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Teen Pregnancy Part 2: Obstetrical Complications in Adolescents

Teen pregnancies are at high risk of obstetrical complications with an increased rate of adverse maternal and fetal outcomes. Acute care clinicians should be familiar with, and adept at, caring for the common or emergent obstetrical complications that may occur in a pregnant teenager.

— Ann M. Dietrich, MD, FAAP, FACEP, Editor

Introduction

Despite a recent decline in teen birth rates in the United States, adolescent pregnancy rates remain high when compared to other developed countries.^{1,2} There are many unique barriers and considerations when diagnosing and caring for pregnant patients of adolescent age, many of which are discussed in depth in “Teen Pregnancy Part 1.” (See *Pediatric Emergency Medicine Reports*, September 2020.) This article will focus on the medical adverse outcomes and obstetrical complications that can occur in adolescent pregnancy. Topics include trauma in pregnancy; preeclampsia and hemolysis, elevated liver enzymes, and low platelet count (HELLP) syndrome; venous thromboembolism; as well as precipitous delivery and postpartum hemorrhage.

Trauma in Pregnancy

A 17-year-old female, gravidity 1, parity 0, at 33 weeks' gestation arrives to the emergency department via emergency medical services after being involved in a motor vehicle crash. The patient was the restrained driver of a vehicle that was rear-ended at approximately 20 miles per hour. She had no loss of consciousness, self-extricated, and was ambulatory on the scene. Her vital signs are within normal limits. She is complaining of mild abdominal pain and cramping without vaginal bleeding or leakage of fluid. She reports normal fetal movement.

Trauma is the number one cause of nonobstetrical, pregnancy-associated maternal death in the United States.³ The most common causes of trauma include motor vehicle collisions (accounting for 50% of pregnancy-related trauma), falls, and assault.⁴ Complications of trauma during pregnancy include preterm labor, premature rupture of membranes, placental abruption, fetal maternal hemorrhage, uterine rupture, and fetal demise. It is important to note that some of these complications, particularly placental abruption, can occur with even minor maternal injuries.⁵

During evaluation and resuscitation of a pregnant trauma patient, maternal resuscitation always takes priority because fetal survival is dependent on maternal survival. Fetal viability is considered at approximately 22-24 weeks' gestation (fundal height at least at or above the umbilicus).

EXECUTIVE SUMMARY

- Fetal viability is considered at approximately 22-24 weeks' gestation (fundal height at least at or above the umbilicus).
- Pregnant trauma patients ≥ 20 weeks' gestation can develop a condition called supine hypotension syndrome, secondary to the inferior vena cava being compressed by a gravid uterus while the mother is lying supine. This can be improved by positioning the mother in the left lateral decubitus position whenever possible.
- As soon as maternal resuscitation allows, all pregnant women at ≥ 20 weeks' gestation presenting with trauma should have cardiocardiographic and fetal heart rate monitoring started and continued for a minimal period of four to six hours, even if the patient is asymptomatic.
- Trauma imaging should be obtained based on traumatic indications and should not be withheld simply due to pregnancy. The risk of missed or delayed diagnosis of traumatic injury outweighs the risk of fetal exposure to ionizing radiation.
- Gestational hypertension is a new onset of elevated blood pressure (systolic pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg) after 20 weeks' gestation without proteinuria or other signs of end-organ damage.
- Pulmonary embolism is the leading cause of maternal death in the United States. The occurrence of venous thromboembolism (VTE) in pregnancy is 10 times that of the general population.
- Pregnancy-specific VTE risk factors include grand multiparity, age > 35 years, obesity, hyperemesis, bed rest for more than four days, and preeclampsia.
- Treatment of VTE in pregnancy should begin with stabilization (airway, breathing, and circulation) and determination of whether the patient has cardiovascular compromise severe enough to be life-threatening, requiring potential thrombolytic therapy or percutaneous or surgical intervention. If acutely stable, therapeutic anticoagulation is indicated, with low molecular-weight heparin (e.g., enoxaparin) being the first-line medication.
- Postpartum hemorrhage occurs in approximately 4% to 6% of all pregnancies, with uterine atony the most common etiology.
- Perform an exam to identify the cause of the hemorrhage (e.g., boggy uterus suggestive of uterine atony vs. bleeding laceration from birth trauma). If the exam is consistent with uterine atony, or no other clear source of traumatic etiology is identified, the next step is to administer oxytocin (Pitocin), either intravenously or intramuscularly, and perform bimanual uterine massage.

The initial approach to a pregnant trauma patient should follow the Advanced Trauma Life Support (ATLS) guidelines. However, there are additional considerations in the evaluation and treatment of pregnant women presenting with trauma. Unique anatomic and physiologic changes of pregnancy can affect trauma resuscitation and care.

- Pregnancy results in a relative hypervolemic state with an increase in cardiac output of 30% to 50%. Therefore, clinically significant injuries can be easily masked. With this, uterine injury can result in significant maternal hemorrhage, given the substantial increase in uterine blood flow during pregnancy.⁶ When giving a crystalloid infusion, consider increasing the volume administered by 50%.
- In addition, pregnant trauma patients can develop a condition called supine hypotension syndrome. At ≥ 20 weeks' gestation, the inferior vena cava can be compressed by a gravid uterus while the mother is lying supine. That can decrease venous return and cardiac output, leading to hypotension. This can be improved by positioning the

mother in the left lateral decubitus position whenever possible.⁶

- The diaphragm can elevate by up to 4 cm during pregnancy. This is important to keep in mind during chest tube insertion. Additional physiologic respiratory changes during pregnancy include a decrease in functional residual volume and in partial pressure of carbon dioxide, making respiratory compensation more difficult. It is important to keep in mind that if intubation is indicated, pregnant women often will become hypoxic more quickly during the apneic period.⁶ They also typically are at higher risk of aspiration given delayed gastric emptying and upward displacement of intra-abdominal organs during pregnancy.

