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Obstetrical Hemorrhage: Clinical Updates, and the Need for Quantification of Blood Loss

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Abstract

Postpartum Hemorrhage (PPH) is preventable with an accurate assessment of blood loss from the use of quantification of blood loss. A standardized method to quantify blood loss provided in this review will allow providers to implement this at their institution. Quantification of Blood Loss (QBL) will allow for timely diagnosis of PPH and improve response time to administer medications, blood products and manage the cause of hemorrhage. Using maternal early warning signs and correlating this with the stages of hemorrhagic shock will prompt more timely activation of Massive Transfusion Protocol (MTP).

Keywords: Postpartum hemorrhage; Quantification of blood loss; Obstetrical hemorrhage

Abbreviations:

PPH: Postpartum Hemorrhage; QBL: Quantification of Blood Loss; MTP: Massive Transfusion Protocol; DIC: Disseminated Intravascular Coagulation; EBL: Estimation of Blood Loss; PRBC: Packed Red Blood Cells

Introduction

As one of the top 5 causes of maternal mortality, PPH is an obstetrical emergency that can be anticipated and rapidly managed to prevent severe maternal morbidity and mortality. Early or primary PPH occurs within the first 24 hours after delivery; Delayed, or secondary PPH occurs after 24 hours to 12 weeks after delivery. Worldwide, there are many different definitions of PPH; traditionally it has been defined as blood loss greater than 500 mL after vaginal delivery or greater than 1,000 mL after cesarean delivery.

The American College of Obstetricians and Gynecologists revised their definition (revitalize) to a cumulative blood loss of greater than or equal to 1,000 mL or bleeding associated with

signs and symptoms of hypovolemia within 24 hours after birth (vaginal or cesarean delivery) in 2017 [1]. The cumulative blood loss of 500-999 mL alone should trigger increased supervision and potential interventions as clinically indicated. The United States Inpatient Sample reports about 2%-3% of all deliveries are complicated by PPH, and of these, 76.6% were attributed to uterine atony [2].

Etiologies of early Postpartum Hemorrhage (PPH)

The "4 Ts"-is a common mnemonic used to help determine etiology of early PPH.

Tone: Uterine atony is the main cause, with ineffective uterine contractility after delivery of the placenta. Uterine atony may mask severe bleeding as there may be a large amount of formed clots retained that must be evacuated. Placental disorders such as placenta previa, placenta accreta, and placenta abruption cause hemorrhage as they inhibit effective uterine contraction and allow for bleeding.

Tissue: Retained tissue, placenta, trailing membranes and blood clots, or succenturiate lobe of the placenta may be causes of hemorrhage as it does not allow effective uterine contraction.

Trauma: Laceration, uterine rupture (and/or uterine inversion). For Vaginal delivery, consider vaginal, cervical or uterine lacerations as causes of hemorrhage from trauma. For Cesarean delivery, consider occult bleeding from retracted lacerated uterine artery-results in retroperitoneal hematoma and expansion, bleeding from uterine hysterotomy site, rectus hematoma. One may consider a Focused Assessment with Sonography in Trauma (FAST) scan to determine this etiology of bleeding.

Thrombin: Coagulopathy, Disseminated Intravascular Coagulation (DIC) may be from inherited or acquired bleeding diathesis or from the reduction of clotting factors during massive hemorrhages. Acute coagulopathies may be from placental abruption, fetal demise, preeclampsia/HELLP syndrome or amniotic fluid embolism.

Stages of hemorrhage

Allow for assessment of severity of bleeding-often a strategic plan of action through the use of checklist may be used along with these stages to help provider initiate timely interventions. Up to 25% of a woman's blood volume is lost 1,500 mL before blood pressure decreases and heart rate increases, emphasizing clinical diligence and monitoring is essential to successfully treat PPH [3].

- **Stage 1**-Normal vital signs and laboratory values:

Blood loss >1,000 mL at delivery.

- **Stage 2**-Normal vital signs and laboratory values:

Continued bleeding up to 1,500 mL or any patient requiring two or more uterotonics.

- **Stage 3**-Abnormal vital signs, laboratory values. Oliguria:

Continued bleeding with Estimation of Blood Loss (EBL) greater than 1500 mL OR two or more units of Packed Red Blood Cells (PRBC) given, OR patient is at risk for occult bleeding (post-cesarean) and DIC.

