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Postpartum Hemorrhage
Emergency Management for Uncontrolled Vaginal Bleeding

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ABSTRACT
Postpartum hemorrhage (PPH) represents total cumulative blood loss in excess of 1,000 ml or blood loss accompanied by signs and/or symptoms of hypovolemia within 24 hr following birth (The American College of Obstetricians and Gynecologists [ACOG], 2017). As a large number of PPHs occur in low-risk women (ACOG, 2019), the emergency nurse practitioner must be prepared to identify and manage this uncommon but life-threatening condition. The etiology, pharmacological management strategies, and other interventions are reviewed in an algorithmic approach. This organized approach not only supports maternal survival during PPH but is also applicable to postprocedural bleeding of obstetric and gynecological etiologies. **Key words:** emergency, ENP, postabortion, postpartum hemorrhage, PPH, uterine atony, vaginal bleeding

A PREVIOUSLY HEALTHY patient in her mid-20s presented to the emergency department (ED) for vaginal bleeding. Vital signs in triage reveal tachycardia at 110, but blood pressure and other vital signs were normal. The patient was placed into an examination room where history revealed she underwent a surgical abortive procedure at 18 weeks' gestation 1 day prior. The patient reported intermittent heavy vaginal bleeding initially, which became increasingly heavy and steady over the preceding 4 hr. She reported currently soaking one pad an hour and endorsed orthostatic dizziness and intermittent sensation of palpitations. Physical examination was normal, with the exception of continued brisk vaginal bleeding during the pelvic examination, and the patient underwent pelvic ultrasound scan and had baseline laboratory test results drawn. While awaiting results, the patient developed increased vaginal bleeding with sinus tachycardia at 152. The blood pressure remained stable without hypotension, and an emergent obstetric (OB) consult was initiated.

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BACKGROUND

Postpartum hemorrhage (PPH) is an uncommon but life-threatening condition due to significant blood loss following childbirth or abortive procedure and is the leading cause of deaths occurring on the day of birth (The American College of Obstetricians and Gynecologists [ACOG], 2019). Defined in terms of total blood loss, PPH represents total cumulative blood loss in excess of 1,000 ml or blood loss accompanied by signs and/or symptoms of hypovolemia within 24 hr following birth (ACOG, 2017). PPH may also occur later in the postpartum period (more than 24 hr after birth).

Despite identified risk factors for PPH (ACOG, 2017), approximately 40% of PPHs occur in low-risk women (ACOG, 2019). Accordingly, the emergency nurse practitioner (ENP) must be prepared to identify and manage this uncommon but life-threatening condition. Reliance on laboratory blood values such as hemoglobin or hematocrit levels is unreliable as the changes are often delayed, thus not effective for early recognition. Clinical findings of acute blood loss such as tachycardia and hypotension are often not present until substantial hemorrhage has occurred. Early indicators of blood loss can be difficult to recognize due to compensatory mechanisms, increased circulating volume in pregnant women, and the complex circulatory changes that occur with placental expulsion. For this reason, the goal is early recognition and treatment of PPH prior to change in a hemodynamic status.

As the diagnosis of PPH is based on volume, the timely and accurate determination of blood loss is critical. Of maternal deaths attributed to PPH, 54%–93% may be preventable, but provider errors in estimation of blood loss lead to delayed responses to hemorrhage (ACOG, 2019). Studies show that visual estimation of blood loss is inaccurate (Blosser, Smith, & Poole, 2021) and more likely to underestimate actual blood loss when volumes are high (ACOG, 2019). Ideally, blood loss should be quantified rather estimated to facilitate early identification of patients with significant blood loss prior to the development of symptoms or hemodynamic changes (Blosser et al., 2021). When able to weigh blood-soaked materials and clots, the following conversion should be used: 1 g weight = 1 ml blood loss volume (ACOG, 2019). If scales are not readily available, estimation should be used by recording the number of pads soaked per hour as well as the percentage of blood-soaked saturation of the pads. Blood clots may be transferred to graduated containers to quantify a portion of blood loss and combine this amount with an estimation of blood-soaked items (e.g., clothes, linens, pads).

