Postpartum hemorrhage (PPH) is an obstetric emergency that requires prompt response. Fortunately, most women with PPH are quickly identified and can be treated satisfactorily without the need for intensive care. Whether in simple or advanced refractory cases, it is critical to maintain a team approach with nursing, physicians, and blood bank to optimize outcome.

PPH is a leading cause of maternal morbidity and mortality. In the third world, it is the leading cause of maternal death. While less commonly associated with adverse outcomes in developed countries, it remains the most preventable cause of maternal mortality. Morbidity is also associated with PPH, as it is a frequent cause for maternal ICU admission.

Clinicians should identify at-risk cases prior to delivery to optimize care of high-risk women. However, rapidly evolving life-threatening PPH may occur in the absence of known risk factors. Thus, an understanding of the principles of diagnosis and treatment of this condition is vital to all obstetric services.

See page 7 for “Postpartum Hemorrhage (PPH) Checklist”

**Diagnosis of PPH**

- An obstetrical emergency diagnosed when there is excessive blood loss after the delivery of the placenta.
- Traditionally > 500 ml for vaginal delivery or >1000 ml for C-section.
- Can be any amount of bleeding that threatens the hemodynamic stability of the woman.
- The California Maternal Quality Care Collaborative further defines PPH as:
  - **Stage 1**: Blood loss: > 500 ml vaginal, or >1000 ml Cesarean, or vital signs changes (by >15% or heart rate > 110, BP < 85/45, O2 sat <95%)
  - **Stage 2**: Continued bleeding with blood loss under 1500 ml
  - **Stage 3**: Total blood loss over 1500 ml, or >2 units PRBCs given or vital signs unstable or suspicion of DIC
- PPH complicates approximately 4% of vaginal deliveries and 6-7% of cesarean sections. The average blood loss at vaginal delivery may be as much as 500 ml and at cesarean delivery 1000 ml. Blood loss in excess of these amounts has been used to define PPH; however, clinical estimates of estimated blood loss are inaccurate.
- Estimation of blood loss has been proven to be inaccurate and in most cases, actual blood loss is underappreciated. Whenever possible, quantification of blood loss should be performed. The diagnosis of PPH is established by observing/measuring excess bleeding and the patient’s clinical status. Excess visual/measured blood loss may or may not precede deterioration in maternal vital signs.
- The patient should be assessed for tachypnea and tachycardia, as these are earlier signs than narrowing of the pulse pressure and eventual hypotension.

**Risk Factors**

Please perform the IHIS OB Hemorrhage Risk Assessment before and after delivery; while being mindful of the following factors:

- Prolonged or rapid, forceful labor
- Over-distention of uterus (macrosomia, multiple gestation)
- Grand multiparity
- History of PPH
- Trauma — lacerations — use of instruments
- Retained placenta
- Placenta accreta
- Maternal coagulopathies
- Hypertensive disorders
- Induction / augmentation with Pitocin

**Physical Findings**

- Large, boggy uterus – often above the umbilicus
- Expelled large clots
- Visible bright red bleeding
- Tachycardia
- Tachypnea
- Altered mental status
- Sweating
- Restlessness
- Palpations
- Nausea
- Weakness
- Dizziness, hypotension, pallor, & oliguria usually do not occur until approximately 10% or more of blood is lost

**Etiologies**

Uterine atony is the most common cause of PPH whether delivery is accomplished vaginally or by cesarean section. Causes of PPH are listed below:

- Uterine atony
- Genital tract laceration (vaginal delivery)
- Uterine rupture
- Uterine laceration or broad ligament extension (C-section)
- Retained products of conception
- Placenta accreta
- Coagulation defects
Management Goal
Perinatal team works together to treat underlying condition, manage blood loss, and minimize risk to the mother:
- Organized response
- Aggressive fluid resuscitation
- Transfusion therapy
- Correct abnormal blood coagulation
- Evaluation of response
- Remedy the cause of bleeding

(See defined provider roles, PPH checklist, page 7.)

