437 Team: Obstetrics and Gynecology

Antenatal Hemorrhage / 3rd Trimester Bleeding

Objectives:

- List the **causes** of third trimester bleeding .
- Describe the **initial evaluation** of a patient with third trimester bleeding .
- Differentiate the **signs and symptoms** of third trimester bleeding.
- List the maternal and fetal **complications** of placenta previa and abruption of placenta.
- Describe the initial **evaluation** and **management** plan for acute blood loss.
- List the indications and potential complications of blood product **transfusion** .

References:

- Kaplan USMLE step 2 CK - Obstetrics and Gynecology
- Online Meded videos
- Team 435

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Color index: Important | Notes | Meded | Video-Case

Editing file link

Introduction:

Any bleeding during pregnancy is Abnormal, it is a leading cause of death and maternal mortality, there are more than 2000 maternal deaths every 24 hrs.

- Types of bleeding :
  1) Bleeding in early pregnancy (Abortion, Ectopic)
  2) Antepartum hemorrhage (bleeding before delivery) which is bleeding in late pregnancy -3rd trimester
  3) Postpartum hemorrhage (bleeding after delivery).

in vaginal delivery it is loss of 500 ml or more, in cesarean section it is loss of 1L or more .

Bleeding in the **third trimester** is usually benign but can also be an ominous sign, so it should always be seriously evaluated. Some common causes of bleeding are cervical lesions (cervicitis, polyp etc). They have nothing to do with the pregnancy itself. This is no big deal and can be dealt with after pregnancy (although if it's cervicitis due to STI, treat that). When contractions are starting or the cervix ripening, there might be some bleeding related to cervical dilation. Since it can be normal or pathological, it must be determined which one it is. Check mom (vital signs), the vagina (speculum exam), baby (non stress test), and the placenta (ultrasound) for clues. If the bleeding is impressive it's also worth checking her "blood status" with CBC, Coags, and a DIC panel.

Late pregnancy bleeding

Late pregnancy bleeding is vaginal bleeding that occurs **after 20 weeks'** gestation.
Prevalence is <5%, but when it does occur, prematurity and perinatal mortality quadruple.

- At term (38th -- 41th week) two important changes occur:
  1. Blood volume ↑ 40%. Blood volume in non pregnant = 5L, in pregnant = 7-8 L
  2. Cardiac output ↑ 30%, 20% of the total cardiac output goes to gravid uterus (thus bleeding of the gravid uterus could lead to a catastrophe).

Causes of 3rd trimester bleeding:

8 causes, 5 that can lead to serious neonatal and maternal morbidity and mortality + 3 benign.

Placental

The most common

1. Abruptio placenta
2. Placenta previa
3. Vasa previa
4. Uterine rupture
5. Preterm labor
6. Congenital bleeding disorder

Cervical / Vaginal

7. Vaginal or Cervical tear.
8. Cervical polyp.
9. Severe Cervicitis
10. Cervical carcinoma
11. Cervical erosion
12. Vaginal varicosities

Initial evaluation of a patient with 3rd trimester bleeding:

- **When performing cardiopulmonary resuscitation assessment (ABC) on a pregnant woman in third trimester → ABB(baby) C**
- **Fetal Heart Rate (FHR).** Always assess it in initial evaluation
- **After confirming stability of mother and FHR, go for Hx (PPQRST):**
  - **P**ain with bleeding
  - **P**lacental location (previous U/S that assessed the location?)
  - **Q**uantity of bleeding
  - **R**ecreational drugs during this pregnancy
  - **S**ex recently
  - **T**iming of bleeding
- **Physical Exam:**
  - Maternal vital signs
  - FHR
  - Concerns about heavy bleeding? IV access.
  - Inspection of skin for petechiae.
  - Palpation of uterus: soft or hard? Tender or not?
  - Placental location? if Confirmed → Cervical exam.
    - Speculum exam for visual assessment of the cervix.
- **Investigation:**
  1. CBC
  2. DIC workup (platelets, PT, PPT, fibrinogen, D- dimer)
  3. Blood type and crossmatch
  4. U/S for placental location

Remember:

Never perform a digital or speculum examination until ultrasound study rules out placenta previa.

