

# Hemostatic assessment, treatment strategies, and hematology consultation in massive postpartum hemorrhage: results of a quantitative survey of obstetrician-gynecologists

Andra H James<sup>1</sup>

David L Cooper<sup>2</sup>

Michael J Paidas<sup>3</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, Division of Maternal-Fetal Medicine, Duke University, Durham, NC, <sup>2</sup>Novo Nordisk Inc., Princeton, NJ, <sup>3</sup>Department of Obstetrics, Gynecology, and Reproductive Sciences, Yale Women and Children's Center for Blood Disorders and Preeclampsia Advancement, Yale University, New Haven, CT, USA

**Objective:** To assess potential diagnostic and practice barriers to successful management of massive postpartum hemorrhage (PPH), emphasizing recognition and management of contributing coagulation disorders.

**Study design:** A quantitative survey was conducted to assess practice patterns of US obstetrician-gynecologists in managing massive PPH, including assessment of coagulation.

**Results:** Nearly all (98%) of the 50 obstetrician-gynecologists participating in the survey reported having encountered at least one patient with "massive" PPH in the past 5 years. Approximately half (52%) reported having previously discovered an underlying bleeding disorder in a patient with PPH, with disseminated intravascular coagulation (88%, n=23/26) being identified more often than von Willebrand disease (73%, n=19/26). All reported having used methylergonovine and packed red blood cells in managing massive PPH, while 90% reported performing a hysterectomy. A drop in blood pressure and ongoing visible bleeding were the most commonly accepted indications for rechecking a "stat" complete blood count and coagulation studies, respectively, in patients with PPH; however, 4% of respondents reported that they would not routinely order coagulation studies. Forty-two percent reported having never consulted a hematologist for massive PPH.

**Conclusion:** The survey findings highlight potential areas for improved practice in managing massive PPH, including earlier and more consistent assessment, monitoring of coagulation studies, and consultation with a hematologist.

**Keywords:** acquired hemophilia, blood coagulation disorders, disseminated intravascular coagulation, von Willebrand disease

## Introduction

Deaths from postpartum hemorrhage (PPH) occur as a result of a suboptimal clinical response to massive hemorrhage, whether due to limited or absent resources in developing countries or to poor coordination of resuscitative efforts in developed countries,<sup>1</sup> and usually occur in the setting of coagulopathy. The most common causes of massive PPH are obstetric bleeding (uterine atony, retained placenta) or surgical bleeding (lacerations and incisions);<sup>2-7</sup> but with massive PPH from any of these causes, women may develop a dilutional coagulopathy due to resuscitation with crystalloids or acute consumptive coagulopathy and disseminated intravascular coagulation (DIC).

Alternatively or additionally, a preexisting coagulation disorder, either acquired or congenital, may underlie immediate or delayed postpartum bleeding.<sup>5</sup> Acquired coagulation disorders that may occur during or after pregnancy and contribute to

Correspondence: Andra H James  
Department of Obstetrics and Gynecology, Division of Maternal-Fetal Medicine, Duke University, DUMC 3967, Durham, NC 27710, USA  
Tel +1 919 681 5220  
Fax +1 919 681 7861  
Email [andra.james@duke.edu](mailto:andra.james@duke.edu)