- **Stage 4**-Cardiovascular Collapse:

Patients with cardiovascular collapse related to massive hemorrhage, severe hypovolemic shock, or amniotic fluid embolism.

Laboratory studies

As early PPH is often acute clinical presentation, hemoglobin and hematocrit values are very poor indicators to measure acute blood loss since the values may not decline immediately. This is why clinical suspicion, assessment of cumulative blood loss, attention to vital signs and using quantification of blood loss allow the provider to paint a more accurate clinical picture. However, a low fibrinogen level (less than 200 mg/dL) is an excellent predictor of severe PPH where the patient may need large order blood transfusion via MTP, need for surgical management of hemorrhage or may result in maternal death [4].

Fibrinogen decreased much earlier than other coagulation factors in the setting of PPH-because the loss of fibrinogen through bleeding increased fibrinolytic activity and hemodilution of clotting factor [5]. Fibrinogen becomes a very sensitive and clinically relevant indicator or ongoing major blood loss [6].

Hemorrhage safety bundles

Multiple variations of these bundles exist, from California Maternal Quality Care Collaborative (CMQCCC), Council on Patient Safety in Women's Health Care are some references that can be used. These bundles all seek to reinforce the following:

- **Readiness**-having hemorrhage carts with supplies such as Bakri Balloon, hemorrhage kits that allow rapid access and administration of medications, amongst a team "Ob rapid response" to quickly control hemorrhage situations in a hospital that has established MTPs

- **Recognition**-Admission, Intrapartum and postpartum assessment of hemorrhage risk, the use of cumulative blood loss (final total blood loss after a PPH) with active management of oxytocin at placental delivery
- **Response**-Allows support of staff, patient and health care team to implement a standardized PPH Emergency Checklist to be deployed as soon as PPH is recognized
- **Reporting/Systems Learning**-Just culture environment that allows reporting of such events to be non-judgmental, allow for a plan of management huddles and after event debriefings

Maternal early warning criteria

This criterion [7] is used to identify maternal patients who require urgent bedside evaluation by a provider using "...a set of predetermined 'calling criteria' (based on the periodic charting of vital signs) as indicators of the need to escalate monitoring or call for assistance..." [8] are identified (Table 1).

Table 1: Maternal early warning criteria.

Systolic BP (mmHg)	<90 or >160
Diastolic BP (mmHg)	>100
Heart rate (beats per min)	<50 or >120
Respiratory rate (breaths per min)	<10 or >30
Oxygen saturation (%room air, sea level)	<95
Oliguria (mL/hr for 2 hours)	<35

The elevated Systolic (>160 mmHg) and Diastolic (>100 mmHg) is for consideration of severe hypertensive disorders, the remainder of the vital signs will trigger the prompt evaluation of the patient by a provider [9]. This early warning system will help with timely recognition, diagnosis, and treatment for women developing critical illness to allow physicians to escalate care for timely interventions (Table 2).

Initial management

- Supportive care, call for additional help and resources
- Available resources may include hemorrhage cart, PPH medication kits
- Vitals, Oxygen, Empty bladder, bimanual fundal massage, evaluate etiology using the 4 T's
- Ensure intravenous access, increase fluids and administer oxytocin
- Crossmatch PRBC

Based on the Etiology of the bleeding:

- Medical therapy
- Manual compression
- Tamponade with Bakri Balloon
- Pelvic pressure pack
- Surgical management (based on etiology)

MTP and recommendations for resuscitation

While providers are recognizing and treating the cause of massive bleeding, often the use of blood products is required to provide adequate resuscitation. Not only is timely and rapid depletion of red blood cells critical, but there also needs to be

immediate recognition and reversal of associated coagulopathy. Activation of an MTP is a mechanism where the blood bank is able to ensure rapid and timely availability of blood components.

Table 2: Medication management.

Medications	Dose	Contraindications
Oxytocin (Pitocin)	10-40 units in 500-1000 cc NS or LR IV via rapid infusion	-
Methylergonovine (Methergine)	0.2 mg IM-or-into myometrium Q 2-4 hours	Hypertension, preeclampsia, cardiovascular disease
15-methyl PGF2 alpha (Hemabate)	0.25 mg IM-or-into myometrium Q 15 minutes (up to 8 doses)	Asthma. Relative contraindication for hypertension, active hepatic, pulmonary or cardiac disease
Misoprostol (Cytotec, PGE-1)	600 µg-1000 µg oral, per rectum -or- sublingual × 1 dose	Known hypersensitivity to NSAIDs, active GI bleeding
Tranexamic Acid (TXA)	1 gram IV over 10 minutes (add 1 gram vial to 100 mL NS) Q 30 minutes until bleeding controlled	Active intravascular clotting, hypersensitivity to TXA