After a standard primary survey per the ATLS protocol, unique adjuncts of a secondary trauma survey in a pregnant patient include an assessment of fetal heart tones and uterine size, as well as a thorough abdominal and genitourinary examination to assess for uterine tenderness, ecchymosis, and vaginal bleeding. As soon as maternal resuscitation allows, all pregnant women at ≥ 20 weeks' gestation presenting with trauma should have

cardiocardiographic and fetal heart rate monitoring started and continued for a minimal period of four to six hours, even if the patient is asymptomatic.^{5,7} If there are any signs of fetal distress (late decelerations, persistent tachycardia, or bradycardia), admission for monitoring for a minimum of 24 hours is indicated. Additionally, an obstetrical ultrasound should be performed to assess for fetal size/gestational age, fetal cardiac activity, and fetal movement.

Regarding other trauma imaging, imaging should be obtained based on traumatic indications and should not be withheld simply due to pregnancy. The risk of missed or delayed diagnosis of traumatic injury outweighs the risk of fetal exposure to ionizing radiation.⁸ Indications for emergent laparotomy or other trauma surgery monitoring/interventions should remain the same as in nonpregnant patients.

Other therapeutic considerations should include tetanus, diphtheria, and pertussis prophylaxis if there has been no booster in the past five years, as well as administration of Rho(D) immunoglobulin (Rhogam) in all Rhesus-negative patients.⁹

Traumatic Placental Abruptio

Placental abruptio can occur with even seemingly minor trauma in pregnant women ≥ 20 weeks' gestation.¹⁰ This is in part because, with trauma, there is a sudden stretching of the underlying uterine wall that can cause shearing stress on an inelastic placenta. Continuous fetal monitoring for signs of uterine irritability (three or more contractions in one hour) or fetal distress is essential. Note that although placental abruptio can be diagnosed via obstetrical ultrasound, the sensitivity for this method is exceedingly low (25%), making it an unreliable test to rule out placental abruptio in trauma.¹¹

Typical symptoms of placental abruptio include uterine contractions or back pain with vaginal bleeding. The uterus often is firm, and contractions typically are high-frequency but low-amplitude.¹² Note that blood loss may be underestimated due to the possibility of blood retention behind the placenta. In some cases, patients will have no vaginal bleeding at all.

Placental abruptions result in significantly increased morbidity and mortality for both the mother and the fetus via an increased risk of maternal disseminated intravascular coagulation (DIC) and fetal-maternal hemorrhage.¹³ If there is concern for a severe traumatic mechanism, DIC laboratory tests (coagulation profile with fibrinogen) and a Kleihauer-Betke test (quantifies the presence of fetal hemoglobin in maternal circulation) could be obtained. If there are concerns for maternal or fetal compromise, an obstetrical evaluation is emergently indicated, as delivery may be imminent.

Traumatic Arrest and Perimortem Cesarean Delivery

A perimortem cesarean delivery is defined as a cesarean delivery performed during active or imminent maternal cardiac arrest. The primary goal is to resuscitate the mother, while the secondary goal is to potentially improve fetal viability. Although the traditional indication for perimortem cesarean delivery was a gestational age of 24 weeks or older, most recommendations now state that it should be considered in any patient whose uterine fundus can be palpated at the umbilicus or above, with the presumption that this makes the gestational age at least 20 weeks.¹⁴

In addition to gestational age, a perimortem cesarean delivery should be performed within four minutes of maternal arrest.¹⁵ Although not a comprehensive description, the following are some key features of the perimortem cesarean delivery technique.⁶

- The physician performing the procedure should be the physician with the most surgical experience whenever possible.
- Using a No. 10 blade, an initial incision should be made beginning from the xiphoid process (or at least from the level of the uterine fundus) and extending inferiorly to the pubic symphysis.
- Once through the subcutaneous tissue to the peritoneum, an incision through the peritoneum should be made using either a scalpel or scissors to deliver the uterus.
- Then, a midline vertical incision should be made on the lower portion of the uterus while taking caution to avoid the placenta, bowel, or bladder.
- Once in the uterine cavity, the physician should digitally separate the uterine wall away from the fetus. Then, the incision can be extended with scissors superiorly until the baby is exposed.
- The cord then should be clamped and cut, and infant resuscitation should begin.
- Simultaneously, the uterine and abdominal cavity should be packed to limit further bleeding while continued maternal resuscitation efforts are made.
- If return of spontaneous circulation is obtained, further surgical closure should be continued in the operating room, and the mother should receive broad-spectrum prophylactic antibiotics.

Preeclampsia, Eclampsia, and HELLP Syndrome

A 15-year-old female, gravidity 1, parity 0, at 36 weeks' gestation, presents to the emergency department with a headache for the past two days. The headache is diffuse and has progressively worsened. It is associated with blurred vision. She denies any fevers, vomiting, or head trauma as well as any contractions, vaginal bleeding, or leakage of fluid. Her vital signs are temperature 36.8°C, heart rate 107 beats/minute, blood

pressure 165/95 mmHg, and respiratory rate 22 breaths/minute.

