MATERNAL911®

Vaginal Bleeding in Pregnancy

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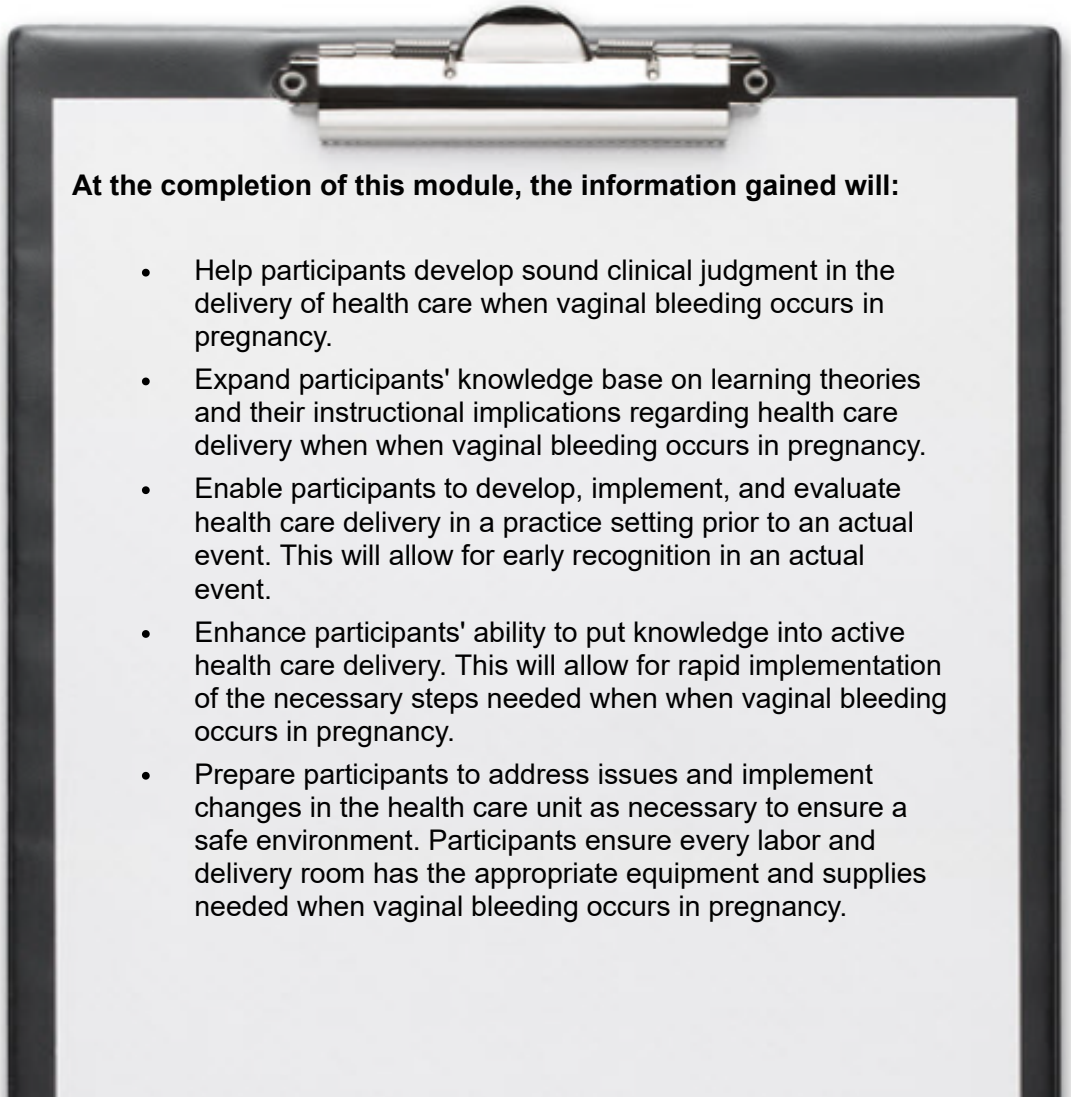
Course Description:

Vaginal bleeding in pregnancy can be an event that is life threatening to both the mother and fetus. This course will help participants develop an understanding of the issues involved when hemorrhage occurs. The participants will gain knowledge in the signs and symptoms the woman may have when hemorrhage occurs. The knowledge gained will be valuable in communicating findings with other providers of the health care team, the patient, and her family.

Approximate Time to Complete: 45 minutes

Click here to download a print version of this course.



At the completion of this module, the information gained will:

- Help participants develop sound clinical judgment in the delivery of health care when vaginal bleeding occurs in pregnancy.
- Expand participants' knowledge base on learning theories and their instructional implications regarding health care delivery when when vaginal bleeding occurs in pregnancy.
- 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 in an actual event.
- Enhance participants' ability to put knowledge into active health care delivery. This will allow for rapid implementation of the necessary steps needed when when vaginal bleeding occurs in pregnancy.
- Prepare participants to address issues and implement changes in the health care unit as necessary to ensure a safe environment. Participants ensure every labor and delivery room has the appropriate equipment and supplies needed when vaginal bleeding occurs in pregnancy.

Vaginal Bleeding in Pregnancy

Vaginal bleeding during pregnancy from the 24th week (sometimes defined as from the 20th week) of gestational age to term.

- *Reduced fetal birth weight may be associated with hemorrhage*

Bleeding in pregnancy is a significant cause of maternal and fetal morbidity, fetal mortality, and preterm delivery.

- Vaginal bleeding is common at all stages of pregnancy.
- Bleeding is generally maternal and not fetal.
- Bleeding may be caused by cervical or vaginal lesions or disruption of blood vessels in the decidua.
- The patient's gestational age, amount of bleeding, associated pain or absence of pain, and intermittent or constant character of bleeding will help direct the health care provider to a clinical diagnosis.
- To confirm or revise the original diagnosis, the provider may use laboratory and imaging tests.
- Physical exam, laboratory evaluation and ultrasound are helpful in identifying the cause of bleeding.

Differential Diagnosis of Vaginal Bleeding Prior to 24 Weeks Gestation

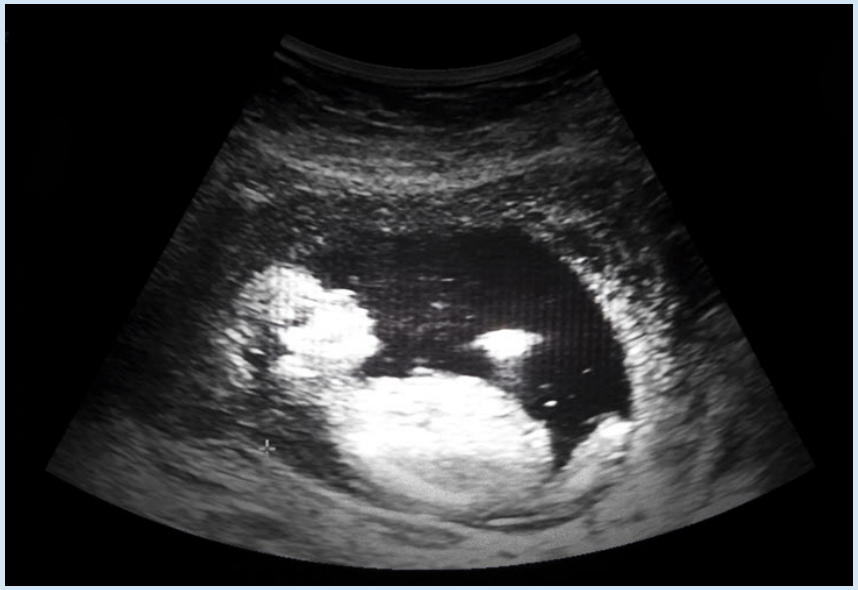
- Fetal demise
- Cervical insufficiency
- Subchorionic hematoma
- Placenta previa
- Low lying placenta
- Cervical ectropion
- Cervical polyp
- Vaginal or cervical laceration

Evaluation of Vaginal Bleeding Prior to 24 weeks

- Begin by performing an abdominal exam to evaluate for abdominal or uterine tenderness.
- At 16 weeks of gestation, the uterine fundus is palpable about midway between the symphysis pubis and umbilicus, while at 20 weeks, it is palpable at about the level of the umbilicus.
- After the abdominal examination, the patient is placed in the lithotomy position and a vaginal and speculum exam should be performed to evaluate the external genitalia, vagina and cervix.

Vaginal Bleeding Prior to 24 Weeks

- Transvaginal ultrasound is essential in the evaluation of bleeding in pregnancy.
- The goal of ultrasound is to evaluate for:
  - Placenta previa is present.
  - Subchorionic hematoma
  - Placental abruption
  - Shortened cervix
  - Dilated cervix
  - Hourglassing membranes



Etiologies of Vaginal Bleeding prior to 24 weeks

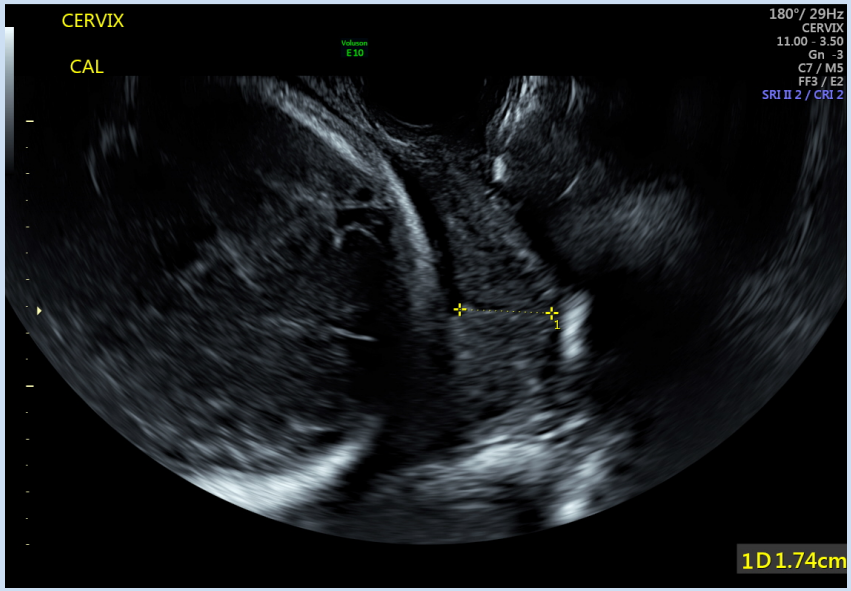
Miscarriage

- Diagnosed by ultrasound by absence of fetal cardiac activity.
- The size discrepancy between known gestational age and the fetal measurement on ultrasound identifies when the fetal demise occurred.
- Typically, there is no medical urgency for immediate delivery when miscarriage is diagnosed; however, if the patient presents with bleeding, expectant management is not recommended.
- If more than 4 weeks has passed from the time of miscarriage to diagnosis, intervention should be undertaken to prevent the rare development of consumptive coagulopathy.
- Management options include dilation and curettage or induction of labor.

