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Postpartum Hemorrhage

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Course Description:

When will the next postpartum hemorrhage occur for a patient under your care? Postpartum hemorrhage is a phenomenon that will continue to plague labor and delivery units. This module will help you to strengthen your knowledge then build upon your base to be better prepared for future hemorrhage encounters.

Approximate Time to Complete: 75 minutes

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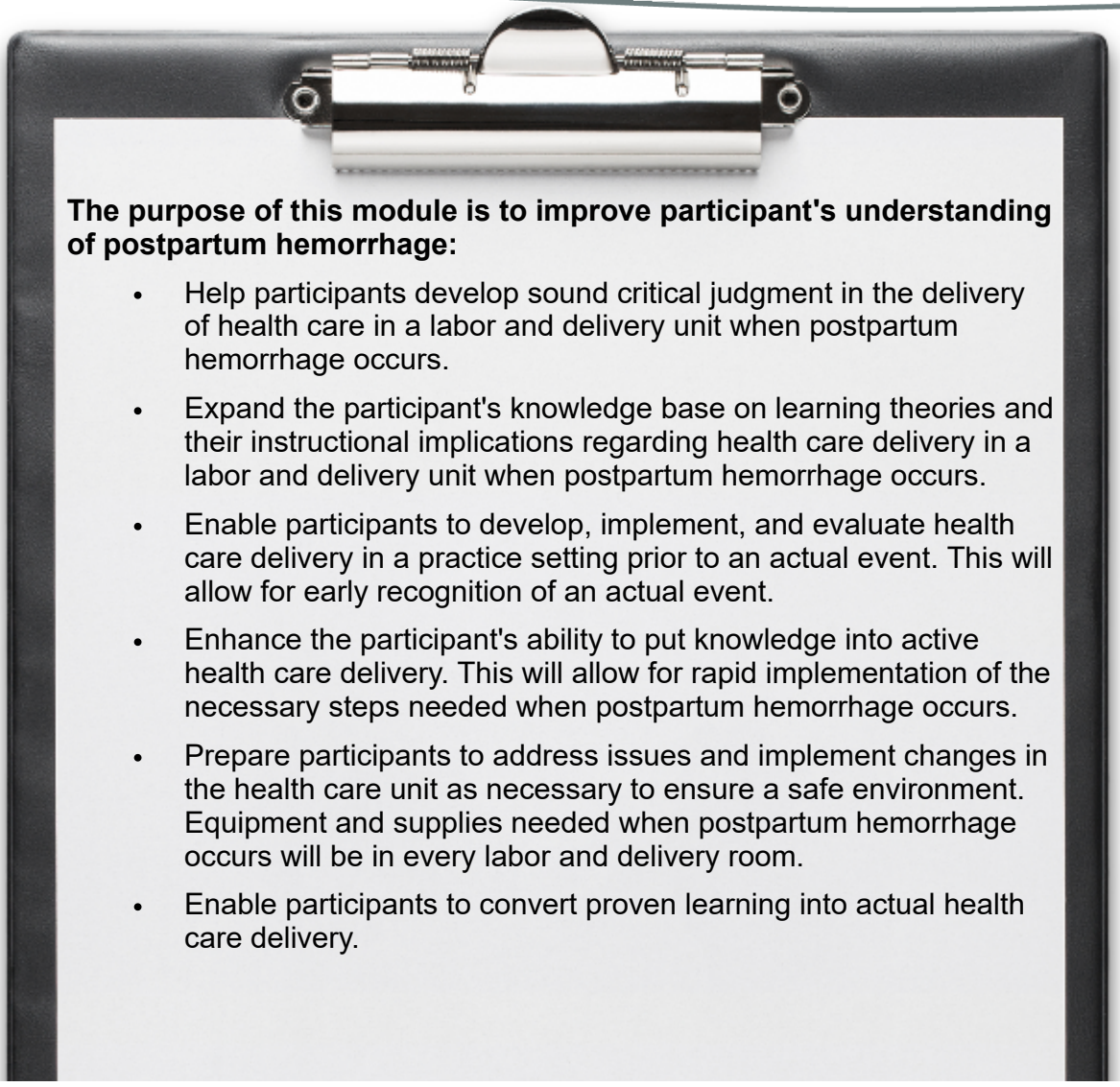


The purpose of this module is to improve participant's understanding of postpartum hemorrhage:

- Help participants develop sound critical judgment in the delivery of health care in a labor and delivery unit when postpartum hemorrhage occurs.
- Expand the participant's knowledge base on learning theories and their instructional implications regarding health care delivery in a labor and delivery unit when postpartum hemorrhage occurs.
- Enable participants to develop, implement, and evaluate health care delivery in a practice setting prior to an actual event. This will allow for early recognition of an actual event.
- Enhance the participant's ability to put knowledge into active health care delivery. This will allow for rapid implementation of the necessary steps needed when postpartum hemorrhage occurs.
- Prepare participants to address issues and implement changes in the health care unit as necessary to ensure a safe environment. Equipment and supplies needed when postpartum hemorrhage occurs will be in every labor and delivery room.
- Enable participants to convert proven learning into actual health care delivery.

Table of Contents

Postpartum Hemorrhage (PPH) is defined as [1]:

Primary PPH

occurs in the first 24 hours after delivery (also called early PPH)

Secondary PPH

occurs 24 hours to 12 weeks after delivery (also called late or delayed PPH) and is beyond the scope of this program

Postpartum hemorrhage is a cumulative blood loss of 1,000 mL or greater accompanied by signs or symptoms of hypovolemia within 24 hours of delivery

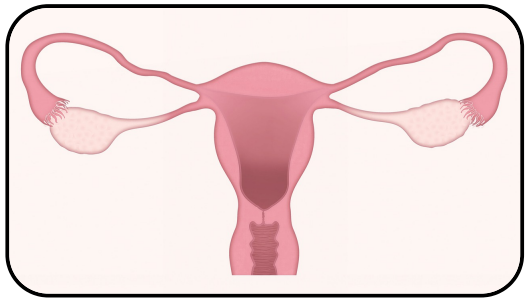
It is the leading cause of maternal mortality worldwide and a major cause of morbidity.

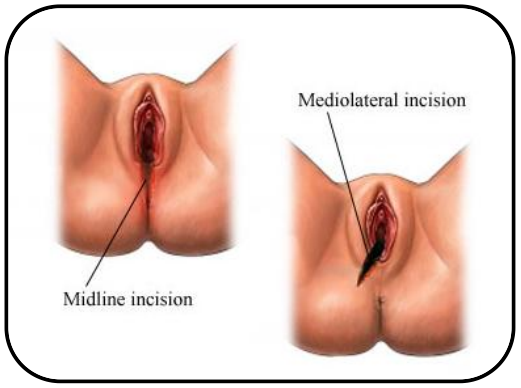
The incidence of PPH varies widely.

PPH occurs in 1-5% of all deliveries [3].

The rate of hemorrhage increased 26% from 1994-2006, primarily related to increased uterine atony. However, the rate of mortality related to hemorrhage decreased, which is attributed to increased rates of transfusion and peripartum hysterectomy.

Antenatal and Intrapartum Risk Factors for PPH





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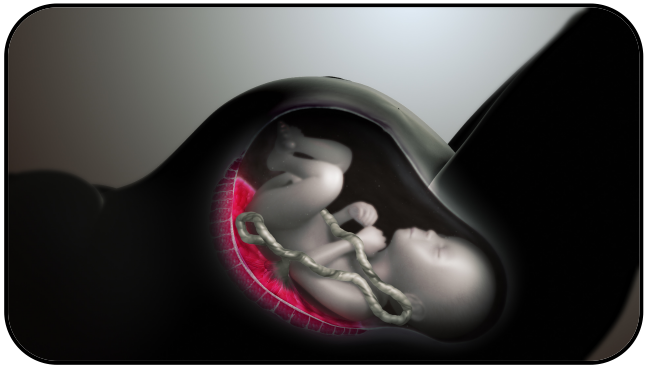

Abnormalities of uterine contraction, atony

- **Primary Problems**
- Atonic Uterus
  - **Risk Factors, Signs**
    - Prolonged use of oxytocin
    - High parity
    - Chorioamnionitis
    - General anesthesia
- Over distended Uterus
  - **Risk Factors, Signs**
    - Twins or multiple gestation
    - Polyhydramnios
    - Macrosomia
- Fibroid Uterus
  - **Risk Factors, Signs**
    - Multiple uterine fibroids
- Uterine inversion
  - **Risk Factors, Signs**
    - Excessive umbilical cord traction
    - Short umbilical cord
    - Fundal implantation of the placenta

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Genital tract trauma

- **Primary Problems**
- Episiotomy
  - **Risk Factors, Signs**
    - Operative vaginal delivery
- Cervical, vaginal, and perineal lacerations
  - **Risk Factors, Signs**
    - Precipitous delivery
- Uterine rupture

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Retained placental tissue

- **Primary Problems**
- Retained placenta
  - **Risk Factors, Signs**
    - Succenturiate placenta
    - Previous uterine surgery
    - Incomplete placenta at delivery
- Placenta accrete
  - **Risk Factors, Signs**
  - Previous uterine surgery
  - Incomplete placenta at delivery

Abnormalities of coagulation
Primary Problems

If the primary problem is:

Therapeutic Anticoagulation → **Risk Factor**
Current thromboembolism treatment

- Severe Infection
- Amniotic fluid embolism
- Excessive crystalloid replacement
- Inherited clotting factor deficiency (von Willebrand, hemophilia)
- Preeclampsia

→ **Risk Factors, Signs**

- Abnormal bruising
- Petechia
- Fetal death
- Placental abruption
- Fever, sepsis
- Hemorrhage
- Current thromboembolism treatment

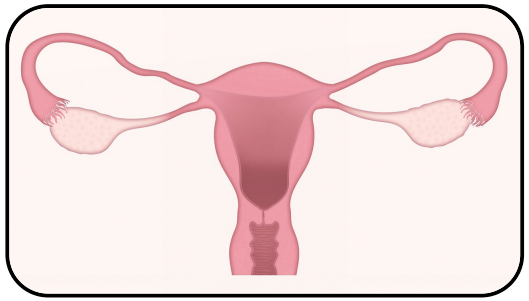
Symptoms related to blood loss with PPH [2]

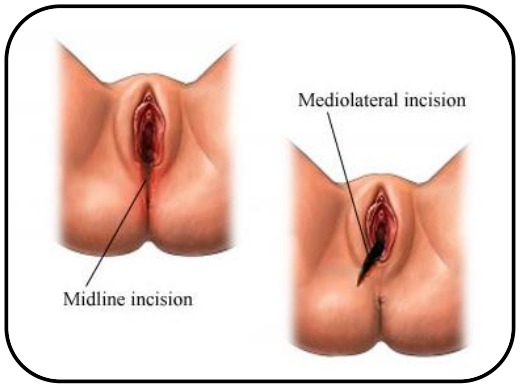
Blood Loss	Blood Pressure, mmHg	Signs and Symptoms
<500mL vaginal or <1000mL cesarean	Normal/stable	May have no symptoms or elevated heart rate (HR), no change in blood pressure (BP), pulse pressure or respiratory rate (RR)
>500mL vaginal delivery or >1000mL cesarean delivery or change in vital signs	≤85/45mmHg	HR ≥110 beats/minute, O_2 saturation <95%, RR 20-24, decreased pulse pressure, weakness, and sweating
Continued bleeding with total blood loss remaining <1500mL	BP continues to be ≤85/45mmHg	HR >120 and thread, RR markedly elevated, capillary refill delayed, restlessness, confusion, pallor, and oliguria
>1500mL Massive Transfusion protocol and surgical approach to control bleeding	unstable systolic and further decreasing BP	HR >120, lethargy, air hunger, anuria, and collapse

Obstetric hemorrhage is unpredictable, common and can cause severe morbidity and mortality. Because of this, all obstetric care providers and units should be prepared to manage hemorrhage.

State and national organizations have suggested that a maternal risk assessment be conducted antenatally, at the time of admission and throughout the delivery process to identify women at increased risk of hemorrhage

Antenatal and Intrapartum Risk Factors for PPH [1]





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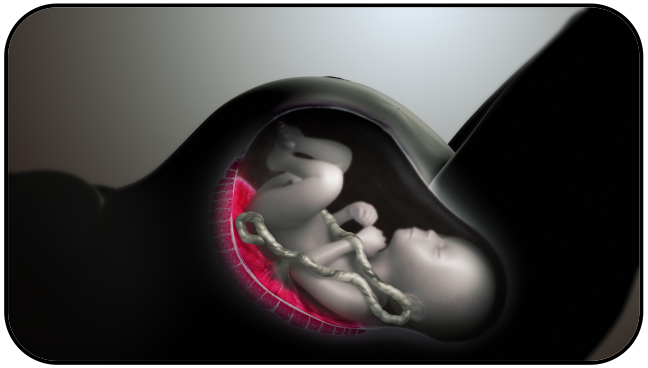

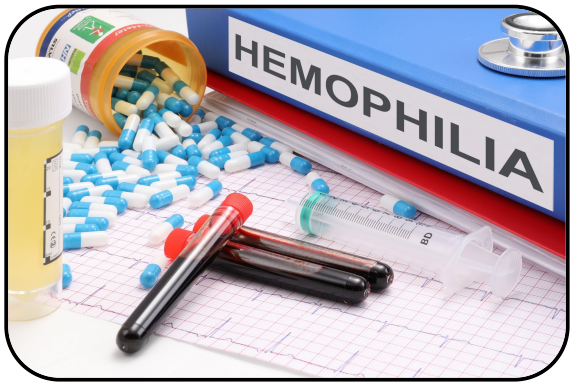

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- Preeclampsia
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    - Abnormal bruising
    - Petechia
    - Fetal death
    - Placental abruption
    - Fever, sepsis
    - Hemorrhage
    - Current thromboembolism treatment
- Inherited clotting factor deficiency (von Willebrand, hemophilia)
  - **Risk Factors, Signs**
    - Abnormal bruising
    - Petechia
    - Fetal death
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    - Fever, sepsis
    - Hemorrhage
    - Current thromboembolism treatment

- Severe infection
  - **Risk Factors, Signs**
    - Abnormal bruising
    - Petechia
    - Fetal death
    - Placental abruption
    - Fever, sepsis
    - Hemorrhage
    - Current thromboembolism treatment
- Amniotic fluid embolism
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    - Abnormal bruising
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    - Fever, sepsis
    - Hemorrhage
    - Current thromboembolism treatment

- Excessive crystalloid replacement
  - **Risk Factors, Signs**
    - Abnormal bruising
    - Petechia
    - Fetal death
    - Placental abruption
    - Fever, sepsis
    - Hemorrhage
    - Current thromboembolism treatment
- Therapeutic anticoagulation
  - **Risk Factors, Signs**
    - Current thromboembolism treatment

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- **Primary Problems**
- Episiotomy
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    - Operative vaginal delivery
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  - **Risk Factors, Signs**
    - Precipitous delivery
- Uterine rupture

In a large series, the most common risk factors associated with need for massive transfusion during hospitalization for delivery were:

- Abnormal placentation
- Abruption
- Severe preeclampsia
- Fetal demise [5]

In addition to the risk factors listed above, placenta previa, personal history of previous PPH, obesity, high parity, Asian or Hispanic race, precipitous labor, first stage of labor >24 hours, uterine over-distention, uterine infection, and some drugs, such as antidepressants, have been associated with PPH [6-17].

Women with severe factor XI deficiency or who are hemophilia carriers are at increased risk of both early and late PPH (16 to 22% for early and 11 to 24% for late).

PPH may be due to an acquired hemophilia A (pregnancy-related FVIII autoantibodies) [18].

- The condition should be suspected with the combination of a normal platelet count and normal prothrombin time with prolonged activated partial thromboplastin time (aPTT) not corrected by admixture with normal plasma.

Amniotic fluid embolism (AFE), placental abruption, preeclampsia with severe features, or can be the cause of acute coagulopathies.

Undiagnosed bleeding disorders are rarely the cause of PPH; therefore, PPH by itself is not an indicator to screen for inherited bleeding disorders [19].

- One of 50 women in a study, who had PPH, had postpartum screening that identified a bleeding disorder.

A bleeding disorder should be considered if a woman experiences PPH that does not respond to general treatment measures when she has a history of menorrhagia, excessive bleeding after minor injury, or a known family history of a bleeding disorder [20].

Generally, hemostasis begins when the placenta separates from the uterus, which causes the myometrium to contract and vessels to constrict that supplied the placental bed and activates the coagulation pathways. This forms a clot at the placental attachment site.

PPH results from a disturbance in one or more of these events.

These disturbances can be associated with incomplete placental separation as seen in invasive placental disease, uterine atony, acquired or inherited factor deficiencies, thrombocytopenia, drugs that affect coagulation, retained products of conception, uterine rupture, uterine inversion and possibly trauma.

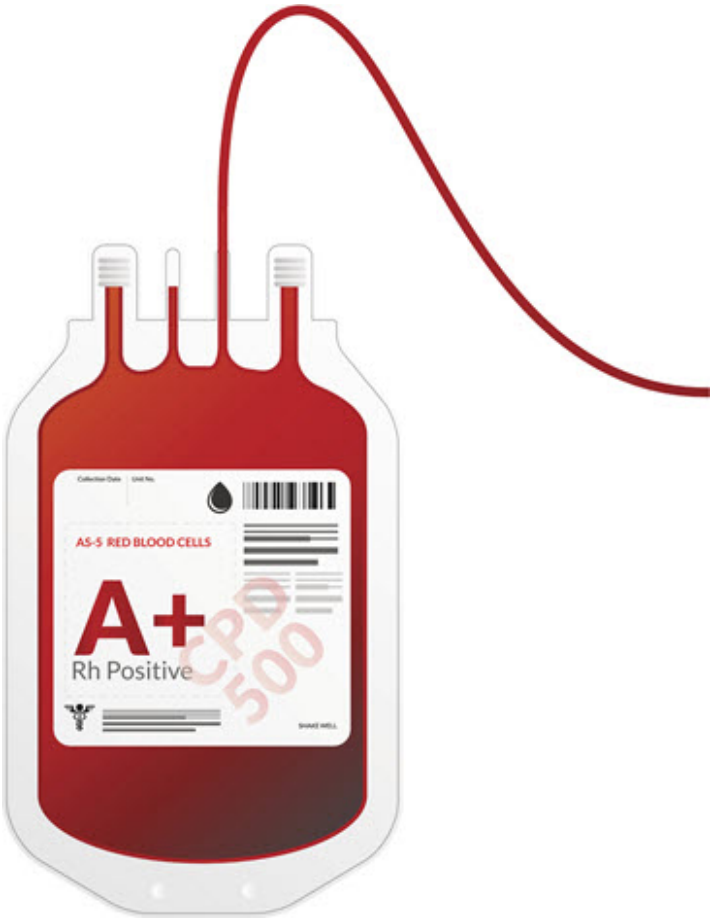
Although uterine atony is the most common cause of PPH, it is often responsive to therapy and thus not the most common reason for massive transfusion after delivery [21].

