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# 2nd and 3rd Trimester Hemorrhage

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**Course Description:**

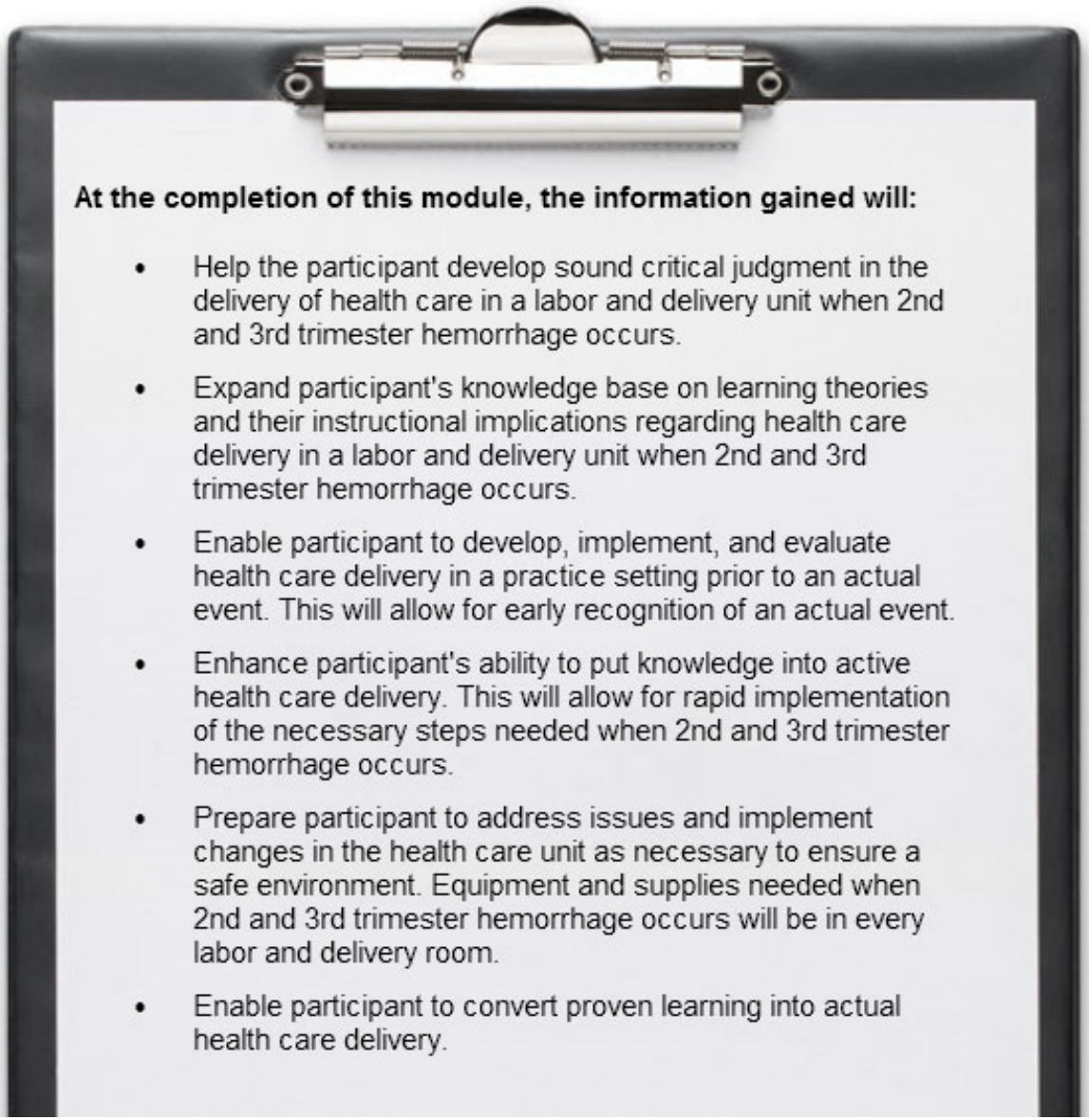
Second and third trimester hemorrhage is an event that is life threatening to both the mother and fetus. This course will help to gain understanding of the issues involved with hemorrhage. The participant will gain comfort to understand the examination in a woman with these signs and symptoms. The knowledge gained will help to communicate with other providers, the patient and her family.

**Approximate Time to Complete:** 45 minutes

# Second and Third Trimester Hemorrhage

*print version*


**Introduction**



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

- Help the participant develop sound critical judgment in the delivery of health care in a labor and delivery unit when 2nd and 3rd trimester hemorrhage occurs.
- Expand participant's knowledge base on learning theories and their instructional implications regarding health care delivery in a labor and delivery unit when 2nd and 3rd trimester hemorrhage occurs.
- Enable participant 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 participant's ability to put knowledge into active health care delivery. This will allow for rapid implementation of the necessary steps needed when 2nd and 3rd trimester hemorrhage occurs.
- Prepare participant to address issues and implement changes in the health care unit as necessary to ensure a safe environment. Equipment and supplies needed when 2nd and 3rd trimester hemorrhage occurs will be in every labor and delivery room.
- Enable participant to convert proven learning into actual health care delivery.

## Antepartum hemorrhage

*Genital 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*

## Intrapartum hemorrhage

*Genital bleeding during pregnancy from the period of onset of labor and the third stage of labor.*


**Definition**

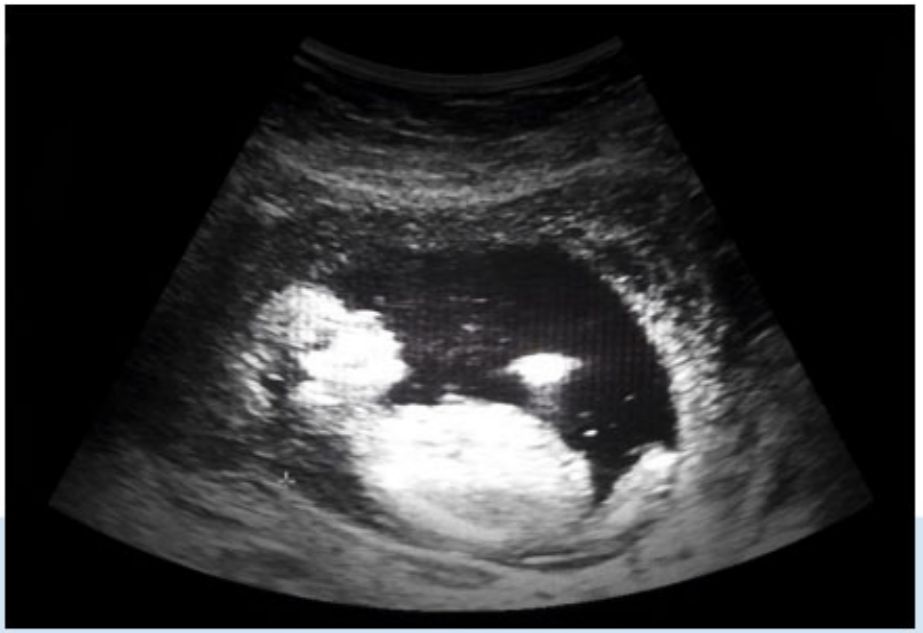
- Vaginal bleeding is common at all stages of pregnancy.
- Bleeding is generally maternal and not fetal.
- Bleeding may be caused by cervical or vaginal lesions or disruption of blood vessels in the decidua.
- The patient's gestational age, amount of bleeding, associated pain or painless, and intermittent 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.
- The etiology and evaluation of vaginal bleeding in pregnant women will be reviewed in this module.
- The specific causes of bleeding and their management are beyond

