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Obstetric Hemorrhage Current Management and Usefulness of Protocols, Checklist, Drills

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Abstract Obstetrical hemorrhage continues to be an important contributor to maternal morbidity and mortality in the USA. Although preventable, it is still the 5th leading cause of maternal death, often due to factors associated with a delay in recognition by providers and/or delay in treatment. We cannot overlook the fact that for every maternal death due to hemorrhage, there are at least 100 women who suffer severe morbidity. It is known that implementing hemorrhage-specific protocols can improve outcomes related to this condition. This review will update readers in early detection and preparation, diagnosis, and treatment of obstetric hemorrhage while highlighting the different institution-specific protocols, cognitive aids, and drills.

Keywords Obstetrical hemorrhage protocols · Risk assessment · Hemorrhage stages

Introduction

Obstetric hemorrhage is one of the leading causes of maternal mortality and severe morbidity worldwide, including within the USA. Most reviews of maternal deaths from hemorrhage conclude that the majority of such cases are preventable [1–4]. The most recent statistics from the US Centers for Disease Control and Prevention (CDC) indicate that US pregnancy-related mortality rates were 17.8 and 15.9 deaths per 100,000 live births in 2011 and 2012, respectively. Maternal hemorrhage accounts for 11.3 % of the maternal deaths [5] and for almost half of all cases of severe morbidity in pregnancy [6]. Variations in definition, prevention, and treatment frequently make the successful management of obstetric hemorrhage an elusive target leading to unnecessary loss of lives or severe morbidity. According to the California Maternal Quality Care Collaborative (CMQCC), human factors should be considered even before any discussion of prevention, preparation, diagnosis, and treatment. They cite such factors as denial, delay, underestimation of blood loss, underutilization of non-pharmacologic approaches, poor utilization of blood products, and inadequate communication as barriers to optimizing outcomes. Several literary reports have demonstrated that the introduction of standardized management protocols can be successful in optimizing the timely and clinically appropriate response to obstetrical hemorrhage [7].

This review will update readers with respect to early detection and preparation, diagnosis, and treatment of obstetric hemorrhage while highlighting the use of different institution-specific protocols, cognitive aids, and drills. As protocols designed to deal with obstetrical emergencies are developed on the tenets of recognition, readiness, response, and reviews, we hope to familiarize readers with the components of these sections in building a similar protocol for obstetrical hemorrhage in their own institution.

The protocols available through the large perinatal safety collaborates—including CMQCC and the New York State Safe Motherhood Initiative (NYS SMI)—provide the template upon which an individual institution can build its own

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protocols according to its capability [7]. A thorough and honest assessment of each unit's capabilities from equipment to personnel to communication is essential, and the importance of this first step cannot be overstated.

The American Congress of Obstetricians and Gynecologists (ACOG) Patient Safety and Quality Improvement Committee believes that all obstetric services should have a written obstetric hemorrhage protocol in order to ensure the highest quality of patient care [9].

Definition, Etiology, and Risk Factors

A frequently used definition of obstetric hemorrhage is an estimated blood loss of >500 mL after vaginal delivery and 1000 mL or greater after a cesarean delivery. However, ACOG has recently published a revised definition of early postpartum hemorrhage (PPH), which is the cumulative blood loss of 1000 mL or greater or blood loss accompanied by signs/symptoms of hypovolemia within 24 h following the birth process [8]. This revised definition will help in cases where the extent of cumulative blood loss is not well appreciated.

Primary PPH is defined as occurring within the first 24 h of delivery and secondary PPH as hemorrhage occurring between 24 h and 6–12 weeks postpartum. Primary PPH, which occurs in 4–6 % of pregnancies, is caused by uterine atony in 80 % or more of cases [9]. Secondary PPH is less common than primary PPH and affects 1–3 % of deliveries. It results most commonly from subinvolution of placental site, infection, pre-existing coagulopathy, and/or retained products of conception [9].

One convenient way to organize thinking about the classification of obstetric hemorrhage is according to time of occurrence (i.e., antepartum, intrapartum, primary postpartum, or secondary postpartum hemorrhage), with uterine atony being the most frequent cause of severe hemorrhage during the immediate postpartum period. Although numerous risk factors for excessive bleeding have been identified, at least 40 % of women who bleed enough at delivery to require a blood transfusion will not have any identifiable risk factors at the time of admission [10]. This is one of the reasons why every obstetrical unit should have a plan of readiness to respond to peripartum hemorrhage.

