

# Hypertension in Pregnancy

Topic- based Uworld Questions

Block 1, 2, 7, 8



The following vignette applies to the next 2 items. The items in the set must be answered in sequential order. Once you click **Proceed to Next Item**, you will not be able to add or change an answer.

A 41-year-old woman, gravida 1 para 0, at 34 weeks gestation comes to the emergency department with blurry vision, nausea, epigastric pain, and a headache unresponsive to acetaminophen. Due to these symptoms, the patient has a poor appetite and has had little to eat or drink today. Her pregnancy has been complicated by gestational diabetes mellitus for which she began insulin therapy at 26 weeks. The patient has no other medical issues. Blood pressure is 155/105 mm Hg, and heart rate is 90/min in the supine position. During physical examination, the patient suddenly loses consciousness. Her extremities stiffen and then begin to jerk and twitch. After 3 minutes, she regains consciousness.

#### Item 1 of 2

This patient's symptoms are most closely associated with which of the following additional features?

- A. Hypocalcemia
- B. Hypoglycemia
- C. Hyponatremia
- D. Meningeal inflammation
- E. Postural hypotension
- F. Proteinuria

Submit

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A 41-year-old woman, gravida 1 para 0, at 34 weeks gestation comes to the emergency department with blurry vision, nausea, epigastric pain, and a headache unresponsive to acetaminophen. Due to these symptoms, the patient has a poor appetite and has had little to eat or drink today. Her pregnancy has been complicated by gestational diabetes mellitus for which she began insulin therapy at 26 weeks. The patient has no other medical issues. Blood pressure is 155/105 mm Hg, and heart rate is 90/min in the supine position. During physical examination, the patient suddenly loses consciousness. Her extremities stiffen and then begin to jerk and twitch. After 3 minutes, she regains consciousness.

#### Item 1 of 2

This patient's symptoms are most closely associated with which of the following additional features?

- A. Hypocalcemia (2%)
- B. Hypoglycemia (9%)
- C. Hyponatremia (2%)
- D. Meningeal inflammation (1%)
- E. Postural hypotension (0%)
- F. Proteinuria (83%)

Omitted

Correct answer

F



83%

Answered correctly



02 secs

Time Spent



02/08/2020

Last Updated



**Eclampsia** is the most common cause of **generalized tonic-clonic seizure** in pregnant patients with **hypertension**. It is defined as new-onset seizures in a patient with preeclampsia (new-onset hypertension and **proteinuria** or end-organ damage at >20 weeks gestation). Risk factors for preeclampsia include advanced maternal age, nulliparity, and diabetes mellitus.

This patient's seizures occurred in the setting of new-onset hypertension at 34 weeks gestation and evidence of **central nervous system dysfunction** (persistent headache, blurry vision), which is highly suggestive of eclampsia. Additional symptoms of impending eclampsia include altered mental status, right upper quadrant or epigastric pain, and shortness of breath. Proteinuria is common in eclampsia/preeclampsia and therefore most likely present in this patient.

**(Choice A)** Hypocalcemia is most commonly due to hypoparathyroidism or renal disease. It can cause seizures but more typically presents with tetany (neuromuscular irritability, muscle twitching). In addition, hypocalcemia is associated with hypotension rather than hypertension.

**(Choice B)** Insulin overdose causes hypoglycemia, which in turn can cause seizures. However, additional symptoms of hypoglycemia typically include anxiety, diaphoresis, tremor, and cognitive impairment. This patient had none of these symptoms prior to her seizure.

**(Choice C)** Hyponatremia is associated with excessive fluid loss from sweating or emesis, or from excessive water retention due to renal, cardiac, or hepatic failure. Although severe acute hyponatremia (sodium <115-120 mEq/L) can cause headache, seizures, and loss of consciousness, this patient has no risk factors for hyponatremia.

**(Choice D)** Meningeal inflammation from meningitis can cause seizures. However, meningitis typically presents with fever, headache, and neck pain/nuchal rigidity. This patient is afebrile.

**(Choice E)** Poor intake and hypovolemia are risk factors for vasovagal syncope due to orthostatic (postural) hypotension. Although syncope causes loss of consciousness, the tonic-clonic movements in this patient are indicative of a seizure.

#### Educational objective:

Eclampsia is the most common cause of new-onset seizures in pregnant patients with hypertension. It is associated with proteinuria and signs of central nervous system dysfunction (eg, headaches, vision changes).

#### References

- [Diagnosis, prevention, and management of eclampsia.](#)

## Item 2 of 2

Which of the following is the best therapy for this patient?

- A. Calcium gluconate
- B. Diazepam
- C. Glucagon
- D. Insulin
- E. Low molecular weight heparin
- F. Magnesium sulfate
- G. Phenytoin

Submit

## Item 2 of 2

Which of the following is the best therapy for this patient?

- A. Calcium gluconate (0%)
- B. Diazepam (2%)
- C. Glucagon (2%)
- D. Insulin (0%)
- E. Low molecular weight heparin (0%)
- F. Magnesium sulfate (93%)
- G. Phenytoin (0%)

Omitted

Correct answer

F



93%

Answered correctly



02 secs

Time Spent



02/08/2020

Last Updated

Explanation

**Eclampsia**  
**(severe preeclampsia + seizures)**

<b>Eclampsia (severe preeclampsia + seizures)</b>	
<b>Clinical features</b>	<ul style="list-style-type: none"> <li>• Hypertension</li> <li>• Proteinuria</li> <li>• Severe headaches</li> <li>• Visual disturbances</li> <li>• Right upper quadrant or epigastric pain</li> <li>• 3-4 minutes of tonic-clonic seizure, usually self-limited</li> </ul>
<b>Management</b>	<ul style="list-style-type: none"> <li>• Administer magnesium sulfate</li> <li>• Administer antihypertensive agent</li> <li>• Deliver the fetus</li> </ul>

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The tonic-clonic seizures of eclampsia generally last 3-4 minutes and are self-limited; treatment is therefore directed at **prevention of further seizures**. **Magnesium sulfate** is first-line therapy and has been shown to be more effective and safer than diazepam (**Choice B**) or phenytoin (**Choice G**) in preventing seizure recurrence. It also has been shown to be superior in preventing maternal death. If magnesium sulfate does not control eclamptic seizures, then diazepam or phenytoin would be indicated as a second choice.