MANAGEMENT

Given increasing awareness of PPH, current ACOG (2017) and World Health Organization guidelines (Althabe et al., 2020) support active management of hemostasis immediately following all births. This includes intravenous infusion of oxytocin diluted in intravenous fluid (rapid infusion of undiluted oxytocin can cause hypotension and cardiac collapse) or 10 units with intramuscular injection. As the majority of EDs do not routinely stock premixed bags of intravenous oxytocin, intramuscular injection of oxytocin should be considered the primary route of administration in the ED as it is more readily and quickly administered to support hemostasis. In addition, vigorous fundal massage should be performed for a minimum of 15 seconds to ensure the uterus is firm. Cumulative blood loss of 500–999 ml should automatically increase patient monitoring and basic interventions such as fundal massage and oxytocin administration. Once the cumulative blood loss is 1000 ml or more or is accompanied by signs/symptoms of hypovolemia, the PPH protocol should be initiated. An applied PPH protocol for the emergency care setting is provided in Figure 1; detailed information regarding medications used in the protocol is outlined in Table 1.

The initial management of PPH should be targeted to the underlying etiology and

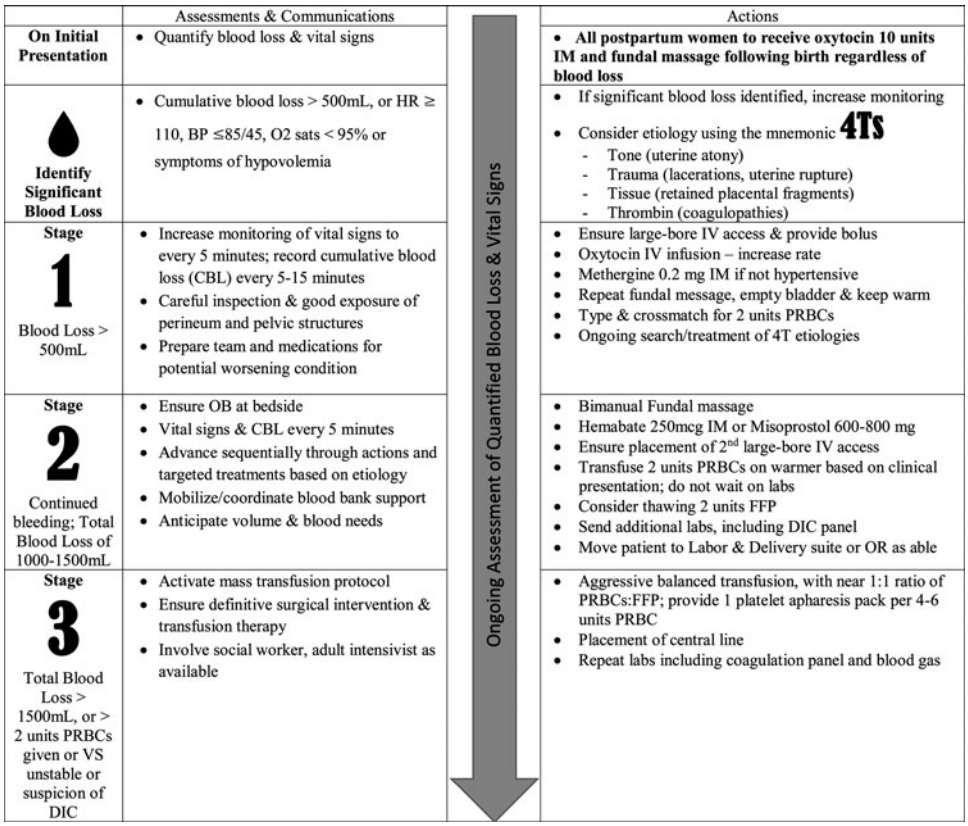

Figure 1. Postpartum hemorrhage management for emergency care settings (ACOG, 2017, 2019; California Maternal Quality Care Collaborative, 2015). BP = blood pressure; DIC = disseminated intravascular coagulation; HR = heart rate; FFP = fresh frozen plasma; IM = intramuscular; IV = intravenous; OB = obstetrics; OR = operating room; PRBC = packed red blood cell.

