

BLOOD SPARING IN OBSTETRICAL EMERGENCIES

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Introduction

In contrast to underdeveloped countries peripartur haemorrhage has steadily declined in western hemisphere but is still the leading cause of maternal and fetal morbidity and mortality. Peripartur haemorrhage occurred in approximately 6.7 per 1000 deliveries (1) and accounted for 17% of maternal deaths in the US between 1991 and 1999 (2). Among white women, the risk ratios for death from haemorrhage - but also infection, embolisms, hypertensive disorders of pregnancy, cardiomyopathy, cerebrovascular accidents, or other medical conditions ranged from 1.8 to 2.7 for those aged 35–39 years and from 2.5 to 7.9 for those 40 years and older. Among black women the risk ratios for death from these conditions ranged from 2.0 to 4.1 for those aged 35–39 years and from 4.3 to 7.6 for those 40 years and older (3). In another investigation a maternal age of > or = 35 years was also an independent risk factor for excess blood loss irrespective of the mode of delivery, even after adjusting for age-related complications such as leiomyoma, placenta previa, and low lying placenta (4).

Peripartur blood transfusion

The increased blood volume associated with normal pregnancy typically accommodates the obligatory blood loss that occurs during vaginal or cesarean delivery. However, in some patients blood loss may overwhelm compensatory mechanisms and may result in hypovolemia and shock with a significant threat for both the mother and the fetus.

Peripartur haemorrhage includes a wide variety of pathophysiologic events (abruptio placentae, placenta praevia and postpartur haemorrhage being the main causes) and despite advances in prevention, diagnosis and treatment massive blood loss during pregnancy remains still a threat. As a consequence, blood transfusions cannot be avoided under all circumstances. Thus it is not surprising, that the first successful transfusion of human blood was performed in a patient for the treatment of postpartur hemorrhage by James Blundell in 1818 (5). On the other hand, women who are Jehovah's Witnesses have been shown to be at a 44-fold higher risk of maternal death due to obstetric haemorrhage (6).

Under normal circumstances blood transfusion in obstetrics is a rare event. In 14,267 consecutive term deliveries without placenta previa red-cell transfusion was used in only 150 deliveries (1.1%). Altogether a total of 424 units was transfused (2.9 per 100 deliveries). Four risk factors were significantly ($p < 0.05$) predictive of peripartur red-cell transfusion: preeclampsia (adjusted odds ratio 3.69), multiple gestation (2.82), elective cesarean (1.71), and nulliparity (1.51). There was no association between transfusion and previous postpartur hemorrhage, previous cesarean with trial of labor, prior abortions, induction of labor, or ethnic group (7). Ransom et al found that out of 16,291 patients admitted for an expectant vaginal delivery, only 76 (0.47%) required blood transfusion during the time of their admission. Most of the blood transfusions were related to previously identified risk factors, including previous postpartur hemorrhage,

multiple pregnancies, previous cesarean delivery, abruptio placentae, and admission anemia (8). During or after their cesarean delivery out of 9596 women a total of 336 received RBC transfusions (9). The overall incidence of transfusion in this patient population declined from 6.2 to 3.2 percent during the study period (p less than 0.001). Slightly more than one-half (54.4%) of all transfusions were given in the operating room or recovery room. The majority of patients (68.4%) received 2 units of RBCs, 11.6 percent received a 1-unit transfusion, and 8.3 percent received 5 units or more. The most common obstetric diagnoses associated with RBC transfusion were disorders of placental implantation, preeclampsia, premature labor with tocolytic therapy, fetal distress, and augmentation of dysfunctional labor. In another evaluation out of 3,962 patients who also underwent cesarean section, 132 (3.3%) required a blood transfusion during their hospital stay. Since then the necessity of an admission type and screen for all women has been questioned because of the low transfusion frequency (8, 10).

Blood conservation methods in obstetrics

Predeposit of autologous blood (PDAB)

PDAB before elective surgery has been questioned in the last few years, because the use of PABD alone provides only a relatively small benefit and is not cost-effective (11). The original premise underlying PABD was that RBC volume would be removed before elective surgery, and sufficient time would elapse to allow the patient's marrow to reconstitute all or a significant portion of the donate. For many patients, however, donating autologous blood in the few weeks immediately before surgery, the only result is chronic hemodilution which may actually place patients at higher risk of leaving the hospital with a lower hematocrit than if they had not engaged in PDAB. To maximize the PDAB benefit, regenerative erythropoiesis must occur, and this may require a longer interval before surgery or the use of erythropoietin.