In a large worldwide series, 54 % of women with PPH received a blood transfusion [73].

Late pregnancy uterine arterial blood flow is 500-700mL/min and accounts for approximately 15% of cardiac output. This increase in blood flow contributes to PPH.

Most women do not hemorrhage because uterine bleeding is controlled by:

- Contraction of the myometrium which constricts the blood vessels supplying the placental bed
- Localized decidual hemostasis



Atony | Trauma | Coagulation Defects

The most common cause of PPH is uterine atony which complicates 1 in 40 births in the United States and is responsible for at least 70-80% of the cases of PPH [21].

Uterine atony is caused by an inability of the uterine myometrium to contract effectively.

Risk Factors for uterine atony include:

- Uterine overdistension (multiple gestation, polyhydramnios, macrosomia)
- Uterine infection
- Uterine relaxants
- Prolonged or induced labor
- Uterine inversion
- Retained placenta
- Prolonged use of oxytocin
- Uterine leiomyoma

Click here to see more about the etiology of PPH.

PPH generally is caused by diffuse uterine atony which responds to uterotonic drugs and is not a common reason for massive transfusion following delivery [6].

If the uterus appears to be firmly contracted after delivery, other etiologies of hemorrhage should be considered.

A well-contracted fundus does not exclude the possibility of atony of the lower segment.

Women with persistent bleeding despite a firm fundus should always undergo a vaginal examination to identify ballooning of the lower uterus, as well as cervical and vaginal lacerations.

Treatment of lower uterine segment atony is evacuation of clot and bimanual compression while waiting for uterintonic medication or intracavitary balloon placement.

click to close

Click here to see more about the etiology of PPH.

Atony | Trauma | Coagulation Defects

Trauma-related bleeding can be due to:

- Lacerations (i.e., perineal, vaginal, cervical, uterine)
- Incisions (i.e., hysterotomy, episiotomy)
- Uterine rupture

Lacerations are more common after instrumental delivery.

Genital tract hematomas involving the labia, vagina, broad ligament or retroperitoneum can also lead to significant blood loss.

Additional risk factors include fetal malpresentation, fetal macrosomia, episiotomy, precipitous delivery, prior cerclage placement, Duhrssen incisions and shoulder dystocia.

A genital tract laceration should be suspected if bleeding persists after delivery despite good uterine tone.

If arterial bleeding is suspected, rapid suture ligation or evaluation by interventional radiology may be required.

Click the tabs to see more information.

Atony | Trauma | Coagulation Defects

Acute Coagulopathy Acute coagulopathy at the time of delivery can be caused by pre-eclampsia with severe features, HELLP, placental abruption, amniotic fluid embolism, sepsis, acute fatty liver of pregnancy or fetal demise.

Acquired causes included disorders related to the pregnancy; severe preeclampsia, HELLP syndrome, placenta abruption, fetal demise, AFE, sepsis, and surgical site bleeding.

The mechanism is related to hemodilution, failure of liver synthetic function, or disseminated intravascular coagulation (DIC).

Treatment of acute coagulopathy is to identify and treat the underlying etiology.

Click the tabs to see more information.

Retained Products of Conception | Invasive Placental Disease | Uterine Rupture/Inversion

- Causes hemorrhage by inhibiting the uterus from adequate contraction.
- Can be diagnosed based on visual inspection of the placenta following delivery or by ultrasound demonstrating a thickened endometrial stripe.
- Risk factors include second trimester delivery, chorioamnionitis, prior uterine surgery and placental succenturiate lobe.
- Treatment includes attempted manual removal, "banjo" curettage or postpartum dilation & curettage

Click the tabs to see more information.

Retained Products of Conception | Invasive Placental Disease | **Uterine Rupture/Inversion**

- Caused by abnormal placental attachment to the myometrium
- Most common in the setting of prior uterine surgery (particularly prior cesarean sections) and placenta previa
- Best diagnosed by ultrasound during pregnancy
- Typically requires cesarean hysterectomy for treatment

Click the tabs to see more information.

Retained Products of Conception | Invasive Placental Disease | Uterine Rupture/Inversion

Uterine rupture

- Rare cause of postpartum hemorrhage.
- Biggest risk factor is a trial of labor after cesarean section.
- May not present with vaginal bleeding, but rather abdominal pain and fetal heart decelerations.

Uterine inversion

- Rare cause of postpartum hemorrhage.
- Presents as a rounded mass in the vagina with no palpable fundus abdominally.
- Most commonly caused by fundal placentation with excessive cord traction following delivery.

Click the tabs to see more information.

To improve outcomes in women who develop PPH, protocol for management should be developed to identify heavy bleeding and hemorrhage before it becomes life threatening [22-25]. Quantifying blood loss (QBL) rather than estimating the blood loss (EBL) is important to help determine the amount of blood loss.

Development of a postpartum hemorrhage protocol has been associated with quicker resolution of bleeding, decreased use of blood products and decreased incidence of DIC.

Clinical training programs or simulations encourage a team approach which may improve outcomes by quicker response to and treatment of hemorrhage.

Women who are identified as at risk for PPH should be educated and counseled appropriately for their level of risk and the gestational age.

Planning for a PPH event involves establishing resources to ensure adequate staffing, intravenous (IV) access, medication, equipment, and availability of blood and blood products.

All labor and delivery units should have a postpartum hemorrhage kit, which includes medication and equipment to manage postpartum hemorrhage.

Simulation drills on a PPH event will assist in identifying areas needing improvement. This practice is recommended by The Joint Commission [26].

Identifying deficiencies in clinical knowledge and performance can be demonstrated in simulation-based teaching of management of PPH [27,28].

Teamwork and communication failures are responsible for up to 70% of obstetric sentinel events [29].

The Joint Commission, the American College of Obstetricians and Gynecologists (ACOG), and the Institute of Medicine, all recognize teamwork and communication as an important element of patient safety [29,30,31].

The management of PPH is multifaceted and potentially requires care by several teams within the hospital: obstetricians, midwives, anesthesiologists, nurses, blood bank, laboratory personnel, surgical specialists, and interventional radiology [22]. Coordination of these teams is essential in outcomes.

To help lower incidence and help prevent maternal mortality, it is imperative every obstetrical unit has:

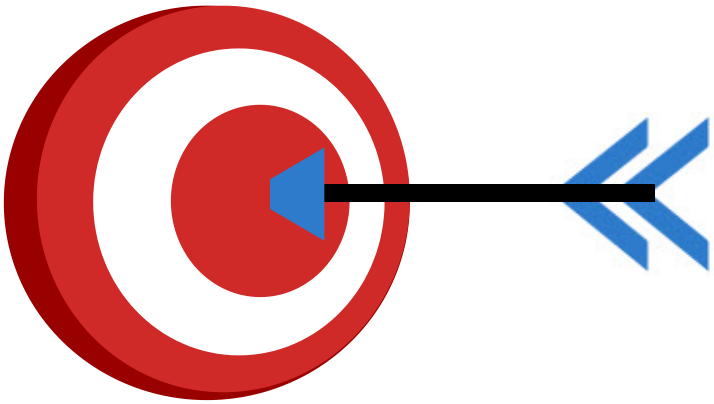
1. Readiness to respond to an obstetrical hemorrhage.
2. Recognition and prevention measures in place for all patients.
3. A multidisciplinary approach to excessive maternal bleeding.
4. De-briefing to learn and improve responsiveness

Knowledge, protocols, and simulation training will allow the healthcare team to coordinate their efforts and function well together.

The approach and aggressiveness of interventions will be dependent on the rate and amount of bleeding, vital signs, and laboratory results of complete blood count (CBC), coagulation studies, and electrolytes and renal function.

Typically, intervention is required before laboratory information is available.

If one treatment option does not adequately control bleeding, the obstetrical provider should promptly select the next treatment. Non-operative and operative interventions for PPH can be used alone or in combination [33,35].