While management of hemorrhage is essential to control blood loss, limit thrombocytopenia and limit consumptive coagulopathy and maintaining the blood pressure from severe hypotension (systolic blood pressure 80-100 mmHg) is critical for optimizing patient outcomes. Early utilization of 1:1:1 ratio of major components (PRBC, Plasma, Platelets) is increasingly recommended, adopted from trauma literature [10]. Some recommendations are to keep Fibrinogen levels above 150 mg/dL through the use of cryoprecipitate which must be thawed by the blood bank and is often only included with the second “run” of products.

One must remember that standard coagulation panel (PT, PTT, INR, platelet count, and fibrinogen) required a minimum of 30 minutes for results. Massive transfusion of products and results of these tests may not accurately reflect the current coagulation function. Finally, there must be considerate to correct electrolyte imbalances, such as hyperkalemia from PRBC, hypocalcemia from citrated anticoagulants and Na and Cl abnormalities from the administration of large volume crystalloids.

Quantification of blood loss (QBL)

Visual EBL consistently results in an underestimation of blood loss, especially for large volumes greater than 1000 ml [11,12] and with smaller volumes EBL resulted in overestimations compared to direct measurement [13]. By relying on visual EBL, the provider is falsely reassured and not diagnosis PPH as readily, leading to delayed recognition, delayed treatment, and poorer patient outcome.

QBL is an objective method to evaluate blood loss and methods to quantify blood loss such as weighing are more accurate than EBL. Implementation of QBL allows the health care team to recognize hemorrhage earlier [14] and reduces the likelihood that the provider will underestimate the blood volume lost, prompting earlier recognition and treatment (Figure 1).

Quantification of Blood Loss Form
SAMPLE (Your Institution Name)

Vaginal Delivery/PPH

Date: _____ [Affix patient Label Here]

QBL in Delivery/Postpartum Hemorrhage			
Weight of all sops (wet), holders, and additional blood loss.			
Total Weight	A		g
Graduated Drape	B		g
total drape subtract (-) amniotic fluid			
PREWEIGHT			
Item	#	Item Dry Weight	=
RIF Gauze	X 5 g	=	g
Blue Chux	X 25 g	=	g
Large Chux	X 100 g	=	g
Green Towel	X 65 g	=	g
Maternity Pad	X 10 g	=	g
White Towel	X 180 g	=	g
ADD ALL TOTAL pre-weight (dry)			C
			g
A + B			g
MINUS C			g
TOTAL QBL			= mL

1ml=1cc

Figure 1: Quantification of blood loss form.

Suggested methods to allow quantification of blood loss:

- Pre-weight commonly used dry weight items during delivery. (see section C, above)
- QBL starts after the birth of the infant, but before delivery of the placenta. The provider must “call out” the amount of recorded amniotic fluid either in the graduated vaginal drape (for NSVD) or suction amniotic fluid (for CD). One can “tie-in” fluid assessment with delayed-cord clamping if this is practiced at your institution

- Record total volume of fluid collected (under-buttock drape, or suction canister) once delivery is completed
- Subtract total volume of fluid from the amniotic fluid volume to calculated blood volume. (See section B)
- Weigh all blood-soaked materials and clots to determine the cumulative volume (see section A, above) and count the total number of those materials
- Subtract the pre-dry weight from the total blood-soaked material to calculate blood from these materials (A minus C) and finally, add B

WET item gram weight-DRY item gram weight=Milliliters of blood within the item:

- For Cesarean Deliveries, Standardize to only one Liter NS used for irrigation and moist laps on the surgical field. At the conclusion of the case, look to see how much NS is left in the basin. 1000 mL minus what is remaining in the basin is what you will subtract from final QBL to remove the NS used during surgery

Summary

Using QBL and providing a means for implementation of QBL will allow the health care team to have a more accurate method of calculating blood loss during delivery, especially useful in the setting of PPH. QBL along with the use of MEWS criteria and understandings the stages of PPH in relationship to signs and symptoms of hemorrhagic shock will accurately direct the health care team to manage hemorrhage situations more appropriately and timely. This will, in turn, decrease maternal morbidity and mortality from obstetrical hemorrhage.

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