Although many trials of PDAB showed a reduction in the need for allogeneic blood the methodological quality of the published trials was poor and the overall transfusion rates (allogeneic and/or autologous) were high. In addition, the transfusions were increased by recruitment into the PDAB arms of the trials. This raises questions about the true benefit of PABD. Nowadays in the absence of large, high quality trials using clinical endpoints, it is impossible to say whether the benefits outweigh the harms of PABD (12). The percentage of PABD has also never approached the predicted 10% for either collection or transfusion. In fact, apparent interest in PABD peaked in 1992 (8.5% collected, 5.0% transfused) and has declined in recent years (4.7% collected, 3.0% transfused in 1999).

The donation of 1 unit of autologous blood in the 3rd trimester was well tolerated by both mother and fetus (13–15). However, in the light of even high-risk obstetric population and the difficulty of accurately predicting those likely to require transfusions antepartum, autologous blood donation may not be justified. For example in 251 women with traditionally accepted risk factors only four (1.6%) required transfusions (16). Among the 150 patients, who delivered by repeat cesarean section, only one (0.7%) required blood, one of 27 (3.7%) multiple gestations, two of eight (25%) patients with placenta previa; and none of the 66 grandmultiparous women had transfusions. In addition, 12 of these 13 women required more than one unit of red cells (92%). Combs et al calculated that a hypothetical antepartum blood donation program restricted to patients with three or more risk factors would cost \$32,800–130,700 per case to prevent

transfusion-related hepatitis and \$26,000,000–78,000,000 per case to prevent human immunodeficiency virus infection. They concluded that in obstetric patients without placenta previa, the need for peripartum red-cell transfusion cannot be predicted with sufficient accuracy to justify the costs of antepartum autologous blood donation (7).

Normovolemic hemodilution (NHD)

The net gain of NHD is small and dependent on preoperative hematocrit, the volume collected and the surgical blood loss. There exists only limited experience with NHD in obstetrics (7, 17). NHD is well tolerated in parturients, but may be only indicated in Jehovah's Witness patients with an expected high blood loss.

Intraoperative blood salvage

Except in emergency situations malignancy, bacterial infection, use of collagen or hemostatic material are contraindicated for the use of cell salvage (18–20). Another concern may be that amniotic fluid and fetal debris may not be adequately removed and transfusion may precipitate the anaphylactoid syndrome of pregnancy. With newer devices alpha-fetoprotein, phospholipids, tissue factor, fetal squamous cells and other cellular debris can be removed or can be at least significantly reduced (21). The salvaged blood product improved with the additional use of a leukocyte depletion filter after washing (20, 22). However, even after this procedure, washed blood is likely to contain fetal red blood cells. As a consequence, isoimmunization of the mother is possible, and anti-D immune globuline should be administered when appropriate. The use of autotransfusion by cell salvage with leucocyte depletion filtration should be limited to life-threatening obstetric haemorrhage and offered to Jehovah's Witnesses.

Conclusions

- Although life-threatening bleeding complications may still occur, the requirement for allogeneic red cell transfusions in obstetrics is rare and hardly predictable.
- Apart from the tolerance of low hematocrit values blood conservation methods like predonation of autologous blood or normovolemic hemodilution cannot be recommended for routine obstetric procedures.
- For emergency situations or in Jehovah Witness patients only blood salvage in combination with leukocyte reduction filters can be recommended.
- In case of coagulopathy combined with life threatening peripartal bleeding the application of recombinant factor VII may be a more direct approach to activating the coagulation system and may be a life saving strategy in some instances (23, 24).

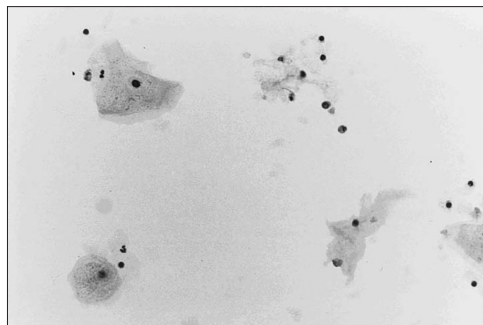


Figure 1: Squamous cells in a typical prewash sample are shown with numerous white blood cells. Red cells are visible but difficult to differentiate from the other contaminants (Papanicolaou stain) (20).

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