The goal is to:

- Maintain or restore circulation to vital organs
- Maintain or restore tissue oxygenation
- Prevent or reverse coagulopathy
- Identify and eliminate the cause of PPH

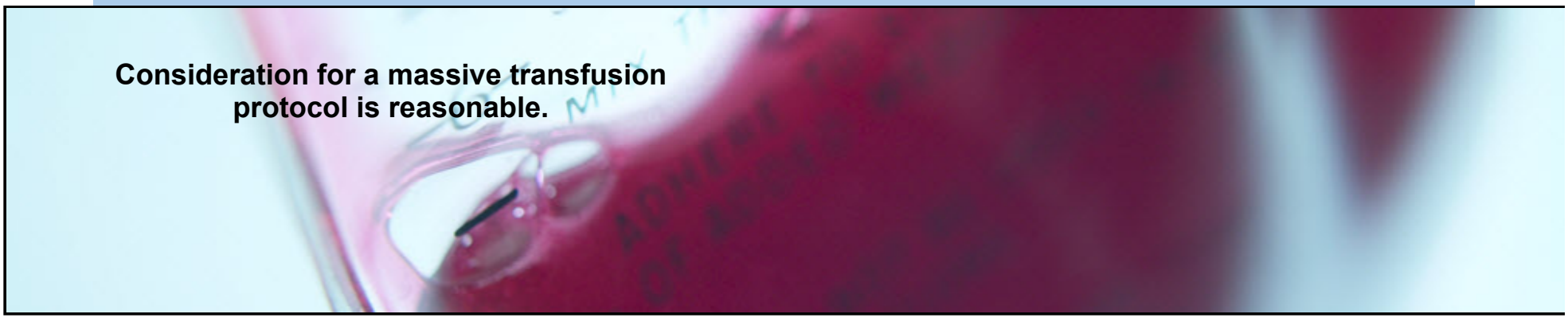
If an intervention does not succeed in decreasing hemorrhage, the next treatment should be quickly implemented.

Delayed recognition or uncertainty in treatment may result in further bleeding which may cause dilutional coagulopathy, life-threatening hypovolemia, tissue hypoxia, hypothermia, and acidosis [33].

Delay in controlling hemorrhage may increase the need for a hysterectomy, or may result in hemorrhagic shock, or death.

Development of a standardized institutional approach to management of PPH improves outcomes.

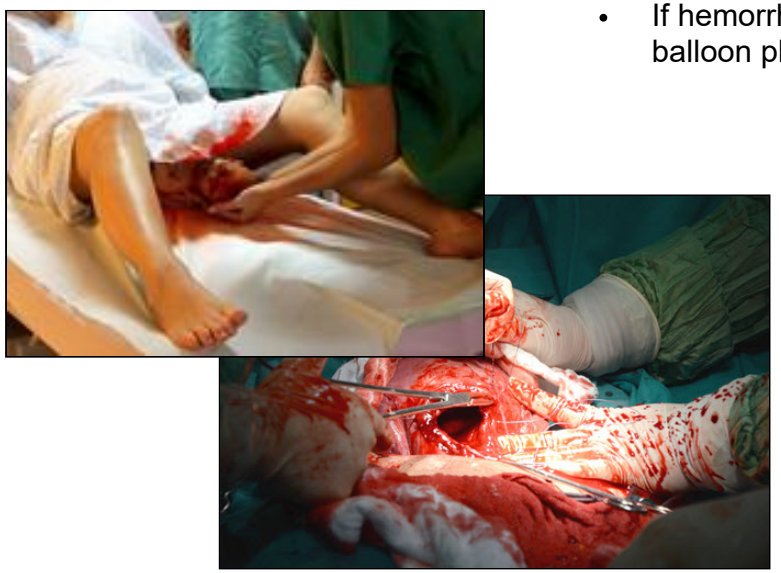
One component of a standardized institutional approach is to implement a standardized massive transfusion protocol for the labor and delivery unit.



Consideration for a massive transfusion protocol is reasonable.

The approach to treatment of PPH differs somewhat depending on the cause and whether hemorrhage occurs after a vaginal birth or after a cesarean delivery.

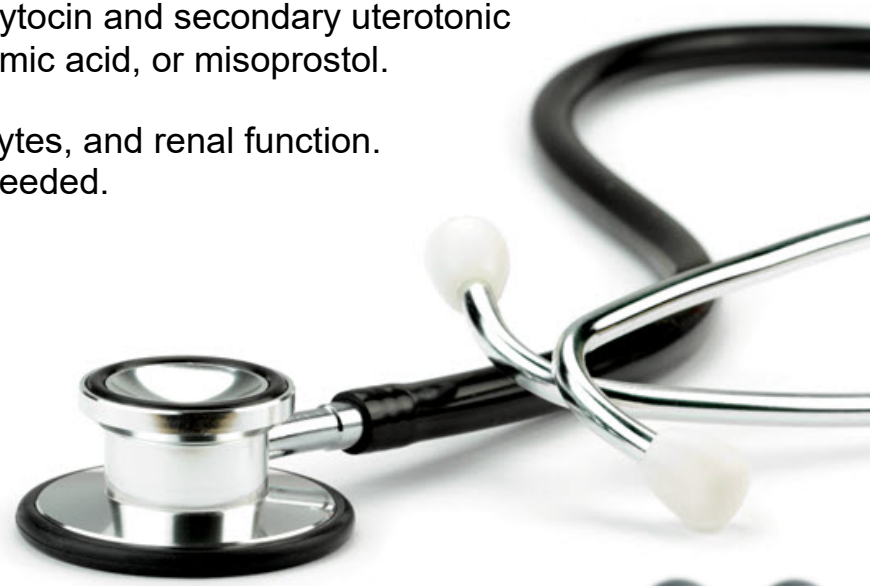
- Hemorrhaging lacerations caused by trauma will need to be repaired using either the transvaginal or transabdominal approach.
- Vaginal hematomas should not be drained unless expanding to reduce likelihood of further blood loss.
- Coagulation defects should be treated medically with transfusion of blood, blood products or a combination of both.
- If hemorrhage is caused by uterine atony, uterotonic medication and/or intrauterine balloon placement is recommended.



Key components of evaluation and treatment

Rapid evaluation and management of excessive vaginal bleeding after delivery requires:

- Frequent assessment of BP, HR, RR, peripheral oxygen saturation, and urine output.
- A provider at bedside.
- Active management of the third stage of labor with oxytocin and secondary uterotonic drugs such as carboprost, methylergonovine, tranexamic acid, or misoprostol.
- Early IV access.
- Early evaluation of CBC, coagulation studies, electrolytes, and renal function.
- Prepare blood and blood products for transfusion, if needed.



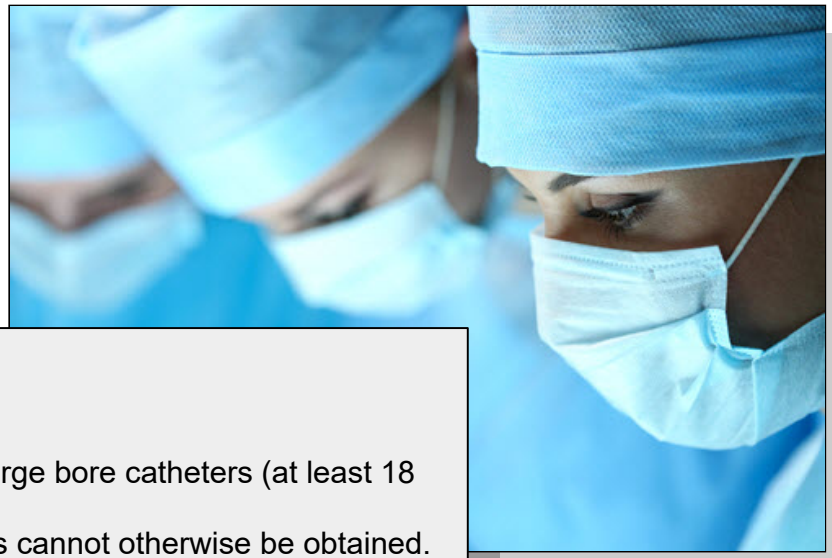
Initial Interventions

- Women with persistent postpartum vaginal bleeding should be closely monitored, provided good IV access, and supported with fluids and blood products, as needed.
- The source of bleeding should be determined and treated; clinical assistance should be requested, as appropriate.
- Baseline laboratory studies include hematocrit/hemoglobin, coagulation studies, electrolyte concentrations, and type and crossmatch of blood products.

Although the initial interventions described below are often successful, in the setting of hemodynamic instability it is important to avoid prolonged, futile attempts at conservative therapy before proceeding to laparotomy and, if necessary, hysterectomy.

Uterine massage and compression is necessary if uterine atony is present.

- Initial evaluation should include a vaginal and uterine exam. The uterus should be evacuated of any blood clots.
- Bimanual uterine massage should be initiated. The provider places one hand into a fist and inserts vaginally to the anterior fornix and the other hand massages the fundus to compress the uterus between the hands.
- Massage should continue until bleeding decreases. If the uterine fundus is firm and bleeding continues, further massage is unlikely to be effective, and other measures should be implemented.



Intravenous Access

IV access should be established (if not already), preferably with two large bore catheters (at least 18 gauge), for administration of fluids, blood, and medications.

- Consideration for Intraosseous access as an option, if access cannot otherwise be obtained.

When a patient has severe bleeding, peripheral blood flow will be diminished, making access of peripheral IV access difficult. The patient should have a central venous line placed into the subclavian or internal jugular.

Early recognition of the event will require that the appropriate team is summoned to assist, such as the anesthesia team, or vascular access team, to establish IV access.

Oxygenation

- Oxygenation is maximized by administering oxygen (10 to 15 liters/minute) by face mask and transfusion to improve oxygen-carrying capacity and delivery.
- If operative intervention is planned, anesthesia assistance should be requested for possible intubation.

Fluid Resuscitation and Transfusion

- Urine output should be closely monitored using a bladder catheter with a urometer.
- To avoid hypothermia, all fluid and blood components should be normothermic or infused using a fluid warmer.