- **Initial management:** Start an IV line with a large-bore needle
  - If maternal vital signs are unstable, run isotonic fluids without dextrose wide open and place a urinary catheter to monitor urine output.
  - If fetal jeopardy is present or gestational age is ≥36 weeks, the goal is delivery.

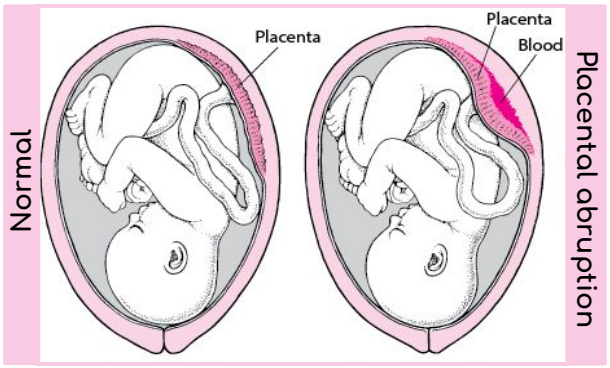
Signs and symptoms of 3rd trimester bleeding:

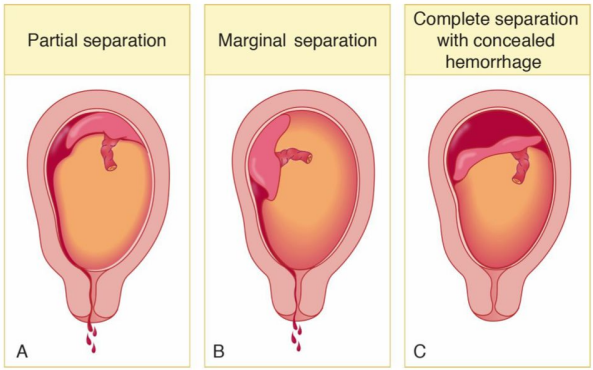
- Per vaginal bleeding (spotting ↔ frank hemorrhage)
- Abdominal, pelvic or back pain
- Fatigue and feeling dizzy (if chronic or severe loss)
- Increased heart rate
- Increased uterine tone

Abruptio placentae

The uterus has two segments : upper (more muscular) and lower (like a stretch muscle, which doesn't contract during labor).

In abruptio placentae, a normally implanted placenta in the upper uterine segment (not in the lower) separates from the uterine wall **before delivery** of the fetus. Separation can be partial or complete, results in bleeding.





- Abruptio placentae is the most common cause of late-trimester bleeding (1% of pregnancies at term).
- The most common cause of coagulopathy in pregnancy.
- Most commonly, bleeding is overt and external. In this situation blood dissects between placental membranes exiting out the vagina.
- Less commonly, if bleeding remains concealed or internal, the retroplacental hematoma remains within the uterus, resulting in an increase in fundal height over time and couvelaire uterus (purple/blue discoloration).

Risk factors

A. Previous Hx of abruption.
B. Hypertension.
   - Patients with any type of HTN are at higher risk for abruptio placenta.
   - It is contraindicated to do ECV "external cephalic version"
C. Maternal Blunt Trauma (MVA, Domestic violence, fall or ECV)
D. Sudden decompression by rupture of membrane

Other risk factors are smoking, maternal cocaine abuse (vasoconstriction), premature membrane rupture, and multiple gestations.

Diagnosis

Is based on the presence of painful late-trimester vaginal bleeding with a normal fundal or lateral uterine wall **placental implantation** not over the lower uterine segment.

The placenta would have been in a normal position on routine ultrasound. But after it's blown off (hypertension, cocaine – which is really just hypertension) or ripped off (trauma - i.e. MVC), an ultrasound can confirm that the placenta is no longer properly attached.

Clinical Presentation

- Classical presentation: vaginal bleeding + **abdominal pain** ± DIC (PA one of the major causes of DIC)
- It is the most common cause of **painful** late- trimester bleeding.
- Classification is made as follows:

Mild abruption	Moderate abruption	Severe abruption
vaginal bleeding is minimal with **no fetal monitor abnormality.** Localized uterine pain and tenderness is noted, with incomplete relaxation between contractions.	symptoms of uterine pain and moderate vaginal bleeding can be gradual or abrupt in onset. From 25–50% of placental surface is separated. **Fetal monitoring** may show tachycardia, decreased variability, or mild late decelerations.	symptoms are usually abrupt with a continuous knife-like uterine pain. More than 50% of placental separation occurs. **Fetal monitor** shows severe late decelerations, bradycardia, or even fetal death. Severe disseminated intravascular coagulation (DIC) may occur.