Approximately 10% of pregnancy-related maternal mortality is due to **eclampsia**. Eclampsia is associated with maternal morbidity from abruptio placentae, disseminated intravascular coagulation, and cardiopulmonary arrest. After maternal stabilization, magnesium sulfate administration, and blood pressure control, **expedient delivery** is indicated as it is the only cure for eclampsia.

**(Choice A)** Calcium gluconate is used for calcium repletion in patients with hypocalcemia. It is also an antidote for magnesium toxicity.

**(Choices C and D)** Diabetic ketoacidosis (hyperglycemia, glucosuria, ketonuria) can present with nausea and epigastric pain and requires treatment with insulin. However, hypoglycemia rather than hyperglycemia causes seizures. Glucagon, an antidote for hypoglycemia, would be indicated if this patient's seizures were due to hypoglycemia.

**(Choice E)** Although this patient's visual symptoms, headache, and seizure could be related to thromboembolic events that would be treated with

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**(Choice E)** Although this patient's visual symptoms, headache, and seizure could be related to thromboembolic events that would be treated with anticoagulation agents (eg, heparin), the epigastric pain and hypertension are more suggestive of eclampsia.

#### Educational objective:

Eclampsia is associated with increased maternal and fetal morbidity and mortality. Treatment of eclampsia includes magnesium sulfate for seizure recurrence prevention, blood pressure control, and expedient delivery.

#### References

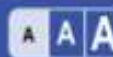
- [Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists' Task Force on Hypertension in Pregnancy.](#)

Obstetrics & Gynecology  
Subject

Pregnancy, Childbirth & Puerperium  
System

Preeclampsia  
Topic





A 42-year-old woman, gravida 4 para 3, at 37 weeks gestation is brought to the emergency department by her sister after falling to the ground and developing full-body twitching and jerking. Her sister says the patient was unresponsive during the event, which lasted approximately 2 minutes. Since regaining consciousness, the patient has been lethargic and weak. She does not recall falling but remembers being bothered by bright light, suddenly unable to see, and experiencing "the worst headache I have ever had." The patient has a history of depression and anxiety but cannot recall the names of her prescribed medications. She also has a history of headaches with "sensitivity to light" for which she typically takes acetaminophen, drinks diet cola, and smokes a cigarette. Her last pregnancy was 13 years ago and she says the current pregnancy has been uncomplicated. Blood pressure is 200/105 mm Hg, and pulse is 112/min. Physical examination shows a tired-appearing woman with no neurologic deficits. She is oriented to person, place, and time. Urinalysis shows 2+ protein. Which of the following is the most likely diagnosis for this patient?

- A. Brain tumor
- B. Cerebral venous thrombosis
- C. Conversion disorder
- D. Eclampsia
- E. Epilepsy
- F. Migraine with aura
- G. Subarachnoid hemorrhage


Submit


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- A. Brain tumor (0%)
- B. Cerebral venous thrombosis (0%)
- C. Conversion disorder (0%)
- D. Eclampsia (90%)
- E. Epilepsy (0%)
- F. Migraine with aura (0%)
- G. Subarachnoid hemorrhage (7%)

Omitted  
Correct answer  
D

 90%  
Answered correctly

 02 secs  
Time Spent

 06/15/2020  
Last Updated

<b>Eclampsia</b> <b>(severe preeclampsia + seizures)</b>	
<b>Clinical features</b>	<ul style="list-style-type: none"> <li>• Hypertension</li> <li>• Proteinuria</li> <li>• Severe headaches</li> <li>• Visual disturbances</li> <li>• Right upper quadrant or epigastric pain</li> <li>• 3-4 minutes of tonic-clonic seizure, usually self-limited</li> </ul>
<b>Management</b>	<ul style="list-style-type: none"> <li>• Administer magnesium sulfate</li> <li>• Administer antihypertensive agent</li> <li>• Deliver the fetus</li> </ul>

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A **seizure during pregnancy** is always concerning for **eclampsia**. Eclampsia is defined as the occurrence of seizures in a patient with preeclampsia (eg, hypertension, proteinuria) and is the most common cause of new-onset seizures in pregnant patients. The risk factors for eclampsia are similar to those of preeclampsia (eg, history of preeclampsia, maternal age >40, history of hypertension).

Eclamptic seizures are typically **tonic-clonic, generalized, and brief**, lasting several minutes. The seizures are frequently preceded by **severe headaches, visual disturbances** (eg, blurry vision, photophobia, loss of vision), and epigastric/right upper quadrant pain. Patients typically have **hypertension** (systolic blood pressure  $\geq 140$  mm Hg or diastolic blood pressure  $\geq 90$  mm Hg) and **proteinuria** but **no focal neurologic defects**. During the postictal phase of an eclamptic seizure, patients are typically fatigued and sleepy.

**(Choice A)** Brain tumors can present with headaches and seizures. However, headaches from brain tumors are typically dull and constant rather than acute and severe. In addition, a brain tumor would not explain this patient's proteinuria.

**(Choice B)** Cerebral venous thrombosis can present with gradual-onset headaches, focal seizures, and focal neurologic deficits. It is not associated with proteinuria.

**(Choice C)** Conversion disorder refers to neurologic symptoms that cannot be explained by a medical condition. Depression and anxiety are risk

eclampsia are similar to those of preeclampsia (eg, history of preeclampsia, maternal age  $>40$ , history of hypertension).

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**(Choice B)** Cerebral venous thrombosis can present with gradual-onset headaches, focal seizures, and focal neurologic deficits. It is not associated with proteinuria.

**(Choice C)** Conversion disorder refers to neurologic symptoms that cannot be explained by a medical condition. Depression and anxiety are risk factors, but conversion disorder would not explain this patient's proteinuria and severe hypertension.

**(Choice E)** Epileptic seizures occur in the absence of provocation. In addition, epileptic seizures are more typically followed rather than preceded by headaches. This patient's seizure occurs in the setting of an acute medical illness (preeclampsia) and is not considered epilepsy.

**(Choice F)** Although migraine headaches can be accompanied by neurologic symptoms (eg, hemiparesis, stupor, coma, vertigo, ataxia) and visual symptoms (eg, hallucinations, diplopia, blindness), seizures typically are not precipitated by migraine headaches.

**(Choice G)** Subarachnoid hemorrhage typically presents as a sudden, extremely severe headache associated with nausea, vomiting, meningismus, and loss of consciousness. Seizures are uncommon but poor prognostic manifestations usually accompanied by altered mental status and papilledema from increased intracranial pressure.