**Definition Cont'd**

- An abdominal examination is performed to assess for pain or other abnormalities and uterine size.
  - 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. The external genitalia are examined and then a speculum is inserted into the vagina.
  - Physical examination may reveal a nonpregnancy-related source of bleeding, such as cervical ectropion, an abnormal growth, a laceration, or sanguinous-purulent discharge.
  - Direct visualization of a dilated cervix or fetal membranes may be sufficient to diagnose impending miscarriage if contractions are present, or cervical insufficiency in the absence of contractions.

**Antepartum Hemorrhage Prior to 20 Weeks Gestation - Evaluation**

- Transvaginal ultrasound is also essential in the evaluation of bleeding in pregnancy.
- The goals of ultrasound use is to determine whether:
  - Placenta previa is present. (The placenta is covering the cervical os).
  - Abruptio placenta is occurring. (Presence of decidual hemorrhage is present causing placental separation).
  - The cervical length is short, cervix is dilated at the internal os, or there is prolapse of the fetal membranes through the cervical



**Antepartum Hemorrhage Prior to 20 Weeks Gestation - Evaluation Cont'd**

## Differential Diagnosis

- Miscarriage
- Pathology of the cervix, vagina, or uterus
- Cervical insufficiency
  - Cervical insufficiency is a clinical diagnosis
  - In the second trimester, the presentation will include cervical dilation and effacement with the absence of uterine contractions. There may be fetal membranes seen at or through the external os of the cervix.
  - One or more of the following symptoms may also be present:
    - Pressure or a fullness type feeling in the vagina
    - Vaginal spotting or bleeding
    - Increased amount of watery, mucus, or brown vaginal discharge
    - An uncertain discomfort in the back or lower abdomen
- A shortened cervix may be present on the ultrasound in a woman with a history of a

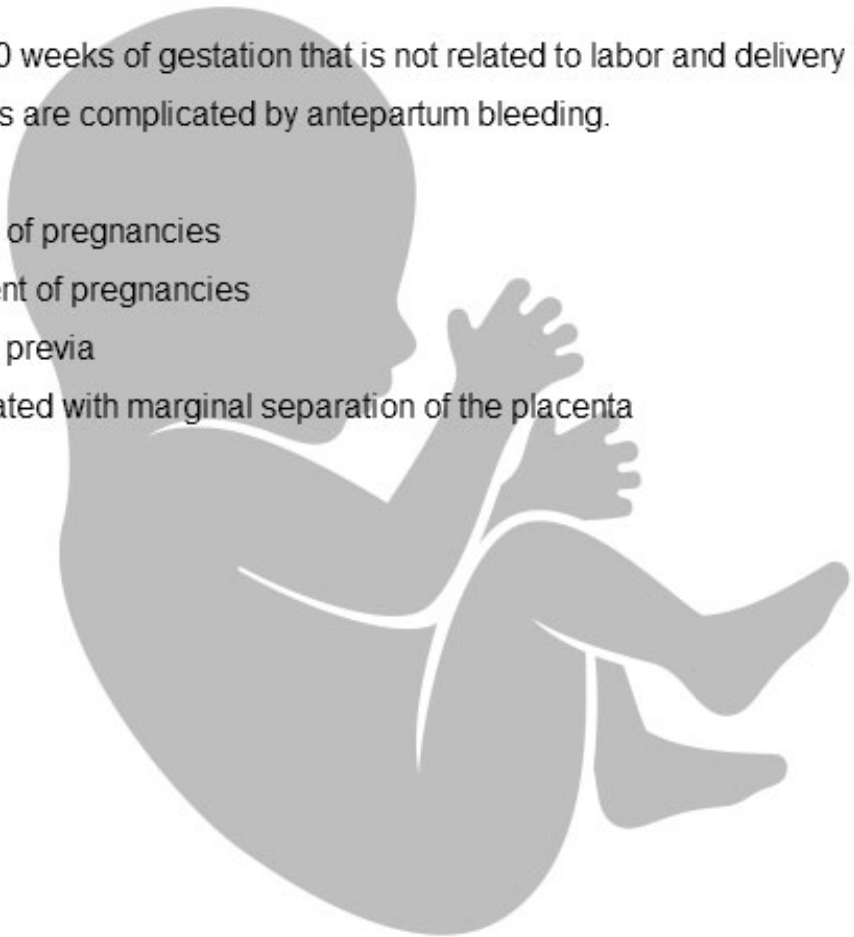
**Antepartum Hemorrhage Prior to 20 Weeks Gestation - Differential**

## Differential Diagnosis

- Abruptio placentae
  - Bleeding and cramping may be present when there is placental separation due to hemorrhage into the decidua
  - Placental separation is not generally observed on ultrasound examination so this diagnosis is one of exclusion.
- Placenta that covers the internal os of the cervix or a subchorionic hematoma supports the diagnosis.
- Ectopic pregnancy
  - Ectopic pregnancy is rare in the second trimester.
  - If an ectopic pregnancy is diagnosed in the second trimester, the location is generally abdominal, cervical, cesarean scar, cornual, or coexistent

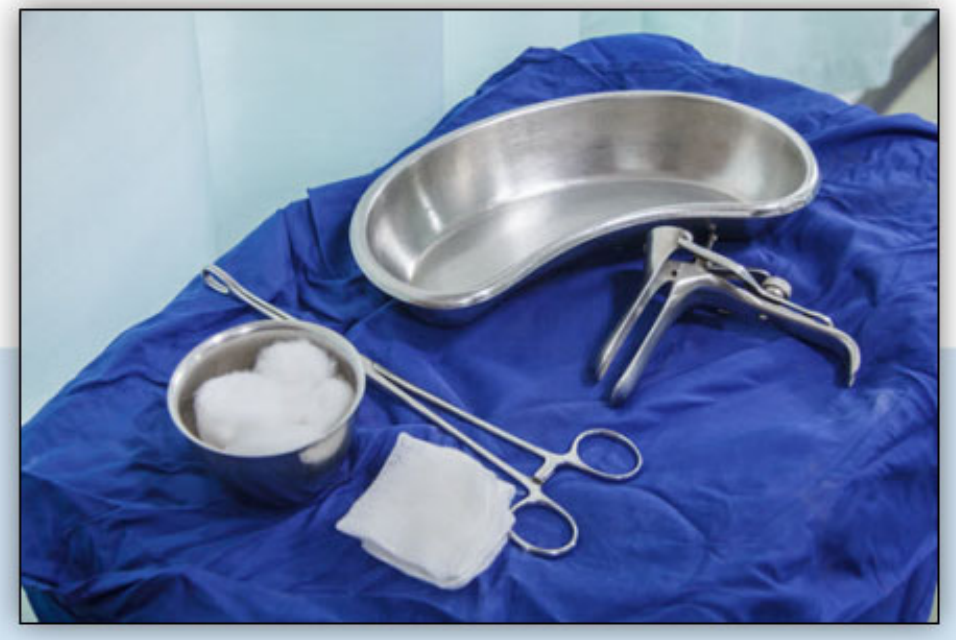
**Antepartum Hemorrhage Prior to 20 Weeks Gestation - Differential Cont'd**