Hypertensive disorders complicate approximately 10% of pregnancies worldwide.¹⁶ By definition, gestational hypertension is a new onset of elevated blood pressure (systolic pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg) after 20 weeks' gestation without proteinuria or other signs of end-organ damage.¹⁷ This patient would meet criteria for severe gestational hypertension, which is defined as a systolic pressure ≥ 160 mmHg and/or diastolic blood pressure ≥ 110 mmHg.

In a newly hypertensive pregnant patient, a key goal in the initial evaluation is to determine the correct diagnosis: gestational hypertension, severe gestational hypertension, preeclampsia, eclampsia, or HELLP syndrome. Each of these diagnoses involves a different course of management and prognosis. See Table 1 for terminology definitions.

Some of these conditions are considered to exist on a spectrum and often can progress to a more severe condition over time. For example, 10% to 50% of women diagnosed with gestational hypertension will go on to develop preeclampsia within a few weeks of initial diagnosis. Then, preeclampsia with severe features can develop rapidly over a period of days.¹⁸

It is important for emergency department providers to be able to distinguish between chronic hypertension, gestational hypertension, preeclampsia without severe features, where patients can be discharged with close follow-up and outpatient management, vs. preeclampsia with severe features, eclampsia, and HELLP, which require emergent actions.

Emergency Department Workup for a Hypertensive Pregnant Patient

If the patient is otherwise stable (i.e., no seizure-like activity, respiratory distress, altered mental status, hemodynamic instability, etc.), the initial step is to obtain a thorough history, including gravidity and parity numbers, prior pregnancy complications, previous medical history and medications, gestational age, and presence of symptoms. Specifically, it is important to ask whether the patient has had any symptoms that would be concerning for the diagnosis

Table 1. Terminology: Hypertensive Disorders of Pregnancy^{19,20}

Term	Definition
Chronic hypertension	• Hypertension in a pregnant woman in which onset of elevated pressure (systolic \geq 140 mmHg and/or diastolic \geq 90 mmHg) was before pregnancy, in early pregnancy ($<$ 20 weeks), or persists \geq 12 weeks post-delivery
Gestational hypertension	• New onset of hypertension in a pregnant woman \geq 20 weeks' gestation with a systolic pressure \geq 140 mmHg and/or diastolic blood pressure \geq 90 mmHg in which the hypertension resolves within 12 weeks after delivery
Severe gestational hypertension	• New onset of hypertension in a pregnant woman \geq 20 weeks' gestation with a systolic pressure \geq 160 mmHg and/or diastolic blood pressure \geq 110 mmHg
Preeclampsia	• Hypertension (chronic or gestational) in a pregnant woman \geq 20 weeks' gestation with proteinuria (\geq 300 mg in 24 hours or a urine protein to creatinine ratio of \geq 0.3) without signs or symptoms suggestive of end-organ damage
Preeclampsia with severe features	• Preeclampsia as described above but with signs or symptoms suggestive of end-organ damage (e.g., elevated liver function tests, renal insufficiency, pulmonary edema, neurologic changes, etc.)
Eclampsia	• Preeclampsia as described above with new-onset seizure(s)
Hemolysis, elevated liver enzymes, and low platelet count (HELLP)	• Pregnancy complication syndrome characterized by hemolysis (elevated lactate dehydrogenase and reticulocyte count, decreased haptoglobin), elevated liver enzymes, and low platelet count; this condition can place patients at risk of serious complications, including disseminated intravascular coagulation, placental abruption, acute respiratory distress syndrome, hepatorenal failure, pulmonary edema, and hepatic rupture • Infant morbidity and mortality rates in patients with HELLP range from 10% to 60%

of preeclampsia with severe features. (See Table 2.)

On physical examination, providers should assess for crackles, bilateral lower extremity edema, or signs of respiratory distress that would be concerning for a fluid overload status with pulmonary edema. The examination also should include a neurologic examination, including reflexes, and an abdominal examination to assess for right upper quadrant (RUQ) tenderness.

Laboratory workup includes complete blood count (to assess for anemia or thrombocytopenia), basic metabolic panel (for serum creatinine), liver function tests (to assess for transaminitis), urinalysis (to assess for proteinuria), urine protein/creatinine ratio, uric acid, and lactate dehydrogenase (elevated levels are associated with adverse maternal and fetal outcomes).^{21,22}

See Table 3 for a summary of how to treat and manage

various pregnancy-related hypertensive disorders.²²⁻²⁶

Venous Thromboembolism in Pregnancy

A 15-year-old female, gravidity 1, parity 0, at 33 weeks' gestation presents with sudden-onset, sharp, left-sided chest pain and shortness of breath beginning five hours prior to arrival. She states that she has had intermittent dyspnea gradually worsening over the past few weeks and worsening acutely today. She has had no abdominal pain, contractions, or vaginal bleeding. Vital signs are temperature 37.4°C, heart rate 108 beats/minute, blood pressure 110/78 mmHg, and respiratory rate 26 breaths/minute.