- Ultrasound visualization of a retroplacental hematoma may be seen.
- Note that: If FHR is Abnormal → Placental Abruption
  If FHR is normal → Placenta Previa

Management is variable:

- **Emergency cesarean delivery** is performed if maternal or fetal jeopardy is present as soon as the mother is stabilized.

- **Vaginal delivery** is performed if bleeding is heavy but controlled or pregnancy is >36 weeks. Perform amniotomy and induce labor. Place external monitors to assess fetal heart rate pattern and contractions. Avoid cesarean delivery if the fetus is dead.

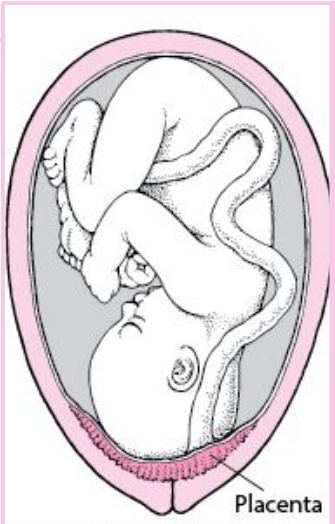
- **Conservative in-hospital observation** is performed if mother and fetus are stable and remote from term, bleeding is minimal or decreasing, and contractions are subsiding. Confirm normal placental implantation with sonogram and replace blood loss with crystalloid and blood products as needed.

Complications include the following:

- Severe abruption can result in hemorrhagic shock with **acute tubular necrosis** from profound hypotension and DIC from release of tissue thromboplastin into the general circulation from the disrupted placenta.
- **Couvelaire uterus** refers to blood extravasating between the myometrial fibers, appearing like bruises on the serosal surface.

Placenta previa

Placenta previa occurs when the placenta is implanted entirely or partially in the **lower** uterine segment, (5cm from the internal os). This is common early in the pregnancy, but is not typically associated with bleeding.
"implanted across the os." In this case, the placenta has implanted over the cervical os. That's not the normal spot of implantation. The placenta looks for a good place to drill; it wants a rich vascular supply.



- Usually the lower implanted placenta atrophies and the upper placenta hypertrophies, resulting in **migration of the placenta**. At term, placenta previa is found in only 0.5% of pregnancies.
    - 428: " in more than 90% placenta previa diagnosed in 2nd trimester will correct itself by the end of pregnancy".

- Symptomatic placenta previa occurs when **painless** vaginal bleeding develops through avulsion of the anchoring villi of an **abnormally implanted** placenta as lower uterine segment stretching occurs in the latter part of pregnancy.
    - (causeless, painless, recurrent, doesn't affect the baby -only secondary to the mother situation- e.g. if the mother is hypoxic then the baby will be affected adversely)

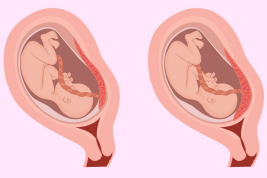
Risk Factors Placenta previa is seen more commonly with previous placenta previa and multiple gestation. Other risk factors are multiparity and advanced maternal age.

Diagnosis is based on the presence of **painless** late-trimester vaginal bleeding with an obstetric **ultrasound** showing placental implantation over the **lower uterine segment**.
NO DIGITAL CERVICAL EXAM due to potential bleeding.

Classification is made as follows:

- **Total, complete, or central previa:** is found when the placenta completely covers the internal cervical os. This is the most dangerous location because of its potential for hemorrhage.

- **Partial previa:** exists when the placenta partially covers the internal os.



- **Marginal or low-lying previa**: exists when the placental edge is near but not over the internal os.

Clinical Presentation The classic picture is painless late-pregnancy bleeding, which can occur during rest or activity, suddenly and without warning. It may be preceded by trauma, coitus, or pelvic examination. The uterus is nontender and non irritable.