Etiologies of Vaginal Bleeding prior to 24 weeks

Cervical Insufficiency

- Diagnosed based on painless cervical dilation without contractions and in the absence of any other pathology (such as bleeding, infection or ruptured membranes).
- Historically diagnosed in retrospect following a second trimester pregnancy loss in the setting of painless cervical dilation.
- Current medical practice may allow diagnosis prior to loss with the advent of cervical length screening.
- One or more of the following symptoms may be present:
  - Vaginal pressure or fullness
  - Vaginal spotting
  - Increased watery or mucous discharge
- If the cervical length measures <10 mm in a patient without a prior preterm delivery, prior to 24 weeks gestation, this is suggestive of cervical insufficiency and cerclage may be indicated.
- Associated with increased risk of preterm delivery and pregnancy loss.



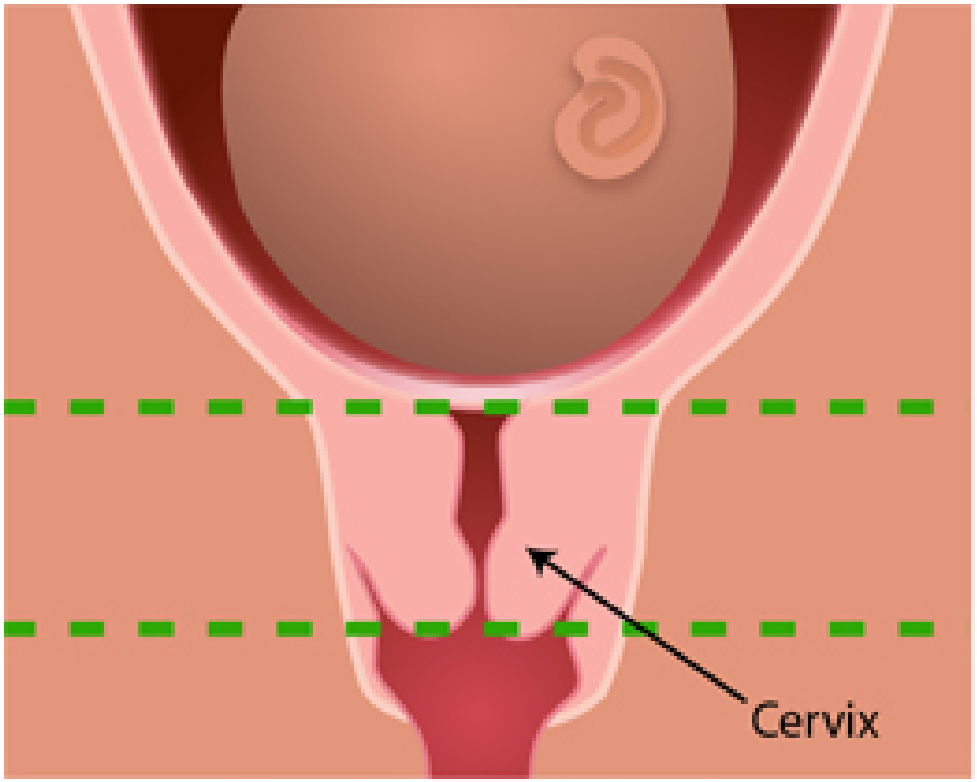
Case courtesy of Dr Henry Knipe, Radiopaedia.org, rID: 36596

Etiologies of Vaginal Bleeding prior to 24 weeks

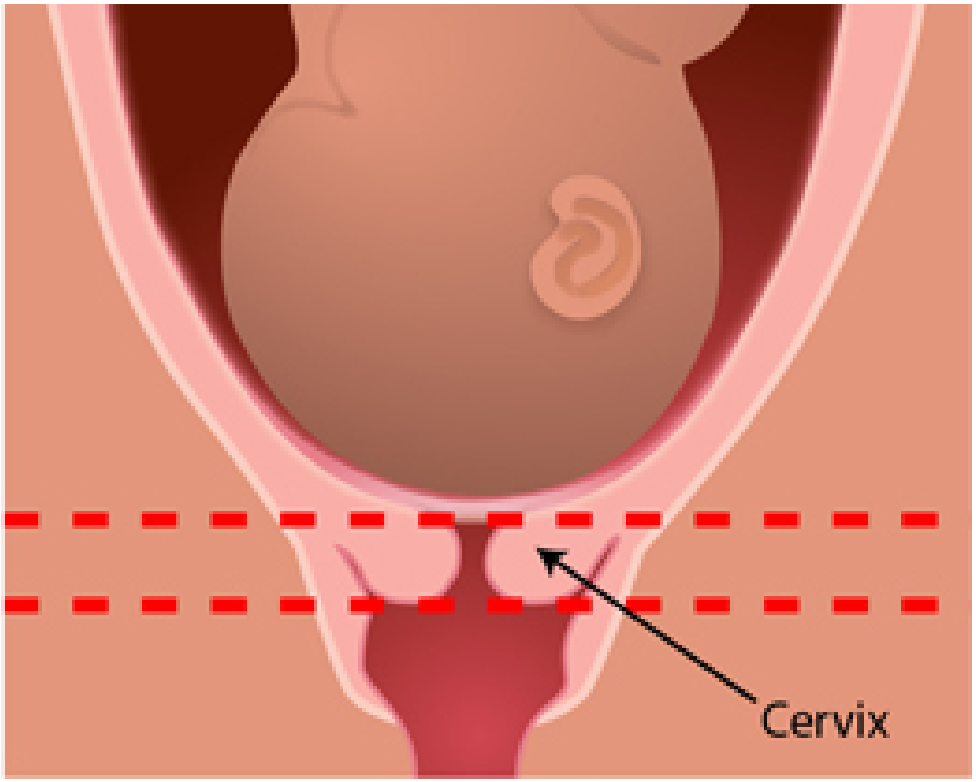
Cervical Shortening

- Diagnosed based a cervical length measurement <25 mm..
- The patient may or may not have any associated symptoms.
- If the patient has a history of prior preterm delivery, supplemental progesterone is recommended and cerclage is typically performed if there is no evidence of labor.
- If the patient does not have a history of prior preterm delivery, vaginal progesterone is recommended.
- If vaginal bleeding is noted in the presence of cervical shortening, the patient should be evaluated for preterm labor.
- Associated with increased risk of preterm delivery.

Click for a graphic representation of cervical length



Normal Length Cervix



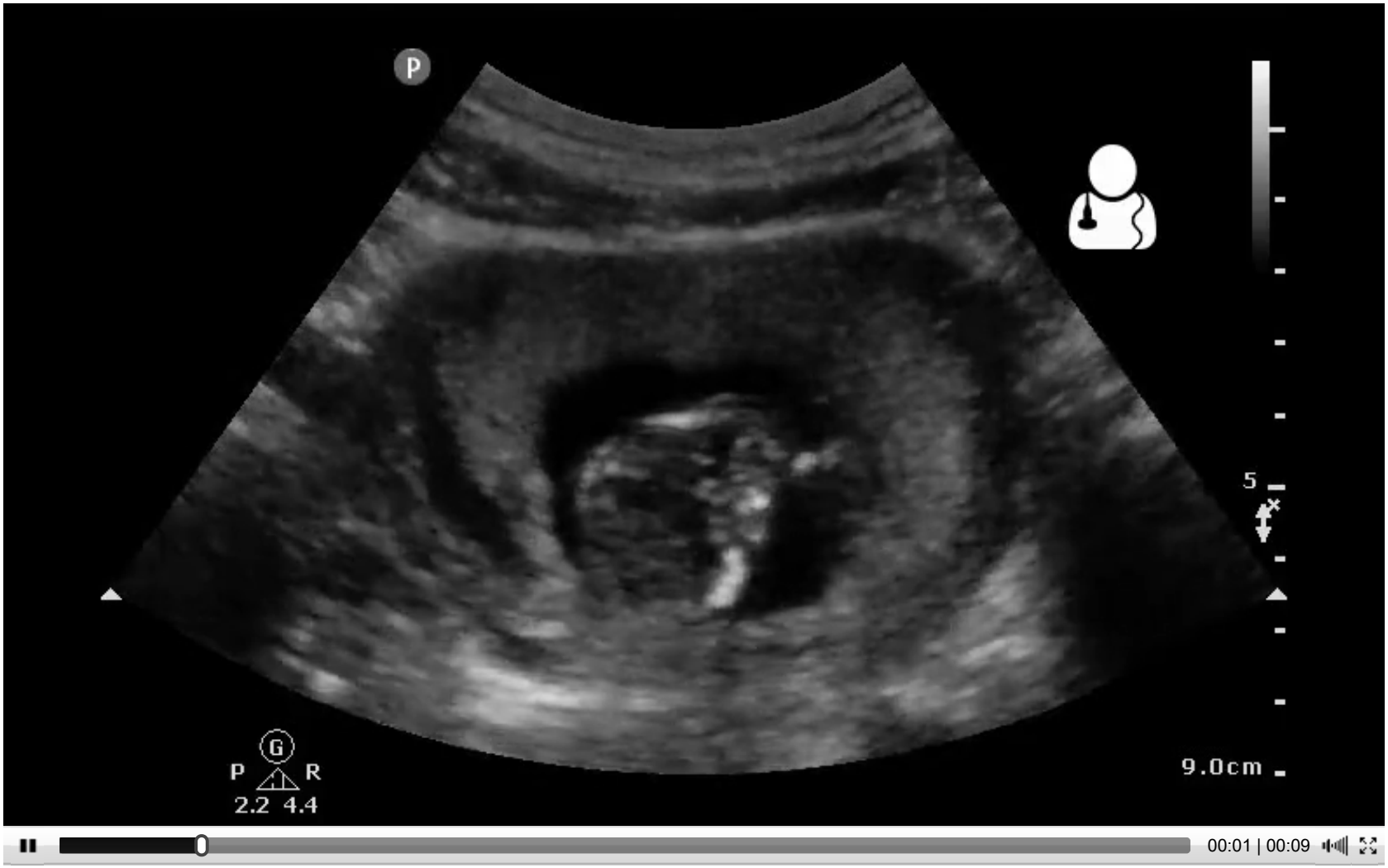
Short Cervix

Etiologies of Vaginal Bleeding prior to 24 weeks

Subchorionic Hematoma

- A hematoma visualized beneath the chorionic membrane on ultrasound
- Occurs prior to 20 weeks
- Commonly associated with vaginal bleeding
- Associated with increased risk of adverse pregnancy outcomes including:
  - Miscarriage
  - Abruption
  - Preterm delivery
  - Preterm premature rupture of membranes (PPROM)

Click for an ultrasound of a subchorionic hematoma



Etiologies of Vaginal Bleeding prior to 24 weeks

Low Lying Placenta

- Diagnosed based on a placental edge within 2 cm, but not covering the internal os.
- Associated with increased risk of bleeding during pregnancy.
- Typically seen at the time of anatomy US, but commonly resolves as pregnancy progresses.