Warm blankets should be used to assist in maintaining normothermia.

- In the setting of hemorrhage, 1-2 L IV fluids should be bolused to aide in resuscitation, regardless of transfusion of blood or blood products.
- Transfusion of red cells can be used to improve and maintain tissue oxygenation.
- Treatment goal is to maintain systolic BP at 90mmHg and urine output at >30mL/hour.
- Monitor effectiveness of treatment, blood loss should be evaluated every 15 to 30 minutes and laboratory evaluation every 30 to 60 minutes to guide further blood product replacement.
- Replacement of blood components are based upon expert opinion as no universally accepted guidelines are available [53,54].

Treatment of Postpartum Hemorrhage

- Oxytocin (Pitocin)
- Carboprost tromethamine (Hemabate)
- Methylergonovine (Methergine)
- Misoprostol (Cytotec)
- Dinoprostone (Prostin E2)
- Carbetocin (Oxytocic agent)
- Tranexamic acid (Lysteda)

Treatment of Postpartum Hemorrhage - Oxytocin

Oxytocin is typically concentrated as 10-40 units in 1 L of saline.

- Can be administered as IV infusion or IM.
- IM dose is 10 units either into the patient's thigh or directly into the myometrium.

Lower doses of oxytocin IV, for a short period of time, have proven to be as effective as higher doses, such as 80 units in 500mL, infused over 30 minutes [34].

- Rapid infusion of high-dose oxytocin can lead to hypotension and cardiovascular collapse.
- It is recommended if a high-dose of oxytocin is used it should be a smaller volume, such as 15 units in 250mL, to reduce the dose administered over the short period of time.

Treatment of Postpartum Hemorrhage Carboprost Tromethamine (Hemabate)

Works by stimulating uterine contractility at the site of placentation. Contraindicated if woman has asthma.

For PPH Carboprost (15 methyl-PGF2alpha, Hemabate) the dose is 250 micrograms (mcg) IM every 15 to 90 minutes. A total cumulative dose of 2 milligrams (mg) or eight doses can be used.

After one or two doses of Carboprost, if the bleeding has not diminished, it is recommended to move on to another uterotonic agent because approximately 75% of women will respond after a single dose.

Carboprost can be injected directly into the myometrium transabdominally or vaginally with or without ultrasound guidance.

Carboprost 250mcg can be diluted in 20mL of normal saline for injection into the myometrium.

Treatment of Postpartum Hemorrhage - Methylergonovine (Methergine)

Methylergonovine 0.2mg intramuscularly or directly into the myometrium (never intravenously), if:

- No hypertension
- No Raynaud's phenomenon
- No scleroderma

If needed, may be repeated every 2 to 4 hours.

Quickly move on to a different uterotonic agent if there is not an adequate response following the first dose.

Click the arrows to see more information.

Treatment of Postpartum Hemorrhage - Misoprostol

Where injectable uterotonics are unavailable or contraindicated Misoprostol is useful for treatment for PPH.

There is no evidence that misoprostol is more effective than other uterotonics either for primary therapy of PPH or as an adjunctive treatment to oxytocin infusion [36].

The optimum dose and route of misoprostol administration is unclear [40-46].

Click the arrows to see more information.

Treatment of Postpartum Hemorrhage - Misoprostol

Sublingual Administration (600-1,000 mcg)	Rectal Administration
Sublingual misoprostol is absorbed rapidly.	Takes up to one hour to peak
Peak concentration in 30 minutes.	800-1000mcg is the most commonly used dose [43,44,47,48].
Peak concentration is higher and sustained for approximately 3 hours compared with oral administration due to avoidance of the first-pass hepatic metabolism.	Duration of action is 4 hours.
Larger doses over 400mcg are associated with an increasing potential for hyperthermia.	

Click the arrows to see more information.

Treatment of Postpartum Hemorrhage - Misoprostol

Due to heavy bleeding, it is not recommended to use the vaginal route of administration.

Misoprostol can be administered to women with hypertension or asthma.

Monitoring of the maternal temperature is important because pyrexia >40 degrees Celsius can occur when increasing misoprostol dose. Elevated temperature should be treated with acetaminophen.

Treatment of Postpartum Hemorrhage - Dinoprostone

Dinoprostone (PGE2) vaginal or rectal suppository can be administered every two hours as an alternate prostaglandin to misoprostol (PGE1).

Treatment of Postpartum Hemorrhage - Carbetocin

Carbetocin, a long-acting analog of oxytocin, is in use in many countries (but not the U.S.) for prevention of uterine atony and hemorrhage [49].

Click the arrows to see more information.

Treatment of Postpartum Hemorrhage - Tranexamic Acid [73,74]

Intravenous tranexamic acid (TXA) is recommended by the World Health Organization (WHO) to be used within 3 hours, following vaginal birth or cesarean delivery of a diagnosis of hemorrhage PPH.

TXA is a competitive inhibitor of plasminogen activation and can reduce bleeding by inhibiting the breakdown of fibrinogen and fibrin clots.

By giving within 3 hours of birth, maternal death from hemorrhage may be prevented, regardless of the cause. There were no noted adverse maternal effects from the medication.

Click the arrows to see more information.

Treatment of Postpartum Hemorrhage - Tranexamic Acid [73,74]

- TXA for PPH should not be utilized more than 3 hours after birth.
  - The benefits of TXA appear to decrease by 10% for every 15-minute delay, with no benefit seen after 3 hours from birth.
- TXA should be initiated as soon as possible after the onset of bleeding and within 3 hours of birth and should be considered part of the standard PPH treatment package (i.e. uterotonics, non-surgical and surgical interventions).
- Regardless of whether the postpartum hemorrhage is from the genital tract trauma or other causes, TXA should be used in all cases.

Click the arrows to see more information.

Treatment of Postpartum Hemorrhage - Tranexamic Acid [73,74]

- TXA administration involves a fixed dose of 1 gram in 10mL (100mg/mL) IV at 1mL per minute (administered over 10 minutes).
  - A second dose of 1g IV if bleeding continues after 30 minutes or if bleeding restarts within 24 hours of completing the first dose.
  - A bolus of TXA should be avoided due to a potential risk of transient lowering of blood pressure.
  - A decreased dose should be given in the setting of renal insufficiency.
  - TXA should not be given with solutions containing blood products, penicillin or mannitol.
- The half-life of TXA is 2 hours and antifribinolytic effect lasts for 7-8 hours.

Click the arrows to see more information.

Treatment of Postpartum Hemorrhage - Tranexamic Acid [73,74]

- **Contraindications to TXA**
  - Known thromboembolic event in pregnancy
  - History of coagulopathy
  - Active intravascular clotting
  - Known hypersensitivity to TXA

Removal of retained products of conception (POC) [49,50]

- Examine the uterus for any retained POC, placenta fragments or fetal membrane. The POC can be removed manually or with ring forceps.
- Bedside ultrasound can be used to guide removal of POC.
- Curettage with a banjo curette or 16mm suction catheter can be used if manual removal is unsuccessful.

Management and Treatment of PPH Cont'd

If hemorrhage is caused by uterine atony, this is typically treated with uterotonics, uterine balloon tamponade, uterine compression sutures or uterine artery embolization. If these measures fail, hysterectomy is required.

If hemorrhage is caused by uterine rupture, operative management is required. The patient may require hysterectomy if uterine repair cannot be performed or bleeding cannot be controlled.

If hemorrhage is caused by invasive placental disease, cesarean hysterectomy is required for definitive treatment.

A woman with concern for invasive placental disease, or uterine rupture may need an early hysterectomy to control the hemorrhage.

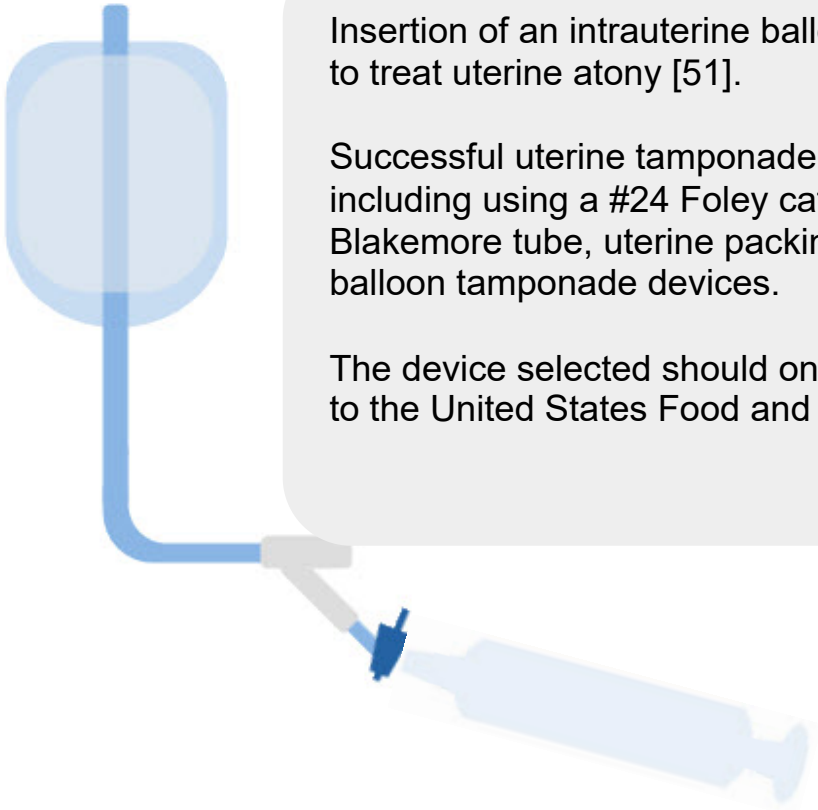
If hemorrhage causes DIC, massive transfusion should be initiated with replacement of blood and blood products. If hemorrhage cannot be controlled, hysterectomy may be required [68,70].