Management

It should balance between prematurity risk and heavy bleeding risk.

- If the bleeding is heavy then you need to deliver her regardless the life of the baby,
- If the bleeding is not that heavy and the mother can be admitted and resuscitated then you can continue the pregnancy until the baby gets a reasonable maturity, then we deliver her.

- **Emergency cesarean delivery** is performed if maternal or fetal jeopardy is present after stabilization of the mother.

- **Conservative in-hospital observation (bed rest)** is performed in preterm gestations if mother and fetus are stable and remote from term. The initial bleed is rarely severe. Confirm abnormal placental implantation with sonogram and replace blood loss with crystalloid and blood products as needed.

- **Scheduled cesarean delivery** is performed if the mother has been stable after fetal lung maturity has been confirmed by amniocentesis, usually at 36 weeks' gestation.

Rx in heavy bleeding

1. volume resuscitation.
2. Betamethasone (for fetal lung maturity) Delivery in placenta previa should be performed via cesarean section.

A routine ultrasound early in pregnancy can help evaluate the location of the placenta. If it's not a previa early in pregnancy on US (second trimester), it never will be. Many previas found on second trimester US will resolve as the baby and uterus grow. Some stay where they are. If this happens, when the cervix opens it stretches the placenta and shears the vessels. The blood is baby's blood so mom won't notice (from a physiological standpoint), but baby is losing its blood supply and will present with fetal distress. This indicates the need for a C-section. Even when the baby doesn't present in distress, the plan for delivery is always cesarean, as there's no way to labor and deliver through the placenta. One clue they may give you is that the baby is in transverse or breech lie since the placenta is blocking the os (where the head would normally be).

Complications

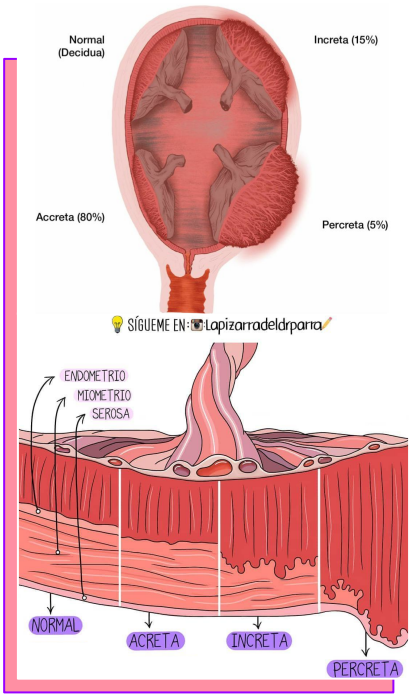
- Bleeding from lower uterine segment with a placenta abnormally attached.
- If placenta previa occurs over a previous uterine scar, the villi may invade into the deeper layers of the decidua basalis and myometrium, resulting in intractable bleeding requiring **cesarean hysterectomy**.
- Profound hypotension can cause anterior pituitary necrosis (**Sheehan's syndrome**) or **acute tubular necrosis.**

Other uncommon causes:

Morbidly Adherent Placenta

Normally, placental villi invade only the superficial layers of the endometrial decidua basalis. When the villi invade too deeply into the wall of the uterus, the condition is known as placenta accreta, placenta increta, or placenta percreta, depending on the depth of the invasion.

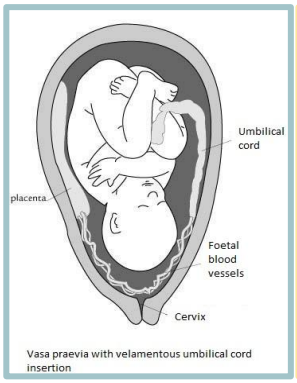
Approximately 1 in 2,500 pregnancies experience placenta accreta, increta, or percreta.



