Postpartum hemorrhage: new insights for definition and diagnosis

A. Borovac-Pinheiro, PhD; R. C. Pacagnella, PhD; J. G. Cecatti, PhD; S. Miller, PhD; A. M. El Ayadi, ScD, MPH; J. P. Souza, PhD; J. Durocher, MA; P. D. Blumenthal, MD, MPH; B. Winikoff, MD, MPH

The current definition of is inadequate for early recognition of this important cause of maternal death that is responsible for >80,000 deaths worldwide in 2015. A stronger definition of postpartum hemorrhage should include both blood loss and clinical signs of cardiovascular changes after delivery, which would help providers to identify postpartum hemorrhage more promptly and accurately. Along with the amount of blood loss, clinical signs, and specifically the shock index (heart rate divided by systolic blood pressure) appear to aid in more accurate diagnosis of postpartum hemorrhage.

Key words: postpartum hemorrhage, definition, clinical sign, shock index

In 2015 there were >80,000 maternal deaths caused by obstetric hemorrhage worldwide.[1] Although there has been a reduction in the absolute number of maternal deaths caused by hemorrhage over the last 25 years, it remains the leading direct obstetric cause of maternal death.[1,2] Recent estimates suggest that 29.3% of maternal deaths and 26.7% of severe adverse maternal outcomes globally are due to hemorrhage.[1-3] Great variation exists regionally; hemorrhage accounts for 9.3% of deaths in countries with a high sociodemographic index and 45.7% in countries with a low sociodemographic index.[1,2] Most deaths caused by hemorrhage occur in the postpartum period in both high-income countries (49.1%) and low-/middle-income countries (73%).[2] Among women with postpartum hemorrhage (PPH), 17% will have either a maternal near miss or death; however, geographic disparities in the incidence of severe maternal outcomes after PPH suggest the need to improve quality of care.[4]

Prevalence estimates for PPH vary in the literature from 1−10% of all deliveries. Risk factors for PPH include a variety of maternal factors (ie, advanced maternal age, nulliparity, anemia, previous cesarean delivery, fibroid tumors), pregnancy complications (ie, placenta previa or abruption, multiple gestation, polyhydramnios, amnionitis, hypertensive disorders of pregnancy), and delivery characteristics (ie, episiotomy, retained placenta, laceration, uterine rupture, high neonatal weight).[5,6] However, the ability to predict PPH from antepartum and intrapartum risk factors is very low.[7] Therefore, efforts to reduce adverse maternal outcomes must focus on the early recognition and treatment of PPH.

Definition and diagnosis

The most commonly accepted definition of PPH is based on the amount of blood lost after birth. In 1990, a technical working group of the World Health Organization (WHO) defined PPH as blood loss of ≥500 mL from the genital tract after vaginal delivery.[8] Despite WHO's statement in the same report that this blood loss threshold might not be clinically significant given the lack of supporting evidence, 500 mL was selected as the volume of blood loss for PPH diagnosis based on the customarily used cutoff and what was considered as normal postpartum blood loss.[8]

Studies preceding the 1990 WHO definition of PPH that measured blood loss with the gold standard spectrometric and labelled erythrocyte methods found an average blood loss of 300−550 mL for vaginal delivery and 500−1100 mL for cesarean delivery.[9-14] However, the sample sizes in these studies were very small (n <123) and limited to hospital deliveries.

The most recent WHO definitions of PPH (2012) reflect the 1990 definition. For vaginal births, PPH is defined as blood loss >500 mL,[15,16] and severe PPH is defined as loss of >1000 mL. In cases of cesarean birth, the standard for PPH is raised to 1000 mL in some guidelines.[17] Other protocols use different definitions (Table 1).[17-23] Nevertheless, recent and more robust studies confirm the great variability in measured blood loss that range from <150 mL to almost 700 mL for uncomplicated vaginal delivery,[24-26] which challenges the clinical relevance of a particular blood loss threshold.

Furthermore, blood loss thresholds may not adequately represent risk of poor outcome. The different PPH definitions by delivery method are even more confusing: why would a blood loss of 500 mL represent a risk for women after vaginal delivery but not for a cesarean delivery? In addition to the wide

From the Department of Obstetrics and Gynecology, School of Medical Sciences, University of Campinas, Campinas, Brazil (Drs Borovac-Pinheiro, Pacagnella, and Cecatti); the Department of Obstetrics, Gynecology, and Reproductive Sciences, University of California, San Francisco, CA (Dr Miller and Ms El Ayadi); the Department of Social Medicine, School of Medicine of Ribeirão Preto, University of São Paulo, Ribeirao Preto, Brazil (Dr Souza); Gynuity Health Projects, New York, NY (Ms Durocher, and Dr Winikoff); Stanford University School of Medicine, Department of Obstetrics and Gynecology, Division of Family Planning Services and Research, Stanford University, Stanford, CA (Dr Blumenthal).

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Corresponding author: R.C. Pacagnella, PhD. rodolfopacagnella@gmail.com

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range of normal postpartum blood loss values, the arbitrary cutoff lacks clinical accuracy.