mobilizing definitive therapy. A quick but careful clinical examination is essential to identify primary etiologies of PPH, including uterine atony, lacerations, uterine rupture, retained placental fragments, and coagulopathies (see Box 1). Etiologies of PPH may be recalled using the "4 Ts" mnemonic (see Figure 1), but uterine atony, abnormal uterine tone, must always be considered the primary diagnosis because of the frequency of occurrence.

As the available interventions are limited in the emergency care settings, the ENP must focus on treating the etiology of the PPH while conducting hemodynamic assessment and support. This includes ensuring administration of uterotonics, hemodynamic resuscitation with blood products, and early mobilization of the OB team for additional treatment and surgical intervention if indicated. In cases of hemorrhage due to uterine atony, devices such as an intrauterine

Box 1. Primary etiologies of postpartum hemorrhage

Uterine atony
Uterine inversion
Lacerations
Retained placenta
Abnormally positioned or adhered placenta
Coagulopathies

Note. From ACOG (2017).

Table 1. Medications used in the management of postpartum hemorrhage

Medication	Mechanism of action	Dosing and administration	Contraindications	Side effects
Cytotec (misoprostol) (ACOG, 2017; Lowe, Openshaw, & King, 2017)	Synthetic prostaglandin E_1 analogue that promotes uterine contractions (Vallera, Choi, Cha, & Hong, 2017)	600–800 mcg sublingual or 800–100 mcg rectally as one-time dose	Known allergy to prostaglandin or hypersensitivity to drug	Nausea, vomiting, diarrhea, shivering, fever, headache
Hemabate (carboprost) (ACOG, 2017; Lowe et al., 2017)	Prostaglandin analogue that increases myometrial intracellular free calcium concentration, ultimately augmenting uterine contractions (Vallera et al., 2017)	250 mcg intramuscularly every 15–90 min; not to exceed eight doses	Asthma; caution in cardiac, pulmonary, or hepatic disease, HTN, hypersensitivity to drug	Nausea, vomiting, diarrhea, fever, headache, chills, HTN, bronchospasm
Methergine (methylergonovine) (ACOG, 2017; Lowe et al., 2017)	Semisynthetic ergot derivative with α-adrenergic properties that initiates uterine contraction	0.2 mg intramuscularly; may repeat in 5 min and then every 2–4 hr (do not give intravenously due to HTN)	HTN, preeclampsia, cardiovascular disease, hypersensitivity to drug	Nausea, vomiting, severe HTN
Oxytocin (Pitocin) (ACOG, 2017; Lowe et al., 2017)	Polypeptide oxytocin receptor agonist that stimulates myometrial contractility by increasing the intracellular concentration of calcium (Vallera et al., 2017)	10 units intramuscularly or 10–40 units in 500 ml to 1 L intravenous fluid rapid infusion	Hypersensitivity to drug	Usually none; may have nausea or vomiting; hypotension and cardiac collapse with intravenous push (not recommended)
Tranexamic acid (ACOG, 2017; WOMAN Trial Collaborators, 2017)	Synthetic derivative of lysine that blocks plasminogen-binding sites and inhibits the enzymatic action of plasmin on fibrin to prevent fibrin degradation (Mielke & Obermeyer, 2020)	1 g intravenously; may repeat × 1 after 30 min	None	Rare

Note. HTN = hypertension.