When Should Risk Assessment for Hemorrhage Take Place?

Risk assessment for peripartum hemorrhage should occur early in the antenatal period, at the time of admission for delivery, periodically throughout labor and in the immediate postpartum period. The purpose of risk evaluation is to plan for effective interventions should the risk materialize. The benefits of antenatal risk assessment include the opportunity to correct maternal anemia if discovered early in pregnancy, to order imaging tests in patients in whom placenta previa or a morbidly adherent placenta is suspected, and to adequately prepare for patients who are chronically anticoagulated or are refusing blood products.

Antenatal Risk Factor Assessment

Risk assessment at the time of admission for delivery will help identify patients who need a blood specimen typed and screened and may trigger the need for a huddle with members of the hemorrhage response team. Examples of such conditions include grand multiparity, multiple gestations, prior PPH, bleeding on admission, or prior uterine scar. A subsequent risk assessment several hours after admission offers the opportunity to identify situations that may further increase the likelihood of peripartum hemorrhage, such as the use of oxytocin in labor, magnesium sulfate (with or without hypertension), chorioamnionitis, or a prolonged second stage of labor. Convenient risk stratification by the NYS SMI includes screening all patients on admission for hemorrhage risk and categorizing them as low, medium, or high risk [11].

Medium-risk factors include, but are not limited to, prior cesarean delivery, uterine surgery or multiple laparotomies, multiple gestation, more than four prior births, prior obstetric hemorrhage, large leiomyomas, estimated fetal weight more than 4000 g, and morbid obesity (BMI >40 kg/m^2). A hematocrit <30 % would also place a patient in the medium-risk category.

High-risk factors include placenta previa, low-lying placenta, suspected accreta or percreta, platelet count <70,000/μL, active bleeding, and known coagulopathy. The presence of two or more medium-risk factors would also put a patient in the high-risk category. Despite thrombocytopenia being a high-risk factor, the absolute cutoff for serious concern varies between protocols: CMQCC uses a platelet count of <100,000/μL, whereas NY SMI uses <70,000/μL.

A reminder about the active management of the 3rd stage of labor can be included at this junction of risk assessment as it is a universal recommendation. It consists in the administration of oxytocin IV or IM immediately after the delivery of the baby, accompanied by uterine fundal massage. [12] This does not interfere with the practice of delayed cord clamping for preemies.

Recognition: Overt and Occult Blood Loss; Interpretation of Hemodynamic Parameters

A delay in recognition will lead to a delay in response. Recognition is often clouded by the team's inability to accurately estimate blood loss. In most settings, clinicians still use a qualitative assessment of estimated blood loss, which typically underestimates actual blood loss [13]. Efforts to train clinicians to accurately estimate blood loss with the use of visual prompts have yielded disappointing results. The proficiency demonstrated in simulation settings is generally lost or diminished when subjects are tested several months later [14]. Thus, the ideal solution would be for obstetrical units to move toward a quantitative blood loss (QBL) assessment. Using calibrated underdrapes coupled with counting and weighing laps and chucks, the wet weight in grams would correspond to milliliters of fluid/blood in the lap pads [15••].

Particularly challenging situations occur when intermittent or slower but persistent bleeding has taken place. Under such situations, clinicians may not recognize the blood loss as significant until the patient decompensates. Training the team to record and report blood loss in a cumulative manner will permit timely recognition of excessive bleeding and provide an opportunity to tailor the intervention. A less frequent but no less perilous situation is this of occult subfascial, intra-abdominal, or posterior peritoneal bleeding after a cesarean section or operative vaginal delivery. Such patients typically present with an inexplicable drop in hematocrit or abnormal hemodynamic signs within the first 12–24 h postpartum. Fleisher and Merowitz have elegantly described such clinical scenarios, and an attached pertinent algorithm to help clinicians walk through such cases can be reviewed [16••].

In addition to reviewing the standard components of an obstetric hemorrhage protocol, Fleischer et al provided a clear description of pathophysiologic changes that result from volume depletion and blood loss, strengthening our understanding on tailoring patient management [16••].