Placenta Previa

- Diagnosed based on the placenta covering the internal os.
- Associated with increased risk of bleeding during pregnancy.
- If diagnosed in the second trimester, commonly resolves as pregnancy progresses.

Etiologies of Vaginal Bleeding prior to 24 weeks

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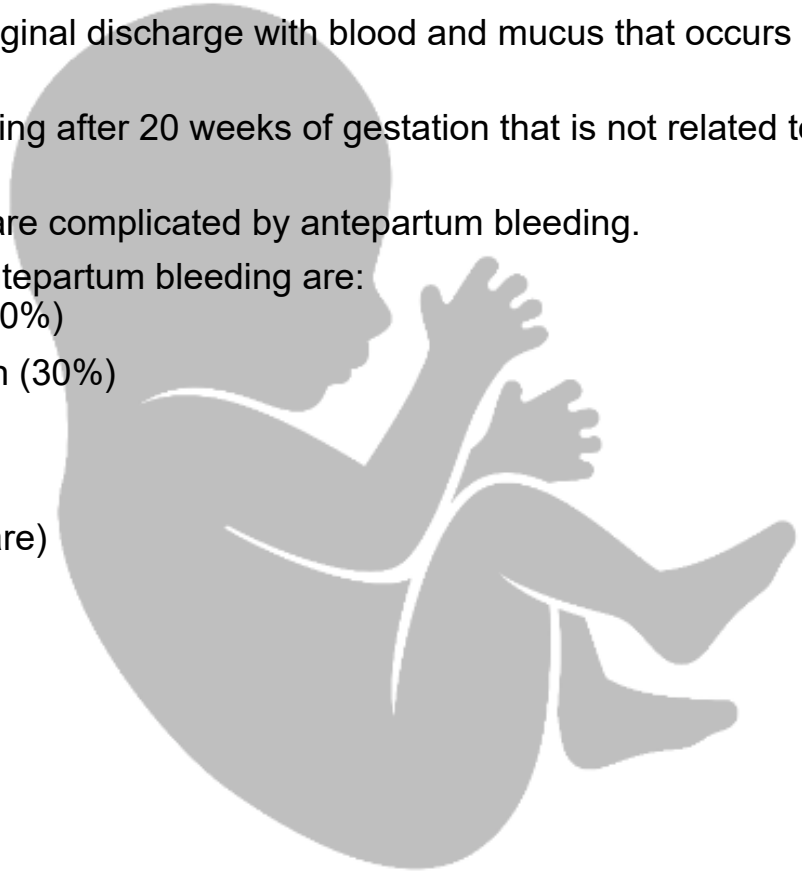
Vaginal Bleeding AFTER 24 Weeks Gestation

- The small amount of vaginal discharge with blood and mucus that occurs in early labor is known as 'bloody show.'
- Uterine bleeding occurring after 20 weeks of gestation that is not related to labor is known as antepartum bleeding.
- 4 - 5% of pregnancies are complicated by antepartum bleeding.
- The major causes of antepartum bleeding are:
  - Placenta previa (20%)
  - Placenta abruption (30%)
  - Chronic abruption
  - Vasa previa (rare)
  - Uterine rupture (rare)



Evaluation of Vaginal Bleeding AFTER 24 Weeks

- Begin by performing an abdominal exam to evaluate for abdominal or uterine tenderness.
- A vaginal and speculum exam should be performed to evaluate the external genitalia, vagina and cervix.
- A digital cervical exam should be avoided in the second half of pregnancy until placenta previa has been excluded.
  - Severe hemorrhage could occur when a digital exam is performed into the placenta.
- A hemodynamically unstable woman may have hypotension, tachycardia, orthostasis, or syncope. A baseline set of labs containing hemoglobin, hematocrit, and coagulation studies should be obtained.

Antepartum Hemorrhage Differential After 24 Weeks Gestation

- **Placenta Previa**
- **Placental Abruption**
- **Uterine Rupture and Vasa Previa**
- **Cervical or Vaginal Pathology**

- In the second half of pregnancy, placenta previa should be considered when the woman is experiencing vaginal bleeding.
- Abdominal pain and uterine contractions are typically more characteristic of placental abruption and distinguishes abruption from placenta previa.
- Placenta previa is determined by ultrasound examination.
- Do not perform a digital cervical exam in a pregnant woman who is bleeding in the second half of pregnancy until placenta previa has been excluded.

Click the terms in blue to see more information.

Antepartum Hemorrhage Differential After 24 Weeks Gestation

Placenta Previa

Placental Abruption

Uterine Rupture and Vasa Previa

Cervical or Vaginal Pathology

- Premature separation of an implanted placenta prior to delivery of the infant is referred to as placental abruption.
- Common risk factors associated with abruption include:
  - Prior placental abruption
  - Trauma
  - Smoking
  - Cocaine use
  - Hypertension
  - PPROM
- The typical presentation of placental abruption:
  - Vaginal bleeding (80%)
  - Uterine tenderness (70%)
  - Uterine contractions (35%) that can be with or without nonreassuring fetal testing
- Extravasation of blood into the myometrium, called a Couvelaire uterus, causes uterine tenderness with enlargement and a bluish-purple color because blood goes through the myometrium to the serosa.

Click here learn more about placental abruption.

Click the terms in blue to see more information.

Antepartum Hemorrhage
Differential After 24 Weeks Gestation

Placenta Previa

Placental Abruption

Uterine Rupture and Vasa Previa

Cervical or Vaginal Pathology

- There may be concealed bleeding within the uterus so the amount of vaginal bleeding does not indicate the severity of the hemorrhage.
- Placental abruption is a clinical diagnosis. It is uncommon to detect abruption on ultrasound.
- Placenta abruption is detected on only 2% of ultrasound exams.
- Placental abruption can range from mild to life-threatening. This may be an acute or a chronic condition.
- When a pregnant woman is being evaluated for trauma such as a motor vehicle accident, fall, or domestic violence, an abruption should be considered.

Click the terms in blue to see more information.

Antepartum Hemorrhage
Differential After 24 Weeks Gestation

- **Placenta Previa**
- **Placental Abruption**
- **Uterine Rupture and Vasa Previa**
- **Cervical or Vaginal Pathology**

- Uterine rupture and vasa previa are rare causes of vaginal bleeding, and is more often associated with intrapartum bleeding rather than antepartum bleeding.
- Uterine rupture is typically associated with prior uterine surgery including prior C/S, prior classical C/S or prior myomectomy.
- Vasa previa refers to bleeding from a fetal blood vessel traversing the internal cervical os. It results in loss of fetal blood, rather than maternal blood.
- Both uterine rupture and vasa previa can be associated with fetal death.

Click the terms in blue to see more information.

Antepartum Hemorrhage
Differential After 24 Weeks Gestation

- **Placenta Previa**
- **Placental Abruption**
- **Uterine Rupture and Vasa Previa**
- **Cervical or Vaginal Pathology**

Possible causes include:

- Vaginitis
- Trauma
- Tumor
- Warts
- Polyps
- Fibroids

- Vaginal bleeding in all trimesters of pregnancy increases the risk of adverse pregnancy outcomes including:
  - Preterm delivery
  - PPROM
  - Hemorrhage
- The degree and cause of bleeding is associated with the level of risk of adverse outcomes [1]. Outcomes worsen when bleeding is heavier and when bleeding is from non-previa sources [2,3].
- Preterm birth has a two-to-three-fold increased rate of occurrence when antepartum bleeding of unknown origin occurs in the second half of pregnancy [2,3].

There are numerous factors to consider in the management of pregnant women with vaginal bleeding in the 2nd and 3rd trimesters, including gestational age, the cause of bleeding, the severity, and fetal status.

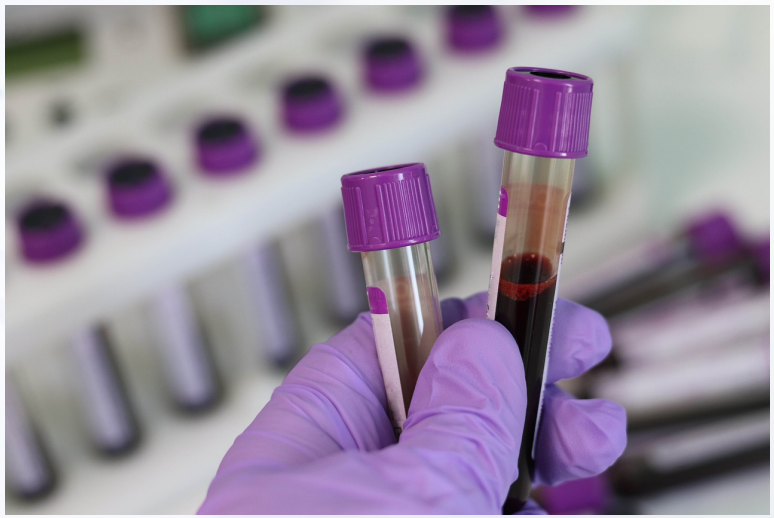
Despite considerable proof of efficacy, there are still a large number of cases of Rh D alloimmunization [4].

- Women who are Rh D positive do not require Rhogam.
- Women who do not carry the Rh D antigen are identified as Rh D negative and will need anti-D immune globulin when vaginal bleeding occurs in pregnancy due to risk of exposure to fetal Rh positive blood.
- If a woman is exposed to fetal Rh positive blood without administration of Rhogam, there is high risk for the development of alloimmunization.
  - Alloimmunization is maternal antibody formation against RBC antigens.
- Fetal-maternal hemorrhage is the term used to identify varying amounts of fetal cells in the maternal circulation caused by small interruptions at the fetal-maternal placental interface. The diagnosis of feto-maternal hemorrhage is made by a positive Klehauer Betke or fetal flow cytometry test on maternal blood.