PPH include quantitative platelet disorders<sup>8</sup> such as HELLP (hemolysis, elevated liver enzymes, low platelets) syndrome or immune thrombocytopenic purpura; acute liver failure of pregnancy resulting in reduced liver synthetic function;<sup>5</sup> and acquired hemophilia.<sup>9</sup> Acquired hemophilia is a rare (incidence, 1–1.5 per million)<sup>10</sup> acquired coagulopathy characterized by alloantibodies against coagulation factors, most often factor VIII, that is associated with pregnancy in 2%–29% of cases<sup>9–14</sup> and occurs in otherwise healthy women without a personal or family history of bleeding. Acquired hemophilia is notable for its potential to cause delayed postpartum bleeding in the mother (up to 117 days after delivery)<sup>9</sup> and the baby, via transplacental transfer of maternal alloantibodies.<sup>9,15–17</sup> Congenital coagulation disorders that may contribute to PPH include von Willebrand disease (VWD), hemophilia carriage, and factor XI deficiency; rare bleeding disorders such as factor II (prothrombin) and VII deficiencies and fibrinogen disorders; and the severe platelet function disorders Glanzmann's thrombasthenia and Bernard-Soulier syndrome. All have higher than expected rates of PPH.<sup>18</sup> Of these inherited bleeding disorders, VWD is the most common resulting from a quantitative or qualitative defect in von Willebrand factor (VWF). The rise in VWF and factor VIII levels during pregnancy may protect against immediate PPH in type I VWD (quantitative defect), but in general, the risk for PPH is increased threefold for women with VWD.<sup>19</sup> Whereas it is relatively uncommon that a preexisting congenital or acquired coagulopathic condition is the primary or sole cause of PPH,<sup>8</sup> failure to recognize the presence of such a condition at the time of delivery or in the postpartum period may impair attempts to control bleeding.

With the exception of limited summary data from administrative databases, clinical guidelines, and the results of another recently published survey,<sup>20</sup> there are few data about how obstetrician-gynecologists manage massive PPH, especially with regard to hemostatic assessment and engagement of hematologic specialists. In the other recently published PPH management survey, fewer than half of patients with PPH managed by obstetrician-gynecologists ever had a hematologic evaluation.<sup>20</sup> The purpose of this study was to assess potential diagnostic and practice barriers to successful management of massive PPH resulting from the most common to the rarest causes, including experience with PPH associated with bleeding disorders.

## Materials and methods

### Study design

This was a quantitative survey of the practice patterns of a cohort of obstetrician-gynecologists with respect to the

management of massive PPH and recognition of bleeding disorders, undertaken as a part of a more comprehensive case-based survey of multiple specialties.<sup>21</sup> The survey aimed to assess respondents' practices with regard to treatment strategies, hemostatic assessment and monitoring, and hematology consultation in the setting of PPH, as well as participants' prior clinical experience with bleeding disorders. Since the practice patterns of obstetrician-gynecologists are unique, the survey questions were specifically addressed to those practice patterns (distinct from the case study used for other specialists), and the responses from the cohort of obstetrician-gynecologists were not compared to the responses of other specialties.

### Setting

All surveys were completed over a 2-week period from January 14, 2010 to January 28, 2010. The time frame was dictated by the budget and the needs of the larger study, in addition to meeting the goal of 50 completed surveys for each specialty group.

### Participants

This study was exempt from Institutional Review Board approval since the survey procedures did not elicit private, protected information or biological specimens, and responses were recorded in a way that did not link back to the physicians who completed the survey. Any disclosure of the responses outside of the research could not reasonably place the physician subjects at risk of criminal or civil liability or be damaging to their financial standing (which could include loss of insurability or employability) or reputation. The obstetrician-gynecologists surveyed were a subset of a larger group of physicians specializing in hematology, hematology/oncology, emergency medicine, geriatrics, internal medicine, rheumatology, critical care medicine, and general surgery who were randomly sampled from the American Medical Association Physician Masterfile. From this sample, physicians who were already part of the Harris Interactive Online Physician Panel were invited to participate in the survey by email. Physicians who were not part of the panel were invited to participate via first-class mail. The invitation included a URL address and password to log on to the survey site, where invitees first encountered a series of questions to determine eligibility for participation in the survey.<sup>21</sup> Eligible obstetrician-gynecologists were required to have an active obstetrics practice. Upon confirmation of eligibility, participants completed the approximately 10-minute-long online survey.