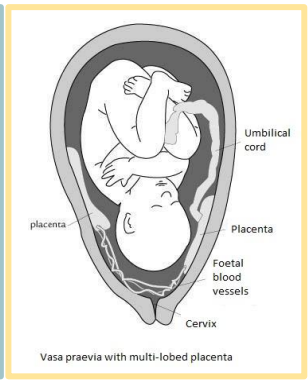
- **Placenta accreta** **(most common**, 80% of cases) occurs when the villi invade the deeper layers of the endometrial decidua basalis but do not penetrate the myometrium.
  - ➢ To superficial layer of myometrium.
- **Placenta increta** (15% of cases) occurs when the villi invade the myometrium further but do not reach the uterine serosal surface or the bladder.
- **Placenta percreta** (5% of cases) occurs when the villi invade all the way to the uterine serosa or into the bladder.
- Note that the depth of invasion correspond with the alphabetical order.
- Increase number of CS leads to increase risk for placental extension.

Vasa Previa

Vasa previa is present when fetal vessels traverse the fetal membranes over the internal cervical os. These vessels may be from either a velamentous insertion of the umbilical cord or may be joining an accessory (succenturiate) placental lobe to the main disk of the placenta. If these fetal vessels rupture the bleeding is from the fetoplacental circulation, and fetal exsanguination will rapidly occur, leading to fetal death.



Vasa praevia with velamentous umbilical cord insertion



Vasa praevia with multi-lobed placenta

Diagnosis This is rarely confirmed before delivery but may be suspected when antenatal sonogram with color-flow Doppler reveals a vessel crossing the membranes over the internal cervical os. The diagnosis is usually confirmed after delivery on examination of the placenta and fetal membranes.

Clinical Presentation The classic triad is **rupture of membranes** and **painless vaginal bleeding**, followed by **fetal bradycardia**.

Vasa previa is seen more commonly with velamentous insertion of the umbilical cord, accessory placental lobes, and multiple gestation.

Management **Immediate cesarean delivery** of the fetus is essential or the fetus will die from hypovolemia.

Uterine rupture

Uterine rupture is complete separation of the wall of the pregnant uterus with or without expulsion of the fetus that endangers the life of the mother or the fetus, or both. The rupture may be incomplete (not including the peritoneum) or complete (including the visceral peritoneum).

Mom presents with a painful bleed. However, the diagnosis doesn't require bleeding; it often presents without bleeding. As the uterus contracts, baby should be pushed out the path of least resistance - the vagina. But if the uterus ruptures under its own force (risk is increased with vaginal birth after cesarean), baby will follow the path of least resistance into the peritoneum. Blood flow to the uterus is extremely high during pregnancy, so this tear can be catastrophic to the mother's vital signs, which will in turn put the baby at risk. What to look for is contractions and sudden fetal distress followed by loss of contractions, and loss of FETAL STATION - these have a high index of suspicion. There isn't time to make the diagnosis so there are NO TESTS. Go to crash section.

Clinical Presentation

The most common findings are:

1. Vaginal bleeding
2. Loss of electronic fetal heart rate signal
3. Abdominal pain
4. Loss of station of fetal head
5. Rupture may occur both before labor as well as during labor.

Diagnosis

Confirmation of the diagnosis is made by **surgical exploration** of the uterus and identifying the tear.

The most common **risk factors** are previous classical uterine incision, myomectomy, and excessive oxytocin stimulation. Other risk factors are grand multiparity and marked uterine distention.

A vertical fundal uterine scar is 20 times more likely to rupture than a low segment incision.

Maternal and perinatal mortality is also much higher with the vertical incision rupture.