Management
- Women with PPH require aggressive steps to restore and maintain circulating blood volume.
- The keys to management are fluid resuscitation and transfusion therapy.

Fluid Resuscitation
- Fluid resuscitation is undertaken initially with large volumes of crystalloid using either normal saline or lactated Ringer’s solution through peripheral IV sites. At the same time, blood work is sent stat (Type and Cross, CBC with platelets, coagulation profile).
- In patients at high risk for postpartum bleeding, consider a second IV placed prior to delivery.
- The loss of one liter of blood requires 4-5 L of crystalloid solution because of shifting of much of the infused fluid into the interstitial space.
- The goal should be to infuse the required replacement over minutes as opposed to hours.
- PPH up to 1500 ml can often be managed with crystalloids alone whereas blood loss exceeding this amount generally requires blood transfusion.

Transfusion Therapy
- If blood loss is ongoing or if vital signs remain abnormal despite vigorous fluid resuscitation, undertake blood transfusion.
- If blood is urgently needed, administer the trauma blood (un-cross-matched O negative blood). This blood is readily available in most cases since a blood group and antibody screen has generally been performed.
- A rapid infusion set with warmer or pressure cuff may be employed to increase the infusion rate.
- If blood requirements are anticipated to be high, initiate the Massive Transfusion Protocol (Emergency Blood Product Release).

Nursing and Physician Approach to Management of PPH

Nursing Management
- Quantify blood loss
  - 1 gram = 1 mL of blood
- Monitor vital signs
  - Assess for tachypnea and tachycardia
  - Assess for narrowed pulse pressure, hypotension and cool extremities
  - Perform uterine massage
- Mobilize additional staff as needed (Charge Nurse)
- Administer uterotonic medications as ordered
- Ensure IV access (2 large bore gauge needles if ordered)
- Type and Cross – Consider use of Trauma blood if type and crossed blood not available
  - Insert Foley catheter
  - Maintain strict I&O
  - Apply pulse oximeter / ECG monitoring
  - Elevate legs to 20-30 degree angle
  - Anticipate and assess pain management needs
  - Notify blood bank to stay two units ahead

Physician Management
- Uterine massage
- Manual examination of the uterus
- Order uterotonic medications
- Order labs (Type & Cross, H&H, Coags)
- Obtain consent for blood products
- Blood transfusion as clinically indicated
  - Administer Trauma blood if type and crossed blood not available
  - Call for massive transfusion protocol: at 293-8467 when needed
- Curettage as indicated
- Surgical repair of lacerations as indicated

Potential Secondary Surgical Therapies
- Arterial embolization
- Uterine artery ligation
- Hypogastric artery ligation
- Hysterectomy
- Intrauterine balloon tamponade
- B-lynch suture

It is important to pay close attention to the response to resuscitation. This includes assessment of level of consciousness, pulse, blood pressure, oxygen saturation and urine output.
- A urine output> 30 ml per minute indicates adequate renal perfusion.
- Monitor CBC, coagulation studies, and blood gas measurements as clinically indicated.
- Women in critical condition with ongoing bleeding require adequate IV access intensive care in close proximity to the operating room should surgical treatment be required.
Coagulopathy

- Most women with PPH do not have an underlying preexisting coagulation disorder; however, it is essential to obtain a full coagulation profile once the diagnosis of hemorrhage is apparent.
- Dilutional (acquired) coagulopathy in the setting of hemorrhage usually does not occur until 80% of the blood volume has been replaced. Thus, regular monitoring of coagulation parameters is necessary in women who receive massive transfusion.
- If findings are abnormal, then fresh frozen plasma (FFP) beginning with four units is indicated, with additional units to normalize coagulation parameters. Some authorities suggest administering one unit of FFP for very two to four units of packed red cells transfused to reduce the chance of dilutional coagulopathy.
- Thrombocytopenia may also follow massive blood loss and transfusion.
- The goal is to keep the platelet count in excess of 50,000. Each unit of platelets raises the count by approximately 10,000, such that platelets are given as packs of 5 or 6 units.
- If bleeding is continuous and initial platelet count is < 50,000, initial transfusion may need to be 10-12 units.
- DIC may develop with shock and hypoperfusion of tissues, leading to tissue thromboplastin release. The management is identical to the patient with dilutional coagulopathy requiring restoration of circulating volume and blood product replacement.
- Cryoprecipitate may be useful with marked depression in fibrinogen levels. Cryoprecipitate is more concentrated than FFP and contains factors 8 and 13 as well as Von Willebrand factor.
- Recombinant activated factor VIIa may be a useful adjuvant treatment. This therapy has been used in cases where conventional therapy has been ineffective or in cases where hysterectomy has been undertaken and bleeding continues.