## Survey instrument

For obstetrician-gynecologists, the survey questionnaire centered on PPH and included questions about definitions and management of PPH; thresholds for obtaining coagulation laboratory studies; the frequency of and rationale for hematology consultation; and prior clinical experience with bleeding disorders. The rest of the physicians completed different surveys about different bleeding issues: one for all of the physicians in medical specialties<sup>21</sup> and another for the general surgeons.<sup>22</sup>

## Analysis

The survey was designed to assess potential diagnostic and practice barriers. To ensure sufficient feedback to generate reasonable hypotheses about obstetrician-gynecologists' stated practice patterns for subsequent testing in face-to-face interviews, a sufficient number of obstetrician-gynecologists was recruited to accrue 50 complete responses. To ensure that the findings were representative of all of the obstetrician-gynecologists surveyed, data were weighted for sex, years in practice, and region.

## Results

A total of 50 obstetrician-gynecologists, the first 50 who responded, participated in the survey. The mean age of respondents was 51.0 years and they had an average (median) of 19.4 (21) years in practice. The majority (60%) reported between 100 and 200 deliveries per year. Detailed demographic and professional information about the participants is shown in Table 1.

All obstetrician-gynecologists surveyed reported having encountered at least one patient with PPH in the past 5 years, and nearly all (98%) reported having specifically encountered a patient with what they defined as "massive" or "severe" PPH in that time frame. The majority (64%) of the respondents defined massive hemorrhage as more than 2,000 mL blood loss; approximately one-quarter (26%) as more than 1,500 mL blood loss; 6% as more than 1,000 mL blood loss; and another 4% as "other". Potential strategies for managing PPH are summarized in Figure 1. With respect to uterotonics, all (100%) of the obstetrician-gynecologists surveyed reported having used methylergonovine, 82% misoprostol, and 52% carboprost tromethamine (Figure 1A). With respect to surgical management, 90% reported having used hysterectomy, 62% B-Lynch or similar compression sutures, and 54% arterial embolization (Figure 1B). All (100%) reported having used packed red blood cells (PRBCs), 88% fresh frozen plasma (FFP), 74% cryoprecipitate, and 26% recombinant clotting factor in the management of PPH (Figure 1C).