- The small amount of blood and mucus vaginal discharge that occurs prior to labor by as much as 72 hours is known as 'bloody show.'
- Uterine bleeding occurring after 20 weeks of gestation that is not related to labor and delivery is known as antepartum bleeding.
- Four to five percent of pregnancies are complicated by antepartum bleeding.
- The major causes are:
  - Placenta previa in 20 percent of pregnancies
  - Abruptio placenta in 30 percent of pregnancies
  - Rarely uterine rupture or vasa previa
  - Remaining cases are associated with marginal separation of the placenta



**Antepartum Hemorrhage After 20 Weeks Gestation - Evaluation**

- A digital cervical exam is to 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.
- If heavy or persistent vaginal bleeding continues, the baseline set of blood tests will be valuable. In particular, these results will help to identify a concealed hemorrhage.



**Antepartum Hemorrhage After 20 Weeks Gestation - Evaluation Cont'd**

## Antepartum hemorrhage differential after 20 weeks gestation

- **Placenta Previa**
- **Abruptio Placenta**
- **Uterine Rupture and Vasa Previa**
- **Cervical, Vaginal or Pathology**
- **Choriocarcinoma**

- In the second half of pregnancy, placenta previa should be considered when the woman is experiencing vaginal bleeding.
- Abdominal pain and uterine contractions where generally thought to be associated with abruptio placenta and distinguished this from placenta previa.
- Some women may experience uterine contractions when placenta previa is present; therefore, she may have painful vaginal bleeding.
    - Placenta previa is determined by ultrasound examination.
- Again, 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.

## Antepartum hemorrhage differential after 20 weeks gestation

- **Placenta Previa**
- **Abruptio Placenta**
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- **Choriocarcinoma**

- Premature separation of an implanted placenta prior to delivery of the infant is referred to as aburptio placenta.
- Common risk factors associated with abruption placenta include:
  - Prior placental abruption
  - Trauma
  - Smoking
  - Cocaine use
  - Hypertension
  - Preterm premature rupture of membranes (PPROM)
- The typical presentation of abruptio placenta with or without non-reassuring fetal testing:
  - Vaginal bleeding (80 percent)
  - Uterine tenderness (70 percent)
  - Uterine contractions (35 percent) 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.

## Antepartum hemorrhage differential after 20 weeks gestation

- **Placenta Previa**
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- **Choriocarcinoma**

Blood can penetrate through the uterine serosa and into the peritoneal cavity in severe cases.

- There may be concealed bleeding within the uterus so the amount of vaginal bleeding does not indicate the severity of the hemorrhage.
- It is uncommon to detect abruption placenta on ultrasound.
  - Placenta abruption is detected on only 2 percent of ultrasound examinations.
  - Ultrasound is commonly used to exclude placenta previa.
- Abruptio placenta can range from mild to life-threatening. This may be an acute or chronic condition.
- A pregnant woman being evaluated for trauma such as a motor vehicle accident, fall, or domestic violence, an abruption should be considered.

## Antepartum hemorrhage differential after 20 weeks gestation

- **Placenta Previa**
- **Abruptio Placenta**
- **Uterine Rupture and Vasa Previa**
- **Cervical, Vaginal or Pathology**
- **Choriocarcinoma**

- Uterine rupture and vasa previa are rare causes of vaginal bleeding, and occur more often intrapartum than antepartum.
- Vasa previa refers to bleeding from the umbilical cord resulting in the loss of fetal rather than maternal blood.
- Both may lead to fetal death.
- Other etiologies for bleeding may include a non-tubal pregnancy or cervical, vaginal, or uterine pathology.

## Antepartum hemorrhage differential after 20 weeks gestation

- Placenta Previa
- Abruptio Placenta
- Uterine Rupture and Vasa Previa
- Cervical, Vaginal or Pathology
- Choriocarcinoma

- The most common symptom of choriocarcinoma is antepartum vaginal bleeding and may occur in any trimester. The bleeding may be from vaginal metastases or the intrauterine tumor.
- However, choriocarcinoma is rare and should only be considered after ruling out the more common causes of antepartum bleeding.

- Adverse pregnancy outcome, chiefly preterm birth is associated with first, second, and third trimester bleeding.
- The degree and cause of bleeding is associated with the level of risk of adverse outcomes [1]. There is worse outcome with heavier bleeding and bleeding 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].

**Prognosis**

There are numerous factors with the management of pregnant women with vaginal bleeding in the second and third trimesters including gestational age, the cause of bleeding, the severity and fetal status.

**Management**

# Management - Quick Overview

Notify staff and services that will or may be needed:

- Anesthesia
- Neonatology
- Blood bank
- Surgery
- Obstetrics
- Pelvic Surgery
- Maternal Fetal Medicine
- Gynecologic Oncology
- Interventional Radiology
- General Surgery

# Management - Quick Overview

- 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.
- Attempts at peripheral and central venous access in the head, neck, and chest should be limited during cardiopulmonary resuscitation (CPR) to avoid interruption of ventilation and chest compressions.
- During CPR or the treatment of severe shock, intraosseous cannulation and peripheral venous access should be pursued

# Management - Quick Overview

- Protocols can help to facilitate the patient's care. Rapid establishment of venous access being a high priority [5].
- In one study, for example, a protocol was designed to limit the time spent in futile attempts to achieve peripheral and central venous catheterization [6].
- Significant improvement on venous access was found when a study revealed rapid sequential steps. In this study, rapid sequential attempts at percutaneous femoral vein catheterization, saphenous vein cutdown, and intraosseous cannulation were initiated if initial peripheral IV insertion failed after 90 seconds [6].
- 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 [6].
- Intraosseous cannulation had a high degree of success when other measures failed.