Management

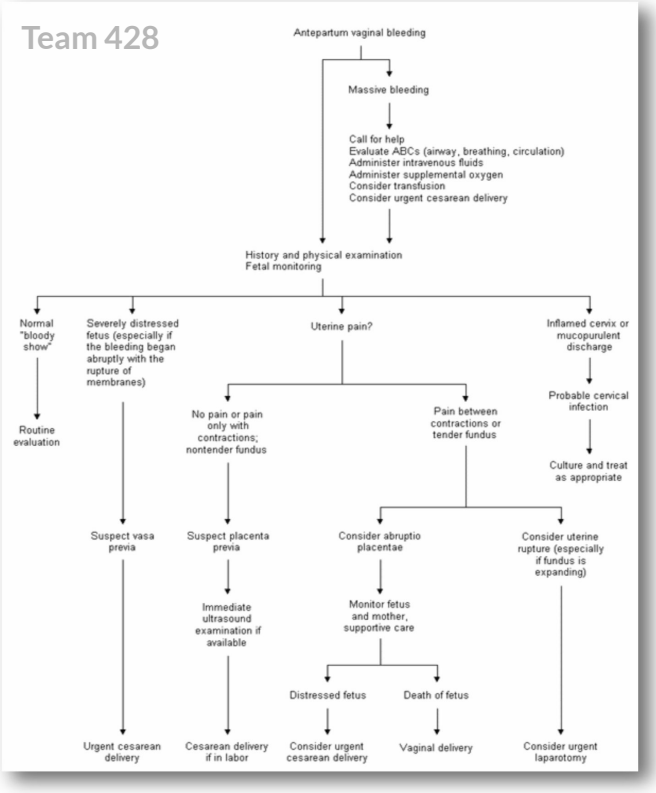
Treatment is surgical. **Immediate delivery** of the fetus is imperative. Uterine repair is indicated in a stable young woman to conserve fertility. Hysterectomy is performed in the unstable patient or one who does not desire further childbearing.

Initial evaluation and management for acute blood loss.

- Obstetric hemorrhage is one of the leading causes of massive blood transfusion (along with trauma, liver transplant and abdominal aortic aneurysm).
- Massive transfusion? >10 units of PRBCs in 24 hrs.
- 1 PRBC unit = 200 cc of RBC → ↑ hematocrit by 3-4%.
- O2 delivery = 4 x O2 consumption → great reserve of O2.
- In order to maintain O2 delivery during bleeding (**until severe bleeding**) :
  - Have a maintained intravascular volume. That's why it is important for anesthesia colleague to aggressively give IV fluid during hemorrhage in order to maintain the intravascular volume.
  - Cardiovascular status is NOT impaired.
- In massive transfusion, giving only PRBC and crystalloid volume → Dilution of plasma clotting proteins. So we give 1 unit of platelets with every 1 unit of FFP + 1 unit of PRBC (1:1:1 ratio).

Indications and complications of blood product transfusion

- Severe hemorrhage → transfuse blood
- Less severe cases, check overall health status + blood count
  - Hb levels:
    - 6-7 → transfuse
    - 7-8 → considered
    - 8-10 → transfuse if symptomatic anemia or acute coronary syndrome.
- Risks of blood transfusion:
  - Infection: HIV risk 1: 450k - 650K
  - Allergy or immune reaction (Transfusion-related acute lung injury, hemolytic transfusion reaction, graft vs host disease...)
  - Volume overload
- **Check mother's Rh, if -ve → kleihauer-betke test to determine the quantity to give of RhoGam.**



Summary

OB Triad **Abruptio Placentae**
• Late trimester painful bleeding • Normal placental implantation • Disseminated intravascular coagulopathy (DIC)

OB Triad **Placenta Previa**
• Late trimester bleeding • Lower segment placental implantation • No pain

OB Triad **Abnormal Placental Invasion**
• Accreta: deeper layers decidua basalis • Increta: myometrium not complete • Percreta: uterine serosa or bladder

OB Triad **Vasa Previa**
• Amniotomy—AROM • Painless vaginal bleeding • Fetal bradycardia

OB Triad **Uterine Rupture**
• Late trimester **painful** bleeding • Previous uterine incision • High perinatal mortality

Teaching case (video case)

A 25-year-old G2P1 woman at 32 weeks gestation is brought to labor and delivery by her husband. About an hour before, **she was watching television when she noted a sudden gush of bright red blood vaginally** hint for placenta previa **.** The bleeding was heavy and soaked through her clothes, and she has continued to bleed since then. She denies any cramps or abdominal pain. She says that her last sexual intercourse was a week ago. A review of her prenatal chart finds nothing remarkable other than a borderline high blood pressure from her first prenatal visit that has not required medication.

There is no mention of bleeding prior to this episode. She had an ultrasound to confirm pregnancy at 14 weeks it is extremely difficult to make diagnosis of placenta previa here, but none since. Physical examination reveals an extremely pale woman whose blood pressure is 98/60, pulse 130, respirations 30, temperature 99° F. **Her abdomen is soft without guarding or rebound to palpation**, and the uterus is **nontender** (characteristic for Placenta Previa) and firm, but not rigid. Fundal height is 33cm. **Fetal heart tones are in the 140s with good variability** normal, hint for placenta previa. The external monitor reveals uterine irritability, but no discrete contractions are seen. There is a steady stream of bright red blood coming from her vagina.