Many women will lose >500 mL without any clinical consequence, and some will bleed less and will still be at risk of adverse outcome.[27,28] A woman's baseline health may be an important determinant of her ability to tolerate blood loss of any volume. For instance, most healthy nonanemic women will not exhibit signs and symptoms of hemodynamic instability until blood loss reaches ≥1000 mL.[13,14,24,29] In a healthy population, this quantity of blood loss will even be considered as physiologic and may not trigger any intervention. In contrast, for women whose organ systems are compromised by a comorbidity, earlier intervention may be required at a lower blood loss volume to avoid poor end organ perfusion.

No high-quality evidence exists to support the current definition of PPH based on the amount of blood loss. Furthermore, reliable measurement of blood loss presents a significant challenge for blood loss threshold—based diagnosis. The WHO recommends visual estimation of blood loss as the standard for blood loss measurement;[30] yet, visual estimation is known to be highly unreliable.[31,32] Visual estimation of postpartum blood loss compared with spectrophotometry underestimates blood loss by 33—50%,[17,31,32] thus possibly delaying both recognition and treatment.

A variety of blood loss measurement techniques have been used in clinical practice to improve measurement validity, such as the under buttocks drape with a graduated/calibrated pouch.[9,17,33-35] Other efforts to improve validity include low-cost strategies such as absorbent delivery mats or soaking of common household cloths.[36,37] When blood loss is recorded by direct measurement techniques, there is a higher mean blood loss (difference, 58.6 mL) and almost twice as many women are identified with PPH than by indirect measurement.[38] However, there is no evaluation method that is used broadly for precise blood loss measurement.

In an attempt to improve the quantification of blood loss after delivery, a movement has begun in high resource settings to measure blood loss comprehensively after delivery with the use of a drape and by weighing all compresses and sponges, not only after vaginal deliveries but also after cesarean deliveries. Although this practice results in improved accuracy of blood loss measurement, it is limited by the utility of blood loss volume in the diagnosis of PPH; women experience PPH differentially at similar levels of blood loss, with some women losing large amounts of blood without entering into a life-threatening situation.

Furthermore, a more accurate assessment of blood loss alone has not been shown to improve the provision of PPH care. A large randomized cluster trial conducted in 78 hospitals across Europe that compared visual estimation of blood loss after delivery to objective assessment with the use of a calibrated receptacle revealed that rates of severe PPH and the provision of additional interventions did not differ substantially between the 2 methods of blood loss assessment.[39]

There is also recognition of the importance of the consideration of clinical status; in fact, most guidelines include the recognition of changes in clinical status as part of the classification of PPH severity. Measureable components include heart rate, arterial blood pressure, respiratory rate, and even the speed of blood flow. Together with the amount of blood loss, clinical conditions could offer a more reliable picture of what is happening within the cardiovascular system of the bleeding woman.

Many clinical guidelines include vital signs in the definitions and diagnosis of PPH[16,17] without specifying which clinical signs are important. Most guidelines refer to hemodynamic instability or evidence of clinical shock as the triggers for intervention.[16]

The WHO working group that established the 500-mL cut-off for defining PPH also concurred that PPH diagnosis is a clinical decision; thus, clinicians may decide to initiate therapeutic action at a lower level of blood loss than 500 mL.[8] In another technical report by WHO in the mid-1990s, it was further clarified that "the 500 mL limit as defined by WHO should be considered an alert line; the action line is then reached when vital functions of the woman are endangered."[40] Although giving the clinician considerable freedom to manage each individual patient's course, these proposals regarding how the 500-mL threshold could be used in practice have generated uncertainty about when to intervene. An imprecise diagnostic threshold makes guideline and protocol development difficult.

An additional challenge is when to consider a postpartum woman as showing "evidence of clinical shock" or "hemodynamic instability." Some authors have proposed classification models to trigger treatment for PPH (Table 2).[28,29,41] However, these systems mainly rely on estimated blood loss and therefore have the same problems as the definitions of WHO described earlier.

In the nonobstetric population, the definition of hypovolemic shock is under discussion. Studies have found that higher blood pressure than once previously thought can still be associated with adverse outcomes in trauma patients. Changes in clinical signs during bleeding do not correlate with the amount of blood lost as proposed by the traditional classifications of hypovolemic shock for trauma populations.[42] Some authors have proposed that hypotension should be redefined with a higher cut-off of blood pressure.[43-45]

In postpartum women, consideration of clinical signs for triggering PPH treatment should rest on a clear understanding of the cardiovascular system during pregnancy. Changes in the cardiovascular system may be protective for most women with hemorrhage because the adaptation of the cardiovascular system helps to compensate for the loss of blood after birth.

Briefly, cardiovascular changes begin around the sixth week of pregnancy, produce an increase in blood volume of 45% (1200—1600 mL), and reach a maximum volume of 4700—5200 mL at approximately 32 weeks gestation.[46,47] Cardiac output increases by approximately 50% during pregnancy