# Management - Quick Overview

- Administer crystalloid with or without colloid, blood, and blood products, as needed.
- O-negative red blood cells, group AB fresh frozen plasma, and lyophilized 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 and cross-match compatible red blood cells.
- The goal with transfusions is to keep:
  - Hemoglobin above 10g/dL
  - Fibrinogen above 200mg/dL
  - Platelets above 50,000/microL

Management - Quick Overview

# Management - Quick Overview

- Maintain oxygen saturation above 95 percent
- Keep the patient warm
- Identify and begin treatment of the triggering event

# Management - Quick Overview

- Order laboratory panel to assess coagulation (PT, aPTT, fibrinogen); draw 5 mL blood in a red top tube and observe clot formation over 8 to 10 minutes
- Order baseline laboratory panel: CBC, BUN, creatinine, liver function tests

# Management - Quick Overview

- Assess fetal status (gestational age, FHR)
- Assess maternal condition (blood loss, hemodynamic stability, uterine contractions, cervical status)
- Appropriate personnel, equipment, and supplies (eg, pelvic pack) should be available if hysterectomy is being considered

Management - Quick Overview

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



## 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

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### Notify the transfusion service

- The transfusion service or blood bank should be notified of the pregnant patient regarding the potential need for blood products, including need for massive transfusion.
- Pretransfusion testing (crossmatching) can be initiated; if necessary,

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



## Establish IV access and begin fluid resuscitation

- Establish IV access peripherally with at least two IV catheters (≥18 gauge) and infuse crystalloid (with or without colloid) and blood products, when available, to support blood pressure (systolic ≥90 mmHg or mean arterial pressure ≥65 mmHg) and maintain urine output (≥0.5 mL/kg/hour).
- The best approach to fluid resuscitation remains controversial.
- Initial fluid resuscitation for hemorrhagic shock with infusion of two to three liters of Lactated Ringer's solution as rapidly as possible

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



## Identify and address the triggering event

- The cornerstone of therapy is to identify the underlying disorder leading to hemorrhage and initiate appropriate treatment for that disorder.
- Obstetric etiologies of hemorrhage usually are readily identified by history, physical examination, and ultrasound findings.
- Delivery is a key component in management of all obstetric etiologies of hemorrhage because termination of pregnancy leads to

Abruption

Preeclampsia

Amniotic Fluid Embolism

Acute Fatty Liver of Pregnancy

Retained Fetal Demise

Septic Abortion

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# Abruption

- Abruption of the placenta is usually characterized by the abrupt onset of mild to moderate vaginal bleeding, abdominal pain, back pain and accompanied by uterine contractions.
- However a placental abruption may be concealed, with no vaginal bleeding.
- The uterus has increased tone/rigidity and may be tender both during and between contractions.
- Patients with classic symptoms, abnormalities of fetal heart rate or fetal demise and/or DIC (disseminated intravascular coagulation) strongly support the clinical diagnosis and indicating extensive placental separation.

## Preeclampsia

Preeclampsia with severe features has hypertensioin associated with one or more signs or symptoms with increased maternal and fetal morbidity/mortality.

- The occurrence of a seizure upgrades the diagnosis to eclampsia
- Women with HELLP syndrome often have many of the clinical findings associated with preeclampsia, as well as the laboratory

## Preeclampsia with Severe Features

Symptoms of central nervous system dysfunction:

- Altered mental status:
  - New onset cerebral or visual disturbance, such as:
    - Photopsia, scotomata, cortical blindness, retinal vasospasm
    - Severe headache (i.e. incapacitating, "the worst headache I've ever had") or headache that persists and progresses despite analgesic therapy
- Hepatic abnormality:
  - Severe persistent right upper quadrant or epigastric pain unresponsive to medication and not accounted for by an alternative diagnosis or serum transaminase concentration ≥ twice normal, or both
- Severe blood pressure elevation:
  - Systolic blood pressure ≥160 mmHg or diastolic blood pressure ≥110 mmHg on two occasions at least four hours apart while the patient is on bedrest (unless the patient is on antihypertensive therapy)
- Thrombocytopenia:
  - <100,000 platelets/microL
- Renal abnormality:
  - Progressive renal insufficiency (serum creatinine >1.1 mg/dL or doubling of serum creatinine concentration in the absence of other renal disease)
- Pulmonary edema

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# Amniotic Fluid Embolism

Amniotic fluid embolism (AFE) is characterized by the abrupt and fulminant onset of hypotension due to cardiogenic shock, hypoxemia and respiratory failure, and coma or seizures immediately postpartum or during labor.

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# Acute Fatty Liver of Pregnancy

- Acute fatty liver of pregnancy initially presents with nausea or vomiting (approximately 75 percent of patients), abdominal pain (50 percent 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.

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# Retained Fetal Demise

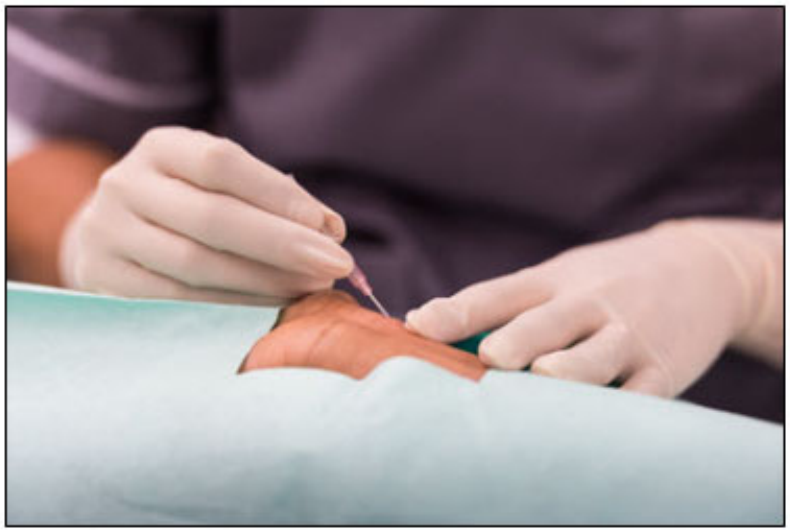
Retained dead fetus is diagnosed readily by ultrasound imaging that confirms the absence of fetal cardiac activity and overlapping skull bones, gross distortion of fetal anatomy (maceration), and soft tissue edema.


# 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.

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**





### Insert an arterial line

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

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



## Blood products

Obstetrical patients have or are at high risk for serious bleeding and thus have a high association to require an invasive procedure, often requiring transfusions.

**Transfusion**

**Massive Transfusion**

# Management - Transfusion

- In most instances, preparation of fully typed and cross-matched red blood cells (RBCs) requires at least 20 minutes.
- Clinicians can begin transfusion immediately using type O, Rh(D)-negative RBCs, if necessary, and then switch to type-specific or typed and cross-matched RBCs when available.
- Initially, type AB Fresh Frozen Plasma (FFP; either Rh(D) positive or negative) can be used when transfusion is necessary prior to obtaining type-specific FFP.