1. What is your differential diagnosis for potential causes of bleeding for this patient?

- Placental abruption
- Placenta Previa (the most likely diagnosis, painless & normal fetal HR)
- Vasa Previa
- Genital lacerations/trauma (e.g. labial, vaginal or cervical)
- Foreign body
- Cervical/vaginal cancer
- Cervicitis
- Bloody show

2. What steps would you take to evaluate this patient?

- Identifying the etiology of the bleeding, also evaluation of both the maternal and fetal status.
- Assess maternal hemodynamic status:
  - Serial vital signs
  - Hematologic studies to assess for acute anemia and DIC (CBC, Coagulation profile, grouping and cross matching)
  - Confirm placental location
  - Avoid digital cervical exam
  - Sonographic evaluation of placental location
- Assess fetal status:
  - Continuous external heart rate monitor or sonographic biophysical assessment
  - Kleihauer-Betke test for maternal-fetal hemorrhage
    - To detect fetal blood cells in maternal circulation. We take blood from the mother and then we look at it after adding acid or alkali , the fetal blood usually resist denaturation by alkali and acid, while maternal RBC will fade while the fetal RBC will be maintained . Then we calculate the amount of fetal blood entered the circulation , to know the amount of Anti-D to give according to the amount of fetal blood in the maternal circulation.

3. What signs and symptoms would help you differentiate the potential causes of the bleeding?

Placental abruption :

Epidemiology	Risk factors	Clinical presentation
• Occurs in 1 in 100 births. • Accounts for approximately 30% of cases of third trimester bleeding . • 25% recurrence risk in a subsequent pregnancy. • Management : if the patient is hemodynamically unstable, stabilize her and then delivered by cesarean section. • We can deliver vaginally	❑ Hypertension (chronic or gestational) ❑ Cocaine use/smoking and Abdominal trauma ❑ Sudden uterine decompression (as with rupture of membranes) ❑ Preterm premature rupture of membranes	• Frequent uterine contractions or hypertonicity • Vaginal bleeding (sometimes catastrophic) • Non-reassuring fetal heart rate tracing • Hypofibrinogenemia supports the diagnosis • Disseminated intravascular coagulation occurs in 10% to 20% of severe abruption

Placenta previa :

Situated in the lower segment . If a patient present at 24 weeks and you did US and anatomy scan and found low line placenta , what do we do ? we wait, because the placenta might migrate up.

Epidemiology It has 4 grades	Risk factors	Clinical presentation
1.Central or total placenta previa– placenta completely covers the os 2.Partial placenta previa– placenta partially covers the os (os must be partially dilated) 3.Marginal previa - the placental edge is adjacent to the os but does not cover it 4.Low-lying placenta - the placenta approaches the os, but is not at its edge. ■ At 24 weeks, about 1 pregnancy in 20 will demonstrate ultrasound evidence of a placenta previa ■ At 40 weeks, the incidence decreases to 1 in 200 ■ Accounts for approximately 20% of cases of third trimester bleeding Placental abruption is more common than placenta previa	■ Prior cesarean delivery ■ History of myomectomy & Increasing number of uterine curettages ■ Increased parity ■ Multiple gestation In a woman who has had multiple pregnancies (multiparity) the uterus may be "dried up" (for the sake of the analogy); the placenta must reach out rather than deep to find blood. The other way this happens is in multiple gestations where competing placenta push each other to implant over the cervical os. Sometimes it's just bad luck. ■ Advanced maternal age ■ Smoking	■ Bleeding is usually painless and may occur after intercourse. ■ Patients may also present with contractions, thus ultrasonography is critical to differentiating from abruption Management of placenta previa : Cesarean section Management of placenta previa accreta or morbidly adherent : Cesarean hysterectomy

Vasa previa : it is not placenta tissue, it is blood vessels from the baby circulation (placenta) covering the os and it ruptures. This is a rare cause of painless 3rd trimester bleeding. In the same way as placenta previa, it's caused by tearing of the connecting vessels that lay across the cervical os, often from a velamentous cord insertion (umbilical cord inserts into the membranes and has to travel to get to the placenta). During cervical dilation and during the rupture of membranes, the vessels break and bleed. This is the baby's blood so it's painless. Baby is going to notice quickly, however, and there will be obvious fetal distress. It's commonly manifested as fetal bradycardia, usually after rupture of membranes.