Uterine tamponade

- Uterine tamponade is effective in patients with atony or lower segment bleeding
- Either a balloon or a pack can be used for tamponade, but a balloon device designed for uterine tamponade is preferable because it can be placed quickly and allows some assessment of ongoing hemorrhage [51].

Click here to see more information.

Intrauterine Balloon Catheter



Insertion of an intrauterine balloon early will reduce blood loss while attempting to treat uterine atony [51].

Successful uterine tamponade can be achieved with alternative methods including using a #24 Foley catheter, with a 30mL balloon, Sengstaken-Blakemore tube, uterine packing with gauze, or commercially available uterine balloon tamponade devices.

The device selected should only be filled until bleeding is controlled and only to the United States Food and Drug Administration approved fill volume [52].

Balloon Tamponade Continued

It is believed the mechanism of action is related to a decrease in uterine artery perfusion pressure either by direct compression of the uterine artery or uterine wall conformational changes [52].

A description of these devices and their placement is addressed in the training portion of Maternal 911 in Action Postpartum Hemorrage.

During treatment with a uterine balloon tamponade, ongoing evaluation of blood loss, labs, and possible blood replacement is crucial.

If bleeding continues with the tamponade in place, the provider should promptly recognize that surgery or embolization is necessary.

Administer a broad spectrum antibiotic IV while uterine tamponade is in place, such as:

- Ancef 1 g q 8 hours
- Gentamicin, 1.5mg/kg every eight hours, and either:
  - Metronidazole, 500mg every eight hours
  - Clindamycin, 300mg every six hours
- These medications are generally administered for 24 hours and discontinued when the uterine tamponade device is removed.

Click here to see more information.

Jada System [75]

Jada system is newly developed device that can be placed into the uterus to induce a low-level vacuum (70-90mmHg), to initiate uterine myometrial contraction.

Evidence from 2020 research publication:

- 107 individuals at 34 weeks of gestation or later.
- 94% effectiveness in treating postpartum hemorrhage.
- Bleeding was controlled within 3 minutes (with a range of 2-5 minutes); the device was removed after 3-3.5hrs. Five participants needed further treatment with another method.
- Exclusion criteria included: retained placenta without easy manual removal, uterine rupture, purulent infection, coagulopathy, or blood loss greater than 1,500 mL at time of device placement.
- Allows for ongoing observation of continued blood loss.
- Remove air from the Cervical Seal prior to device use to minimize risk of air embolism if Cervical Seal bursts. Always fill the Cervical Seal with sterile fluid.
- The cervix must be dilated to > 3cm for Jada system use.

Click this button for video demonstrating the Jada system.

Click the arrows to see more information.

https://youtu.be/46Wiei8sUgM

Jada System [75]

Jada system is newly developed device that can be placed into the uterus to induce a low-level vacuum (70-90mmHg), to initiate uterine myometrial contraction.

Evidence from 2020 research publication:

- The Jada system should not be left within the uterus for more than 24 hours due to the possibility of an adverse tissue reaction or infection. The Jada system can be removed once the PPH is under control for at least an hour, the uterus is firm and the patient is stable.
- When placing the Jada system, ensure the Seal Valve is oriented to 6 or 12 o'clock. Ultrasound may be used to confirm placement of the intrauterine loop within the uterus. The Cervical Seal should be located within the vagina at the external cervical os. If clinically relevant, a B-Lynch compression suture may be used in conjunction with the Jada.

Click this button for video demonstrating the Jada system.

Click the arrows to see more information.

https://youtu.be/46Wiei8sUgM

Jada System [75]

Jada system is newly developed device that can be placed into the uterus to induce a low-level vacuum (70-90mmHg), to initiate uterine myometrial contraction.

Evidence from 2020 research publication:

- It is recommended to stop the vacuum, remove the fluid from the cervical seal and keep the Jada system in place for 30 minutes while monitoring the patient for recurrent bleeding
- Be sure the vacuum tubing is disconnected before removal

Click this button for video demonstrating the Jada system.

Click the arrows to see more information.

3 of 3

https://youtu.be/46Wiei8sUgM

Compensated shock may present in the woman with an increasing HR and tachypnea with a stable BP. When these symptoms present, the PPH protocol should be instituted even if light vaginal bleeding is observed.

Women can lose a substantial amount of blood prior to showing any hemodynamic changes; therefore, an obstetric provider should not wait for vital sign changes prior to treating hemorrhage.

In the postpartum period, hemoglobin and hematocrit may be poor indicators of acute blood loss since they may not decline immediately after acute bleeding.

Aggressive volume resuscitation with IVF, packed red blood cells (PRBC) and other blood products is used for treatment of hypovolemic shock.

In a patient with postpartum hemorrhage, if bleeding continues after uterine massage, repair of lacerations, administration of IVF, uterotonics, blood products, and placement of intrauterine balloon, further treatment is recommended.

Options include uterine artery embolization (if interventional radiology is available) or laparotomy.

If persistent bleeding continues in a hemodynamically stable woman after IVF and blood product replacement has been provided, arterial embolization is an appropriate treatment option.

- This procedure should not performed on an unstable patient who has to be transferred to a radiology suite.

Generally, an unstable and/or coagulopathic patient should receive bimanual uterine compression, balloon tamponade, transfusion of blood and blood products.

When considering an emergency hysterectomy, the patient should have stable coagulation with adequate IV access for massive transfusion and electrolyte imbalance treatment.

Laboratory evaluation in the setting of hemorrhage should include:

- CBC
- Type and cross
- Coagulation studies:
  - Fibrinogen
  - Prothrombin time (PT)
  - Activated partial thromboplastin time (aPTT)

Serial labs should be performed, the frequency of which should be determined by the clinical course.

Click each here to see more information.

Hemoglobin levels typically decrease by about one gram/dL for every 500mL of blood loss.

Coagulation studies are usually normal in the early stages of hemorrhage.

If abnormal coagulation studies are noted, the patient has a severe hemorrhage and massive transfusion should be initiated (if not already started), including transfusion of cryoprecipitate.

Prior to the return of the first set of laboratory studies, a red top tube of 5mL blood can be observed for clotting.

The patient is likely to have adequate fibrinogen stores if the blood tube clots within 8 to 10 minutes and remains intact.

The patient is likely to have markedly deficient blood clotting factors if the blood in the tube does not clot or the clot dissolves [4].

The fibrinogen level at the time of diagnosis of PPH is predictive of severity and can be used to guide the aggressiveness of management [55-58].

A fibrinogen level less than 200mg/dL is predictive of severe PPH. These women typically require transfusion of multiple units of blood, blood products, arterial embolization, surgical management of bleeding, and are at risk of maternal death [55-59].

When PPH occurs, the fibrinogen level is a better predictor of ongoing major blood loss than PT, aPTT, or platelet count [34,60].

The coagulation panel should be repeated every 30 to 60 minutes until PPH is controlled.

Caution if fibrinogen ↓200

Electrolytes

- In any massive transfusion situation where multiple units of blood are rapidly transfused, electrolytes should be monitored, with prompt treatment of abnormalities.
- The most common electrolyte abnormalities are hyperkalemia and low ionized calcium levels.
- Electrolyte disturbances can lead to cardiac arrest or significantly depressed cardiac function that precludes optimal resuscitation.

Ionized calcium should be measured at baseline and then every 15 minutes during a massive transfusion.

An ionized calcium level <1mmol/L (normal 1.1 to 1.3mmol/L) impairs coagulation and places the patient at risk of cardiac arrest.

Emergency replacement may be accomplished with 10% calcium chloride (1g/10mL vial calcium chloride) 1g/100mL saline over 2 to 5 minutes via a central line.

Alternatively, 10% calcium gluconate (1g/10mL) 1 to 2g over 2 to 3 minutes can be given intravenously for every four units of PRBCs transfused [9].

Hypocalcemia is more important in predicting hospital mortality than the fibrinogen concentration, lowest platelet count, or presence of acidosis [62].

Following the transfusion of multiple units of PRBCs, the patient can develop hyperkalemia.

K+

Hyperkalemia may be prevented by using an in-line K+ filter or using washed units of PRBCs. During a PPH emergency with massive blood transfusion this practice is unlikely.

When hyperkalemia is detected, treatment with 10 to 20 units of regular insulin in 500mL of 10% dextrose IV over 60 minutes can be considered [63].

Repeat bolus doses of regular insulin 10 U may be required [25].

- The action of insulin administration is that it lowers the serum potassium concentration by driving potassium into the cells.
- To monitor for hypoglycemia, the serum glucose should be measured every hour for 5 to 6 hours after the administration of insulin.

Massive Transfusion Protocol [32]

Many protocols exist so an institution should implement the one most appropriate for their organization.