#### Educational objective:

Eclampsia is the most common cause of new-onset seizures in a pregnant patient. Additional manifestations include hypertension, proteinuria, headache, and visual changes.

#### References

- [Characterization of symptoms immediately preceding eclampsia.](#)

A 29-year-old woman, gravida 1 para 1, is evaluated in the emergency department for a headache. Three days ago, she had an uncomplicated vaginal delivery with neuraxial anesthesia. This morning, the patient developed an occipital headache that has not improved with acetaminophen. The headache has become progressively worse, and the patient cannot sit without becoming nauseated and vomiting. The patient has no chronic medical conditions and does not use tobacco, alcohol, or illicit drugs. Temperature is 36.7 C (98.1 F), blood pressure is 162/96 mm Hg, pulse is 98/min, and respirations are 18/min. On examination, heart sounds are normal with no rubs or murmurs, and the lungs are clear to auscultation. Cranial nerves are intact and deep tendon reflexes are 3+. There is 5/5 strength in the right lower extremity and 3/5 strength in the left. Which of the following is the best next step in management of this patient?

- A. 100% oxygen
- B. CT scan of the head
- C. Epidural blood patch
- D. Lumbar puncture
- E. Sumatriptan therapy

Submit

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- A. 100% oxygen (2%)
- B. CT scan of the head (57%)
- C. Epidural blood patch (34%)
- D. Lumbar puncture (5%)
- E. Sumatriptan therapy (1%)

Omitted

Correct answer

B



57%

Answered correctly



02 secs

Time Spent



06/06/2020

Last Updated

Explanation

**Preeclampsia**

Preeclampsia	
<b>Risk factors</b>	<ul style="list-style-type: none"> <li>• Nulliparity</li> <li>• Obesity</li> <li>• Preexisting medical condition (eg, SLE, chronic hypertension)</li> <li>• Multiple gestation</li> <li>• Advanced maternal age</li> </ul>
<b>Definition</b>	<ul style="list-style-type: none"> <li>• New-onset hypertension (SBP <math>\geq</math>140 or DBP <math>\geq</math>90 mm Hg) at <math>&gt;</math>20 weeks AND</li> <li>• Proteinuria OR signs/symptoms of other end-organ damage</li> </ul>
<b>Severe features</b>	<ul style="list-style-type: none"> <li>• Severe-range hypertension (SBP <math>\geq</math>160 or DBP <math>\geq</math>110 mm Hg)</li> <li>• Platelets <math>&lt;</math>100,000/mm<sup>3</sup></li> <li>• Creatinine <math>&gt;</math>1.1 mg/dL or 2x normal</li> <li>• Elevated transaminases (2x upper limit of normal)</li> <li>• Pulmonary edema</li> <li>• Visual or cerebral symptoms (eg, headache)</li> </ul>
<b>Management</b>	<ul style="list-style-type: none"> <li>• <math>&lt;</math>37 weeks &amp; no severe features: expectant</li> <li>• <math>\geq</math>37 weeks (or <math>\geq</math>34 weeks with severe features): delivery</li> <li>• Severe-range blood pressure: IV labetalol, IV hydralazine, PO nifedipine</li> <li>• Seizure prophylaxis: magnesium sulfate</li> </ul>

DBP = diastolic blood pressure; IV = intravenous; PO = by mouth; SBP = systolic blood pressure; SLE = systemic lupus erythematosus.

This **postpartum** patient with **worsening headache** and **severe hypertension** (eg, systolic  $\geq$ 160 or diastolic  $\geq$ 110 mm Hg) has **preeclampsia**

= systemic lupus erythematosus.

This **postpartum** patient with **worsening headache** and **severe hypertension** (eg, systolic  $\geq 160$  or diastolic  $\geq 110$  mm Hg) has **preeclampsia with severe features**, which can present up to 6 weeks after delivery. The most common presenting symptom is a severe headache in the bilateral occipital or frontal regions that does not improve with acetaminophen or nonsteroidal anti-inflammatory drugs.

Patients with preeclampsia are at increased risk of **hemorrhagic and ischemic stroke** due to acute elevations in cerebral perfusion pressure and vessel rupture (hemorrhagic), as well as preeclampsia-mediated vascular endothelial damage and microthrombi formation (ischemic). To decrease this risk, preeclamptic patients with severe-range blood pressures require aggressive antihypertensive therapy (eg, labetalol, nifedipine) and magnesium sulfate, which helps prevent eclamptic seizures that can worsen stroke symptoms.

Most preeclamptic patients do not require imaging; however, in those with **focal neurologic deficits**, such as this patient with asymmetric motor deficits (strength right > left), **CT scan of the head** should be performed to evaluate for possible stroke and help guide management.

**(Choices A and E)** Oxygen administration is used to alleviate cluster headaches, which typically present with a short-lived, unilateral, orbital headache with autonomic symptoms (eg, ptosis, lacrimation). Triptans (eg, sumatriptan) are used to treat migraines, which can present as occipital headaches with nausea, vomiting, and occasionally motor aura (eg, hemiplegic migraine). However, CT scan should be performed in this patient prior to attempting symptomatic therapy in order to exclude life-threatening causes of neurologic deficit.

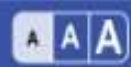
**(Choice C)** An epidural blood patch is used to treat postdural puncture headaches, which can occur after neuraxial anesthesia and may present as an occipital headache that worsens with sitting or standing due to cerebrospinal fluid (CSF) leakage. However, this type of headache is not associated with hypertension or focal neurologic deficits.

**(Choice D)** Lumbar puncture can evaluate for CSF infection (eg, meningitis, encephalitis), which may present with headache after neuraxial anesthesia. This patient is afebrile, making this diagnosis less likely. In addition, lumbar puncture is usually performed after CT scan to exclude a brain mass because there is a risk of herniation with mass effect.

#### **Educational objective:**

Preeclampsia can present up to 6 weeks postpartum with headache and hypertension. Patients with preeclampsia are at increased risk of stroke, and those with focal neurologic deficits should be evaluated with CT scan of the head.