Specific Causes of PPH

Factors Associated with Uterine Atony

- Prolonged labor
- Oxytocin use
- Multiple gestation
- Polyhydramnios
- Fetal macrosomia
- Grand multiparity
- Infection (choriamnionitis)

Retained Products of Conception

- If the uterus remains boggy despite bimanual compression and massage as well as administration of uterotonic agents, then retained products should be suspected. Manual exploration of the uterus is performed if possible.
- If the placenta has not been delivered, then manual removal is undertaken. An alternative to manual exploration in cases where the placenta has been extracted is to proceed first with curettage under ultrasound guidance with anesthesia personnel readily available to assist.
- Uterotonics should be continued during uterine exploration, and the protocol for massive hemorrhage should also be continued.
- Many advocate broad spectrum antibiotic administration after postpartum uterine exploration, although evidence is limited to support this practice.

Genital Tract Lacerations

- Genital tract trauma should be suspected if bleeding persists despite a well contracted uterus.
- Careful inspection with assistance is often necessary to identify the source.
- Lacerations of the cervix and vagina should be ruled out.
- The full extent of either type of laceration must be appreciated prior to undertaking repair.
- Lacerations associated with continued bleeding despite suturing or hematoma formation may be amenable to selective arterial embolization.
- Pressure packing may also be employed in selective cases if the patient stabilizes.
- Lower tract genital tract hematomas (vulvar hematomas) are generally managed by incision and drainage, although expectant management may be employed for small lesions that are not expanding.
- Broad ligament hematomas and retroperitoneal hematomas may also be managed expectantly if the patient is stable.
- Imaging studies are necessary to assess the size and progress of these blood collections.
- Selective arterial embolization can be employed for treatment in select cases, although surgical exploration is more often necessary.
Surgical Treatment

- Surgical management is generally indicated if the uterus fails to contract in cases of atony and bleeding persists despite medical management.
- Postpartum patients already transferred to the postpartum floor or patients presenting through the Emergency Department should go to the main OR.
- Postpartum patients still in Labor and Delivery should be evaluated in the L&D OR.
- If the OB attending will face potential major delays until the main OR can accommodate an emergency postpartum patient (i.e., activation of the massive transfusion protocol is necessary) a discussion between the attending and the anesthesia colleagues may allow such cases to be evaluated in the L&D OR.
- Packing of the uterus (2-4 inch gauze) or placement of an intravascular balloon (Bakri device) may be attempted in certain cases where uterine preservation is important.
- In either case, careful patient monitoring is essential and removal of the pack or balloon is not attempted for approximately 24 hours.
- Prior to laparotomy, the patient should be adequately resuscitated.
- Blood products should be ordered as indicated, and the blood bank should be aware of the need for possible massive transfusions.
- Proper surgical consultation should be obtained as well.
- At the time of laparotomy, the uterus and surrounding tissues should be inspected for rupture or hematoma formation. If uterine rupture is present, the option to repair the rupture site may exist. If uterine atony is the etiology for bleeding, then uterotonic should be continued. Bilateral uterine and/or hypogastric artery ligation may be attempted as treatment, depending on the experience and skill of the surgeon. Similarly, B-Lynch transmural compression sutures may be effective and allow for uterine preservation.
- If hysterectomy is undertaken, either subtotal (supracervical) or a total procedure is performed, depending on the bleeding source.
- For cases of atony, supracervical hysterectomy should be adequate for definitive treatment.