- The Kleihauer-Betke test may not be accurate when maternal circulation shows an increase in hemoglobin F, which occurs when sickle-cell disease and thalassemias are present.
- The anti-D immune globulin should be given within 72 hours of the fetal-maternal exposure of blood.
- When there is evidence of feto-maternal hemorrhage, the Kleihauer Betke or fetal flow cytometry study estimates the amount of fetal blood in maternal circulation. A standard 300 mcg dose of Rhogam covers 30 mL of fetal blood. If the bleed is estimated to involve a larger amount of fetal blood (>30 mL), additional doses of Rhogam are required. The number of additional doses should be calculated based on the amount of fetal blood in maternal circulation.
- Women testing positive for weak D, formerly termed Du, are candidates for anti-D immune globulin and should be given this medication as indicated through the pregnancy to avoid alloimmunization.

Management of Vaginal Bleeding after 24 Weeks

- Assess for any evidence of hemodynamic instability
  - Obtain vital signs
  - Initiate fetal monitoring
- Obtain intravenous (IV) access with 1 or 2 large gauge IVs
- Obtain labs for CBC, type and screen and coagulation studies
- If significant hemorrhage is noted, 2-4 units of PRBC should be requested from the blood bank
- Assess for etiology of vaginal bleeding by vaginal/speculum exam



Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

- If bleeding is self limited without hemorrhage, conservative management is recommended.
- If hemorrhage is ongoing or if there is concern for fetal status, delivery is recommended regardless of gestational age.

Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

Conservative Management

- Administration of antenatal corticosteroids
- Administration magnesium sulfate for fetal neuroprotection
- Tocolysis may be indicated if there is evidence of uterine contractions
  - Indocin if <32 weeks
  - Nifedipine if 32 weeks or greater
- If conservative management is undertaken, the pregnancy is prolonged by an average of 4 weeks after the initial bleeding episode

1 of 3

Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

Conservative Management

- After initial presentation, a patient should remain in the hospital until she has been free of bleeding for at least 48 hours.
- Patients may be eligible for discharge home if they are asymptomatic with no ongoing bleeding, have support at home and have ability to return to the hospital if any pregnancy complications arise.
- If a second significant bleeding episode occurs, typically patients are hospitalized for the remainder of pregnancy.
- The timing of delivery is dependent on the clinical course.

2 of 3

Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

Conservative Management

- The timing of delivery is dependent on the clinical course.
- Typically, if it is a single episode of bleeding in the second or early third trimester, it is reasonable to plan delivery at 37-39 weeks.
- If there are multiple episodes of bleeding, delivery may be indicated at any point; however, if the patient remains stable, delivery is typically planned at 36-37 weeks.
- If a patient presents with bleeding at 36 weeks or later, delivery is recommended.

3 of 3

Click the grey arrows to see more information.

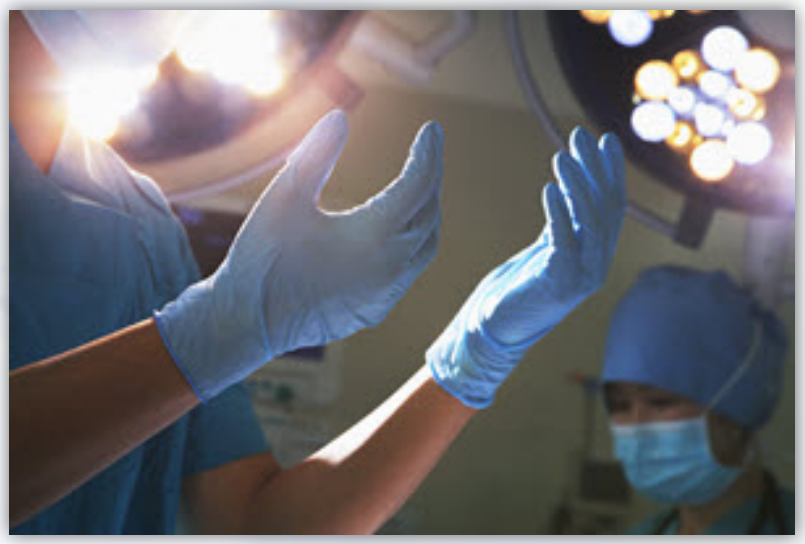
Management of Vaginal Bleeding after 24 Weeks

- O-negative red blood cells, group AB fresh frozen plasma cryoprecipitate, and fibrinogen can be given immediately and continued until the type and cross-match is complete, at which point the patient should be switched to type-specific fresh frozen plasma (FFP) cryoprecipitate and cross-match compatible red blood cells (RBC).
- The goal with transfusions is to keep:
  - Hemoglobin ≥7g/dL
  - Platelet count ≥50,000/microL
  - Fibrinogen ≥200mg/dL
  - PT and aPTT <1.5 times control

Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

- Call for help
- Notify staff that the following resources will likely be needed:
  - Anesthesia
  - Neonatology
  - Blood bank
  - Obstetrics
  - Maternal Fetal Medicine
  - Gynecologic Oncology
  - Interventional Radiology
  - General Surgery
  - Critical Care



Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

- Basic treatment for disseminated intravascular coagulation (DIC) is to treat the inciting event.
- While simultaneously treating the inciting event, IV fluids and blood products should be administered.
- Monitoring intake and output is critical in resuscitation efforts. Placement of a foley catheter is recommended.

Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

- Place at least two large bore (≥18 gauge) catheters.
- Peripheral venous access should be attempted before attempting other forms of vascular access if peripheral veins can be readily seen or palpated.
- If the patient develops shock or requires cardiopulmonary resuscitation (CPR), intraosseous cannulation and peripheral venous access should be pursued simultaneously [5,6].
- 1-2 liters of crystalloid IV fluids should be bolused early in the course of DIC.

Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

- Protocols can help standardize the management of patient's with DIC. Rapid establishment of venous access is the first priority [7].
  - In one study, a protocol was designed to limit the time spent in attempts to achieve peripheral and central venous catheterization [8].
  - Significant time to achieve improvement on venous access was found when a study followed rapid sequential steps. In this study, rapid sequential attempts at percutaneous femoral vein catheterization, saphenous vein cutdown, and intraosseous cannulation were initiated if IV insertion failed after 90 seconds [8].
  - The study found resuscitations in compliance with the protocol achieved IV access more rapidly than did those deviating from the protocol when initiating percutaneous peripheral IV attempts failed [8].
  - Intraosseous cannulation had a high degree of success when other measures failed.

Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

- Maintain oxygen saturation above 95%.
- Maintain normal body temperature:
  - This may require a warming blanket and/or an IVF warmer

Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

- As soon as DIC is suspected, order the following labs:
  - CBC
  - CMP
  - PT/INR
  - aPTT
  - Fibrinogen
- Additionally, draw 5 mL into a red top tube and observe for clot formation over 8-10 minutes.
- If there continues to be concern for DIC, labs should be followed every 1-2 hours until the condition is treated.

Click the grey arrows to see more information.

Management of Vaginal Bleeding after 24 Weeks

- Assess fetal status (gestational age, fetal heart rate (FHR)).
- Assess maternal condition (blood loss, cervical status, hemodynamic stability, uterine contractions).
- Appropriate personnel, equipment, and supplies should be gathered for management.

Click the next button to continue with the lesson

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Management of Vaginal Bleeding

1 2 3 4 5 6 7 8 9 10 11 12

Notify the Anesthesia Staff

- Notify the anesthesia staff for assistance with patient management and to provide anesthetic support for delivery if the patient is not already in the operating room.
- Placement of epidural and spinal anesthesia techniques is generally contraindicated in patients with a severe bleeding diathesis because of the risk of spinal epidural hematoma.
- In addition to delivery anesthesia, the anesthesiologist can also assist with IV access and placement of an arterial line and/or central venous access, if indicated.

Click each number in order to learn more.

Management of Vaginal Bleeding

Notify the Blood Bank

- The blood bank should be notified of the potential need for massive transfusion.
- Cross matching of at least 2 units of PRBC should be initiated. If possible, the blood bank should also prepare 1 unit of fresh frozen plasma, 1 unit of cryoprecipitate and 1 pack of platelets.
- If necessary, emergency-release blood products can be made available.

Click each number in order to learn more.

Management of Vaginal Bleeding

Establish IV Access and Begin Fluid Resuscitation

- Establish IV access peripherally with at least two IV catheters (≥18 gauge) and infuse crystalloid and blood products, when available, to support blood pressure (systolic ≥90mmHg or mean arterial pressure ≥65mmHg) and maintain urine output (≥0.5mL/kg/hour).
- Initial fluid resuscitation for hemorrhagic shock with infusion of two to three liters of Lactated Ringer's (LR) is reasonable when blood and blood products are not available.
- If blood products are available, fluid resuscitation should include 1-2 liters of LR. If LR is not available, normal saline is also acceptable.

Click each number in order to learn more.

Management of Vaginal Bleeding

Recognize and Treat the Inciting Event

Click the terms and icons to see more information.

- The mainstay of treatment is to identify the underlying disorder leading to hemorrhage and initiate appropriate treatment for that condition.
- Obstetric causes of hemorrhage are generally readily identified by history, physical exam, and ultrasound findings.
- The pivotal element of treatment of all obstetric etiologies of DIC is delivery, because termination of pregnancy leads to resolution of the disorder that initiated the obstetric hemorrhage.

Abruption

Preeclampsia

Amniotic Fluid Embolism

Acute Fatty Liver of Pregnancy

Retained Fetal Demise

Septic Abortion

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Abruption

- Vaginal bleeding, abdominal pain, back pain, and uterine contractions are characteristics of placenta abruption.
- No vaginal bleeding may be present in concealed placental abruption.
- The woman may complain of uterine tenderness during and between contractions. The uterus will have increased tone and rigidity.
- Clinical symptoms, abnormal fetal heart tracing, fetal demise and/or DIC support the diagnosis of placental abruption.

Preeclampsia with Severe Features

- If seizures are present, the diagnosis is revised to eclampsia.
- Pre-eclampsia is a pregnancy complication that presents after 20 weeks gestation with hypertension accompanied by maternal symptoms and/or lab abnormalities.
- Pre-eclampsia with severe features and HELLP syndrome can result in DIC if delivery is not undertaken in a timely fashion.
- Typically, patients who progress to DIC in the setting of pre-eclampsia will have thrombocytopenia; however, this is not diagnostic of DIC unless clinical bleeding or other abnormal coagulation studies are present.

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Amniotic Fluid Embolism

AFE is an exceedingly rare complication that is characterized by sudden onset of hypotension due to cardiogenic shock, hypoxemia due to respiratory failure, and coma or seizures during labor or immediately postpartum.