**Table 1** Demographic and professional characteristics of survey participants

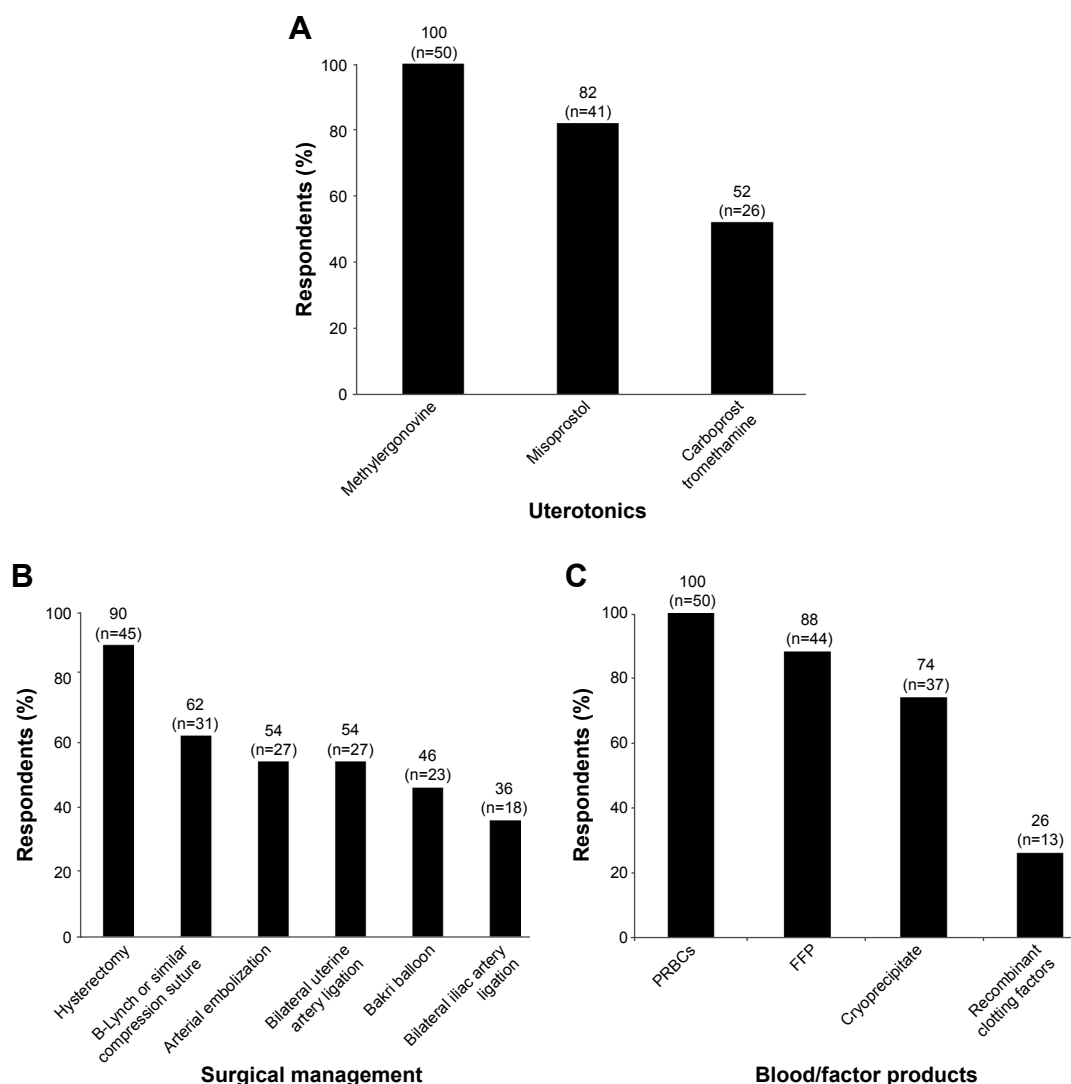
Characteristic	
Sex, n (%)	
Male	42 (84)
Female	8 (16)
Mean age, years	51.0
Mean years in practice	19.4
Practice description, n (%)	
Mostly office- or clinic-based	36 (72)
Mostly/exclusively hospital- or laboratory-based	3 (6)
Equally hospital- and office-/clinic-based	11 (22)
Office/clinic description (n=47), n (%)	
Solo practice	13 (28)
Single-specialty practice	27 (57)
Multispecialty practice	7 (15)
Number of deliveries per year, n (%)	
Less than 50	3 (6)
50–100	9 (18)
101–200	30 (60)
More than 200	8 (16)
Mean number of patients per typical week	113

**Notes:** From a total number of 50 participants, unless otherwise indicated. Percentages may exceed 100% in some cases due to rounding.

Common thresholds for rechecking a "stat" complete blood count (CBC) in a patient with PPH included a drop in blood pressure (82%), ongoing visible bleeding (76%), and tachycardia (68%; Table 2). Nearly half of respondents reported that blood losses of 1,000 mL (48%) or 1,500 mL (40%) would prompt immediate rechecking of the CBC; only 32% would have rechecked a CBC after 2,000 mL blood loss (Table 2). The most common threshold for checking coagulation studies (defined in the question as prothrombin time, activated partial thromboplastin time [aPTT], and international normalized ratio) was ongoing visible bleeding (84%; Table 3). Only 4% of respondents reported that they would not routinely order coagulation studies.

The vast majority (92%) of obstetrician-gynecologists reported that the centers or hospitals with which they were affiliated performed most coagulation laboratory studies on site. A majority (62%) of respondents reported that they did not send coagulation laboratory studies out for analysis, while 24% reported sending at least some coagulation studies out to a central laboratory and 14% out to a regional center or academic hospital.