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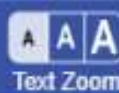
A 38-year-old woman, gravida 1 para 0, comes to the office for her first prenatal visit. Her last menstrual period was 12 weeks ago. The patient has had nausea and vomiting occasionally over the past few weeks but no other symptoms. She has not seen a health care provider in years but has no known medical conditions and takes no medications. Supine blood pressure is 142/96 mm Hg and 138/92 mm Hg on repeat measurement 15 minutes later. Physical examination shows an anxious woman with mild bilateral ankle edema and an enlarged uterus. Ultrasound confirms an intrauterine pregnancy consistent with dates. A urinalysis dipstick is negative for protein and glucose. The patient returns to the office for a blood pressure measurement a week later and her blood pressure is 152/106 mm Hg.

#### Item 1 of 2

Which of the following is the most likely diagnosis in this patient?

- A. Chronic hypertension
- B. Gestational hypertension
- C. Normal pregnancy
- D. Preeclampsia
- E. White coat hypertension

Submit



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**Item 1 of 2**

Which of the following is the most likely diagnosis in this patient?

- A. Chronic hypertension (60%)
- B. Gestational hypertension (26%)
- C. Normal pregnancy (1%)
- D. Preeclampsia (4%)
- E. White coat hypertension (7%)

Omitted  
Correct answer  
A

60%  
Answered correctly

02 secs  
Time Spent

03/01/2020  
Last Updated



Hypertensive disorders of pregnancy	
<b>Chronic hypertension</b>	<ul style="list-style-type: none"> <li>Systolic pressure <math>\geq 140</math> mm Hg &amp;/or diastolic pressure <math>\geq 90</math> mm Hg prior to conception or 20 weeks gestation</li> </ul>
<b>Gestational hypertension</b>	<ul style="list-style-type: none"> <li>New-onset elevated blood pressure at <math>\geq 20</math> weeks gestation</li> <li>No proteinuria or end-organ damage</li> </ul>
<b>Preeclampsia</b>	<ul style="list-style-type: none"> <li>New-onset elevated blood pressure at <math>\geq 20</math> weeks gestation</li> </ul> <p><b>AND</b></p> <ul style="list-style-type: none"> <li>Proteinuria <b>OR</b> signs of end-organ damage</li> </ul>
<b>Eclampsia</b>	<ul style="list-style-type: none"> <li>Preeclampsia</li> </ul> <p><b>AND</b></p> <ul style="list-style-type: none"> <li>New-onset grand mal seizures</li> </ul>
<b>Chronic hypertension with superimposed preeclampsia</b>	<p>Chronic hypertension <b>AND</b> 1 of the following:</p> <ul style="list-style-type: none"> <li>New-onset proteinuria or worsening of existing proteinuria at <math>\geq 20</math> weeks gestation</li> <li>Sudden worsening of hypertension</li> <li>Signs of end-organ damage</li> </ul>

Hypertension is defined as a **systolic blood pressure  $\geq 140$  mm Hg and/or a diastolic blood pressure  $\geq 90$  mm Hg**. **Chronic hypertension** predates pregnancy but can be diagnosed any time **before 20 weeks gestation**. To make a diagnosis of chronic hypertension during pregnancy, blood pressure should be elevated at **2 measurements** taken  **$\geq 4$  hours apart**. This patient presents with elevated blood pressure during 2 separate office visits before 20 weeks gestation and meets criteria for chronic hypertension.

**(Choices B and D)** Gestational hypertension is hypertension diagnosed after 20 weeks gestation in the absence of proteinuria or signs of end-organ damage. Preeclampsia is newly diagnosed hypertension after 20 weeks gestation with signs of end-organ damage (eg, proteinuria, thrombocytopenia, elevated transaminases, elevated creatinine, pulmonary edema, headache, visual changes). This patient's hypertension presents *before 20 weeks gestation*.

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**(Choice C)** Pregnancy causes marked systemic vasodilation that lowers the blood pressure by 5-10 mm Hg from baseline during the first trimester. Blood pressure generally returns to pre-pregnancy levels during the third trimester. This patient's blood pressure is elevated.

**(Choice E)** White coat hypertension is a syndrome in which anxiety over medical care causes an elevation in blood pressure that is not present in other settings. White coat hypertension is very unlikely with diastolic blood pressure  $\geq 105$  mm Hg.

#### Educational objective:

Chronic or preexisting hypertension is defined as a systolic blood pressure  $\geq 140$  mm Hg and/or a diastolic blood pressure  $\geq 90$  mm Hg before 20 weeks gestation during 2 separate measurements taken at least 4 hours apart.

#### References

- [Elevated blood pressure in pregnancy and subsequent chronic disease risk.](#)
- [Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists' Task Force on Hypertension in Pregnancy.](#)

Obstetrics & Gynecology  
Subject

Pregnancy, Childbirth & Puerperium  
System

Primary hypertension  
Topic

## Item 2 of 2

This patient is at greatest risk of which of the following complications?

- A. Fetal heart defect
- B. Fetal macrosomia
- C. Fetal neural tube defect
- D. Placenta accreta
- E. Polyhydramnios
- F. Preterm labor
- G. Preterm premature rupture of membranes

Submit

## Item 2 of 2

This patient is at greatest risk of which of the following complications?

- A. Fetal heart defect (2%)
- B. Fetal macrosomia (1%)
- C. Fetal neural tube defect (0%)
- D. Placenta accreta (5%)
- E. Polyhydramnios (3%)
- F. Preterm labor (75%)
- G. Preterm premature rupture of membranes (11%)

Omitted

Correct answer

F



75%

Answered correctly



02 secs

Time Spent



03/01/2020

Last Updated

Explanation

**Pregnancy-related risks due to hypertension**

- Superimposed preeclampsia

### Pregnancy-related risks due to hypertension

<b>Maternal</b>	<ul style="list-style-type: none"> <li>• Superimposed preeclampsia</li> <li>• Postpartum hemorrhage</li> <li>• Gestational diabetes</li> <li>• Abruption placentae</li> <li>• Cesarean delivery</li> </ul>
<b>Fetal</b>	<ul style="list-style-type: none"> <li>• Fetal growth restriction</li> <li>• Perinatal mortality</li> <li>• Preterm delivery</li> <li>• Oligohydramnios</li> </ul>

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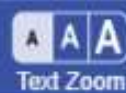
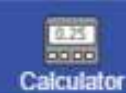
**Hypertension** is associated with both fetal and maternal morbidity. The risk for **preterm labor** and other complications may be linked to the increased systemic vascular resistance and arterial stiffness leading to **placental dysfunction**. In addition, expedited preterm delivery may be indicated for treatment of an unstable maternal (eg, **superimposed preeclampsia**, **abruption placentae**) or fetal complication (eg, **growth restriction**, stillbirth).