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Acute Fatty Liver of Pregnancy

- AFL of pregnancy initially presents with nausea or vomiting (approximately 75% of patients), abdominal pain (50% epigastric region), anorexia, and jaundice.
- Approximately one-half of patients have signs of preeclampsia at presentation or at some time during the course of illness.
- AFL is a rare cause of DIC.

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Retained Fetal Demise

Retained fetal demise is diagnosed by ultrasound imaging that confirms the absence of the fetal heart rate.

If a demised fetus is retained for more than 2 weeks, there is risk of development of DIC.

If there is an unknown timeline for a fetal demise, a coagulation profile should be obtained at the time of diagnosis of demise.

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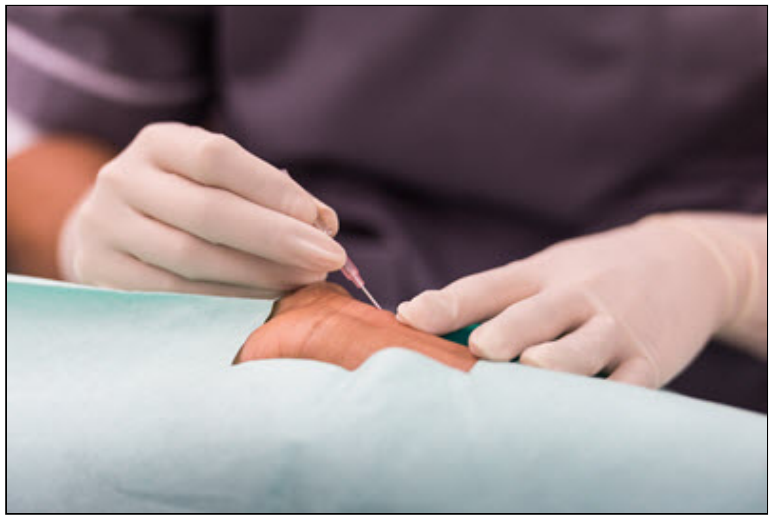
Septic Abortion

Septic abortion is characterized by abdominal and/or pelvic pain, malodorous vaginal discharge, fever and chills, bleeding or spotting, and uterine or adnexal tenderness after a spontaneous or induced abortion.

Management of Vaginal Bleeding



Insert an Arterial Line

An arterial line may be appropriate in the patient who needs continuous blood pressure monitoring, but the benefits versus risks depend on the severity of the hemorrhage.

Click each number in order to learn more.

Management of Vaginal Bleeding

Blood Products

Obstetrical patients with hemorrhage typically require blood products as part of resuscitation.

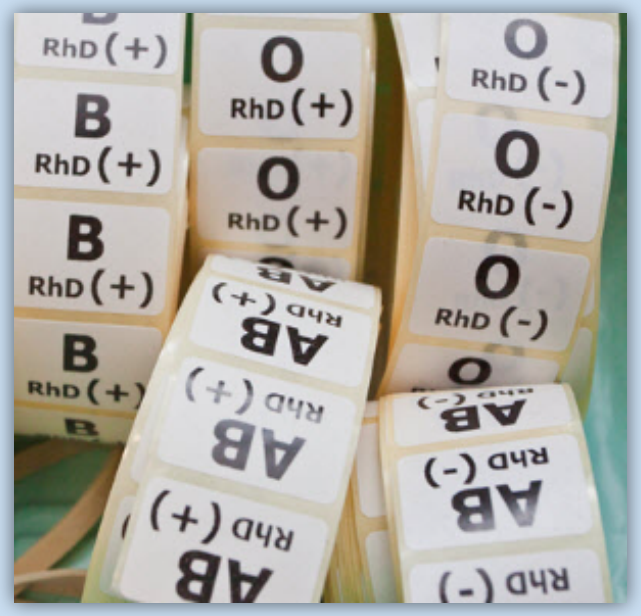
Transfusion

Massive Transfusion

Click the blue boxes to learn more about transfusions.

Management - Transfusion

- Fully typed and crossmatched RBCs requires at least 20 minutes to receive from the blood bank.
- Transfusion may begin immediately using type 0, Rh(D)-negative RBCs. When fully typed and crossmatched RBCs are available the patient should be switched to matched blood products.
- When transfusion is necessary prior to obtaining type specific FFP, type AB FFP, either Rh(D) positive or negative can be safely used.



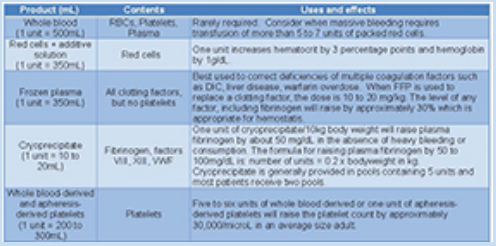
Management - Transfusion

- When ordering a massive transfusion protocol, it typically includes 4 units of pRBC, in addition to the following:
  - 4 units of FFP
- 1 pack of platelets, either:
  - A pool of 4 to 6 whole blood- derived platelet concentrates OR a single apheresis platelet unit.
  - 1 or 2 cryoprecipitate pools should also be requested for obstetric DIC.
    - A pool contains 5 individual units.
- Many massive transfusion protocols recommend transfusion of RBCs, FFP, and platelets in a ratio of 1:1:1.

Management - Transfusion

- Correcting low fibrinogen levels, which commonly occur in obstetrical hemorrhage, is important.
- FFP is generally given to correct hypovolemia and normalize coagulation in cases of obstetric hemorrhage.
- Cryoprecipitate is indicated when large amounts of fibrinogen must be administered in a low-volume product.
- A fibrinogen concentration below 100mg/dL is generally treated with 10 units of cryoprecipitate, which is two pools of 5 units (Table 3).
- Cryoprecipitate requires preparation by the blood bank, so if fibrinogen is <100 mg/dL, the blood bank should be alerted to start preparing this blood product.

Click on Table 3 to view a larger version.



Product (mL)	Contents	Uses and effects
Whole blood (1 unit = 500mL)	RBCs, Platelets, Plasma	Rarely required. Consider when massive bleeding requires transfusion of more than 5 to 7 units of packed red cells.
Red cells + additive solution (1 unit = 350mL)	Red cells	One unit increases hematocrit by 3 percentage points and hemoglobin by 1g/dL.
Frozen plasma (1 unit = 350mL)	All clotting factors, but no platelets	Best used to correct deficiencies of multiple coagulation factors such as DIC, liver disease, warfarin overdose. When FFP is used to replace a clotting factor, the dose is 10 to 20 mg/kg. The level of any factor, including fibrinogen will raise by approximately 30% which is appropriate for hemostasis.
Cryoprecipitate (1 unit = 10 to 20mL)	Fibrinogen, factors VIII, XIII, VWF	One unit of cryoprecipitate/10kg body weight will raise plasma fibrinogen by about 50 mg/dL in the absence of heavy bleeding or consumption. The formula for raising plasma fibrinogen by 50 to 100mg/dL is: number of units = 0.2 x bodyweight in kg. Cryoprecipitate is generally provided in pools containing 5 units and most patients receive two pools.
Whole blood derived and apheresis-derived platelets (1 unit = 200 to 300mL)	Platelets	Five to six units of whole blood derived or one unit of apheresis-derived platelets will raise the platelet count by approximately 30,000/microL in an average size adult.

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Management - Transfusion

- Lyphilized fibrinogen (RiaSTAP), a human fibrinogen concentrate, is very expensive but can be reconstituted immediately for use to correct low fibrinogen levels.
  - The use of purified, virally inactivated fibrinogen concentrate had a similar outcome as cryoprecipitate in resolving hypofibrinogenemia in an observational study of 77 cases of major obstetrical hemorrhage [9].
- It is essential to have rapid restoration of blood components in massive hemorrhage to ensure adequate tissue perfusion, prevention of acidosis, coaguloapthy and hypothermia, which is often lethal.
- Laboratory studies every 30-60 minutes will help to guide blood product replacement. Then, as the clinical situation improves, the interval may be extended.
- Some centers have found thromboelastography (TEG) or rotational thromboelastometry (ROTEM), useful in the setting of massive hemorrhage as it provides a "rapid global assessment" of hemostatic function [10-12].

Bedside Responsibilities

Blood Bank Responsibilities

Nursing Responsibilities

Transfusion Targets

Laboratory Testing

Review of Massive Transfusion Protocol Events by Transfusion Services

Attending Physician, Surgeon, or Anesthesiologist Responsibilities

Click each blue term above to learn more.

Massive Transfusion Policy

- The massive transfusion protocol (MTP) is a multidisciplinary process whereby blood and blood components are obtained rapidly for an exsanguinating patient.
- The MTP is initiated as soon as possible reporting to the physician in charge of the transfusion service (TS MD) by the blood bank staff or patient care provider.
- The TS MD serves as a consultant in the evaluation and management of the patient's transfusion therapy during the massive transfusion episode.

Example Reasons for Initiation:

- Replacement of at least one blood volume (8 to 10 red blood cell units in a 70kg adult) within 24 hours or at least one half blood volume within 2 hours
- Life-threatening trauma presenting to the emergency department
- Unexpected or anticipated surgical blood emergencies
- Severe obstetrical hemorrhage

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- Bedside Responsibilities
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- Nursing Responsibilities
- Transfusion Targets
- Laboratory Testing
- Review of Massive Transfusion Protocol Events by Transfusion Services
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Click each blue term above to learn more.

- The massive transfusion protocol (MTP) is initiated by the patient's staff physician or the staff anesthesiologist by calling the blood bank (this phone call may be delegated to another individual).
- Clearly state to the blood bank: "Initiate the massive transfusion protocol." Indicate whether it is an adult MTP or pediatric MTP (for patient's less than 35kg).
- Give the patient's name and medical record number.
- Provide the patient's current location and a phone number that can be used to reach the patient's care team.
- Determine if patient requires emergency release of two uncrossmatched and untagged O Neg RBCs for immediate transfusion.

Note: Average time for first MTP set is 15 to 20 minutes

- Send a properly labeled specimen (3mL purple tube) to the blood bank for a type and screen if not done in last three days. The specimen label must contain the patient's name, medical record number, date, and the initials of the collector written on the tube.
- Record initiation of protocol in patient's chart.

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Blood Bank Responsibilities

- Release 2 emergency O Neg RBCs if requested.
- Prepare 4 RBCs, 4 plasma, and 1 pack of platelets for adult MTP or 2 RBCs, 2 plasma, and ½ platelet apheresis for pediatric MTP.