Physical Exam and Vital Sign Interpretation-Response to Hypovolemia

Beyond the obstacles described above, the recognition of obstetric hemorrhage can be confounded by the normal anatomic and physiologic changes of pregnancy and the protective compensatory mechanisms in response to blood loss. The normal movement of organs plus the expected peritoneal stretching can make the physical exam of the abdomen a challenge to even the most seasoned surgeons and emergency physicians. Physiologically, pregnancy is a high-flow low-resistance state that is somewhat akin to compensated shock or early-stage hypovolemic shock. Blood pressure reaches its nadir in the second trimester while normalizing at term. At the same time, there is an increase in blood volume which allows pregnant women to lose up to 35 % of blood volume before showing signs of shock [17].

The hemodynamic parameters that we rely upon such as blood pressure and pulse rate, despite having a good positive predictive value, have a rather poor negative predictive value for ruling out significant blood loss. A drop in systolic blood pressure often appears in later stages, which can mask the severity of the situation for clinicians relying on clinical signs as determinant for significant blood loss. In the initial phase of blood loss, cardiac output can be maintained by an increase in heart rate, thus maintaining blood pressure at a normal baseline level. With continued bleeding, the blood pressures can remain near normal as systemic vascular resistance rises.

$$\begin{aligned}\text{Blood pressure}\\ &= \text{cardiac output (stroke volume} \times \text{heart rate)}\\ &\quad \times \text{systemic vascular resistance}\end{aligned}$$

Therefore, physiological compensatory mechanisms can conceal the actual degree of volume depletion leading to a false sense of reassurance on the part of clinicians who may be relying on abnormal vital signs to determine volume and blood replacement.

Adopting a method for the quantification of blood loss and understanding the meaning of hemodynamic parameters in the puerperium will sharpen the team's clinical acumen and may lead to earlier recognition and timely intervention. This in turn may decrease the downspiraling effects of unanticipated obstetric hemorrhage.

Intervention/Treatment

Staging Hemorrhage

This system was designed to encourage a consistent approach to the evaluation and treatment of a bleeding patient. Though pioneered by the CMQCC in the USA, it has been modified by other quality collaboratives around the country. ACOG's NYS SMI added a stage 4 to characterize situations when patients manifest cardiovascular collapse and need simultaneous aggressive resuscitation and surgical management as a life-saving intervention [18]. This organization has also simplified the document describing the various stages to facilitate its use during emergencies (Table 1 Checklist of SMI staging). Stages 0–3 describe situations of progressively increasing quantities of blood loss, requiring increasing numbers of uterotonic agents and progressively aggressive resuscitative measures. Commensurate with recognition of clinical severity comes the mobilization of various members of the hemorrhage team as one moves from stage 1 to stage 3 as illustrated in Table 2 (CMQCC Hemorrhage management protocol).

Table 1 Obstetrics hemorrhage checklist

EXAMPLE

Obstetric Hemorrhage Checklist

Complete all steps in prior stages plus current stage regardless of stage in which the patient presents.

RECOGNITION:

☐ Call for assistance (Obstetric Hemorrhage Team)

Designate: ☐ Team leader ______________ ☐ Checklist reader/recorder ☐ Primary RN

Announce: ☐ Cumulative blood loss ☐ Vital signs ____________________ ☐ Determine stage

STAGE 1: BLOOD LOSS > 500 mL vaginal OR blood loss > 1000 mL cesarean with normal vital signs and lab values

INITIAL STEPS:

☐ Ensure 16G or 18G IV Access
☐ Increase IV fluid (crystalloid without oxytocin)
☐ Insert indwelling urinary catheter
☐ Fundal massage

MEDICATIONS:

☐ Increase oxytocin, additional uterotonics

BLOOD BANK:

☐ Type and Crossmatch 2 units RBCs

ACTION:

☐ Determine etiology and treat
☐ Prepare OR, if clinically indicated (optimize visualization/examination)

Oxytocin (Pitocin):
10-40 units per 500-1000mL solution

Methylergonovine (Methergine):
0.2 milligrams IM

15-methyl PGF$_2$α (Hemabate, Carboprost):
250 micrograms IM
(may repeat in q15 minutes, maximum 8 doses)

Misoprostol (Cytotec):
800-1000 micrograms PR
600 micrograms PO or 800 micrograms SL