# Management - Transfusion

- Initial orders should be for a minimum of 6 units packed red blood cells (pRBCs) to be typed and cross-matched, 6 units of FFP, 1 or 2 cryoprecipitate pools (each pool is composed of 5 individual units), and 1 dose of platelets (either a pool of 4 to 6 whole blood-derived platelet concentrates or a single apheresis platelet unit).
- Many massive transfusion protocols recommend transfusion of RBCs, FFP, and platelets in a ratio of 1:1:1.

# Management - Transfusion

- Correcting the 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 source of concentrated fibrinogen is cryoprecipitate, but takes time to be prepared for transfusion and brings risks of transmissible infections since it is a product that has pooled donors.
- Clinicians need to order cryoprecipitate with enough advanced planning to allow for this time.
- A fibrinogen concentration below 100 mg/dL is generally treated with 10 units of cryoprecipitate (table 3).

| Product (mL) | Contents | Uses and effects |
|---|---|---|
| Whole blood (1 unit = 500 mL) | All components | 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 = 350 mL) | Red cells | One unit increases hematocrit by 3 percentage points and hemoglobin by 1 g/dL. |
| Frozen plasma (1 unit = 200 to 300 mL) | All clotting factors, but no platelets | Best used to correct deficiencies of multiple coagulation factors (eg, DIC, liver disease, warfarin overdosage). One unit FFP increases fibrinogen by 7 to 10 mg/dL. Usual dose is 10 to 15 mL/kg. |
| Cryoprecipitate (1 unit = 10 to 20 mL) | Fibrinogen, factors VIII, XIII, VWF | One unit of cryoprecipitate/10 kg 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 100 mg/dL is: number of units = 0.2 x body weight 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 300 mL) | Platelets | 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 sized adult. |

# Table 3

| Product (mL) | Contents | Uses and effects |
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# Management - Transfusion

- Lyophilized fibrinogen (RiaSTAP, a human fibrinogen concentrate) can be reconstituted immediately for use in correcting low fibrinogen levels, but it is expensive [21].
- In an observational study of 77 cases of major obstetrical hemorrhage, the use of purified, virally inactivated fibrinogen concentrate had similar efficacy as cryoprecipitate in resolving the hypofibrinogenemia [22]
- The blood bank should be notified of the potential need for massive transfusion and a massive transfusion protocol initiated, if indicated and available.
- 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 thirty 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) useful in the setting of massive hemorrhage as it provides a "rapid global assessment" of hemostatic function [23-25].

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

## 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 70 kg 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

- 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

- 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 35 kg).
- 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 (3 mL 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.

- 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

## Blood Bank Responsibilities

- Release two emergency O Neg RBCs if requested.
- Prepare 4 RBCs, 4 plasma, and 1 dose 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 process until notified to discontinue the protocol.

- 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

- 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

- Bedside Responsibilities
- Blood Bank Responsibilities
- Nursing Responsibilities
- Transfusion Targets
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- Review of massive transfusion protocol events by transfusion services
- Attending Physician, Surgeon, or Anesthesiologist Responsibilities

Blood products are transfused to achieve the following minimum levels for delivery:

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

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

## Hemoglobin Management

- To determine the optimal hemoglobin concentration for pregnant women about to delivery many factors need to be evaluated: expected blood loss during delivery, baseline hemoglobin, rate of blood loss and medical comorbidities.
- The overall risk of mortality increases as the hemoglobin concentration decreases; some experts have suggested a minimum hemoglobin of 7 g/dL for pregnant patients receiving massive transfusion with an overall treatment target of 8 to 10 g/dL in women with severe postpartum hemorrhage [29,30].
- Additional evidence to support transfusion targets in other settings is beyond the scope of this program.
- Maintaining the hemoglobin above 10g/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 lower hemoglobin level is acceptable after the patient has delivered, is no longer actively bleeding, or is hemodynamically stable.
- A fibrinogen level ≥100 mg/dL is considered the minimum level necessary for adequate coagulation.
- An observational study demonstrated that 100 percent of postpartum women who developed severe hemorrhage had fibrinogen levels <200 mg/dL, while 80 percent of those with fibrinogen >400 mg/dL did not develop severe hemorrhage [27]

# Table 5

| Product (mL) | Contents | Uses and effects |
|---|---|---|
| Whole blood (1 unit = 500 mL) | All components | 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 = 350 mL) | Red cells | One unit increases hematocrit by 3 percentage points and hemoglobin by 1 g/dL. |
| Frozen plasma (1 unit = 200 to 300 mL) | All clotting factors, but no platelets | Best used to correct deficiencies of multiple coagulation factors (eg, DIC, liver disease, warfarin overdosage). One unit FFP increases fibrinogen by 7 to 10 mg/dL. Usual dose is 10 to 15 mL/kg. |
| Cryoprecipitate (1 unit = 10 to 20 mL) | Fibrinogen, factors VIII, XIII, VWF | One unit of cryoprecipitate/10 kg 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 100 mg/dL is: number of units = 0.2 x body weight 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 300 mL) | Platelets | 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 sized adult. |

- 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

- Laboratory studies are drawn initially every 30 minutes to guide blood product replacement.
- As the clinical situation is stabilized, the interval for laboratory testing can be extended.
- Some centers have found thromboelastography (TEG) useful in the setting of massive hemorrhage as it provides a "rapid global assessment" of hemostatic function [23-25].

- 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

- Each event is summarized by blood bank staff
- Review is performed by blood bank supervisor and transfusion service physicians

- 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**

- Obtain baseline CBC and coagulation studies
- Determine if rFVIIa is required (see section below for guidelines)
- Monitor CBC, ABG, potassium, ionized calcium, and coag tests frequently
- If a coagulopathy is suspected measure the fibrinogen test and other coagulations studies
- Determine when the protocol should be discontinued
    - Call the blood bank (this phone call may be delegated to another individual)
    - Document discontinuation in the patient's chart

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

## Use of rFVIIa (Novaseven) 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 1.2 mg. 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

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



## Maintain oxygenation

Keep arterial oxygen saturation above 95 percent.

## Avoid hypothermia

- The patient should be kept warm with a forced-air warming system (eg, 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

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



## Assess Blood Loss

- Although not very accurate, blood loss can be estimated by collection in a volumetric flask, and by weighing pads/towels used to soak up the blood.
- Concealed hemorrhages may occur in cases of severe abruption with the magnitude of blood loss being estimated and monitored using a combination of parameters: hourly assessment of changes in fundal height, clot volume on ultrasound, urine output and serial hemoglobin/hematocrit assessment
- Indirect assessment of blood loss can be accomplished with vital signs, knowing pregnant women can display changes in vitals later than non-pregnant counterpart.
- Hemodynamic instability in non-anesthesthesized pregnant women may be suspected when:
    - Systolic blood pressure <100 mmHg
    - Pulse >100 bpm
    - Urine output <30 mL 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

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



### Notify the neonatology service

- The neonatology service should be notified so they can prepare for the birth of a possibly premature and/or compromised infant.
- If time permits, they may counsel the parents about newborn issues, as needed.