Forty-two percent of obstetrician-gynecologists surveyed reported never having consulted a hematologist for PPH (Figure 2A). A slightly smaller percentage (34%) reported having consulted a hematologist one or two times for this purpose. Of several potential options, the most common reasons for considering consultation with a hematologist (n=29)



**Figure 1** Strategies utilized by surveyed obstetrician-gynecologists (n=50) for postpartum hemorrhage.

**Notes:** (A) Uterotonics, (B) surgical management, and (C) blood or factor products. Participants were advised to select as many strategies as applied.

**Abbreviations:** FFP, fresh frozen plasma; PRBCs, packed red blood cells.

**Table 2** Number (%) of respondents who would recheck a stat CBC in response to the following thresholds/criteria in a patient with PPH

Thresholds/criteria	Number (%) of respondents
Drop in blood pressure	41 (82)
Ongoing visible bleeding	38 (76)
Tachycardia	34 (68)
1,000 mL blood loss	24 (48)
Lack of response to misoprostol	21 (42)
1,500 mL blood loss	20 (40)
2,000 mL blood loss	16 (32)
Failure to respond to bilateral iliac artery ligation	16 (32)
Lack of response to carboprost	13 (26)
500 mL blood loss	7 (14)
Other	2 (4)

**Note:** Survey participants were instructed to select all thresholds that applied.

**Abbreviations:** CBC, complete blood count; PPH, postpartum hemorrhage.

included abnormal coagulation studies that were not normalizing with administration of FFP or cryoprecipitate (86%, n=25/29), worsening abnormal coagulation studies (86%, n=25/29), and suspicion of DIC (72%, n=21/29; Figure 2B). More than half (52%) of obstetrician-gynecologists reported having previously discovered an underlying bleeding disorder in a patient with PPH. DIC (88%, n=23/26), VWD (73%, n=19/26), and platelet disorders (58%, n=15/26) were the most commonly reported diagnoses, followed by lupus anticoagulant (misinterpreted as a bleeding disorder by the respondents, but not actually a bleeding disorder, 23%, n=6/26) and “other” bleeding disorders (15%, n=4/26). Only one of the obstetrician-gynecologists surveyed reported having ever encountered a patient with acquired hemophilia.

**Table 3** Number (%) of respondents who would order coagulation studies (PT/aPTT/INR) in response to the following thresholds/criteria in a patient with PPH