Tone (i.e., atony)
Trauma (i.e., laceration)
Tissue (i.e., retained products)
Thrombin (i.e., coagulation dysfunction)

STAGE 2: CONTINUED BLEEDING (EBL up to 1500mL OR > 2 uterotonics) with normal vital signs and lab values

INITIAL STEPS:

☐ Mobilize additional help
☐ Place 2nd IV (16-18G)
☐ Draw STAT labs (CBC, Coags, Fibrinogen)
☐ Prepare OR

MEDICATIONS:

☐ Continue Stage 1 medications

BLOOD BANK:

☐ Obtain 2 units RBCs (DO NOT wait for labs. Transfuse per clinical signs/symptoms)
☐ Thaw 2 units FFP

ACTION:

☐ Escalate therapy with goal of hemostasis

Huddle and move to Stage 3 if continued blood loss and/or abnormal VS

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Table 1 (continued)

STAGE 3: CONTINUED BLEEDING (EBL > 1500mL OR > 2 RBCs given OR at risk for occult bleeding/coagulopathy OR any patient with abnormal vital signs/labs/oliguria)

INITIAL STEPS:

- ☐ Mobilize additional help
- ☐ Move to OR
- ☐ Announce clinical status (vital signs, cumulative blood loss, etiology)
- ☐ Outline and communicate plan

MEDICATONS:

- ☐ Continue Stage 1 medications

BLOOD BANK:

- ☐ Initiate Massive Transfusion Protocol (If clinical coagulopathy: add cryoprecipitate, consult for additional agents)

ACTION:

- ☐ Achieve hemostasis, intervention based on etiology

Oxytocin (Pitocin):
10-40 units per 500-1000mL solution

Methylergonovine (Methergine):
0.2 milligrams IM

15-methyl PGF$_2\alpha$ (Hemabate, Carboprost):
250 micrograms IM
(may repeat in q15 minutes, maximum 8 doses)

Misoprostol (Cytotec):
800-1000 micrograms PR
600 micrograms PO or 800 micrograms SL

STAGE 4: CARDIOVASCULAR COLLAPSE (massive hemorrhage, profound hypovolemic shock, or amniotic fluid embolism)

INITIAL STEP:

- ☐ Mobilize additional resources

MEDICATIONS:

- ☐ ACLS

BLOOD BANK:

- ☐ Simultaneous aggressive massive transfusion

ACTION:

- ☐ Immediate surgical intervention to ensure hemostasis (hysterectomy)

Post-Hemorrhage Management

- Determine disposition of patient
- Debrief with the whole obstetric care team
- Debrief with patient and family
- Document