References

- Lyndon A, Lagrew D, Shields L, Melsop K, Bingham B, Main E (Eds). Improving Health Care Response to Obstetric Hemorrhage. (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care)
- Developed under contract #08-85012 with the California Department of Public Health; Maternal, Child and Adolescent Health Division; Published by the California Maternal Quality Care Collaborative, July 2010.
Related Tools

- Massive Transfusion Protocol (Emergency Blood Product Release)
- IHIS Massive Transfusion Protocol (MTP) Documentation
- IHIS OB Hemorrhage Risk Assessment

Outcome Measures

- Percent of women with a postpartum hemorrhage (who gave birth ≥20 0/7 weeks gestation) who:
  - were transfused with any blood product during the birth admission
  - were transferred to ICU
- Percent of women with postpartum hemorrhage and uterine atony who receive:
  - Methergine® (methylergonovine)
  - Hemabate® (carboprost)
  - Cytotec® (misoprostol)
- Rate of peripartum hysterectomies in women (who gave birth > 20 0/7 weeks gestation) per 1,000 live births

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Guideline Approved

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Disclaimer: Clinical practice guidelines and algorithms at The Ohio State University Wexner Medical Center (OSUWMC) are standards that are intended to provide general guidance to clinicians. Patient choice and clinician judgment must remain central to the selection of diagnostic tests and therapy. OSUWMC’s guidelines and algorithms are reviewed periodically for consistency with new evidence; however, new developments may not be represented.
<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Dose / Route</th>
<th>Adverse Effects</th>
<th>Contraindications</th>
<th>Storage</th>
</tr>
</thead>
</table>
| Pitocin (oxytocin) | • 0-40 units/L in normal saline or lactated Ringer's, continuous IV  
• May be given IM | • Nausea and Vomiting  
• Cramping  
• Undiluted rapid IV can cause hypotension | • Allergy to oxytocin  
• Pitocin for IM use available in Pyxis.  
• IV bag with Pitocin available from L&D. | |
| Methergine (methylergonovine) | • 0.2 mg IM q 2 - 4 hr;  
• 0.2 mg IVP over 1-2 minutes for life-saving use only and with BP monitoring | • Hypertension  
• Nausea and vomiting  
• Diarrhea, diaphoresis, cramping, headache  
• Dizziness, bradycardia or tachycardia | • Hypertension or toxemia  
• Notify MD prior to admin for BP >140/90 | • Refrigerator (medication is light sensitive) |
| Hemabate (carboprost) | • 250 mcg IM  
• May repeat every 15-90 minutes.  
• Do not exceed 8 doses | • Severe bronchospasm  
• Nausea and vomiting  
• Diarrhea  
• Shivering  
• Fever  
• Chills | • Avoid in Asthma  
• Avoid in patients with active cardiac, pulmonary, hepatic, or renal disease | • Refrigerator |
| Cytotec (misoprostol) | • RECTAL: 1000 mcg | • Nausea and vomiting  
• Shivering  
• Diarrhea  
• Fever | • Allergy to prostaglandins | • Pyxis (100 or 200 mcg) |
## Postpartum Hemorrhage (PPH) Checklist with Defined Provider Roles

**Note:** At any time during the event, if additional support services are needed, consider activating ERT or Code Blue Team. Activation of the OB STAT Call System should also be considered if additional support services are required.