- Texas Children's Hospital Pavilion for Women.
- Stanford University Medical Center: an initial package consisting of 6 units RBCs, 4 units fresh frozen plasma (FFP), and 1 apheresis platelet unit [73].
- Brigham and Women's Hospital: immediate availability of 2 units RBCs and 2 units of FFP followed by 4 units each of RBCs and FFP and thawing of one pool (6 bags) cryoprecipitate.
- California Maternal Quality Care Collaborative OB Hemorrhage Protocol: For patients with unstable vital signs, suspicion of DIC, or blood loss >1500 mLs, transfuse pRBC, FFP, and platelets in a ratio of 6:4:1 or 4:4:1. If coagulopathy persists after 8 to 10 units pRBCs and coagulation factor replacement, recombinant activated factor VIIa is a reasonable option.

Estimated blood loss (EBL) should be converted to quantitative blood loss (QBL). The loss should be quantified every 15 to 30 minutes. Quantifying the blood loss will likely lead to a more accurate recognition and documentation of blood loss.

To evaluate for dilutional coagulopathy effects of RBC transfusion, monitoring of the PT, aPTT, platelet count or a viscoelastic test should be performed after every 5 to 7 units of RBC.

Blood and blood product replacement should be based on the above stated results.

Transfusing RBCs, platelets, cryoprecipitate, and fresh frozen plasma (FFP) to achieve the following targets are reasonable actions:

- Hemoglobin greater than 7.5g/dL
- Platelet count greater than 50,000/mm^3
- Fibrinogen greater than 300mg/dL
- PT less than 1.5 times the control value
- aPTT less than 1.5 times the control value

The optimal ratio of blood product replacement, RBC:FFP: platelet, is controversial [53,64,65].

Following the massive transfusion protocol within your institution is recommended. If the patient's fibrinogen is <150, cryoprecipitate should also be administered.

Domestic and foreign trauma centers, a military hospital, and clinical experience in Iraq and Afghanistan, suggest that until the patient is stable and there is absence of coagulopathy, she receive one unit of FFP for every 1-2 units of RBCs [66-69].

Guidelines for diagnosis, management, and prevention of postpartum hemorrhage have been developed by several organizations and are generally similar and consistent with the approach described in the Up-to-Date topics [32].

- California Maternal Quality Care Collaborative (CMQCC) best practices for management of obstetrical hemorrhage **www.cmqcc.org/ob_hemorrhage/ob_hemorrhage_compendium_of_best_practices**)
- Royal College of Obstetricians and Gynaecologists (RCOG) guideline for prevention and management of postpartum hemorrhage **www.rcog.org.uk**
- World Health Organization (WHO) guideline for prevention and treatment of postpartum haemorrhage **http://apps.who.int/iris/bitstream/10665/75411/1/9789241548502_eng.pdf**
- Society of Obstetricians and Gynaecologists of Canada (SOGC) guideline for prevention and management of postpartum hemorrhage **www.sogc.org**
- American College of Obstetricians and Gynecologists (ACOG) practice bulletin for postpartum hemorrhage
- New York health advisory recommendations for reducing the risk of maternal death from hemorrhage **https://www.nyspfp.org/Materials/NYSPFP_NYSPQC_Resources.pdf**

PPH is one of the most common causes of maternal morbidity and mortality.

Morbidities associated with PPH include:

- Hypovolemic shock and organ failure: renal failure, stroke, myocardial infarction, postpartum hypopituitarism (Sheehan syndrome)
- Fluid overload (pulmonary edema, dilutional coagulopathy)
- Abdominal compartment syndrome
- Anemia
- Acute respiratory distress syndrome
- Anesthesia-related complications
- Sepsis, wound infection, pneumonia
- Venous thrombosis and embolism
- Unplanned sterilization due to need for hysterectomy
- Asherman syndrome (related to curettage if performed for retained products of conception)

Sheehan Syndrome aka Postpartum Hypopituitarism

- Rare complication of PPH.
- During pregnancy the pituitary gland becomes enlarged and can infarct when hypovolemic shock occurs.
- Mild to severe pituitary damage can occur with an infarction. This can result in diminished secretion of one, several, or all of its hormones.

Sheehan syndrome should be considered if a woman presents following delivery with lactation failure, amenorrhea, or oligomenorrhea. She may also present with hypotension, hyponatremia, or hypothyroidism, which are manifestations of hypopituitarism. This event can occur in the immediate postpartum period to years following delivery.

If the patient remains hypotensive after adequate resuscitation, she should have evaluation of adrenal function and other hormone deficiencies. This evaluation can be performed 4 to 6 weeks postpartum but should not be overlooked.

Abdominal Compartment Syndrome

This is a rare life-threatening condition that causes intra-abdominal organ hypertension.

The patient may present with a tensely distended abdomen and progressively worsening oliguria. This may lead to the development of multi-organ failure.

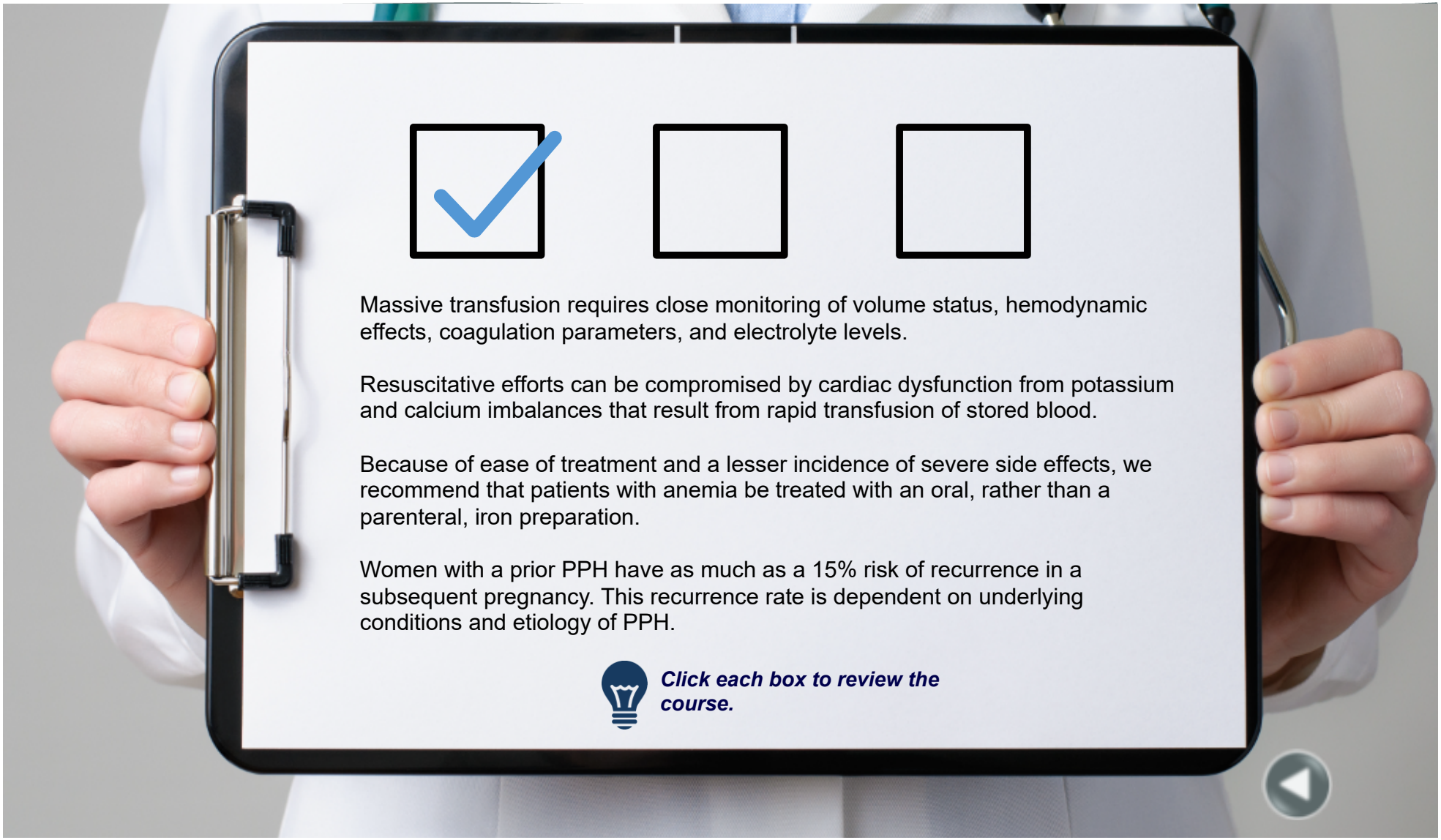
Post operative cesarean delivered women have been reported to have intra-abdominal pressure at levels seen in abdominal compartment syndrome [70].