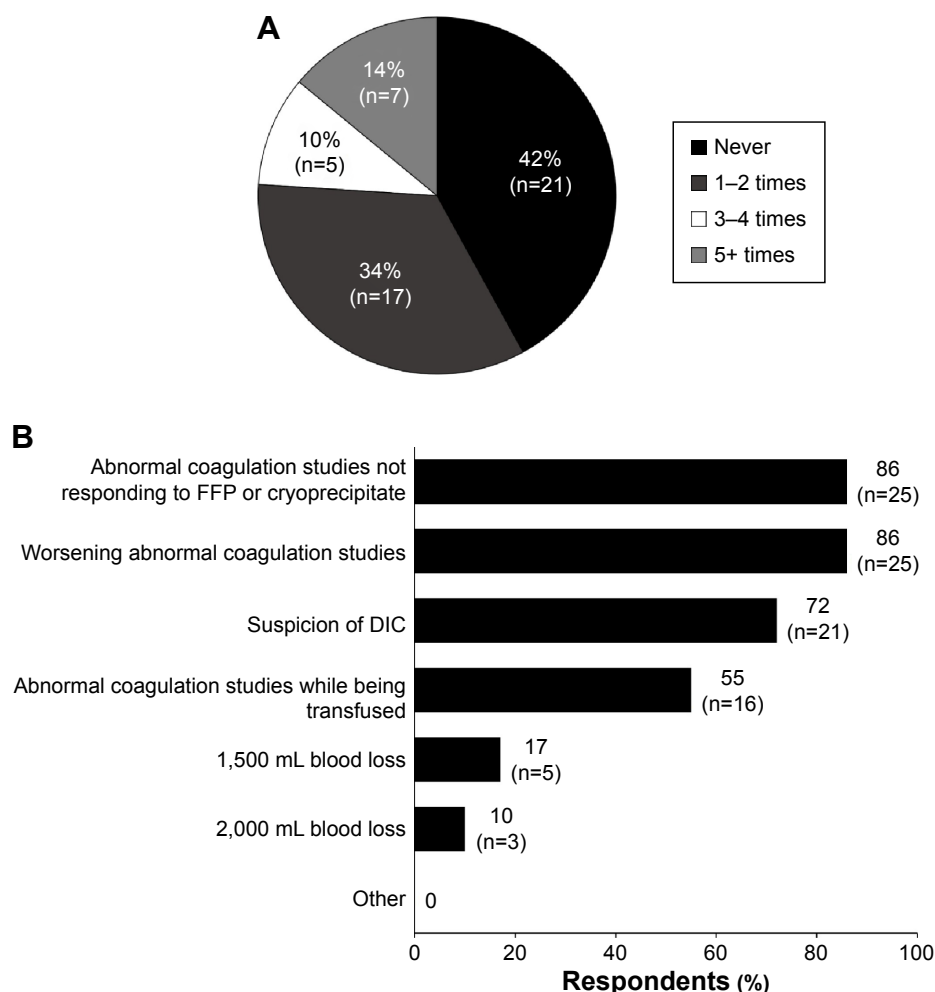
Thresholds/criteria	Number (%) of respondents
Ongoing visible bleeding	42 (84)
2,000 mL blood loss	22 (44)
Lack of response to misoprostol	21 (42)
Drop in blood pressure	19 (38)
Drop in hematocrit/hemoglobin	19 (38)
1,500 mL blood loss	17 (34)
Tachycardia	16 (32)
Failure to respond to bilateral iliac artery ligation	13 (26)
1,000 mL blood loss	12 (24)
Lack of response to carboprost	11 (22)
Other	2 (4)
Would not routinely order coagulation studies	2 (4)
500 mL blood loss	1 (2)

**Note:** Survey participants were instructed to select all thresholds that applied.

**Abbreviations:** aPTT, activated partial thromboplastin time; INR, international normalized ratio; PPH, postpartum hemorrhage; PT, prothrombin time.

## Discussion

We found that all survey participants reported having had experience with the management of PPH within the prior 5 years and that nearly all reported having had experience, specifically, with what they defined as massive PPH. This is not surprising, since the majority of participants attended between 100 and 200 deliveries per year and the published incidence of massive obstetric hemorrhage ranges from 0.15% to 2.7% of pregnancies.<sup>5</sup> Whereas most participants identified massive PPH as correlating with a blood-loss volume of 2,000 mL or more, the variability among survey respondents in defining this condition is reflected in the literature, in which massive PPH has been variably defined based on such factors as blood-loss volume, the need for transfusion of blood products (most often PRBCs), presence of coagulopathy, or some combination thereof.<sup>5</sup> Recently, a multidisciplinary panel of internationally recognized experts on PPH emphasized the ongoing nature of



**Figure 2** Prior hematology consultation by survey participants.

**Notes:** (A) Prior frequency of hematology consultation by survey participants specifically for postpartum hemorrhage (n=50) and (B) reasons participants would consider consulting a hematologist for this purpose (n=29). Participants were advised to select as many reasons for considering a hematology consultation as applied.

**Abbreviations:** DIC, disseminated intravascular coagulation; FFP, fresh frozen plasma.



bleeding in their definition of PPH, defining severe persistent (ongoing) PPH as “active bleeding >1,000 mL within the 24 hours following birth that continues despite the use of initial measures including first-line uterotonic agents and uterine massage.”<sup>23</sup>