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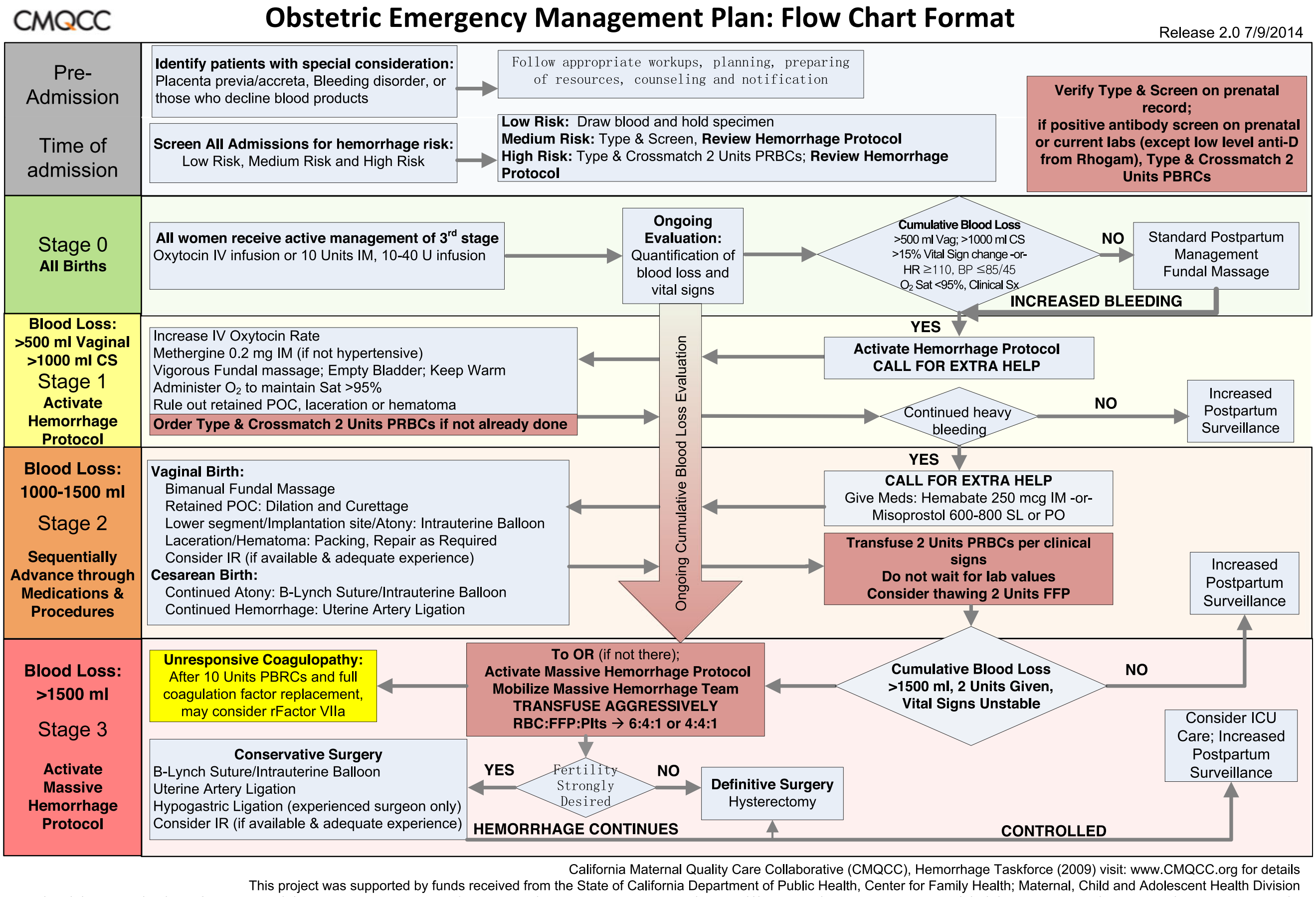
Table 2 Obstetric emergency management plan: flowchart format



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It is worth noting that clinical scenarios do not always follow the path of progressive severity. Some cases will initially manifest as later stages requiring immediate and aggressive clinical response.

Creating a Hemorrhage Protocol Main et al. propose a framework for putting in place a hemorrhage protocol using four important domains of readiness, recognition, response, reporting, and systems learning. They use an explicit and succinct language to describe each domain [15••].

Readiness: Having the Resources to Identify and Respond to These Emergencies

Staff Training

–Who?
Interdisciplinary: nursing, providers, surgeons, anesthesiologists, blood bank personnel, pharmacy, knowledge across all disciplines, pharmacological, intensivist, administration (for resources)

–What do they need to know?
Risk assessment tool, clinical risk factors, maternal early warning signs, blood bank capacity, knowledge of blood products, knowledge of drugs, hemorrhage cart, how to mobilize a team, who is on the team, how to monitor response, criteria for transfer to higher level of care, who is the most experienced surgeon in the system

–Uncommon items and techniques
What is a tamponade balloon? How and when should it be used?
How to perform uterine compression surgically: B-Lynch, Hayman, and uterine artery ligation

–Types of blood products
When and what to transfuse? How much? Factor VII availability
What is tranexamic acid? How much and when?
What is rotational elastometry (RoTEM) or thromboelastography (TEG)?

Response and Management: the Value of Protocols

In cases of obstetrical hemorrhage, early recognition and identification of etiology followed by a targeted well-orchestrated response and support with minimal delay afford patients with the greatest chance of survival and the least morbidity [19, 22].

The main idea behind the use of a protocol is to create uniformity, to reduce human errors, and to provide a reminder of key steps, which may be overlooked in high-stress situations, avoiding the reliance on an individual's memory. They are particularly useful in high-stress and high-turnover environments such as the labor and delivery suite or the operating room. Protocols improve communication and standardize the responses in limiting variations based on provider preferences.