<table>
<thead>
<tr>
<th>Obstetric Provider</th>
<th>Primary Nurse</th>
<th>Secondary Nurse</th>
<th>Anesthesia Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PPH identified – Initial steps</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Uterine massage</td>
<td>- Monitor cumulative blood loss q 5 minutes</td>
<td>- Bring PPH medication/ pain medication</td>
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<tr>
<td>- Manual examination of the uterine cavity, cervix, vaginal walls and placenta</td>
<td>- Apply pulse oximeter - Monitor vital signs and O2 sat. q 5 minutes</td>
<td>- Call for equipment / PPH kit</td>
<td></td>
</tr>
<tr>
<td>- Order uterotonic medication</td>
<td>- Assist with uterine massage</td>
<td>- Mobilize additional staff if needed- i.e. Anesthesia with second round of medications.</td>
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<tr>
<td>- Pitocin 20-40 units in 1000 ml NS IV</td>
<td>- Mobilize staff- i.e. Charge Nurse &amp; physicians</td>
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</tr>
<tr>
<td>- 10 units IM</td>
<td>- Calls for/request PPH medication kit</td>
<td>- Assist with additional IV</td>
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<tr>
<td>- Methergine (methylergonovine) 0.2 mg IM – DO NOT give if patient has hypertension or history of hypertension – IV use in life-threatening emergency only.</td>
<td>- Administers meds and increase IV fluid rate per order.</td>
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</tr>
<tr>
<td>- PGF2 (carboprost or Hemabate) 250 mcg IM -Use with caution in cardiac disease and asthma -Side effects-nausea, vomiting, diarrhea</td>
<td>- Assign timekeeper / documentation</td>
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<tr>
<td>- Cytotec (misoprostol) 400-1000 mcg</td>
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<tr>
<td>- Give rectally- Do not use lubricant</td>
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<tr>
<td><strong>Moderate- ongoing care</strong></td>
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<tr>
<td><strong>Potential for transfusion/ surgical intervention</strong></td>
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<tr>
<td>- Order labs</td>
<td>- Maintain strict I/O</td>
<td>- Review medical, obstetric and anesthesia history</td>
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<tr>
<td>- (T&amp;C, H&amp;H, coags) DIC screen</td>
<td>- Elevate legs</td>
<td>- Assess airway</td>
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<tr>
<td>- Order O2 supplementation</td>
<td>- Assess pain</td>
<td>- Assess vital signs/core temp.</td>
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<tr>
<td>- If the patient is on the postpartum unit, arrangements should be made for this patient to go to the main OR</td>
<td>- Administer O2 per order</td>
<td>- Assess analgesia</td>
<td></td>
</tr>
<tr>
<td>- Should a potential major delay occur after a discussion with Anesthesia, this patient may be evaluated in the L&amp;D OR</td>
<td>- Assist with tamponade balloon set-up. Requires 500 ml of sterile water</td>
<td>- Assist with additional IV access</td>
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<tr>
<td>- Curettage as indicated</td>
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<td>- Review and manage fluid resuscitation- Fluid warmer</td>
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<tr>
<td>- Surgical Repair of lacerations as indicated</td>
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<td>- Provide anesthesia as indicated</td>
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<tr>
<td>- Consider intrauterine balloon tamponade</td>
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<tr>
<td>- Obtain consent for blood products</td>
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<tr>
<td>- Blood transfusion as clinically indicated</td>
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<tr>
<td>- <strong>Administer trauma blood if type and crossed blood not available.</strong> Activate Massive Transfusion Protocol (Emergency Blood Product Release)</td>
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<tr>
<td>- Arterial Embolization in hemodynamically stable patients only</td>
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<tr>
<td><strong>Severe PPH – Potential for massive transfusion</strong></td>
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<tr>
<td>- Consider secondary surgical therapies</td>
<td>- Suture for B-Lynch procedure: 4 packs of J880: 2-0 Vicryl, 54 inches long, taper needle</td>
<td>- Blood warmer</td>
<td></td>
</tr>
<tr>
<td>- B-Lynch procedure</td>
<td>- Surgical counts</td>
<td>- Rapid infuser</td>
<td></td>
</tr>
<tr>
<td>- Uterine Artery Ligation</td>
<td>- Assist with obtaining and transfusion of blood products.</td>
<td>- Upper body warming device</td>
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<tr>
<td>- Hysterectomy</td>
<td>- Assist with lab draws and ABGs. (ABGs can be done in the Newborn Intensive Care Unit.)</td>
<td>- Monitor EBL</td>
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<tr>
<td>- Call for advanced GYN surgeon or Adult Intensivist</td>
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<td>- Central line</td>
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</tr>
<tr>
<td>- Repeat labs including ABGs and coags</td>
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</tbody>
</table>