Pulmonary embolism (PE) is the leading cause of maternal death in the United States.²⁷ The occurrence of venous thromboembolism (VTE) in pregnancy is 10 times that of the general population. Evaluation of VTE

Table 2. Severe Features Associated with Preeclampsia¹⁷

Systolic blood pressure \geq 160 mmHg and/or diastolic blood pressure \geq 110 mmHg and proteinuria (with or without signs and symptoms of end-organ damage)
New-onset cerebral or visual disturbance <ul style="list-style-type: none"> • Photopsia, scotomata, severe headache or headache that persists despite analgesics, altered mental status
Severe, persistent right upper quadrant or epigastric abdominal pain not accounted for by alternative diagnosis
Serum transaminase \geq two times the upper limit of normal
Platelet count $<$ 100,000 platelets per microliters
Renal insufficiency (creatinine $>$ 1.1 mg/dL)
Pulmonary edema

in pregnancy is further complicated by the fact that symptoms concerning for VTE also are often common signs and symptoms of normal pregnancy (e.g., dyspnea, tachycardia, and/or lower extremity swelling).²⁸ Additionally, traditional diagnostic testing for pulmonary embolism poses higher risks to the fetus, which further complicates the VTE workup in pregnancy.

Pregnant women meet all three of Virchow's triad for VTE, including hypercoagulation, vascular damage, and venous stasis.²⁹ Pregnancy-specific VTE risk factors include grand multiparity, age $>$ 35 years, obesity, hyperemesis, bed rest for more than four days, and preeclampsia.³⁰ It is important to note that women remain at higher risk of VTE for more than eight weeks postpartum.

Signs and symptoms of VTE are similar in pregnant and nonpregnant individuals. For deep vein thrombosis (DVT), one would expect to see asymmetric extremity swelling (typically lower extremities) and pain. Of note, the majority of DVTs are left-sided (90%).³¹ For PE, symptoms vary from mild dyspnea and tachypnea to full cardiopulmonary collapse.³²

Figure 1 shows an approach to the diagnosis of VTE in pregnant patients. If there is clinical concern for DVT, clinicians should obtain compression

Table 3. Emergency Department Management of Hypertensive Disorders of Pregnancy²²⁻²⁶

Hypertensive Disorder	Treatment
Preeclampsia without severe features	<ul style="list-style-type: none"> • Ultrasound to assess for fetal growth and heart rate • No indication for emergent blood pressure management as long as pressures are < 160/110 mmHg, but it is important to have and arrange close outpatient OB follow-up • If < 37 weeks' gestation: <ul style="list-style-type: none"> - Expectant management with serial outpatient (weekly) visits with platelet count and liver enzymes • If > 37 weeks' gestation: <ul style="list-style-type: none"> - Consultation with OB for delivery of fetus and placenta
Preeclampsia with severe features	<ul style="list-style-type: none"> • MgSO₄ for seizure prophylaxis <ul style="list-style-type: none"> - IV loading dose 4-6 g, followed by maintenance of 1-2 g/hour • BP management (indicated for BP >160/110 mmHg and should not be dropped below 110/80 mmHg as this could lead to placental underperfusion) <ul style="list-style-type: none"> - Labetalol 10 to 20 mg IV, then 20 to 80 mg every 10-30 minutes; max cumulative dose of 300 mg - Hydralazine 5 to 10mg IV every 20-40 min; max cumulative dose of 20 mg - Nifedipine 10 to 20 mg orally; repeat in 20 mg after 20 min if needed; max cumulative dose of 180 mg. • If > 34 weeks' gestation: <ul style="list-style-type: none"> - Consultation with OB for urgent delivery • If < 34 weeks' gestation: <ul style="list-style-type: none"> - Consultation with OB for urgent vs. delayed (24-48 hours) delivery (allowance for steroid administration)
Eclampsia	<ul style="list-style-type: none"> • ABCs: Consider RSI, place in left lateral decubitus position • Seizure termination: <ul style="list-style-type: none"> - MgSO₄ 4 to 6 g IV, followed by 1 to 2 g/hour infusion - Benzodiazepines, phenytoin, amobarbital, or thiopental if refractory to MgSO₄ • BP management (indicated for BP >160/110 mmHg and should not be dropped below 110/80 mmHg) <ul style="list-style-type: none"> - Labetalol 10 to 20 mg IV, then 20 to 80 mg every 10-30 minutes; max cumulative dose of 300 mg - Hydralazine 5 to 10mg IV every 20-40 min; max cumulative dose of 20 mg • Emergency delivery regardless of gestational age
HELLP syndrome	<ul style="list-style-type: none"> • Consider hepatic imaging in patients with severe abdominal pain to assess for subcapsular hematoma or rupture • Corticosteroids (both for fetal lung maturity if < 34 weeks' gestation and has shown to markedly improve laboratory abnormalities associated with HELLP syndrome) <ul style="list-style-type: none"> - Dexamethasone 10 mg every 12 hours • Seizure prevention <ul style="list-style-type: none"> - MgSO₄ 4 to 6 g IV, followed by 1 to 2 g/hour infusion • BP management (indicated for BP >160/110 mmHg and should not be dropped below 110/80 mmHg): <ul style="list-style-type: none"> - Labetalol 10 to 20 mg IV, then 20 to 80 mg every 10-30 minutes; max cumulative dose of 300 mg - Hydralazine 5 to 10mg IV every 20-40 min; max cumulative dose of 20 mg • Platelet transfusion if: <ul style="list-style-type: none"> - < 50,000 per mm³ in patients undergoing cesarean section - < 20,000 per mm³ in any patient • If < 34 weeks' gestation: <ul style="list-style-type: none"> - Consultation with OB for urgent vs. delayed (until 34 weeks) delivery; patient should be admitted for management at a tertiary care facility • If > 34 weeks' gestation: <ul style="list-style-type: none"> - Consultation with OB for urgent delivery

