

Failure to Rescue the Mother

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The Case

A 27-year-old woman, G5 P2 A2, was first admitted to the hospital at 25 weeks of pregnancy for vaginal bleeding. An ultrasound showed an anterior placenta, low lying and covering the cervix. She received 4 units of packed red blood cells and 2 doses of iron injections, and she was discharged after 3 days with an improved hemoglobin level.

The patient continued to have regular visits to her obstetrics clinic for monitoring. At 32 weeks, she was readmitted for vaginal bleeding, received 1 unit of packed red blood cells, and was then discharged. An ultrasound at 34 weeks revealed a central placenta previa covering the internal os and evidence of placenta percreta, with part of the placenta growing into the uterine wall. The scan results were discussed by the patient's obstetrician, the obstetrics and gynecology department chief, and a urologist, and they recommended that the delivery be done by elective lower segment cesarean delivery with possible hysterectomy.

At 35 weeks, the patient was admitted for the elective cesarean delivery. Intraoperatively, placenta previa and percreta were confirmed, an upper uterine segment incision was made, and the newborn was delivered in good condition. Immediately after, a subtotal hysterectomy was performed, during which the urologist dissected the bladder so that the cervix could be removed with a vaginal cuff. The anesthesiologist then noted that the patient was hypotensive; blood was transfused. A rash developed surrounding the transfusion site and then widespread ecchymosis appeared as the patient became more unstable. The physicians attempted to stabilize the patient with fluids and medications. Cardiopulmonary resuscitation was performed for 60 minutes, but the patient died.

Root cause analysis of the case revealed several crucial missed steps in preparing for this procedure, including failure to order a complete blood count on admission, failure to ensure blood availability for the surgery, lack of knowledge by the anesthesiologist of the patient's history of bleeding and prior transfusions, slow response to the patient's deteriorating condition, and failure to detect the early signs of a potential transfusion reaction.

The Commentary

by Melissa S. Wong, MD; Angelica Vivero, MD; Ellen B. Klapper, MD; and Kimberly D. Gregory, MD, MPH

The United States spends more than any other country on hospital-based maternity care. Despite declines in the global maternal mortality rate, the maternal mortality rate in the US has continued to steadily increase: from 7.2 deaths per 100,000 live births in 1987 to 18 deaths per 100,000 live births in 2014.⁽¹⁾ Although some common causes such as hypertension and infection have decreased in frequency, deaths due to postpartum hemorrhage (PPH) remain stubbornly unchanged, accounting for 11.4% of pregnancy-related mortality.⁽²⁾ Significant racial disparities persist as well; black women experience pregnancy-related deaths at nearly four times the rate of white women.⁽²⁾

Several organizations, including the California Maternal Quality Care Collaborative (CMQCC) ⁽³⁾ and the National Partnership for Maternal Safety (NPMS), have published guidelines on the recognition and management of PPH ([Figure](#) and [Table](#)).⁽⁴⁾ Similarly, national obstetrics and gynecology subspecialty societies have collaborated on a consensus guideline for diagnosis and treatment of placenta accreta spectrum (PAS) disorders, an increasingly significant cause of cesarean and hemorrhage-related mortality.⁽³⁻⁶⁾ However, despite all the above guidance, errors in the management of obstetric hemorrhage persist. A recently published study found that 70% of pregnancy-related deaths from hemorrhage were preventable.^(7,8)

The case above demonstrates several opportunities to impact care and potentially prevent obstetric hemorrhage, including identifying risk for hemorrhage early on, adequate preparation for possible transfusion, and unit-based protocols in the event of transfusion-related complications. This patient had a known placenta previa since at least 25 weeks, and while a percreta was eventually diagnosed, it was not recognized until 9 weeks later. Additionally, the need for 5 units of blood during the antepartum period is uncommon, which should have raised suspicion that this might be a particularly complicated surgical case. Per the NPMS guidelines, transfer to a tertiary center should be considered for women at the highest risk for hemorrhage.⁽⁴⁾ Tertiary centers are more likely to have skilled surgeons readily available, 24-hour access to an active, high-acuity, and well-stocked blood bank, and unit protocols to manage these patients. In this case, no accreta-specific preparations appear to have been made. Specifically, despite receiving 5 units of blood during the antepartum period, the preoperative hemoglobin value was not optimized as per guidelines.⁽⁵⁾ It is not clear when the patient's last hemoglobin was checked prior to her planned surgery or that any additional oral or IV iron therapy was given in the weeks leading up to her surgery.