In The MCQ (VERY IMP !) : It is NOT a cord prolapse, it is only a blood vessel covering the os

Definition	Risk factors	Clinical presentation
★ Fetal vessels of a velamentous cord insertion cover the cervical os (Incidence is less than 1% of all pregnancies) ★ In vasa previa the bleeding is from the fetus, thus it is associated with fetal distress.	Common in **Multiple gestations**: up to 11% in twins and up to 95% in triplets (which is associated with IVF) Should be delivered by cesarean section	suggested by painless vaginal bleeding in the absence of evidence of placenta previa or abruption. It give us a very characteristic feature on CTG called sinusoidal pattern.

Other causes:

causes of 3rd trimester bleeding such as cervicitis, cervical erosions, trauma, cervical cancer, foreign body or even bloody show can usually be differentiated on physical exam once the preceding etiologies are ruled out

4. What steps would you take to manage the low blood pressure and tachycardia that the patient is displaying?

- Ensure adequate airway and assess vitals
  - Serial blood pressure, heart rate, and respirations
  - Continuous oxygen saturation monitor

- Establish adequate IV access (2 large bore IVs or central venous line)
- Monitor blood and coagulation profiles
  - Serial CBC and platelet counts
  - Serial prothrombin time, partial thromboplastin time, and fibrinogen

- Volume resuscitation: Crystalloid, Packed red blood cells (Platelets, fresh frozen plasma
- and cryoprecipitate as indicated).

- Monitor vitals and response to therapy:
  - Serial blood pressure, heart rate, and respirations.
  - Continuous oxygen saturation monitor.
  - Continuous urine output assessment via indwelling Foley catheter.

- Management of the patient with significant 3rd trimester hemorrhage, when the fetus is mature, is hemodynamic stabilization and delivery.
- Vaginal delivery is generally precluded in the setting of abruption with persistent hemodynamic instability.
- Cesarean delivery is required for all cases of previa and vasa previa.

5. Under what circumstances would you consider blood product transfusion?

- Acute blood loss of 30-40% blood volume
- Chronic blood loss with hemoglobin < 6 g/dL (or <10g/dL + cardiopulmonary problems)
- Coagulation problems:
    - Fibrinogen < 150 mg/DL
    - Prolongation of PTT
    - Platelets < 20,000
    - Platelets < 50,000 + cesarean delivery

- Complications:
    - Febrile non-hemolytic and chill-rigor reactions
    - Acute hemolytic reaction due to ABO incompatible transfusion
    - Delayed hemolytic transfusion reaction
    - **Transfusion-related acute lung injury** by heavy blood transfusion because of WBC have deleterious effect on the lung and can injure the lung tissue .
    - Allergic reactions to unknown blood components
    - Volume overload
    - Graft vs. Host Disease (GVHD)
    - Infectious complications (HIV, HepB, HepC, etc)

- Blood products :

Product (mL)	Contents	Uses and effects
Whole Blood (1 unit = 500mL)	All components	Rarely used. Only in the setting of massive bleeding
Packed RBC (1 unit = 350 mL)	RBC only	One unit increased hematocrit by 3 percentage points
Frozen plasma (1 unit = 200–300 mL)	All clotting factors, no platelets	Use for deficiencies in multiple clotting factors. One unit of FFP increased fibrinogen by 7-10 mg/dL
Cryoprecipitate (1 bag – 10-15 mL)	Fibrinogen, factors VIII, XIII, vWF	Ten bags of cryoprecipitate will raise plasma fibrinogen by 70 mg/dL in a 70 kg recipient
Platelets (1 unit = 50mL)	Platelets	Six units of whole blood-derived or one unit of apheresis-derived platelets will raise the platelet count by approximately 30,000/μL