## Hematologic laboratory assessment in PPH

The most common reasons obstetrician-gynecologists in this survey would have repeated a stat CBC included ongoing visible bleeding and changes in vital signs suggesting evolving hemodynamic instability. Fewer than half would have repeated a CBC for thresholds based on blood volume lost or insufficient response to either uterotonics or bilateral iliac artery ligation. The value of hematocrit measurement in an acutely bleeding patient may be limited, as drops in hematocrit may not immediately correlate with the magnitude of blood loss;<sup>24</sup> however, inconsistent assessment and follow-up of hemoglobin concentration were noted in a retrospective analysis of 38 maternal deaths due to PPH in France and were identified as potential areas for improvement in the critical-care management of women with PPH.<sup>2</sup>

Fewer than half of obstetrician-gynecologists in the survey would have relied on specific blood loss volumes as a threshold for obtaining hematologic laboratory studies. Given that visual estimates of blood loss are often inaccurately low,<sup>24–26</sup> intensified surveillance and more aggressive management should, perhaps, occur at lower than usual blood-volume thresholds when relying on visual estimates.<sup>24</sup> Underestimation of blood loss appears to be greatest (by up to 50%) when volumes exceed 1,000 mL.<sup>24,26</sup> A recently evaluated visual aid depicting known volumes of blood on obstetric materials may improve the accuracy of blood-loss estimation by obstetric providers with varying years of experience.<sup>26</sup> It has been suggested that blood loss exceeding 1,000 mL should prompt mobilization of additional resources for managing PPH.<sup>27</sup> Ongoing heavy bleeding with an estimated blood loss of 1,500 mL or more should prompt initiation of the local massive blood-loss protocol.<sup>6,28</sup> Such protocols have been the standard of care in the United Kingdom for years, but were not universally implemented at the time of this survey and are only now being widely adopted in the United States. In contrast, hemodynamic parameters may underestimate the extent of blood loss in women with PPH, who may tolerate blood loss better because of normal intrapartum physiological changes.<sup>29,30</sup>

The majority (84%) of obstetrician-gynecologists in this survey would have ordered coagulation studies for ongoing visible bleeding. Fewer than half of respondents chose any other scenario (blood volume lost, hemodynamic parameters, hemoglobin measurements, or failed response to initial treatments) as a threshold for ordering coagulation studies. Nearly 4% (n=2/50) of obstetrician-gynecologists in this survey would not have ordered coagulation studies, despite the majority of all respondents reporting that coagulation studies were performed on-site at their institution. The explanation for this finding may be the obstetrician-gynecologists' reliance on anesthesiologists and, in cases of intensive care unit transfer, intensivists to assess and manage any coagulopathy associated with PPH.

Assessment for coagulopathy in PPH is important not only to exclude preexisting bleeding diatheses but also, and more often, to identify an acquired coagulopathy resulting from massive hemorrhage.<sup>5</sup> The reported incidence of massive PPH accompanied by coagulopathy ranges from 0.15% to 0.5%.<sup>5</sup> Despite the potential contribution of hemostatic disorders to PPH, in the aforementioned French study of maternal deaths due to PPH, coagulation tests were performed in only 20 of the 38 women, despite on-site clinical laboratory support in 30 (76%) cases.<sup>2</sup> Global tests of hemostasis such as thromboelastometry or thromboelastography can provide potentially valuable information in real time at the patient's bedside.<sup>31</sup> Thromboelastography has been reported to have decreased the use of FFP and platelets in the setting of massive transfusion,<sup>32</sup> but it has not been adequately studied in obstetric hemorrhage and may have limited predictive value, according to recent guidelines from the European Society of Anesthesiology.<sup>33</sup>

## Prior experience with bleeding conditions

It was surprising that DIC was the most common bleeding diathesis previously encountered by obstetrician-gynecologists. The explanation for this finding may be that most VWD is mild type I, which does not usually pose a significant bleeding challenge at the time of delivery. More than half of respondents reported having encountered platelet disorders in women with PPH. Platelet disorders that may present during pregnancy encompass a broad range of acquired and inherited quantitative and qualitative platelet defects. However, not all are clinically significant, many (especially severe qualitative platelet disorders) are rare, and some inherited disorders may be diagnosed before an affected woman becomes pregnant.<sup>8</sup>