balloon system with vacuum-induced hemorrhage control (D'Alton et al., 2020; Haslinger, Weber, & Zimmerman, 2021) or a mini-sponge tamponade device (Rodriguez et al., 2020) may be used. Bimanual uterine compression, essentially squeezing the uterus between the hands, may be used if additional resources are unavailable or while awaiting OB support. This compression is exerted by gently inserting one hand into the anterior vaginal fornix and forming a fist with the palmar side up and placing the other hand externally on the abdomen behind the uterine fundus (Althabe et al., 2020; Schorn, 2019). Pressure is applied to the corpus of the uterus between the hands, in the area of the fundus. This compression stimulates uterine contractions. Continue with bimanual compression until the uterus is firm for several minutes or until additional uterine treatment is planned. Intrauterine exploration to reduce uterine volume may be necessary for effective hemostasis to be achieved (Haslinger et al., 2021).

Beyond uterotonics, additional medications that may be used are highlighted in Table 1. The use of tranexamic acid (TXA) has more recently been recognized in the treatment of PPH. More often used for traumatic bleeding in emergency care settings, TXA can be also used in women experiencing PPH to inhibit the breakdown of blood clots, which ultimately reduces bleeding. Current World Health Organization PPH recommendations include administration of 1 g TXA intravenously as soon as possible after giving birth, followed by a second dose if bleeding continues after 30 min or restarts within 24 hr of the first dose. Urgent treatment is essential, given the increased effectiveness of TXA when given early and evidence of no benefit when the drug is given more than 3 hr after the onset of bleeding (Brenner, Ker, Shakur-Still, & Roberts, 2019).

Ensuring large-bore intravenous access (two lines if bleeding is uncontrolled), as well as type and screen for blood products, should occur early in all patients experiencing and at risk for PPH (see Figure 1). Massive transfusion protocols (MTPs) are an integral part of saving lives for people with PPH, and the ENP should be prepared to follow facility procedures for activation and utilization. Some community and rural hospitals may have limited stock of blood components (especially during blood shortages). In these areas, comprehensive guidelines for alternative therapies, which may include use of blood component therapies, TXA, fibrinogen concentrate, and prothrombin complex concentrates (ACOG, 2017; Kogutt & Vaught, 2019), should be available.

In addition to blood product administration, the patient must be kept warm to prevent coagulopathic bleeding caused by hypothermia in combination with acidosis caused by poor perfusion. Basic interventions such use of warming mechanisms for blood and keeping the patient covered and not exposed are easily accomplished. Explanations and reassurance during what is stressful and potentially traumatic for the individual experiencing PPH are important for cooperation during the event and reduction of posttraumatic effects after the event. For patients who enter Stage 3 PPH, OB involvement with urgent transfer is essential. Providers in critical access facilities in particular must be aware of support options and transfer processes for PPH before caring for such patients.

CONCLUSION

Although developed to support maternal survival during PPH, the steps utilized to promote hemostasis are more broadly applicable. Bleeding presentations occurring in the postprocedure (e.g., abortive procedures) and postoperative periods may require and benefit from aggressive resuscitation strategies as outlined in PPH algorithms. For example, patients such as the one in the case study who present with heavy vaginal bleeding and have retained placental tissue following induced abortions are most likely experiencing uterine atony but could have uterine trauma. No matter the etiology, PPH guidelines are effective and appropriate in prioritizing

intravenous medications and transfusion needs until definitive treatment or surgical therapy can be achieved. The patient in the case study received 1 L of intravenous normal saline as well as intramuscular Pitocin (oxytocin) in the ED and was emergently evaluated by the OB/GYN service. Ultimately, she underwent surgical dilation and curettage on the same day of her presentation, which resolved her bleeding and she was discharged home in less than 24 hr.

Increased familiarity with and adherence to evidence-based guidelines for PPH support best possible patient care outcomes with timely interventions and enhance team communication and resource allocation. For providers in small facilities with fewer resources, a comprehensive plan for PPH is essential.

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