Key: OB: obstetrical/obstetrician; IV: intravenous; BP: blood pressure; ABCs: airway, breathing, circulation; RSI: rapid sequence intubation; HELLP: hemolysis, elevated liver enzymes, and low platelet count

duplex ultrasounds of the lower extremities. This diagnostic test is non-invasive, posing little risk to the fetus without exposure to radiation, and has a sensitivity of 89% to 96%.^{33,34} If the presentation is concerning for PE, some would recommend starting with bilateral lower extremity compression duplex ultrasounds, even in patients without the clinical signs of DVT. Given that treatment would be the same for both conditions, clinicians should stop further diagnostic workup if duplex ultrasounds are positive for DVT, therefore minimizing radiation exposure to the mother and fetus.³⁵

In nonpregnant women, a D-dimer often is used as a screening test for patients who are otherwise low-risk for VTE. However, D-dimer levels are elevated in normal pregnancies and gradually increase with gestational age and into the postpartum period. Therefore, they are not as reliable as screening tools.

A 2019 study by Van der Pol et al proposed the YEARS algorithm, which used three criteria (clinical signs of DVT, hemoptysis, and PE as the most likely diagnosis), plus a D-dimer for the diagnostic evaluation of PE in pregnant women.³⁶ The authors concluded that PE was safely ruled out by the pregnancy-adapted YEARS algorithm and that chest computed tomography (CT) was avoided in a large cohort

of patients (32% to 65%). However, external validation of this study is still needed. Therefore, use of D-dimer for diagnostic evaluation of PE in pregnancy remains controversial.

A chest X-ray can be obtained prior to more invasive tests, as it can rule out other pathologies (e.g., pneumonia, pneumothorax), and, if abnormal, may increase or decrease clinical suspicion for PE. Abnormal features that could be attributed to PE include atelectasis, pulmonary edema, pleural effusions, and focal opacities.³⁷

The decision to proceed with a CT pulmonary angiogram (CTPA) vs. a ventilation perfusion (V/Q) scan is multifactorial, including availability, institutional guidelines, and clinician preference. However, studies have shown that CTPA typically is the diagnostic study of choice in patients who have abnormal findings on chest radiography.³⁸

It is important to note that both CTPA and V/Q scans carry similar fetal radiation exposure risks (~0.5 mGy) and that one study exposes a fetus to well below the threshold for fetal malformation related to radiation (threshold 100-200 mGy).³⁹

Treatment of VTE in pregnancy should begin with stabilization (airway, breathing, and circulation) and determination of whether the patient has cardiovascular compromise severe enough

to be life-threatening, requiring potential thrombolytic therapy or percutaneous or surgical intervention. If acutely stable, therapeutic anticoagulation is indicated, with low molecular-weight heparin (LMWH) (e.g., enoxaparin) being the first-line medication.^{34,40,41} Therapeutic anticoagulation should be continued for a minimum of three to six months and at least until six weeks postpartum.³⁴

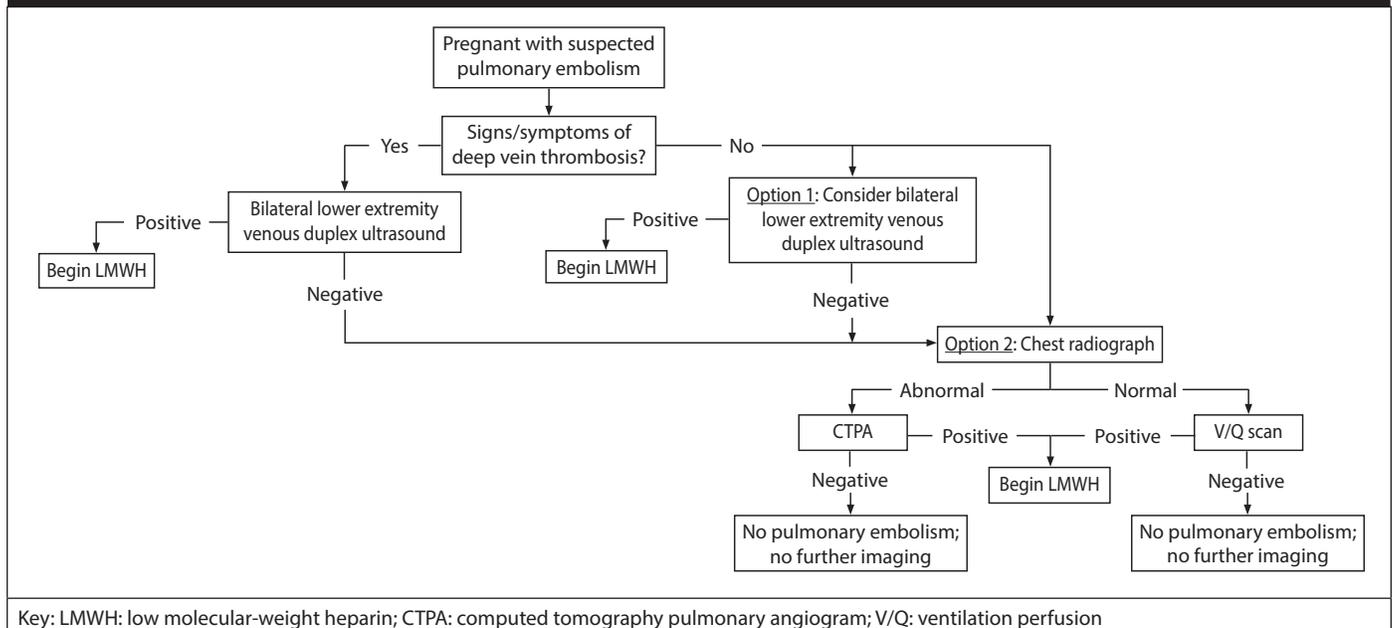
Precipitous Delivery and Postpartum Hemorrhage

A 16-year-old female, gravidity 1, parity 0, at 40 weeks' gestation presents by emergency medical services with strong uterine contractions reported to be two to three minutes apart. The patient is in obvious distress and states that she feels like she needs to push. On genitourinary examination, the infant's head is visible at the vaginal introitus.