### Fetal assessment

- Fetal viability and gestational age significantly impact management of pregnant women with hemorrhage.
- If an intrauterine fetal demise is identified or the fetus is clearly previable, then the entire focus of care becomes the optimal care of the mother.

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



## Fetal assessment continued

- By determining the limits of viability desired futile interventions that are painful and costly may be avoided in the fetus or neonate that does not have a reasonable favorable outcome.
- The threshold of viability is challenging, particularly those born at 23-24 weeks of gestation. The decision lies upon a reasonable chance of survival without severe deficits.
- Determining the morbidity from prematurity, intensity of care and likelihood at various gestational ages is beyond the scope of this program.
- 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.
- Weighing the outcomes between immediate delivery versus delaying delivery to optimize fetal outcome are considered when maternal hemorrhage occurs.
- 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.
- Involving the neonatology and anesthesia services can help when discussing these issues with the patient and her families.

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



## Management of Delivery

A key component to management is delivery, termination of pregnancy, which usually leads to resolution of obstetrical disorder that initiated the hemorrhage.

Non-Viable Fetus | Vaginal Delivery | Cesarean Delivery | Hysterectomy

# 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 less than 23-24 weeks, lethal or life threatening congenital anomaly, preterminal FHR tracing).
- In many but not all cases, this means avoiding cesarean delivery because of the risk of uncontrollable hemorrhage from surgical incisions and lacerations.
- Delivery is initiated and the mother is supported with crystalloid (with out or with colloids) and blood products.
- The trigger for bleeding is generally removed upon delivery in many obstetrical cases, causing the myometrium to contract (involution of the uterus), thus removing both the major sources and site 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).

# Vaginal Delivery

- The safest maternal option may not be vaginal delivery when hemodynamic instability from ongoing brisk uterine bleeding is occurring, nor if the mother would be endangered by vaginal delivery (for example, prior classical hysteretomy).
  - In these cases, cesarean delivery is indicated to save the mother's life.
  - Cesarean delivery is also indicated if prompt delivery has the potential to reduce fetal morbidity and mortality.

# Cesarean Delivery

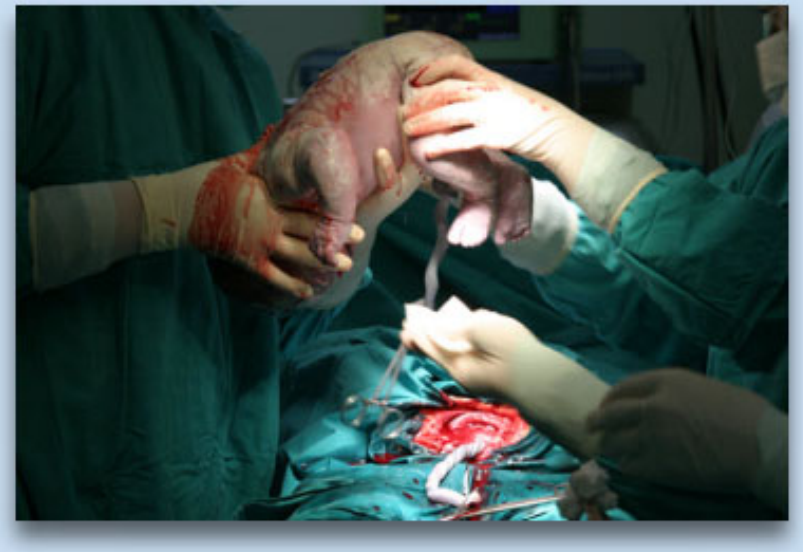
- Not always possible, but desirable to correct and improve the clotting abnormality prior to cesarean delivery.
- If there were a delay in operative intervention this could lead to worsening of coagulopathy, further blood loss, and potential fetal death.
- However, immediate operative intervention in a woman with severe hypovolemia and DIC could prove fatal to the woman.
- When cesarean delivery is imminent, then RBC's, plasma (or FFP), platelets, and cryoprecipitate should be readily available in the operating room and administer 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.
- Without waiting for laboratory results, 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 will be helpful.
- When an interventional radiologist is available, notify them of their potential need.

# Cesarean Delivery

- The surgical approach does not have data of randomized trials or controlled studies to recommend a certain surgical approach.
- The surgical approach decision is based on individual patient's characteristics and the clinical experience of the surgeon involved.
- Knowing the vertical inframumbilical 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. It would also be diligent to have uterotonic drugs (such as oxytocin or methylergonovine) given and the hysterotomy incision closed promptly. All of these efforts are to curtail bleeding.



# Cesarean Delivery

- Important points to communication 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 drain or catheter is placed, to place it as low as possible around the lower uterine segment without involving the urinary bladder is the goal. Then to pull the two ends in the opposite directions as tightly as possible around the corpus to mechanically obstruct the vascular supply.
  - The tourniquet can be held in place with a clamp.
  - This procedure markedly reduces blood loss and allows time for the anesthesia team members to catch up with transfusion requirements.
  - 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 rescue measures some patients will enter a lethal downward spiral characterized by hypothermia, coagulopathy and metabolic acidosis.
- Criteria proposed for this "in extremis" state 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 [29]
- To abort the cycle, the bleeding area can be tightly packed using a pelvic pressure pack or lap sponges [30].
- The abdominal wound, including the fascia, is left open and a pressure dressing is applied.
- Towel clips have been utilized to temporarily re-approximate the skin/subcutaneous tissue.

**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



## 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 [29].
- When the patient continues to need two or more units of packed RBC's per hour for three hours it is a sign she has ongoing bleeding and needs surgical intervention or arterial embolization by an interventional radiologist.
- Otherwise, when the patient is stable, she is returned to the operating room to undergo definitive surgical care.
- This approach halts the downward spiral and lessens the risk of abdominal compartment syndrome.

