples were contaminated with microorganisms. Bacteria identified on culturing included E. coli, Enteroccocus sp., Staphylococcus epidermidis, coliforms, nonhaemolytic Streptococcus and diphtheroid organisms. Conclusions Current cell salvage methods appear to be insufficient to completely remove microbiological contamination from blood salvaged at vaginal delivery, but the level of contamination was not assessed. Further research might compare contamination of salvaged blood from caesarean section and vaginal delivery, and investigate the efficacy of augmenting the salvage technique with an antibiotic wash. The microorganisms identified may help guide the antibiotic management of cell salvage used in extremis for PPH following vaginal delivery if a patient refuses allogeneic blood transfusion. Funding This study was funded Tameside Hospital NHS Foundation Trust and some disposable equipment for the cell salvage device was provided free of charge by Haemonitics.

Database: EMBASE

Strategy 276447

#	Database	Search term	Results
1	Medline	(cell* ADJ2 salvag*).ti,ab	910
2	Medline	(blood ADJ2 salvag*).ti,ab	924
3	Medline	exp "OPERATIVE BLOOD SALVAGE"/	251
4	Medline	(1 OR 2 OR 3)	1681
5	Medline	(vagina* ADJ2 (birth* OR deliver*)).ti,ab	16804
6	Medline	(4 AND 5)	6
7	Medline	exp "BLOOD PRESERVATION"/	11867
8	Medline	(5 AND 7)	9
9	Medline	("delivery obstetric").ti,ab,af	25671
10	Medline	(4 AND 9)	6
11	Medline	(7 AND 9)	8
12	EMBASE	(cell* ADJ2 salvag*).ti,ab	1165
13	EMBASE	(blood ADJ2 salvag*).ti,ab	1158
14	EMBASE	exp "BLOOD SALVAGE"/	606
15	EMBASE	(12 OR 13 OR 14)	2247
16	EMBASE	(vagina* ADJ2 (birth* OR deliver*)).ti,ab	25099
17	EMBASE	exp "VAGINAL DELIVERY"/	25772
18	EMBASE	(16 OR 17)	34365
19	EMBASE	(15 AND 18)	18

20	EMBASE	exp "BLOOD AUTOTRANSFUSION"/	8420
21	EMBASE	(18 AND 20)	26
22	Medline	exp "BLOOD TRANSFUSION, AUTOLOGOUS"/	6943
23	Medline	(autotransfus*).ti,ab	1840
24	Medline	(22 OR 23)	7315
25	Medline	(5 AND 24)	7
26	PubMed	(cell* ADJ2 salvag*).ti,ab	12543
27	PubMed	(blood ADJ2 salvag*).ti,ab	758
28	PubMed	(autotransfus*).ti,ab	1815
29	PubMed	(blood ADJ2 autologous).ti,ab	50624
30	PubMed	(26 OR 27 OR 28 OR 29)	62182
31	PubMed	(vagina* ADJ2 (birth* OR deliver*)).ti,ab	2844
32	PubMed	(30 AND 31)	2
33	PubMed	((nonoperative OR "non operative") ADJ2 (deliver* OR birth*)).ti,ab	14
34	PubMed	("cell salvag*" OR "blood salvag*" OR autotransfus* OR autologous).ti,ab	8678176
35	PubMed	("vaginal birth*" OR "vaginal deliver*").ti,ab	2934
36	PubMed	("cell salvage").ti,ab	510
37	PubMed	("blood salvage").ti,ab	696
38	PubMed	(autotrans*).ti,ab	9235

39	PubMed	(autologous).ti,ab	110891
40	PubMed	(36 OR 37 OR 38 OR 39)	115124
41	PubMed	(35 AND 40)	3