Despite evidence showing improvement in certain obstetrical clinical outcomes after the adoption of protocols [19, 20•], many clinicians and health systems are reluctant to rely on them. The pushback often comes from several sources: a feeling of loss of autonomy on the part of clinicians, the skepticism around the applicability of "research data" to every day patients, and the fear of being held hostage to the protocol (litigation).

The fact is that protocols function to streamline and focus a clinician's thinking and actions, which leads to better outcomes [19, 21–24]. An example of this is seen where the implementation of a comprehensive maternal hemorrhage protocol led to a significant shift toward resolution of hemorrhage at earlier stages with the use of fewer blood products and 64 % reduction in DIC [20]. Implementing the postpartum hemorrhage protocol also increased the number of days between maternal intensive care unit admissions. This demonstrates that early and timely recognition and interventions prevent more costly unexpected outcomes [23]. Clark et al. also demonstrated improved outcomes and decreased maternal morbidity with checklist-based protocols on oxytocin administration, hypertension treatment, and obstetric hemorrhage management [25–27].

Shields et al. demonstrated the value of implementing an obstetric hemorrhage protocol in reducing the number of patients transfused, the number of blood products per patient and the likelihood of progressing to stage 3 hemorrhage. [20•].

Triggers

Reviews of maternal fatality and severe morbidity have identified delay in recognition and treatment as contributors to adverse outcomes [4]. Much of this is attributable to delay in recognizing early triggers of deterioration [4]. In the UK, the Maternal Early Warning Systems (MEWS) protocol has been operational, and its use has led to a decrease in number of transfers to intensive care units [28]. In the USA, the National Partnership for Maternal Safety collaborative has modified it as an Obstetrics Early Warning Systems [29, 30]. Others have coined it the

FIGURE 1
Maternal early warning criteria

Systolic BP (mm Hg)	<90 or >160
Diastolic BP (mm Hg)	>100
Heart rate (beats per min)	<50 or >120
Respiratory rate (breaths per min)	<10 or >30
Oxygen saturation on room air, at sea level, %	<95
Oliguria, mL/hr for ≥2 hours	<35
Maternal agitation, confusion, or unresponsiveness; Patient with preeclampsia reporting a non-remitting headache or shortness of breath	

Early warning system proposed by National Partnership for Maternal Safety.

BP, blood pressure.

Arora. Triggers, bundles, protocols, and checklists for obstetric safety. Am J Obstet Gynecol 2016.

Fig. 1 Maternal early warning criteria. Reprinted from American Journal of Obstetrics and Gynecology, 214(4), Kavita Shah Arora, Larry E. Shields, William A. Grobman, Mary E. D'Alton, Justin R. Lappen, Brian M. Mercer, Triggers, bundles, protocols, and checklists—what every maternal care provider needs to know, 444–451, 2016, with permission from Elsevier

Maternal Early Warning Criteria. In this system, vital signs falling outside of specific parameters will trigger a nurse to request a bedside evaluation by a provider (Fig. 1). Seven parameters have been identified [31••], and it is expected to shorten the response time to potential hemodynamic instability and to improve outcomes in obstetrical units [32].

Mhyre et al.'s believe that maternal morbidity and mortality cases result from both interpretation and delays in recognition and treatment, thus incorporation of MEWS should improve quality in obstetrics by preventing acute severe illnesses [31••].

It Is Not Enough to Create the Protocol: It should Be Rehearsed for Specific Situations and Include Team Training

A protocol is a living tool that should be modified and updated based on the team's feedback and the incorporation of the latest data. Consolidating resources rapidly and efficiently is paramount during a PPH crisis. One such way to do this is through effective communication across disciplines (i.e., between obstetrics and anesthesia). This is probably the most compelling argument for the creation of a protocol based on interdisciplinary involvement. This not only leads to reduction in morbidity for obstetrical hemorrhage but also creates a safer work environment for the staff where panic in crisis scenarios is replaced by confidence, control over the situation, and trust in the system. CMQCC and NYS Safe Motherhood Initiative have created resources that are readily accessible and provide guidance for the creation of protocols and checklists.