Note: ***Group "O" uncrossmatched RBCs will be issued, if necessary, until type specific and later crossmatched becomes available.***

- Provide a cooler with ice for each set of RBC and plasma components.
- Notify the patient's care team when a set of components is ready for pickup.
- Notify physician on-call.
- Stay 1 MTP set ahead (prepare each set immediately following pickup of previous set).
- Continue the process until notified to discontinue the protocol.

Click each blue term above to learn more.

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Click each blue term above to learn more.

- Assign personnel to obtain the set of components from the blood bank.
- Blood bank will call when each set is ready for pickup.
- Send a completed release form with the personnel picking up the components.
- Order labs as directed by the team.
- Communicate the lab results to the team and the blood bank.

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Blood products are transfused to achieve the following minimum levels

- Hemoglobin ≥7g/dL
- Platelet count ≥50,000/microL
- Fibrinogen greater than or equal to 200mg/dL
- PT and aPTT less than 1.5 times control

Click here to learn more.

- Bedside Responsibilities
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Hemoglobin Management

- Many factors need to be considered when determining the optimal hemoglobin concentration for a pregnant woman about to deliver. Factors include expected blood loss during delivery, the baseline hemoglobin, rate of blood loss, and medical comorbidities.
- As the hemoglobin concentration decreases, the overall risk of mortality increases. Experts recommend the target hemoglobin for pregnant women be a minimum of 7g/dL in the setting of severe PPH or DIC [14,15].
- Maintaining the hemoglobin ≥7g/dL is a goal in massive transfusion due to pregnant women with DIC having ongoing blood loss, which further increases at the time of delivery and because equilibration generally results in a fall of hemoglobin.
- A fibrinogen level ≥100mg/dL is considered the minimum level necessary for adequate coagulation.
- An observational study demonstrated that 100% of postpartum women who developed severe hemorrhage had fibrinogen levels <200mg/dL, while 80% of those with fibrinogen >400mg/dL did not develop severe hemorrhage [13].
- Similar predictive data for platelet concentration are not available.

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- Review of Massive Transfusion Protocol Events by Transfusion Services
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- Laboratory studies are drawn initially every 30-60 minutes to guide blood product replacement.
- As the patient stabilizes, the laboratory testing interval can be extended.
- Some centers have found TEG useful in the setting of massive hemorrhage as it provides a "rapid global assessment" of hemostatic function [10-12].

- Bedside Responsibilities
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- **Review of Massive Transfusion Protocol Events by Transfusion Services**
- Attending Physician, Surgeon, or Anesthesiologist Responsibilities

- Each event is summarized by blood bank staff.
- Review is performed by blood bank supervisor and transfusion service physicians.
- The events are reported to the transfusion committee.

Click each blue term above to learn more.

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Click each blue term above to learn more.

Click here to learn more.

- Determine if rFVIIa is required (see section below for guidelines).
- Monitor CBC, ABG, potassium, ionized calcium, and coag tests frequently.
- Determine when the protocol should be discontinued.
- Call the blood bank (this phone call may be delegated to another individual).
- Document discontinuation of massive transfusion protocol in the patient's chart.

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Use of rFVIIa (Novo-Seven) in Surgery and Trauma
(not indicated in pregnancy; but may be utilized postpartum)

- Indication of the use of rFVIIa:
  - Active bleeding following administration of 6 to 8 units of red blood cells, 6 to 8 units of plasma, and one dose of platelets.
- Administer 10 units of cryoprecipitate if the fibrinogen is <100 mg/dL
- Contraindications for the use of rFVIIa:
  - pH <7.00
  - Immediately following cardiac arrest
  - Patient considered "unsalvageable" by staff surgeon
  - **Pregnancy**
  - Recent thrombotic event, MI, or stroke
- Dosing of rFVIIa:
  - If the patient has been on warfarin and arrives with an elevated INR and rapid bleeding, consider using one small vial of rFVII or 1.2mg. This is usually a 15 micrograms/kg dose for adults.
  - If the patient is not on warfarin, consider using 45 micrograms/kg as a half dose and repeat this dose in 30 to 60 minutes.
  - Always round down to the nearest full vial for doses of rFVIIa.

Click each blue term above to learn more.

Management of Vaginal Bleeding

Maintain Oxygenation

Keep arterial oxygen saturation above 95%.

Avoid Hypothermia

- The patient should be kept warm with a forced-air warming system (e.g., Bair Hugger), which is the most effective method to maintain normothermia.
- Other interventions include the use of warmed blankets and fluid warmers, which should be used as needed.
- If large volumes of fluid and blood products are given, the infused fluids/blood products should be warmed so they are close to body temperature to prevent a significant drop in maternal core temperature.

Click each number in order to learn more.

Management of Vaginal Bleeding

Assess Blood Loss

- Quantifying blood loss [1]
- Closely monitor vital signs.
- Hemodynamic instability in non-anesthesthesized pregnant women may be suspected when:
  - Systolic blood pressure <100mmHg
  - Pulse >100bpm
  - Urine output <30mL per hour
- Other signs and symptoms of hemodynamic instability may be present, such as altered level of consciousness, shortness of breath, cold clammy skin, and pallor.
- Signs of concealed abruption include maternal pain, rapid increase in fundal height, presence of hematoma on ultrasound, decreased urine output and decreasing hemoglobin.

Click each number in order to learn more.

Quantifying Blood Loss

- Visual estimation of blood loss can result in both over and underestimations.
- Quantified blood loss can be determined by weighing blood soaked items, subtracting the dry weight of the item and understanding that 1gm of weight equals 1mL of blood loss [1].
    - Additionally, quantifying blood loss can be performed by using measured suction containers or suction systems.
- Ongoing blood loss assessment should continue as long as active bleeding is present or if the patient is unstable [1].
- Quantifying the blood loss is an important part of evidence-based hemorrhage bundles [1].
    - The clinical utility specific to the quantification approach remains unproven.
- Fluid and blood clots from the sterile or surgical drapes can be measured by volume and added to the weighed items for an accumulative quantification of blood loss.
    - Calibrated drapes have been proven to have an error rate less than 15% [2].

Management of Vaginal Bleeding

Notify Neonatology Service

- To prepare for birth of a compromised or premature infant, the neonatology or pediatric department should be notified.
- If time allows, neonatology services may counsel the parents about newborn issues prior to the delivery.

Fetal Assessment

- Management of the pregnant woman is impacted by fetal viability and gestational age.
- The focus is on the mother when there is an intrauterine fetal demise or the fetus is confirmed to be previable.
- Viability is the stage of maturity that would likely result in a chance of survival without severe deficits.
- Viability is determined by local practices; however, commonly is determined to be 23-24 weeks gestation. Recent data suggests there is also a chance of survival as early as 22 weeks.
- If the fetus is viable, measures should be taken to optimize the fetus prior to delivery. These measures typically include administration of antenatal corticosteroids, IV magnesium sulfate and Group B strep prophylaxis.

Click here to learn more about fetal assessment.

Management of Vaginal Bleeding

Fetal Assessment Continued

- With a live fetus at a viable gestational age, a FHR typically shows a category III tracing in pregnancies complicated by major bleeding often resulting in poor placental perfusion and suboptimal fetal oxygenation.
- In a pregnancy complicated by DIC, fetal heart rate tracings may demonstrate abnormalities due to poor placental perfusion and compromised fetal oxygenation.
- In these cases, the maternal and fetal risks and benefits of immediate delivery for treatment of hemorrhage versus delaying delivery to optimize fetal outcomes need to be weighed.
- If time allows, maternal and fetal risks related to immediate versus delayed delivery should be weighed; however, in an obstetric hemorrhage, immediate delivery is typically indicated, regardless of gestational age.

Click number 10 to continue learning about interventions.

Management of DIC

Management of Delivery

Mode of delivery is determined based on fetal viability, gestational age, fetal heart tracing, obstetric history and the acuity of the maternal presentation.

Non-Viable Fetus	Vaginal Delivery	Cesarean Delivery	Hysterectomy

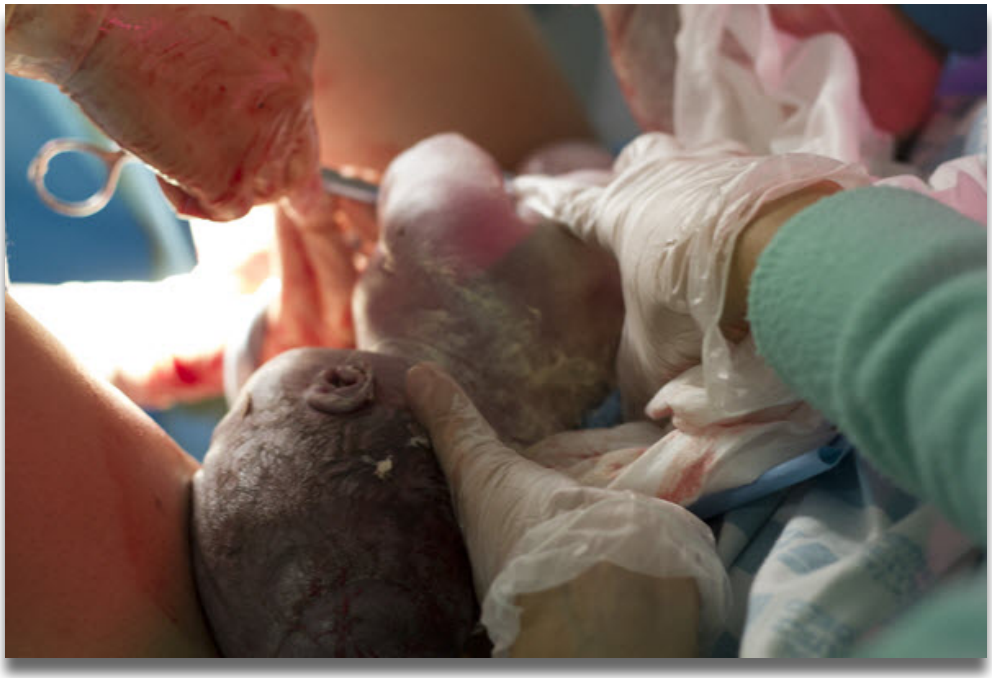
Click the blue boxes to learn more about delivery management.