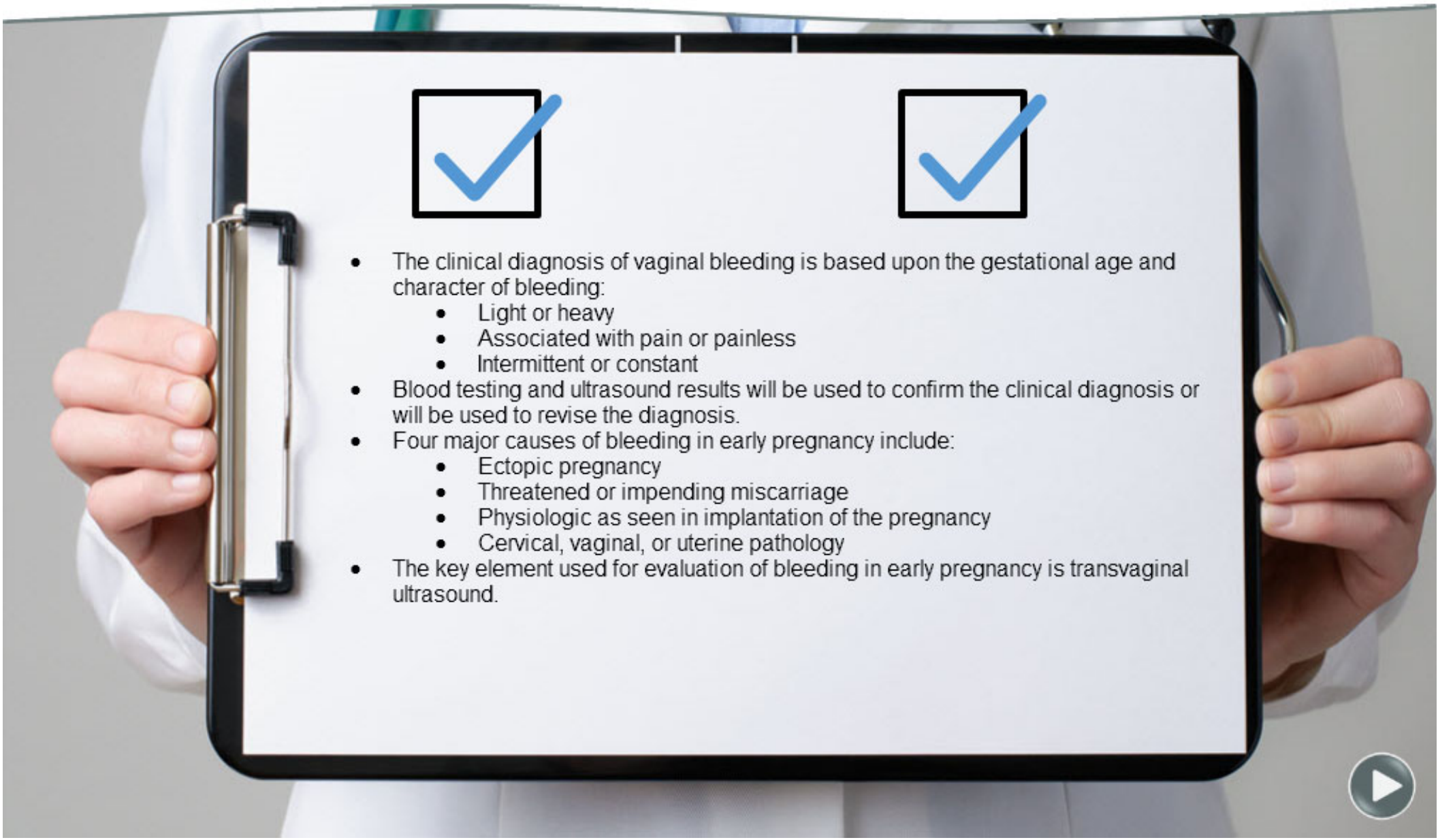
**Management -Steps**

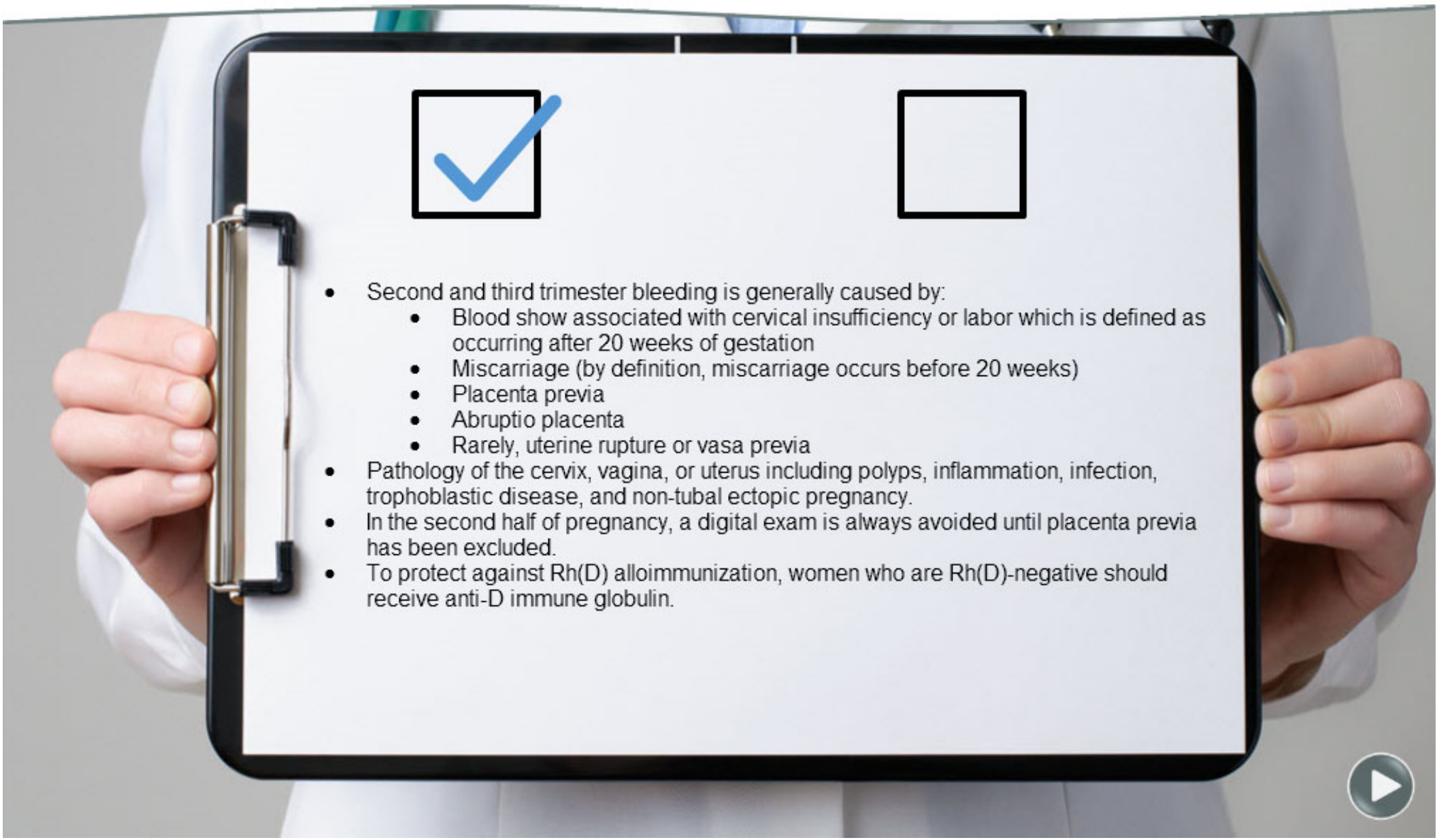
**Many of the interventions will be appropriate in acutely ill patients even if the etiology of hemorrhage is uncertain, and these can be initiated while the diagnostic evaluation is ongoing.**