Several details regarding the timing of delivery in this case are worth discussing. After the patient developed a second bleed requiring transfusion at 32 weeks, it would have been prudent to reevaluate whether continuing the pregnancy rather than proceeding with delivery remained in the best interest of mother and fetus. While decision analyses have found that placenta accreta is best delivered at 34 weeks gestation in asymptomatic patients, this recommendation does not take into account the mother with ongoing bleeding.⁽⁹⁾

It is unclear from the case description if the decision regarding the location of the uterine incision was made preoperatively. The PAS guidelines recommend that hysterotomy should avoid the placenta site if possible; in the setting of anterior previa, this condition often requires making a vertical or fundal uterine incision.⁽⁵⁾ Ultimately a vertical hysterotomy was performed; whether this delayed care or contributed to additional hemorrhage in this patient is unclear. In addition, intraoperative resources to reduce blood loss such as a cell salvage technique could have been employed. Historical concerns for the possibility of amniotic fluid embolism with the use of cell salvage therapy during cesarean delivery were based primarily on theory and recently made moot with advanced filtration techniques.⁽¹⁰⁾ The PAS guidelines regarding other potential preoperative interventions (including ureteral stents and iliac balloon placement by interventional radiology) should be considered on a case-by-case basis.

This patient ultimately did develop a hemorrhage. During obstetrical hemorrhage, the primary goals are to provide adequate blood product replacement and to either prevent or correct disseminated intravascular coagulation.⁽⁴⁾ Implementing a standardized massive hemorrhage protocol with an optimal ratio of red blood cells (RBCs), plasma, and platelets is essential to avoid coagulopathy. Standardized ratios vary (6:4:1 vs 4:4:1), but should be consistent throughout the hospital.⁽⁴⁾ In emergent situations, it may be necessary to use uncrossmatched O Rh-negative blood.⁽⁴⁾ Once the massive hemorrhage protocol is initiated, communication and coordination between the obstetrical team and the blood bank management team is vital for having appropriate blood products ongoing and readily available.

Further complicating this patient's hemorrhage is her history of having received multiple blood transfusions during pregnancy. Both pregnancy itself and antepartum exposure to blood increase the risk of RBC alloimmunization.⁽¹¹⁾ Routine prenatal care should include screening for the detection of antibodies to minor red cell antigens that can cause hemolytic disease of the newborn, and upon admission for an anticipated vaginal or cesarean delivery, a repeat blood type and antibody screen should be obtained.⁽¹²⁾ Complete blood count prior to delivery in a patient with history of antepartum bleeding is recommended.

Blood transfusion can lead to various acute or delayed transfusion reactions. The patient in this case received several units of packed RBCs during the antepartum period and at the time of delivery. During the latter episode, she developed signs suggestive of a transfusion reaction, which may represent an acute hemolytic transfusion reaction, and possibly the development of disseminated intravascular coagulation.

Acute hemolytic transfusion reactions are caused by transfusion of ABO incompatible blood either as the result of a clerical/identification error, or due to the presence of certain antibodies to minor red cell antigens. If an acute hemolytic transfusion reaction is suspected, the transfusion should be stopped, with IV access maintained.⁽¹³⁾ The blood bank should be contacted immediately to initiate a transfusion reaction workup. In the interim, options for emergent transfusion include selection of another unit of O-negative blood to account for the unlikely possibility of a mislabeled unit, provision of crossmatch compatible blood, or provision of antigen-matched blood for minor red cell antigens to account for the possible presence of previously formed red cell antibodies. Both crossmatching and antigen-matching will delay the availability of blood, which underscores the critical importance of preoperative antibody identification.

Finally, this patient had several individual risk factors (previous transfusions, continued bleeding, and suspected PAS disorder) as well as her planned surgery, all of which—individually and collectively—placed

her into the highest risk CMQCC category for developing a hemorrhage and potentially requiring a blood transfusion. In these women, a type-specific crossmatch of at least 2–6 units packed RBCs is strongly recommended in advance of surgery, in addition to having uncrossmatched blood available.