**(Choice A)** Congenital heart defects are commonly associated with genetic abnormalities (eg, trisomy 21, Turner syndrome), family history of congenital heart disease, and maternal diabetes in pregnancy but not with hypertension.

**(Choice B)** Uncontrolled diabetes in pregnancy is a common risk factor for fetal macrosomia. Hypertension is associated with fetal growth restriction, not macrosomia.

**(Choice C)** Neural tube defects are associated with genetic syndromes (eg, trisomies 13 and 18) and inadequate maternal folate levels.

Hypertension does not increase the risk of neural tube defects.



**Hypertension** is associated with both fetal and maternal morbidity. The risk for **preterm labor** and other complications may be linked to the increased systemic vascular resistance and arterial stiffness leading to **placental dysfunction**. In addition, expedited preterm delivery may be indicated for treatment of an unstable maternal (eg, **superimposed preeclampsia**, **abruptio placentae**) or fetal complication (eg, **growth restriction**, stillbirth).

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**(Choice C)** Neural tube defects are associated with genetic syndromes (eg, trisomies 13 and 18) and inadequate maternal folate levels. Hypertension does not increase the risk of neural tube defects.

**(Choice D)** Placenta accreta occurs when the placental villi attach to the myometrium rather than the uterine decidua. It is a potential complication in patients with prior cesarean delivery or uterine curettage. Hypertension is not associated with placenta accreta.

**(Choice E)** Hypertension is associated with oligohydramnios. In contrast, polyhydramnios is commonly associated with poorly controlled diabetes in pregnancy and fetal anomalies that cause structural or functional obstruction of the intestinal tract (eg, esophageal atresia).

**(Choice G)** Preterm premature rupture of membranes (PPROM) is the rupture of membranes prior to 37 weeks gestation and prior to the onset of labor. PPRM is associated with genital tract infection and a history of prior PPRM. Hypertension does not increase the risk for PPRM.

#### **Educational objective:**

Hypertension increases the risk of superimposed preeclampsia, abruptio placentae, fetal growth restriction, preterm labor, and stillbirth.

#### **References**

- [Elevated blood pressure in pregnancy and subsequent chronic disease risk.](#)
- [Chronic hypertension and pregnancy outcomes: systematic review and meta-analysis.](#)



The following vignette applies to the next 2 items. The items in the set must be answered in sequential order. Once you click **Proceed to Next Item**, you will not be able to add or change an answer.

A 37-year-old primigravid woman at 34 weeks gestation is referred to the labor and delivery unit from the office due to a blood pressure of 152/96 mm Hg. The patient has a spontaneous dichorionic diamniotic twin gestation, but her prenatal course has otherwise been uneventful with normal blood pressure measurements throughout the pregnancy. She has no known medical problems and has exercised throughout her pregnancy. The patient reports good fetal movement, no contractions, no vaginal bleeding, and no leakage of fluid. She also has no headaches or visual disturbances. Her current blood pressure is 150/102 mm Hg. Deep tendon reflexes are 3+. Nonstress test is reactive for both fetuses. Laboratory results are as follows.

Hemoglobin	12 g/dL
Hematocrit	38%
Platelets	126,000/mm <sup>3</sup>
Aspartate aminotransferase	806 U/L
Alanine aminotransferase	414 U/L
Creatinine	1.8 mg/dL
Urine protein/creatinine ratio	0.82

**Item 1 of 2**

Which of the following is the most likely diagnosis?

- A. Acute fatty liver of pregnancy
- B. Gestational hypertension

Laboratory results are as follows.

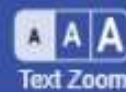
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Item 1 of 2

Which of the following is the most likely diagnosis?

- A. Acute fatty liver of pregnancy
- B. Gestational hypertension
- C. Intrahepatic cholestasis of pregnancy
- D. Preeclampsia with severe features
- E. Preeclampsia without severe features

Submit



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### Item 1 of 2

Which of the following is the most likely diagnosis?

- A. Acute fatty liver of pregnancy (7%)
- B. Gestational hypertension (4%)
- C. Intrahepatic cholestasis of pregnancy (3%)
- D. Preeclampsia with severe features (60%)
- E. Preeclampsia without severe features (23%)

Omitted

Correct answer



60%  
Answered correctly



05 secs  
Time Spent



01/27/2020  
Last Updated

<b>Preeclampsia</b>	
<b>Definition</b>	<ul style="list-style-type: none"> <li>• New-onset hypertension (SBP <math>\geq</math>140 mm Hg &amp;/or DBP <math>\geq</math>90 mm Hg) at <math>\geq</math>20 weeks gestation <b>plus</b></li> <li>• Proteinuria &amp;/or end-organ damage</li> </ul>
<b>Severe features</b>	<ul style="list-style-type: none"> <li>• SBP <math>\geq</math>160 mm Hg or DBP <math>\geq</math>110 mm Hg (2 times <math>\geq</math>4 hours apart)</li> <li>• Thrombocytopenia</li> <li>• <math>\uparrow</math> Creatinine</li> <li>• <math>\uparrow</math> Transaminases</li> <li>• Pulmonary edema</li> <li>• Visual or cerebral symptoms</li> </ul>
<b>Management</b>	<ul style="list-style-type: none"> <li>• Without severe features: Delivery at <math>\geq</math>37 weeks</li> <li>• With severe features: Delivery at <math>\geq</math>34 weeks</li> <li>• Magnesium sulfate (seizure prophylaxis)</li> <li>• Antihypertensives</li> </ul>

DBP = diastolic blood pressure; SBP = systolic blood pressure.

**Preeclampsia** is defined as new-onset **hypertension** (systolic  $\geq$ 140 mm Hg and/or diastolic  $\geq$ 90 mm Hg) at  **$\geq$ 20 weeks gestation** and **proteinuria** ( $\geq$ 300 mg/24 hr, protein/creatinine ratio  $\geq$ 0.3, or dipstick  $\geq$ 1+) or signs of end-organ dysfunction. Risk factors for preeclampsia include multiple gestation, nulliparity, preexisting diabetes mellitus, advanced maternal age, chronic kidney disease, and prior preeclampsia.

The presentation of preeclampsia is variable. Most patients with preeclampsia have mild hypertension and proteinuria and no end-organ dysfunction. A subset has manifestations of **severe disease**, such as severe hypertension, platelet count  $<$ 100,000/mm<sup>3</sup>, transaminitis, creatinine  $\geq$ 1.1 mg/dL, and headaches or visual changes. Although all patients with preeclampsia are at risk for eclamptic seizures, placental abruption, hepatic rupture, and disseminated intravascular coagulation, those with severe features are at increased risk for these complications.