Management: Swift Transition from Medical to Balloon Tamponade to Surgical Options

In the setting of uterine atony, initial treatment would include administration of uterotonics. Direct injection of methylergonovine maleate and 15-methyl prostaglandin (PG) F2 into the uterine corpus is preferred by some practitioners on failed IM or IV attempts. When uterotonics fail, uterine tamponade techniques such as packing, foley catheter, Sengstaken-Blakemore tube, or more recently, a Bakri tamponade balloon, can be used. Human recombinant factor VIIa is a new treatment method shown to be effective in controlling severe, life-threatening hemorrhage by acting on the extrinsic clotting pathway [9, 33].

When uterotonic agents fail to control bleeding with or without tamponade techniques, exploratory laparotomy is indicated on patients who had normal vaginal delivery. A midline vertical abdominal incision is preferred for better visualization. Several techniques are available to control bleeding. Hypogastric/internal iliac artery ligation is often not implemented as most obstetric practitioners are not familiar with its anatomy and has been found to have limited success [34], whereas bilateral uterine artery ligation (O'Leary sutures) is an easier method to lessen blood flow to the uterus. Similar sutures can be placed across the vessels within the utero-ovarian ligaments for the same purpose. [9, 35, 36].

Several uterine compression-suturing techniques have been implemented in hemorrhage situations. These techniques may prevent hysterectomy in an atonic PPH, especially in a stable patient who is seeking future fertility [37–39]. The B-lynch procedure is a popular technique which compresses the uterine corpus to diminish bleeding [40–42] via the use of compression sutures. Hayman described a simpler but similar procedure using two longitudinal separate transfundal sutures [43]. Other techniques like multiple square suturing techniques have been described for postpartum hemorrhage caused by uterine atony, placenta previa, or placenta accreta. This procedure closes the uterine cavity by suturing both anterior and posterior uterine walls. [44] Case reports of adhesions and abscesses must be taken into consideration on the multiple square suturing technique [45, 46]. Arterial embolization procedure can be considered in patients who have continuing postpartum hemorrhage and are hemodynamically stable to be transferred to the interventional radiology unit [47, 48]. Uterine artery embolization is also used prophylactically in deliveries with placenta accreta, after the delivery of the infant [49, 50]. Potential complications of this procedure must also be taken into account [51–53].

A systematic review of conservative measures in PPH by Doumouchtsis et al. demonstrated success rates of 90.7 % for arterial embolization, 84.0 % for balloon tamponade, 91.7 % for uterine compression sutures, and 84.6 % for internal iliac/hypogastric artery ligation or uterine devascularization [54]. Thus, uterine balloon tamponade seems to be one of the most effective methods, while less invasive, at controlling severe hemorrhage from atony in his cohort.

What Is on the Horizon?

There is an FDA-approved iPhone application from Triton, which uses photographic extraction of amniotic fluid, irrigation, urine, and ascites to calculate blood loss. Might this provide a better way to estimate blood loss? We look forward to a tool that will help trigger the earliest response to significant blood loss.

TEG and thromboelastogram (RoTEM) technology, although not new technologies, are being used more frequently in obstetrical hemorrhage cases. TEG and RoTEM may provide a solution to complicated hemorrhage cases by yielding a relatively quick, point-of-care method to determine the procoagulant and fibrinolytic nature of whole blood. Although there are limitations, TEG or RoTEM, compared to conventional coagulation tests, can make blood product management more discriminate. [55].

The use of tranexamic acid in obstetrical hemorrhage is emerging and shows promise to decrease obstetrical blood loss. Further research is needed before its use becomes widespread. [56].

Conclusion

Peripartum hemorrhage is a major contributor of maternal mortality and morbidity accounting for 11 % of all maternal deaths. For every maternal death, there are up to 100 women who suffer major morbidity from hemorrhage. State-wide mortality and morbidity reviews have found that this outcome was preventable in at least 60 % of cases [4]. Provider-related factors such as delay in recognition and treatment played a significant role in timely intervention. Implementation of protocols has yielded measurable benefits in improving maternal outcomes, reducing ICU admissions and massive transfusions. The widespread acceptance of the standardized approach, which involves team training and bundles of care, is essential in reducing maternal morbidity and mortality from hemorrhage.

Compliance with Ethical Standards

Conflict of Interest Andrew D. Miller, Ceyda Oner, and Edward S. Kosik declare that they have no conflict of interest.

Sandra McCalla declares that she is a member of ACOG-District 2 and a member of the SMI Hemorrhage Workgroup.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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