Approximately one in five (23%,  $n=6/26$ ) of respondents identified lupus anticoagulant as a bleeding disorder that they previously encountered in the setting of PPH, yet lupus anticoagulant is typically associated with thrombosis rather than bleeding.<sup>34</sup> However, lupus anticoagulant may confound the diagnosis of coagulation factor inhibitors if an abnormal coagulation study (typically an isolated prolonged aPTT) or reduced factor levels are attributed to lupus anticoagulant, whether erroneously<sup>35</sup> or in the presence of a coexisting lupus anticoagulant and coagulation factor inhibitor.<sup>36–39</sup> Whereas the small percentage of obstetrician-gynecologists who had ever encountered acquired hemophilia may be expected in light of the rarity of the condition (even in postpartum women), this finding nevertheless highlights the fact that, like most non-hematologists, most obstetrician-gynecologists lack experience with the condition and thus may not recognize the signs and symptoms of acquired hemophilia or consider the diagnosis in affected patients. At one of the authors' institutions (AHJ), a patient recently presented 2 months postpartum with delayed PPH due to acquired hemophilia, which was recognized based upon abnormal aPTT. She was subsequently managed jointly by obstetrics and hematology.

## Hematology consultation for PPH

In this survey, 34% of obstetrician-gynecologists reported having consulted a hematologist for PPH only once or twice in their career; 42% of these respondents had never consulted a hematologist for this purpose. Yet, nearly all respondents had occasion to manage what they defined as massive PPH in the previous 5 years. It is possible that this finding relates again to reliance on anesthesiologists and, in cases of intensive care unit transfer, intensivists to assess and manage any coagulopathy associated with PPH. Nevertheless, this finding may reveal an opportunity to involve a hematologist sooner (ie, before having to intervene surgically or transfer the patient to a higher level of care) to optimize diagnostic evaluation and management, particularly with regard to the use of blood products and other resources. Furthermore, prompt and accurate identification of any acquired or undiagnosed congenital bleeding disorder underlying PPH is critical.

## Study strengths and limitations

The sample of obstetrician-gynecologists captured in this survey consisted of a cross-section of practicing, contemporary physicians. It is true that the participants elected to participate

and those with an interest may have been more likely to respond to the invitation. The number of cases of DIC and other bleeding disorders managed is rather high, but the answers appear to have covered many years of practice; therefore, their responses may not be completely representative of all obstetrician-gynecologists. While the sample size was quite small, it was sufficiently large to generate reasonable hypotheses for subsequent qualitative analyses intended to explore the rationale behind participants' responses, something that this quantitative survey could not capture. These data are consistent with findings of the parallel case-based survey including 402 physicians (~50 each) specialized in hematology, hematology/oncology, emergency medicine, geriatrics, internal medicine, rheumatology, and critical care medicine where there were also delays in interpretation of significantly abnormal coagulation assay results and a reluctance by non-hematologists to consult hematology, particularly by emergency medicine and critical care health care professionals.<sup>21</sup>

## Conclusion

Early identification of coagulopathy – whether a preexisting coagulopathy or a “transient” dilutional or consumptive coagulopathy resulting from massive hemorrhage and subsequent resuscitation – may be essential to controlling bleeding and minimizing morbidity and mortality in massive PPH. Given reports of increased morbidity and mortality among insufficiently resuscitated women with PPH, early assessment of coagulation status in PPH, especially massive PPH, is justified and prudent. Early intervention and treatment of coagulopathy may be fertility-preserving and lifesaving. The results of this survey highlight potential areas for improved practice in the management of PPH, including development and implementation of algorithms or hospital protocols to assure earlier and more consistent assessment and monitoring of hematologic (including coagulation) laboratory indices and consultation with a hematologist, particularly in cases in which an acquired or previously undiagnosed inherited bleeding disorder may be a contributing cause.

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