Hemodynamically Stable Mother with Dead or Nonviable Fetus

- The goal is to minimize maternal morbidity and mortality risk when the fetus is dead or has a very poor prognosis (gestation is <23 weeks, lethal or life threatening congenital anomaly).
- The trigger for DIC is removed upon delivery in many obstetrical cases, causing the myometrium to contract, thus removing both the major sources of hemorrhage.
- Dilation and extraction (D&E) is a good option in the second trimester for rapid uterine evacuation if the clinician is skilled in this procedure.
- Women able to labor should be induced if not already in labor or augmented if not progressing rapidly.
- When the cervix is not favorable, the use of either a mechanical method of ripening (balloon catheter or hygroscopic dilator) or a pharmacologic method of induction (misoprostol or oxytocin) is suggested.
- The woman may require support with IV fluids as well as blood products during the course of delivery.
- Typically, if the fetus has demised or is not viable, efforts should be made to avoid cesarean section; however, if the patient has ongoing hemorrhage or is hemodynamically unstable, cesarean section may be required to expedite delivery.

Vaginal Delivery

- Although vaginal delivery carries the least morbidity; the patient and fetus may not tolerate the length of time required to achieve vaginal delivery.
- If there is ongoing hemorrhage, hemodynamic instability or other contraindication to vaginal delivery, C/S is recommended.



Cesarean Delivery

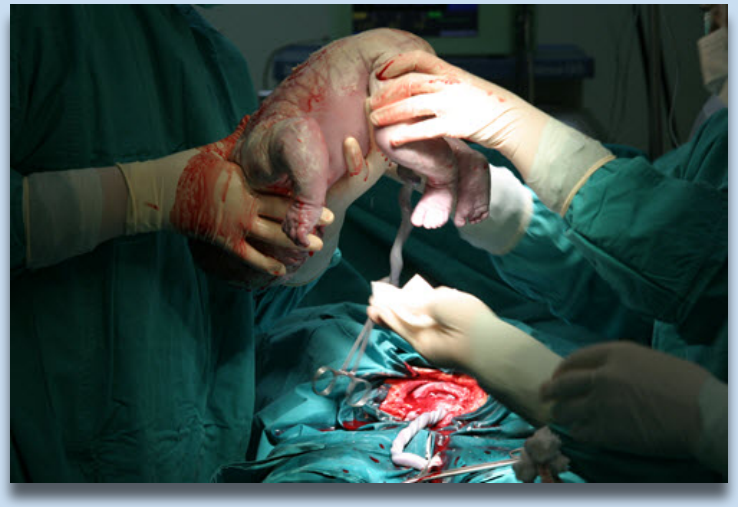
- If there is ongoing hemorrhage, hemodynamic instability or other contraindication to vaginal delivery, C/S is recommended.
- Not always possible, but desirable to correct and improve the clotting abnormality prior to cesarean delivery.
- If possible, begin blood product transfusion prior to beginning cesarean section in order to improve operative coagulation.
- Severe hypovolemia and DIC could prove fatal to the woman.
- With severe hypovolemia and DIC could prove fatal to the woman.
- When cesarean delivery is undertaken, then RBC's, FFP, platelets, and cryoprecipitate should be readily available in the operating room and administered if there is clinical or laboratory evidence of impaired coagulation. With cesarean birth, bleeding without clotting from the incision and needle sites is a clinical sign of coagulopathy.
- When bleeding is severe, there is no need to wait for laboratory studies, the FFP and cryoprecipitate should be given immediately.

Cesarean Delivery

- Surgeons with experience in puerperal hysterectomy, pelvic surgery, and management of pelvic hemorrhage should be present.
- A GYN oncology surgeon, maternal fetal medicine specialist, obstetrician or general surgeon should be considered.
- Involvement of anesthesia, neonatology, and transfusion medicine service can be helpful for maternal and fetal outcome.
- Notifying the neonatal staff so they can prepare for resuscitation of a potentially compromised newborn is helpful.
- If interventional radiology is available, request their assistance for potential uterine artery embolization.

Cesarean Delivery

- The surgical approach is based on individual patient's characteristics and the clinical experience of the surgeon.
- Knowing the vertical infraumbilical incision is fast, provides excellent exposure and is less likely to be complicated by a rectus sheath hematoma, it makes this approach a good choice.
- Once the fetus is delivered, manual extraction of the placenta is important to perform to hasten involution of the uterus.
- Additionally, tranexamic acid (TXA), uterotonic medications and intrauterine balloon tamponade devices should be made available and administered if there are no contraindications.
  - Uterotonic medications include misoprostol, oxytocin, methylergonovine and carboprost.



Cesarean Delivery

- Important points to communicate between the obstetrician, anesthesia and surgical team members may include the volume of blood loss, rate of blood loss, quality of clot formation and response to techniques used to control hemorrhage.
- When uterine bleeding remains brisk and maternal hemodynamic status deteriorates despite initial surgical intervention and blood component transfusion, consideration of a penrose drain or urinary catheter as a uterine tourniquet may be useful.
- When the Penrose drain or catheter is placed, place it as low as possible around the lower uterine segment without involving the urinary bladder. Once positioned, pull the two ends in the opposite directions as tightly as possible around the corpus to mechanically obstruct the vascular supply.
- A clamp may be used to hold the tourniquet in place.
- This technique decreases blood loss and allows ongoing transfusion of blood products.
- The tourniquet can be removed once the patient is hemodynamically stable. The surgery can then be completed and the abdomen closed in standard fashion.

Hysterectomy

- As a last resort in a woman desiring childbearing preservation, hysterectomy is performed, but should be initiated sooner than later when future pregnancy is not planned.
- Delaying hysterectomy increases blood loss and frequency of complications.
- Despite resuscitative measures, some patients will continue to decompensate, which is characterized by hypotension, hypothermia, coagulopathy and metabolic acidosis.
- Criteria associated with decompensation include pH <7.30, temperature <35 degrees Celsius, combined resuscitation and procedural time >90 minutes, non-mechanical bleeding, and transfusion requirement >10 units packed RBCs [14].
- To stop the cycle, the bleeding area can be tightly packed using a pelvic pressure pack or lap sponges [15].
- The abdominal wound, including the fascia, can be left open and a pressure dressing is applied.
- Towel clips have been utilized to temporarily re-approximate the skin/subcutaneous tissue.

Management of Vaginal Bleeding

Post Delivery

- It is reasonable to transfer the patient to the intensive care unit (ICU) for continued monitoring, replacement of appropriate blood products, broad spectrum antibiotics and correcting physiologic derangements [14].
- If there is concern for ongoing bleeding, as determined by abnormal vital signs, decreasing hemoglobin or abnormal physical exam, further surgical intervention or uterine artery embolization is likely required.
- If the patient's abdomen has been left open, definitive surgical closure should be attempted once the patient has stabilized.

Click each number in order to learn more.

Management of Vaginal Bleeding

Hemostatic and Anticoagulant Therapies

- There are no randomized clinical trials on the safety and efficacy of most hemostatic and antithrombogenic drugs or products in the treatment of the hemorrhage in women during pregnancy.
- These include heparin, danaparoid sodium, synthetic protease inhibitor, antithrombin, human recombinant activated protein C, recombinant human soluble thrombomodulin, recombinant tissue factor pathway inhibitor and recombinant activated factor VII (rFVIIa) [16].
- Pro-hemostatic treatment with tranexamic acid is recommended in the management of postpartum hemorrhage [17].

Click to learn more about tranexamic acid

Click each number in order to learn more.

Tranexamic Acid

- Intravenous TXA is recommended by the World Health Organization (WHO) to be used early, even within 3 hours, following vaginal birth or cesarean delivery in addition to standard care for women diagnosed with PPH [13].
- TXA is a competitive inhibitor of plasminogen activation and can reduce bleeding by inhibiting the breakdown of fibrinogen and fibrin clots.
- When administered within 3 hours of birth, maternal death from hemorrhage, regardless of cause, is reduced with no adverse maternal effects noted.

Tranexamic Acid

- 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 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.
- 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 when there is 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.

Contraindications to TXA

- Known thromboembolic event in pregnancy
- History of coagulopathy
- Active intravascular clotting
- Known hypersensitivity to TXA
- Known subarachnoid hemorrhage

- DIC often leads to severe hemorrhage and the mortality depends on the ability to reverse the underlying cause as rapidly as possible.
- Most patients with DIC due to pregnancy-related complications rapidly improve with delivery and treatment of coagulopathy.
- In cases of acute fatty liver of pregnancy, however, resolution of DIC can take as long as 4 to 5 days postpartum because of ongoing liver dysfunction [18].

Maternal **Neonatal**

Click each button to learn more.

- Approximately one-quarter of maternal deaths between 1998-2009 were, at least in part, attributed to DIC from a study based on data from the US Nationwide Inpatient Sample [19].
  - However, the majority of women with obstetric DIC survive.
- Hysterectomy rates in DIC vary.
  - In the series of 49 cases mentioned above, one-fifth required hysterectomy to control bleeding.
  - The risk of DIC recurrence in subsequent pregnancies is unknown, and depends on the underlying cause.
  - Uterine sparing surgical interventions for management of hemorrhage do not appear to adversely affect fertility.

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Maternal

Neonatal

Click each button to learn more.

- Neonatal survival depends on the gestational age at the time of delivery and the underlying etiology of DIC.
- In a series of 91 cases of DIC, there were 40 neonatal deaths (44%); 28 occurred antepartum, three intrapartum, and nine postpartum [5].