This patient meets the criteria for preeclampsia based on her new-onset elevated blood pressure and proteinuria (elevated protein-to-creatinine

**Preeclampsia** is defined as new-onset **hypertension** (systolic  $\geq 140$  mm Hg and/or diastolic  $\geq 90$  mm Hg) at  **$\geq 20$  weeks gestation** and **proteinuria** ( $\geq 300$  mg/24 hr, protein/creatinine ratio  $\geq 0.3$ , or dipstick  $\geq 1+$ ) or signs of end-organ dysfunction. Risk factors for preeclampsia include multiple gestation, nulliparity, preexisting diabetes mellitus, advanced maternal age, chronic kidney disease, and prior preeclampsia.

The presentation of preeclampsia is variable. Most patients with preeclampsia have mild hypertension and proteinuria and no end-organ dysfunction. A subset has manifestations of **severe disease**, such as severe hypertension, platelet count  $< 100,000/\text{mm}^3$ , transaminitis, creatinine  $\geq 1.1$  mg/dL, and headaches or visual changes. Although all patients with preeclampsia are at risk for eclamptic seizures, placental abruption, hepatic rupture, and disseminated intravascular coagulation, those with severe features are at increased risk for these complications.

This patient meets the criteria for preeclampsia based on her new-onset elevated blood pressure and proteinuria (elevated protein-to-creatinine ratio). The presence of **transaminitis** and **elevated creatinine** meets the criteria for preeclampsia with severe features.

**(Choice A)** Patients with acute fatty liver of pregnancy typically present with nausea, vomiting, abdominal pain, and jaundice, none of which are present in this patient.

**(Choices B and E)** The patient is too ill for the diagnosis of preeclampsia without severe features and gestational hypertension; the latter is defined as new-onset hypertension at  $\geq 20$  weeks gestation with no proteinuria or end-organ damage.

**(Choice C)** Intrahepatic cholestasis of pregnancy is characterized by elevated bilirubin and transaminases as well as generalized pruritus. Although this patient has elevated transaminases, she has no pruritus.

#### Educational objective:

Preeclampsia is marked by new-onset elevated blood pressure ( $\geq 140$  mm Hg systolic and/or  $\geq 90$  mm Hg diastolic) plus proteinuria or signs of end-organ dysfunction at  $\geq 20$  weeks gestation. Patients with evidence of end-organ damage (eg, severe headache, visual changes, severe transaminitis, elevated creatinine) have preeclampsia with severe features, which is associated with increased morbidity.

#### References

- [Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists's Task Force on Hypertension in Pregnancy.](#)

## Item 2 of 2

During the patient's evaluation, her blood pressure increases to 170/115 mm Hg. Her pulse is 58/min. Fifteen minutes later, her blood pressure is 172/117 mm Hg and pulse is 56/min. The patient has a severe headache and has an episode of emesis. Which of the following is the most appropriate medication for obtaining blood pressure control in this patient?

- A. Furosemide
- B. Hydralazine
- C. Labetalol
- D. Lisinopril
- E. Methyldopa
- F. Nitroprusside

**Submit**

## Item 2 of 2

During the patient's evaluation, her blood pressure increases to 170/115 mm Hg. Her pulse is 58/min. Fifteen minutes later, her blood pressure is 172/117 mm Hg and pulse is 56/min. The patient has a severe headache and has an episode of emesis. Which of the following is the most appropriate medication for obtaining blood pressure control in this patient?

- A. Furosemide (0%)
- B. Hydralazine (45%)
- C. Labetalol (35%)
- D. Lisinopril (0%)
- E. Methyldopa (15%)
- F. Nitroprusside (3%)

Omitted

Correct answer  
B45%  
Answered correctly02 secs  
Time Spent01/27/2020  
Last Updated

Explanation

Treatment of preeclampsia	

Treatment of preeclampsia	
Drug	Indication
Hydralazine IV, labetalol IV, or nifedipine PO	Lower blood pressure acutely to decrease stroke risk
Magnesium sulfate IV or IM	Prevent or treat eclamptic seizures

IM = intramuscular; IV = intravenous; PO = by mouth.

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Hypertension is a leading cause of maternal and perinatal morbidity and mortality. Severe hypertension places the mother at risk for hemorrhagic or ischemic stroke, pulmonary edema, and myocardial ischemia and can disrupt flow through the uterine arteries or lead to abruptio placentae. In pregnancy, **severe hypertension** is defined as a **systolic blood pressure  $\geq 160$  mm Hg** or **diastolic pressure  $\geq 110$  mm Hg** for  $\geq 15$  minutes. During a maternal hypertensive crisis, the initial goal is to **stabilize the mother** by administering anti-hypertension medicines. Treating the mother also benefits the fetus.

The first-line drugs for maternal hypertensive crisis include:

- Intravenous **hydralazine** – a vasodilator.
- Intravenous **labetalol** – a beta blocker with alpha-blocking activity. Intravenous labetalol is fast-acting and safe in pregnancy; however, this patient has bradycardia (pulse  $< 60$ /min), and a beta blocker such as labetalol can lower her pulse even further, resulting in dizziness or lightheadedness (**Choice C**).
- Oral **nifedipine** – a calcium channel blocker. This patient may not be able to tolerate oral medications given her emesis.

Given her bradycardia and emesis, hydralazine is the best choice for this patient.



Hypertension is a leading cause of maternal and perinatal morbidity and mortality. Severe hypertension places the mother at risk for hemorrhagic or ischemic stroke, pulmonary edema, and myocardial ischemia and can disrupt flow through the uterine arteries or lead to abruptio placentae. In pregnancy, **severe hypertension** is defined as a **systolic blood pressure  $\geq 160$  mm Hg** or **diastolic pressure  $\geq 110$  mm Hg** for  $\geq 15$  minutes. During a maternal hypertensive crisis, the initial goal is to **stabilize the mother** by administering anti-hypertension medicines. Treating the mother also benefits the fetus.

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- Oral **nifedipine** – a calcium channel blocker. This patient may not be able to tolerate oral medications given her emesis.

Given her bradycardia and emesis, hydralazine is the best choice for this patient.