## Hemostatic and anticoagulant therapies

- There is lack of sufficient data on safety and efficacy in hemorrhaging pregnant women to make recommendations on hemostatic and antifibrinolytic drugs.
- 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 and postpartum.
- 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) [31].
- Pro-hemostatic treatment with tranexamic acid has been used for management of postpartum hemorrhage [33] and is under

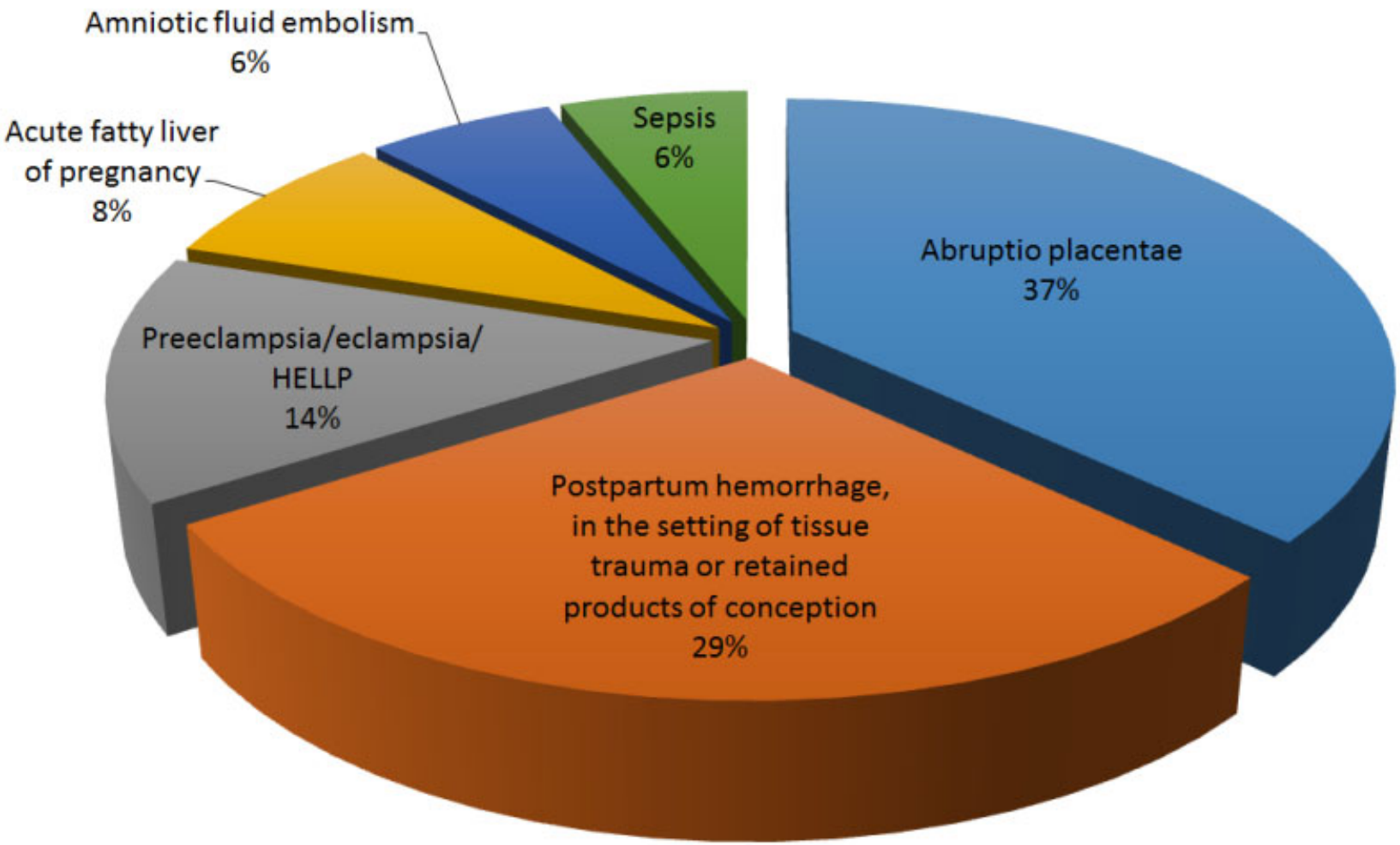

The clinical diagnosis of vaginal bleeding is based upon the gestational age and character of bleeding:
Light or heavy
Associated with pain or painless
Intermittent or constant
Blood testing and ultrasound results will be used to confirm the clinical diagnosis or will be used to revise the diagnosis.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


MATERNAL911
- Second and third trimester bleeding is generally caused by:
  - Blood show associated with cervical insufficiency or labor which is defined as occurring after 20 weeks of gestation
  - Miscarriage (by definition, miscarriage occurs before 20 weeks)
  - Placenta previa
  - Abruptio placenta
  - Rarely, uterine rupture or vasa previa
- Pathology of the cervix, vagina, or uterus including polyps, inflammation, infection, trophoblastic disease, and non-tubal ectopic pregnancy.
- 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.

# 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.*




**Risk Factors Graph**

# Table 1

| Events | That | Initiate | DIC | |
|---|---|---|---|---|
| Septiciemia – gram Neg and Gram + | Crush injury or complicated surgery | Severe head injury | Abdominal aortic aneurysm | Peritoneovenous shunt |
| Cancer procoagulant (Trousseau's syndrome) | Acute Leukemia, especially promyelotic | Amphetamine overdoese | Giant Hemangioma (Kasaback-Merritt Syndrome) | Acute hemolytic transfusion reaction (ABO incompatibility) |
| Complications of pregnancy:<br>• Amiotic fluid embolism<br>• Abruption<br>• HELLP syndrome<br>• Eclapmsia and severe preeclampsia<br>• Septic abortion | Paroxysmal nocturnal hemoglobinuria | Snake and Viper venoms | Liver disease:<br>Fulminant hepatic failure<br>Reperfusion after liver transplant | Heat stroke |
| Burns | Purpura fulminans | Events that propagate and complicate DIC:<br>• Shock<br>• Complement pathway activation | | |

# Table 2

| Test | Normal (reference) range | | |
|---|---|---|---|
| | First trimester | Second trimester | Third trimester |
| Prothrombin time (seconds) | 9.7 to 13.5 | 9.5 to 13.4 | 9.6 to 12.9 |
| Activated partial thromboplastin time (seconds) | 23.0 to 38.9 | 22.9 to 38.1 | 22.6 to 35.0 |
| Platelet count ($x10^9$/L) | 174 to 391 | 155 to 409 | 146 to 429 |
| Fibrinogen (mg/dL) | 244 to 510 | 291 to 538 | 301 to 696 |
| D-dimer (micrograms/mL) | 0.05 to 0.95 | 0.32 to 1.29 | 0.13 to 1.7 |

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