Emergency medicine clinicians also should be prepared in the case of a precipitous vaginal delivery. Precipitous labor is defined as labor that lasts less than three hours from onset of contractions to completion of delivery.⁴² Women presenting in precipitous labor typically have had little or no prenatal care and, therefore, the neonates are more likely to be premature or have higher-risk features.⁴³

When a woman presents in precipitous labor, if delivery is not immediately

Figure 1. Diagnostic Approach to Venous Thromboembolism in Pregnancy



imminent, clinicians should obtain a brief history, including questions regarding gestational age, number of babies expected to be delivered, when contractions began and how far apart they are, leakage of fluid from the vagina, fetal movement, and any complications with the current or past pregnancies. While there are numerous possible maternal or fetal complications, the vast majority of precipitous deliveries presenting to the emergency department occur without complication. While all peripartum complications cannot be discussed in detail here, further details regarding postpartum

hemorrhage (one of the most common and life-threatening complications of childbirth) are described later.

Uncomplicated Delivery of the Newborn

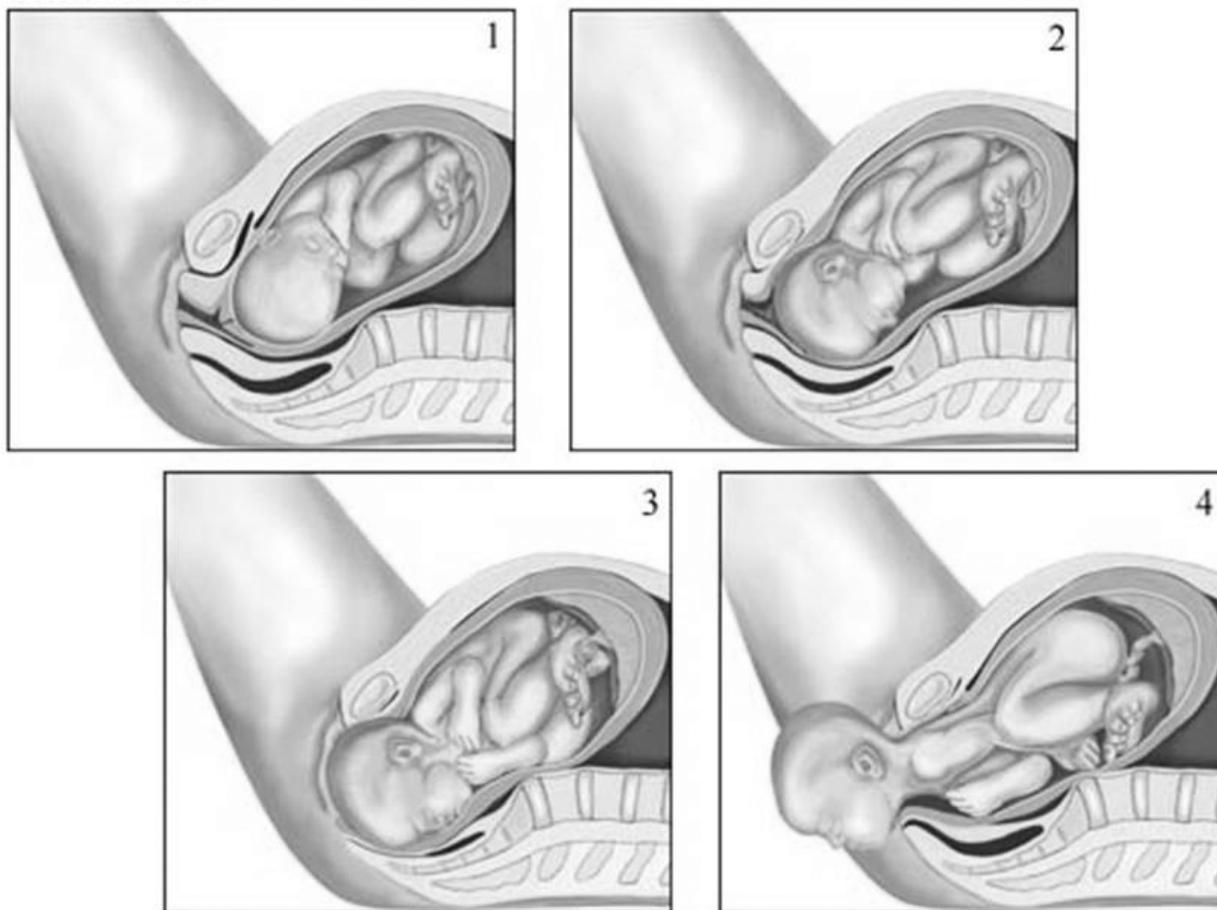
Physical delivery of the newborn as the baby passes through a completely dilated cervix through the birth canal is known as the second stage of labor. (See Figure 2.) During this time, it is the delivering clinician's responsibility to reduce the risks of maternal trauma and neonatal injury. Multiple methods that are subtly different can be used to deliver the head of the baby. There is no

true consensus regarding which method is best.⁴⁴⁻⁴⁸ One common method is the "hands on" approach, in which one hand is used to place gentle pressure of the occiput of the baby's head through crowning while simultaneously using the thumb and index finger of the other hand to provide counter protection to the perineum.^{49,50}