**(Choice A)** Loop diuretics (eg, furosemide) lower blood pressure but can also deplete intravascular volume. They are typically used to manage pulmonary edema in patients with preeclampsia. This patient has no signs of pulmonary edema (eg, crackles, dyspnea).

**(Choice D)** ACE inhibitors (eg, lisinopril) are contraindicated in pregnancy as they can cause fetal growth restriction, renal failure, pulmonary hypoplasia, oligohydramnios, and skeletal abnormalities if administered in the second or third trimester.

**(Choice E)** Methyldopa has a long history of safety in pregnancy but is used to treat chronic hypertension rather than hypertensive emergencies. Its use is limited by its slow onset and comparative weakness, which necessitates high doses that can cause sedation.

**(Choice F)** Sodium nitroprusside is generally a last resort for the treatment of hypertension and is used with great caution due to cyanide as a metabolic byproduct.

**Educational objective:**

Maternal hypertensive crisis occurs when the systolic blood pressure is  $\geq 160$  mm Hg or the diastolic pressure is  $\geq 110$  mm Hg for  $\geq 15$  minutes.

First-line drugs for blood pressure control include hydralazine, labetalol, and nifedipine.

The following vignette applies to the next 2 items. The items in the set must be answered in sequential order. Once you click **Proceed to Next Item**, you will not be able to add or change an answer.

**Item 1 of 2**

A 35-year-old obese woman, gravida 2 para 1, at 31 weeks gestation comes to the physician with severe heartburn and right upper quadrant abdominal pain. She had experienced several episodes of nausea and vomiting this morning. The patient has had gastroesophageal reflux disease throughout the pregnancy, but the symptoms have rapidly become much worse. During her visit last week, she was fatigued and her blood pressure was 130/80 mm Hg. Current blood pressure is 160/90 mm Hg and pulse is 86/min. Physical examination shows extreme tenderness to palpation in the midline and right upper quadrant of the abdomen but absence of peritoneal signs. Fetal heart tones are audible using Doppler ultrasound. Laboratory results are as follows:

## Complete blood count

Hemoglobin	9.7 g/dL
Platelets	80,000/ $\mu$ L

## Liver function studies

Total protein	6 g/dL
Albumin	2.6 g/dL
Total bilirubin	2.2 mg/dL
Direct bilirubin	0.5 mg/dL
Alkaline phosphatase	170 U/L
Aspartate aminotransferase	112 U/L

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Direct bilirubin	0.5 mg/dL
Alkaline phosphatase	170 U/L
Aspartate aminotransferase	112 U/L
Alanine aminotransferase	124 U/L
Lipase	80 U/L (Normal < 160 U/L)

Urine dipstick shows 2+ protein. Which of the following is the most likely cause of this patient's upper abdominal pain?

- A. Cystic duct obstruction
- B. Distension of liver capsule
- C. Fatty infiltration of the liver
- D. Pancreatic inflammation
- E. Peptic ulcer perforation
- F. Rupture of a hepatic adenoma



## Liver function studies

Total protein	6 g/dL
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Aspartate aminotransferase	112 U/L
Alanine aminotransferase	124 U/L
Lipase	80 U/L (Normal < 160 U/L)

Urine dipstick shows 2+ protein. Which of the following is the most likely cause of this patient's upper abdominal pain?

- A. Cystic duct obstruction (17%)
- B. Distension of liver capsule (64%)
- C. Fatty infiltration of the liver (12%)
- D. Pancreatic inflammation (0%)
- E. Peptic ulcer perforation (2%)
- F. Rupture of a hepatic adenoma (2%)

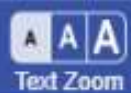
HELLP syndrome	
<b>Clinical features</b>	<ul style="list-style-type: none"> <li>• Preeclampsia</li> <li>• Nausea/vomiting</li> <li>• Right upper quadrant abdominal pain</li> </ul>
<b>Laboratory findings</b>	<ul style="list-style-type: none"> <li>• Microangiopathic hemolytic anemia</li> <li>• Elevated liver enzymes</li> <li>• Low platelet count</li> </ul>
<b>Treatment</b>	<ul style="list-style-type: none"> <li>• Delivery</li> <li>• Magnesium for seizure prophylaxis</li> <li>• Antihypertensive drugs</li> </ul>

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This patient's clinical features are most consistent with HELLP syndrome (**H**emolysis, **E**levated **L**iver enzymes, **L**ow **P**latelet count). HELLP syndrome may be a variation of severe preeclampsia and affects 10%–20% of women with preeclampsia. Serious liver problems include centrilobular necrosis, hematoma formation, and thrombi in the portal capillary system. These processes can cause liver swelling with distension of the hepatic (Glisson's) capsule, resulting in right upper quadrant or epigastric pain. The diagnosis is based on clinical presentation and laboratory findings (Table). This patient is hypertensive and has signs of hemolysis (anemia with indirect hyperbilirubinemia), elevated hepatic transaminases, and thrombocytopenia. Alkaline phosphatase is normally elevated in pregnancy.

**(Choice A)** Obstruction of the cystic duct may cause right upper quadrant pain, fever, and elevated hepatic markers. However, symptoms of thrombocytopenia and severe hypertension are more consistent with those of HELLP syndrome.

**(Choice C)** Acute fatty liver of pregnancy (AFLP) is characterized by nausea, vomiting, abdominal pain, and significant elevations of liver markers



This patient's clinical features are most consistent with HELLP syndrome (**H**emolysis, **E**levated **L**iver enzymes, **L**ow **P**latelet count). HELLP syndrome may be a variation of severe preeclampsia and affects 10%–20% of women with preeclampsia. Serious liver problems include centrilobular necrosis, hematoma formation, and thrombi in the portal capillary system. These processes can cause liver swelling with distension of the hepatic (Glisson's) capsule, resulting in right upper quadrant or epigastric pain. The diagnosis is based on clinical presentation and laboratory findings (Table). This patient is hypertensive and has signs of hemolysis (anemia with indirect hyperbilirubinemia), elevated hepatic transaminases, and thrombocytopenia. Alkaline phosphatase is normally elevated in pregnancy.

**(Choice A)** Obstruction of the cystic duct may cause right upper quadrant pain, fever, and elevated hepatic markers. However, symptoms of thrombocytopenia and severe hypertension are more consistent with those of HELLP syndrome.