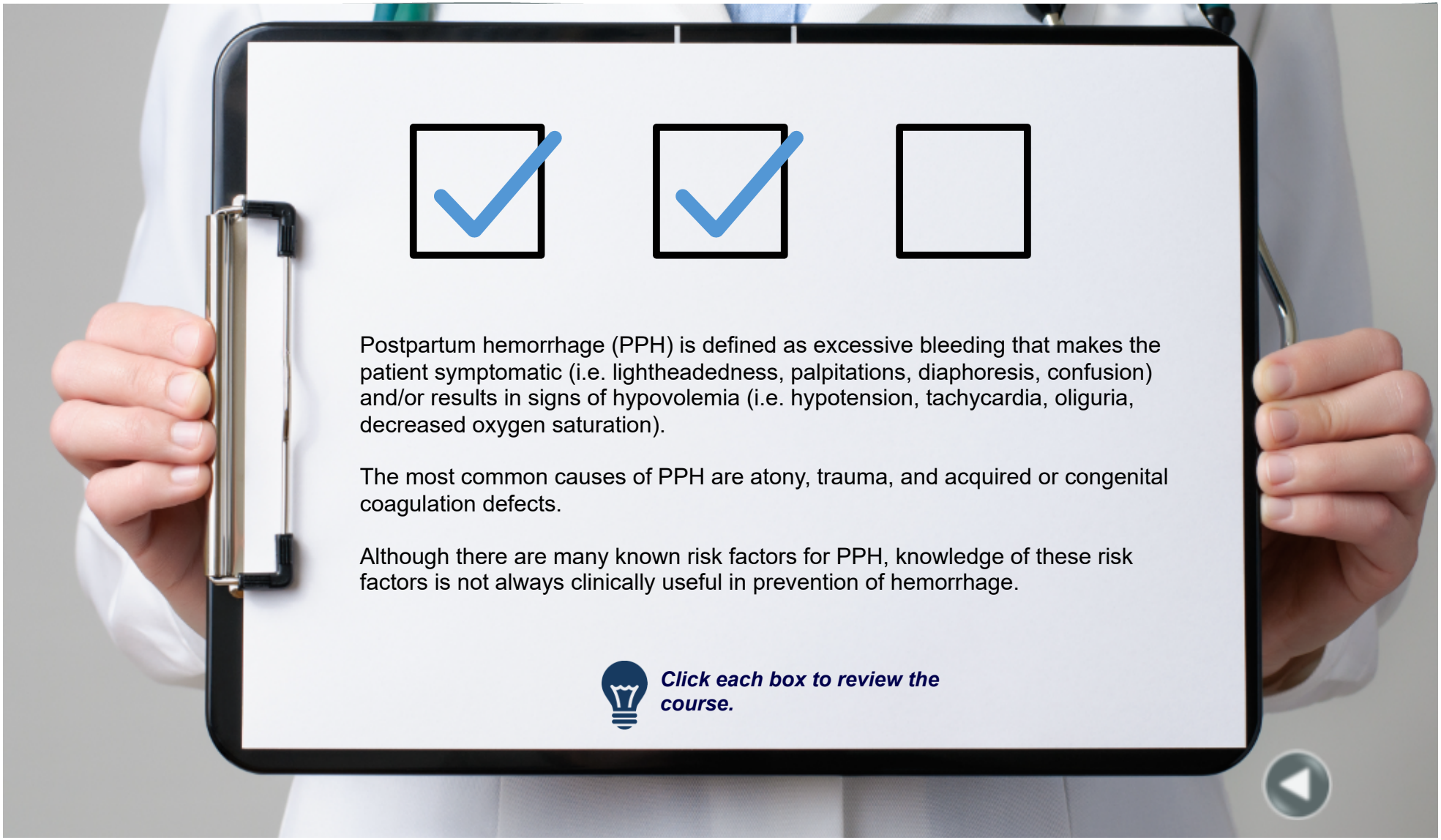
Thromboembolism

Thromboembolism is a risk factor following transfusion in trauma patients [83].

VTE prophylaxis should be performed in all women who have been treated for PPH with transfusions with compression stockings or a pneumatic compression device. After bleeding has been controlled, consideration should be given for thrombophylaxis with heparin until discharge. Prolonged anticoagulation may be required based on any additional risk factors for VTE. thromboprophylaxis until discharge [84].

Thromboprophylaxis should be initiated 12 to 24 hours after bleeding is controlled and coagulation tests are normal or near normal values [72].


Massive transfusion requires close monitoring of volume status, hemodynamic effects, coagulation parameters, and electrolyte levels.
Resuscitative efforts can be compromised by cardiac dysfunction from potassium and calcium imbalances that result from rapid transfusion of stored blood.
Because of ease of treatment and a lesser incidence of severe side effects, we recommend that patients with anemia be treated with an oral, rather than a parenteral, iron preparation.
Women with a prior PPH have as much as a 15% risk of recurrence in a subsequent pregnancy. This recurrence rate is dependent on underlying conditions and etiology of PPH.
Click each box to review the course.

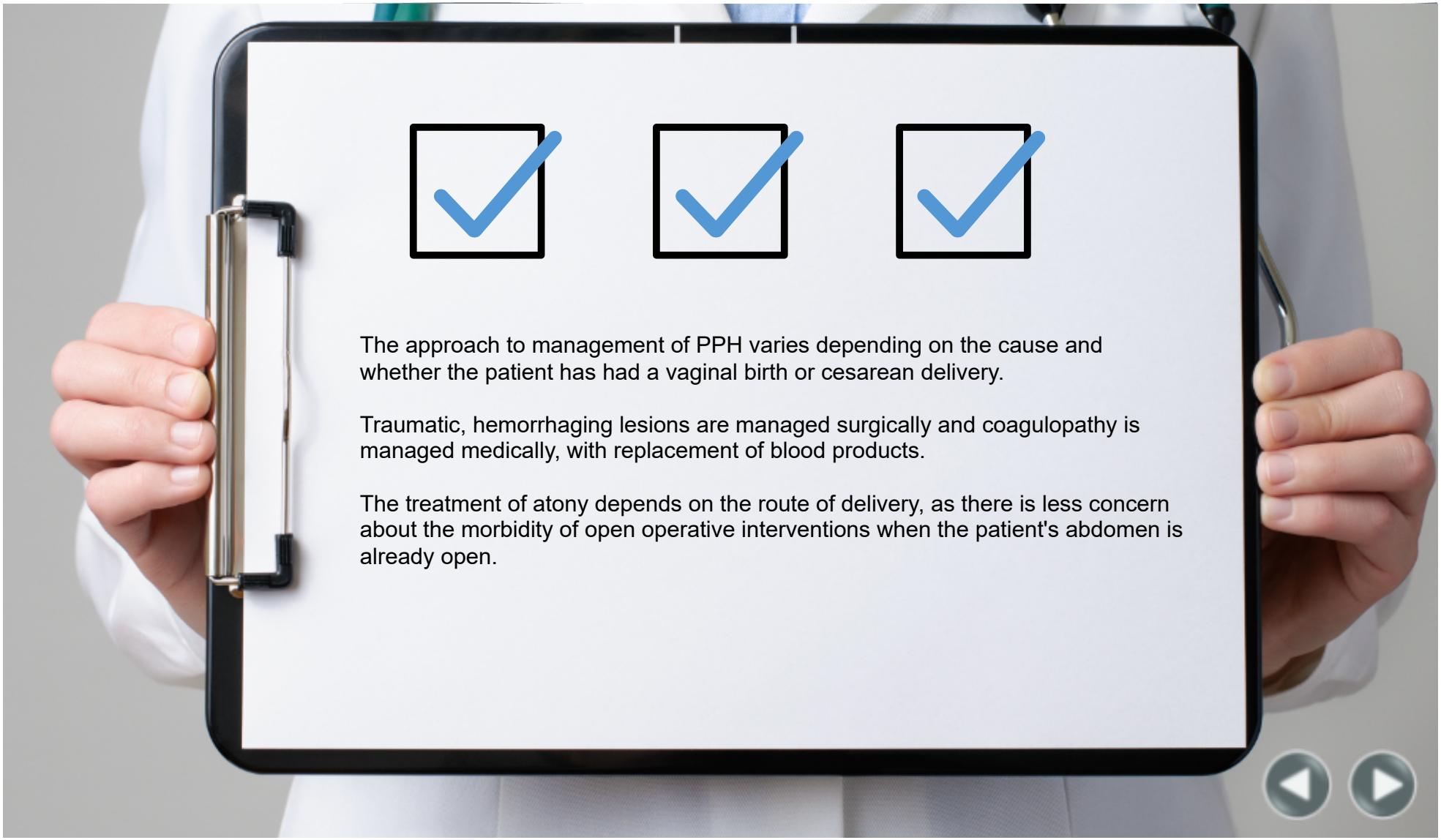


Postpartum hemorrhage (PPH) is defined as excessive bleeding that makes the patient symptomatic (i.e. lightheadedness, palpitations, diaphoresis, confusion) and/or results in signs of hypovolemia (i.e. hypotension, tachycardia, oliguria, decreased oxygen saturation).

The most common causes of PPH are atony, trauma, and acquired or congenital coagulation defects.

Although there are many known risk factors for PPH, knowledge of these risk factors is not always clinically useful in prevention of hemorrhage.

Click each box to review the course.



The approach to management of PPH varies depending on the cause and whether the patient has had a vaginal birth or cesarean delivery.

Traumatic, hemorrhaging lesions are managed surgically and coagulopathy is managed medically, with replacement of blood products.

The treatment of atony depends on the route of delivery, as there is less concern about the morbidity of open operative interventions when the patient's abdomen is already open.

MATERNAL911®

Congratulations!

You have successfully completed this module.

Click on the above 'X' to take the post-test for this course.
If you do not attain a passing score after two attempts at the post-test the entire program must be repurchased.

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