After the fetal head has been completely delivered, allow for restitution of the fetal head (i.e., rotation of the head to where the face is oriented laterally to the right or left). After restitution, the fetal shoulders will need to be delivered. The clinician should place one hand

Figure 2. Delivery Process

Normal Birth



1. Fetal engagement begins
2. Further descent, fetal rotation begins
3. Fetal rotation completes, extension begins
4. Complete fetal extension

Source: © Relias LLC 2020

on each side of the head and should place gentle downward traction toward the mother's sacrum to help guide the baby's anterior shoulder under the maternal symphysis pubis. After delivery of the anterior shoulder, the posterior shoulder can be released by then applying direct, gentle, upward traction on the baby. Once the shoulders are delivered, the remainder of the neonate's body will easily expulse. The cord then should be clamped and cut. Finally, the third stage of labor includes delivery of the placenta.

Active management of delivery of the placenta includes beginning a uterotonic agent, typically oxytocin intramuscularly (IM) or intravenously (IV). Then, the clinician should use one hand to apply firm, but controlled, downward traction on the transected umbilical cord while applying firm downward pressure suprapubically to prevent uterine inversion.⁵¹ After delivery of the placenta, a clinician should explore for lacerations that need repair and assess for uterine atony to help reduce the risk of postpartum hemorrhage (discussed in more detail later).

Postpartum Hemorrhage

Postpartum hemorrhage occurs in approximately 4% to 6% of all pregnancies, with uterine atony the most common etiology.⁵²

Postpartum hemorrhage is defined as blood loss of 1,000 mL or more accompanied by signs or symptoms

of hypovolemia (e.g., lightheadedness, tachycardia, palpitations, hypotension) within 24 hours of giving birth.⁵³ The initial management step for postpartum hemorrhage includes thinking about the resuscitation basics. Ensure the mother is on a monitor and has adequate vascular access (a minimum of two large-bore IV infusions).

Perform an exam to identify the cause of the hemorrhage (e.g., boggy uterus suggestive of uterine atony vs. bleeding laceration from birth trauma). If the exam is consistent with uterine atony, or no other clear source of traumatic etiology is identified, the next step is to administer oxytocin (Pitocin), either IV or IM, and perform bimanual uterine massage.

A bimanual uterine massage is performed by placing one hand inside the vagina and placing firm pressure on the uterine body with a closed fist. The other hand is placed over the uterine fundus to compress it down against the uterine body. If oxytocin and uterine massage fail to control the hemorrhage, several additional medications can be considered. Table 4 describes options for medical management of postpartum hemorrhage, the typical recommended dosages, and special considerations regarding contraindications.^{52,54,55}

Should the hemorrhage persist despite exhaustion of medical management, the uterus and vaginal canal should be packed, and emergent obstetrical consultation or transfer to a facility

with obstetrical specialists is indicated. Additionally, for any patient with significant hemorrhage or hemodynamic instability, transfusion with blood products should be considered, beginning with packed red blood cells. Clinicians also should consider the potential need for the use of a massive transfusion protocol.

Conclusion

Teen pregnancies are at higher risk of obstetrical complications with adverse maternal and fetal outcomes than adult pregnancies in the United States.^{56,57} Pediatric emergency medicine clinicians should be familiar with and adept at caring for the common or emergent obstetrical complications as outlined earlier.

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Table 4. Options for Medical Management of Postpartum Hemorrhage⁵⁴⁻⁵⁶

Medication	Dose	Contraindications	Adverse Effects
Oxytocin	10 units IM or 10 to 40 units per 500-1,000 mL saline as a continuous infusion	Possible hypotension with IV use following cesarean delivery	Minimal; nausea or vomiting with prolonged use
Methylergonovine	0.2 mg IM taken orally every two to four hours	Hypertension or preeclampsia; known cardiovascular disease	Severe hypertension (especially if given intravenously), nausea, or vomiting
Carboprost	0.25mg IM or into myometrium every 15-90 minutes; max cumulative dose 2 mg	Avoid in patients with asthma, or significant renal, hepatic or cardiac disease	Nausea or vomiting, diarrhea, transient fever, shivering, headache, bronchospasm
Misoprostol (PGE1)	1,000 mcg rectally once; alternate dose 400 to 800 mcg saline lock	Use caution in patients with cardiovascular disease	Nausea or vomiting, diarrhea, transient fever, shivering, headache
Tranexamic acid (TXA)	1 g infused in 10-20 minutes	Rare/none	Thrombosis/venous thromboembolism

IM: intramuscularly

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CME/CE Questions

1. A 16-year-old female, gravidity 1, parity 0, at 28 weeks' gestation presents to the emergency department (ED) after being involved in a low-speed motor vehicle collision in which the patient was properly restrained, with no loss of consciousness or airbag deployment. The patient was ambulatory at the scene. Her vital signs are within normal limits and she has no complaints at this time. The examination is unremarkable,

and there are positive fetal heart tones on Doppler. The patient has had no vaginal bleeding or leakage of fluid and is feeling the baby move as normal. Which of the following is the next step in management?