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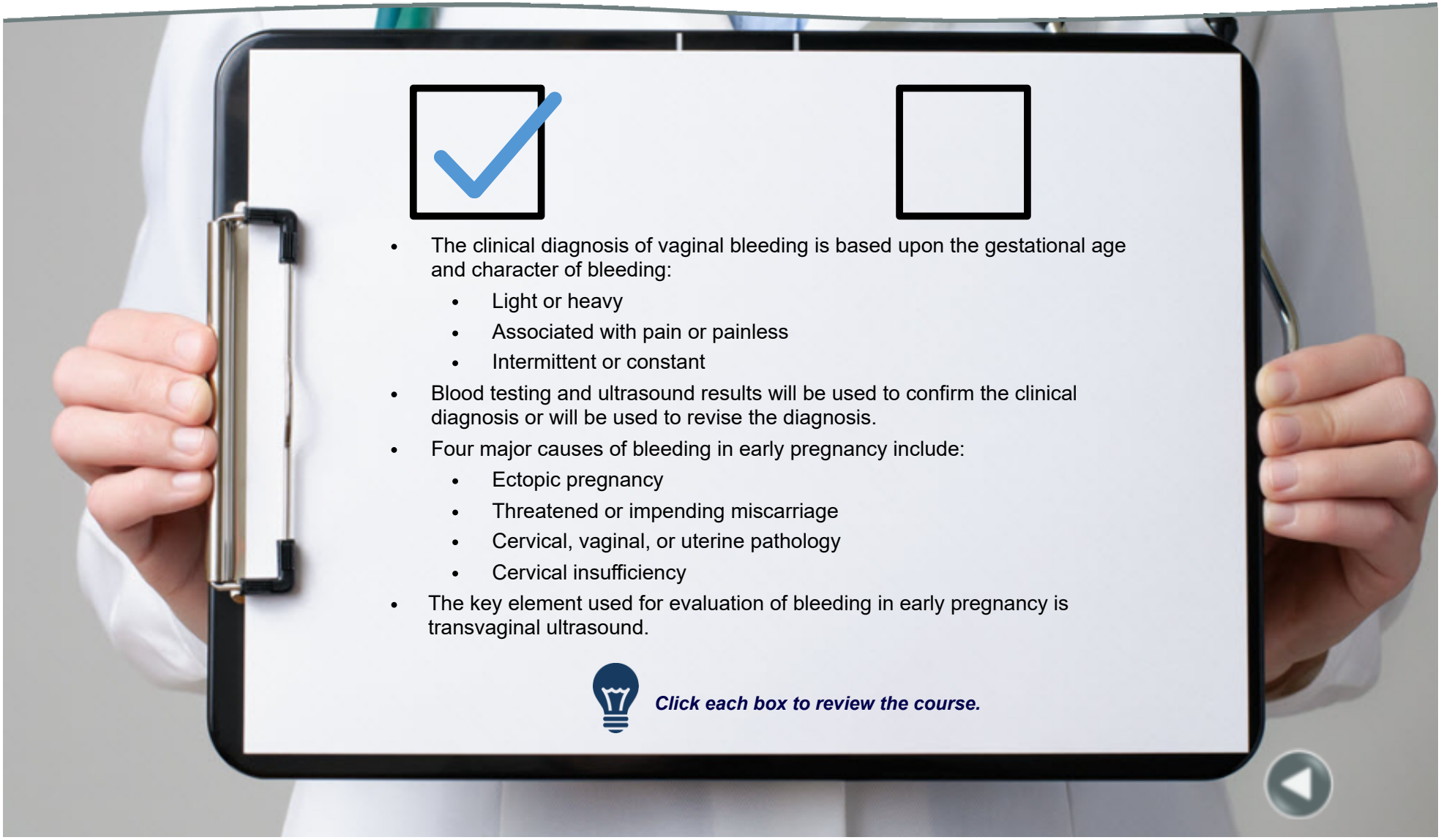
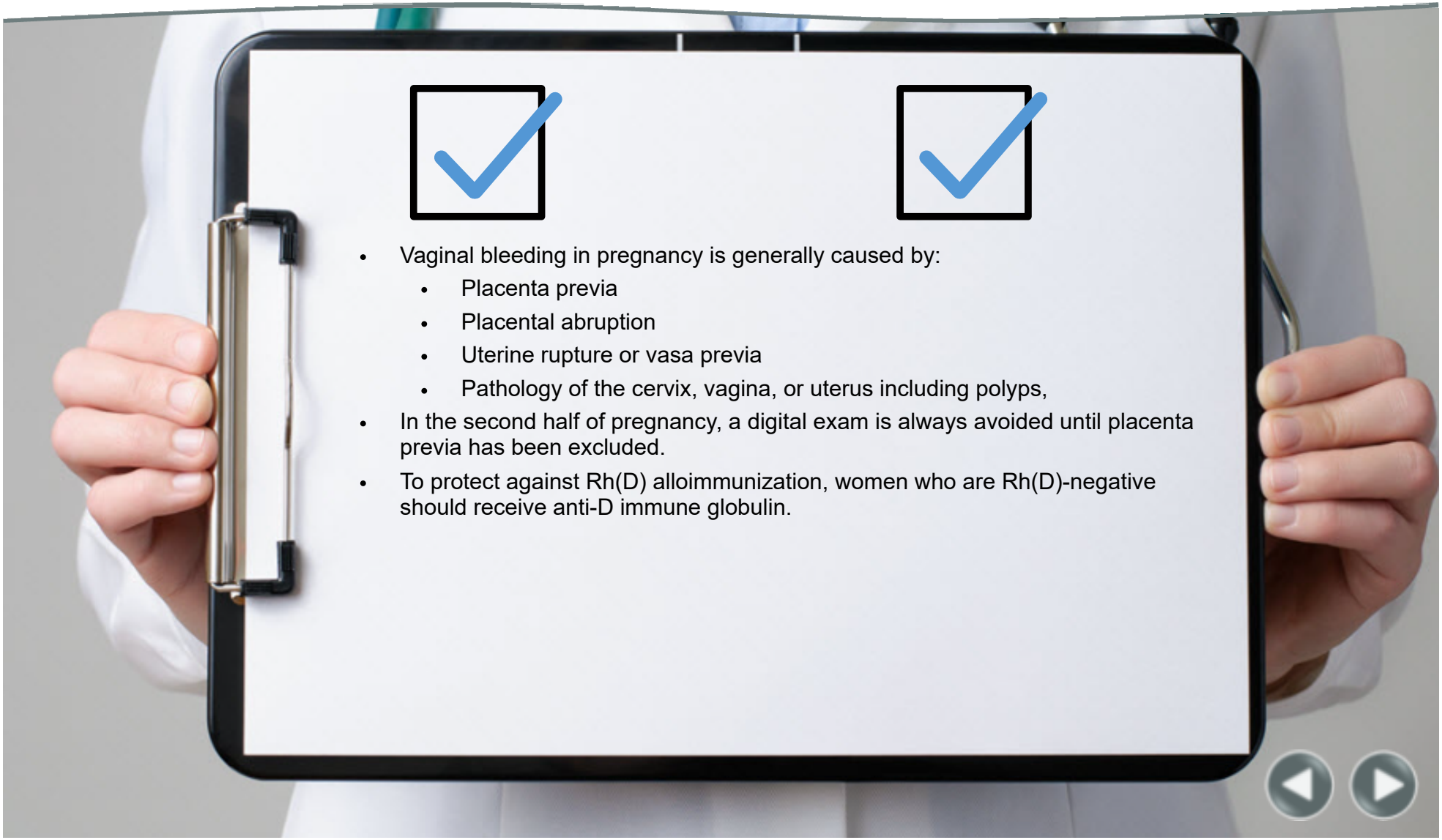


- The clinical diagnosis of vaginal bleeding is based upon the gestational age and character of bleeding:
  - Light or heavy
  - Associated with pain or painless
  - Intermittent or constant
- Blood testing and ultrasound results will be used to confirm the clinical diagnosis or will be used to revise the diagnosis.
- Four major causes of bleeding in early pregnancy include:
  - Ectopic pregnancy
  - Threatened or impending miscarriage
  - Cervical, vaginal, or uterine pathology
  - Cervical insufficiency
- The key element used for evaluation of bleeding in early pregnancy is transvaginal ultrasound.

Click each box to review the course.



- Vaginal bleeding in pregnancy is generally caused by:
  - Placenta previa
  - Placental abruption
  - Uterine rupture or vasa previa
  - Pathology of the cervix, vagina, or uterus including polyps,
- In the second half of pregnancy, a digital exam is always avoided until placenta previa has been excluded.
- To protect against Rh(D) alloimmunization, women who are Rh(D)-negative should receive anti-D immune globulin.

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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.

1. AWHONN Practice Brief. Quantification of Blood Loss: AWHONN Practice Brief Number 1. JOGNN, 44, 158-160; 2015. DOI: 10.1111/1552-6909.1219.
2. Toledo, P., McCarthy, R., Hewlett, B., Fitzgerald, P., & Wong, C. (2007). The accuracy of blood loss estimation after simulated vaginal delivery. Anesthesia & Analgesia, 105, 1736-1740.
3. Bhandari S, Raja EA, Shetty A, Bhattacharya S. Maternal and perinatal consequences of antepartum haemorrhage of unknown origin. BJOG 2014; 121:44.
4. Prevention of Rh D Alloimmunization. ACOG Practice Bulletin. Number 181, August 2017.
5. Erez O, Novack L, Beer-Weisel R, et al. DIC score in pregnant women-- a population based modification of the International Society on Thrombosis and Hemostasis score. PLoS One 2014; 9:e93240.
6. Gilbers WM, Danielsen B. Amniotic fluid embolism: decreased mortality in a population-based study. Obstet Gynecol 1999; 93:973.
7. Sibai BM, Ramdan MK, Usta I, et al. Maternal morbidity and mortality in 442 pregnancies with hemolysis, elevated liver enzymes, and low platelets (HELLP syndrome). Am J bstet Gynecol 1993; 169: 1000.
8. Earez O, Mastrolia SA, Thachil J. Disseminated Intravascular coagulations in pregnancy: insights in pathophysiology, diagnosis and management. Am J Obstet Gynecol 2015.
9. Harrity C, Johnson S, et al. The efficacy of fibrinogen concentrate compared with cryoprecipitate in major obstetric haemorrhage-- an observational study. Transfuse Med 2012; 22:344.

10. Sharma SK, Vera RL, Stegall WC, Whitten CW. Management of a postpartum coagulopathy using thrombelastography. J Clin Anesth 1997; 9:243
11. Huissoud C, Carrabin N, Audibert F, et al. Bedside assessment of fibrinogen level in postpartum haemorrhage by thrombelastometry. BJOG 2009; 116:1097.
12. Miall FM, Deol PS, Barnes TA, et al. Coagulation status and complications of pregnancy. Thromb Res 2005; 115:461.
13. Charbit B, Mandelbrot L, Samain E, et al. The decrease of fibrinogen is an early predictor of the severity of postpartum hemorrhage. J Thromb Haemost 2007; 5:266.
14. Sagraves SG, Toschlog EA, Rotondo MF. Damage control surgery-- the Intensivist's role. J Intensive Care Med 2006; 21:5.
15. Dildy GA, Scott JR, Saffer CS, Belfort MA. An effective pressure pack for severe pelvic hemorrhage. Obstet Gynecol 2006; 108:122
16. Martí-Carvajal AJ, Comunián-Carrasco G, Peña-Martí GE. Haematological interventions for treating disseminated intravascular coagulation during pregnancy and postpartum. Cochrane Database Syst Rev 2011; CD008577.
17. Rotondo MF, Zonies DH. The damage control sequence and underlying logic. Surg Clin North Am 1997; 77:761.
18. Nelson DB, Yost NP, Cunningham FG. Hemostatic dysfunction with acute fatty liver of pregnancy. Obstet Gynecol 2014; 124:40.
19. Callaghan Creanga AA, Kukllina EV. Severe maternal morbidity among delivery and postpartum hospitalizations in the US. Obstet Gynecol 2012; 120: 1029.