Take-Home Points

- Obstetric hemorrhage remains a common event and the most preventable cause of maternal mortality in the United States and worldwide.
- Prefilled, prelabeled syringes from the manufacturer or pharmacy can reduce perioperative errors.
- Where possible, patients with placenta accreta spectrum disorder should be cared for in tertiary care centers with skilled surgical teams and well-resourced blood banks.
- Preparation for an obstetric hemorrhage requires identification of high-risk patients, unit protocols, training for staff, and systems and teams in place in the event of need for massive transfusions. Standardized hospital-specific protocols for massive transfusion should include packed red blood cells, plasma, and platelets in the appropriate ratio.
- All patients should undergo repeat type and screen on admission—particularly women who have had transfusions during pregnancy. If a transfusion reaction is suspected, the blood unit being transfused should be immediately stopped, the blood bank notified, and resuscitation continued as described above.

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Figure

Figure. National Partnership for Maternal Safety Obstetric Hemorrhage Safety Bundle.[\(4\)](#)



READINESS

Every unit

- Hemorrhage cart with supplies, checklist, and instruction cards for intrauterine balloons and compressions stitches
- Immediate access to hemorrhage medications (kit or equivalent)
- Establish a response team - who to call when help is needed (blood bank, advanced gynecologic surgery, other support and tertiary services)
- Establish massive and emergency release transfusion protocols (type-O negative/uncrossmatched)
- Unit education on protocols, unit-based drills (with post-drill debriefs)

RECOGNITION & PREVENTION

Every patient

- Assessment of hemorrhage risk (prenatal, on admission, and at other appropriate times)
- Measurement of cumulative blood loss (formal, as quantitative as possible)
- Active management of the 3rd stage of labor (department-wide protocol)

RESPONSE

Every hemorrhage

- Unit-standard, stage-based, obstetric hemorrhage emergency management plan with checklists
- Support program for patients, families, and staff for all significant hemorrhages

REPORTING/SYSTEMS LEARNING

Every unit

- Establish a culture of huddles for high risk patients and post-event debriefs to identify successes and opportunities
- Multidisciplinary review of serious hemorrhages for systems issues
- Monitor outcomes and process metrics in perinatal quality improvement (QI) committee

Click on thumbnail for full view of Figure.

Table

Table. Opportunities for Improvement in Obstetric Hemorrhage Management With Reference to the National Partnership for Maternal Safety Obstetric Hemorrhage Safety Bundle.⁽⁴⁾

Event	Opportunity	NPMS Bundle Category
Anterior placenta previa is noted, but percreta is missed.	<ul style="list-style-type: none"> • Earlier identification of percreta by skilled sonographers or MRI. 	Recognition and Prevention
Transfusion of 5 units of blood in the antepartum period.	<ul style="list-style-type: none"> • Antibody screen could have been obtained in days prior to her surgery so that crossmatched blood could be available on the day of surgery. 	Recognition and Prevention
Patient had multiple risk factors for a significant hemorrhage; it is unclear if there was a huddle beyond the obstetricians and urologist.	<ul style="list-style-type: none"> • A culture of huddles and debriefs encourages a culture of safety and improves situational awareness, particularly in anticipation of potentially highly emergent and critical events. 	Reporting and Systems
<ul style="list-style-type: none"> • No CBC was obtained on admission. • A lower segment hysterotomy was considered. 	<ul style="list-style-type: none"> • A standardized system should be in place to ensure that CBCs are routinely obtained for high-risk patients. • The NPMS recommends avoiding the placenta at hysterotomy. • A stage-based emergency management plan should be implemented in the case of hemorrhage. 	Recognition and Prevention Response
<ul style="list-style-type: none"> • Inadequate blood products were available. • Potentially delayed recognition of transfusion reaction and inadequate resuscitation. 	<ul style="list-style-type: none"> • Ready access and availability of O negative uncrossed match blood at the unit level, which also should have been confirmed before the start of the case. Periodic unit education is critical as are regular drills to ensure all team members are prepared for these frequent occurrences. • Providers should be aware of the signs of a transfusion reaction and have an institutional protocol for the next steps when one occurs. 	Recognition and Prevention Readiness

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