- a. Discharge home with return precautions and obstetrical (OB) follow-up.
 - b. Obtain a transvaginal ultrasound.
 - c. Obtain abdominal/pelvic computed tomography.
 - d. Obtain OB consultation for four to six hours of cardiocotographic and fetal heart rate monitoring.
2. In which of the following patients would an ED perimortem cesarean delivery be indicated?
 - a. A 15-year-old at 18 weeks' gestation who has a witnessed traumatic arrest while in the ED trauma bay
 - b. A 16-year-old at 25 weeks' gestation who arrested in the field after a motor vehicle collision and has had ongoing chest compressions for the past 15 minutes
 - c. A 16-year-old of unknown gestational age with palpable uterine fundus 4 cm above the umbilicus who has a witnessed traumatic arrest while in the ED trauma bay
 - d. A 17-year-old of unknown gestational age with uterine fundus palpable 2 cm below the umbilicus who had a traumatic arrest with emergency medical services two minutes prior to arrival undergoing ongoing cardiopulmonary resuscitation
 3. A 17-year-old female, gravidity 1, parity 0, at 36 weeks' gestation presents with headache and blurred vision once per day. Vital signs are: temperature 37.4°C, heart rate 97 beats/minute, respiratory rate 18 breaths/minute, blood pressure 178/112 mmHg. The patient has an intact neurologic examination. Which of the following are the next steps in management for this patient?
 - a. Give acetaminophen and symptomatic treatment, then discharge with close OB follow-up.

- b. Give oral hydralazine, then discharge with close OB follow-up.
 - c. Give intravenous (IV) labetalol, IV MgSO₄, then admit for observation.
 - d. Give IV labetalol, IV MgSO₄, then admit for urgent delivery.
4. A 16-year-old female at 28 weeks' gestation presents to the ED with acute onset left-sided pleuritic chest pain and shortness of breath. She is tachycardic to 112 beats/minute and has an SpO₂ of 92% on room air. Blood pressure is stable at 108/81 mmHg. On exam, she has no lower extremity tenderness or swelling. Her chest X-ray shows trace bilateral pleural effusions. Which of the following is the best next diagnostic step?
 - a. Obtain a D-dimer.
 - b. Obtain a ventilation perfusion scan.
 - c. Obtain a computed tomography pulmonary angiogram.
 - d. Obtain bilateral lower extremity compression venous ultrasound.
 5. A 15-year-old female, gravidity 1, parity 1, with a history of asthma delivered a term infant at home four hours ago and presents to the ED for heavy vaginal bleeding. She reports that she was approximately 39 weeks' gestation. After delivery of the infant, she reports persistent, continued heavy vaginal bleeding and now is complaining of lightheadedness. Vital signs include temperature 36.7°C, heart rate 122 beats/minute, respiratory rate 20 breaths/minute, and blood pressure 100/67 mmHg. On examination, the patient has a boggy uterus with fundus palpable just superior to the level of the umbilicus. She has large clots and fairly brisk, bright red vaginal bleeding without signs of perineal or cervical lacerations. Which of the following would be contraindicated in this patient?
 - a. Oxytocin
 - b. Carboprost
 - c. Methylergonovine
 - d. Tranexamic acid
 6. Which of the following grossly suggests a gestational age consistent with fetal viability in a pregnant trauma patient?
 - a. Gravid-appearing abdomen
 - b. Positive fetal heart tones on Doppler
 - c. Fundal height at or above the umbilicus
 - d. Patient report of positive fetal movement
 7. A 17-year-old female, gravidity 1, parity 0, at 12 weeks' gestation presents for a routine prenatal visit. Her vital signs are temperature 37.1°C, heart rate 85, respiratory rate 18, and blood pressure 148/91 mmHg. She is otherwise asymptomatic with a normal physical exam. Which of the following is correct regarding this patient's diagnosis?
 - a. Chronic hypertension
 - b. Gestational hypertension
 - c. Severe gestational hypertension
 - d. Preeclampsia
 8. Which of the following is *not* a risk factor for pregnancy-related venous thromboembolism?
 - a. Age > 35 years
 - b. Primigravida
 - c. Hyperemesis
 - d. Preeclampsia
 9. Which of the following maneuvers should be performed to help prevent uterine inversion during the third stage of labor?
 - a. Perform bimanual uterine massage
 - b. Hyperflex the mother's legs tightly to her abdomen
 - c. Apply firm downward pressure directly over the pubic symphysis
 - d. Apply firm downward pressure suprapubically
 10. A 15-year-old female, gravidity 1, parity 1, arrives to the ED after just precipitously delivering a term infant in the car in the hospital parking lot. Her vital signs are reassuring, but she is continuing to have moderate to heavy vaginal bleeding. In addition to uterine massage, which of the following medications would you start first?
 - a. Oxytocin
 - b. Methylergonovine
 - c. Misoprostol
 - d. Tranexamic acid

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CME/CE Objectives

Upon completion of this educational activity, participants should be able to:

- recognize specific conditions in pediatric patients presenting to the emergency department;
- describe the epidemiology, etiology, pathophysiology, historical, and examination findings associated with conditions in pediatric patients presenting to the emergency department;
- formulate a differential diagnosis and perform necessary diagnostic tests;
- apply up-to-date therapeutic techniques to address conditions discussed in the publication;
- discuss any discharge or follow-up instructions with patients.

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