**(Choice C)** Acute fatty liver of pregnancy (AFLP) is characterized by nausea, vomiting, abdominal pain, and significant elevations of liver markers in the third trimester. Many features of AFLP overlap with those of HELLP syndrome, but patients with AFLP are more likely to have additional extrahepatic complications such as leukocytosis, hypoglycemia, and acute kidney injury. Severe hypertension is less likely in AFLP than in HELLP syndrome.

**(Choice D)** Lipase is normal in this patient, making the diagnosis of pancreatitis less likely. Pain associated with pancreatitis is typically midline and radiates to the back.

**(Choice E)** Peptic ulcer perforation presents with sudden, severe epigastric pain that may become generalized. Patients will have peritonitis with abdominal rigidity on examination and may be hypotensive, which differentiates a perforated peptic ulcer from HELLP syndrome.

**(Choice F)** Rupture of a hepatic adenoma results in intraabdominal bleeding with peritonitis (tenderness and rebound) and hypotension from acute blood loss. It requires immediate surgical intervention.

#### Educational objective:

HELLP syndrome is a potential manifestation of severe preeclampsia. Right upper quadrant pain, **H**emolytic anemia, **E**levated **L**iver enzymes, and **L**ow **P**latelet count in a pregnant patient raise suspicion for the syndrome. The abdominal pain is due to liver swelling with distension of the hepatic (Glisson's) capsule.

#### References

## Item 2 of 2

The patient is admitted to the hospital, and an intravenous line and urinary catheter are placed. She receives corticosteroids to accelerate fetal lung maturity and magnesium sulfate for fetal neuroprotection. She develops dyspnea and a drop in arterial oxygen saturation 3 hours later. Her temperature is 36.7 C (98 F), blood pressure is 150/80 mm Hg, pulse is 112/min, and respirations are 24/min. The patient's pulse oximetry shows 91% on room air. Examination shows bibasilar crackles, use of accessory muscles for breathing, and 2+ pitting edema of the lower extremities; otherwise, the examination is normal. Urine output is 60 mL/hr. What is the most likely cause of this patient's respiratory symptoms?

- A. Amniotic fluid embolism
- B. Bronchospasm
- C. Magnesium sulfate toxicity
- D. Pneumonia
- E. Pulmonary edema
- F. Pulmonary embolus


**Submit**


## Item 2 of 2


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- A. Amniotic fluid embolism (7%)
- B. Bronchospasm (1%)
- C. Magnesium sulfate toxicity (20%)
- D. Pneumonia (0%)
- E. Pulmonary edema (63%)
- F. Pulmonary embolus (7%)

Omitted  
Correct answer  
E

 63%  
Answered correctly

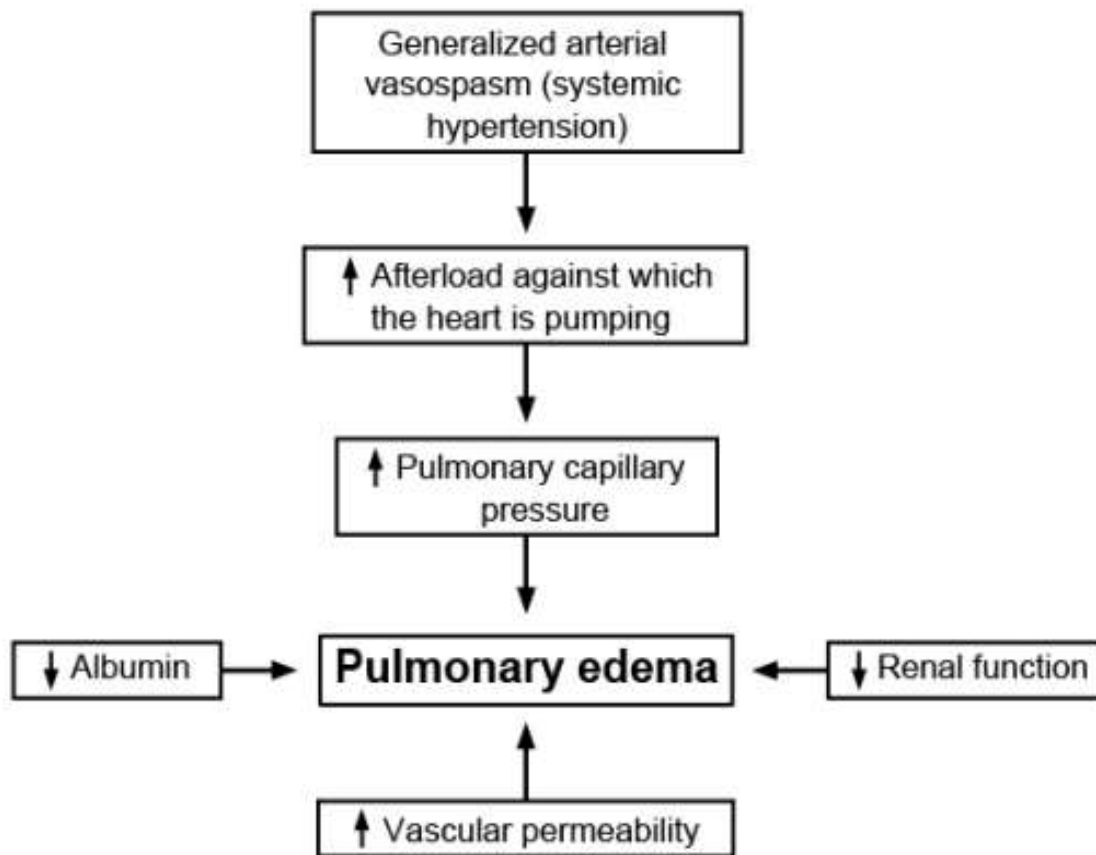
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 05/07/2020  
Last Updated

Explanation



### Pathophysiology of pulmonary edema in preeclampsia/eclampsia



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This patient's sudden-onset dyspnea, hypoxia, and crackles are most likely due to acute pulmonary edema, a rare and life-threatening complication of severe preeclampsia. Preeclamptic patients have **generalized arterial vasospasm** leading to **increased systemic vascular resistance** and **high cardiac afterload**. The heart becomes hyperdynamic to try to overcome the systemic hypertension. Additional factors that may contribute to pulmonary edema include **decreased renal function**, **decreased serum albumin**, and endothelial damage leading to



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Management includes supplemental oxygen, fluid restriction, and diuresis in severe cases. Fluid restriction and diuresis must be used with caution as plasma volume is effectively decreased through third-spacing and placental perfusion can be compromised.

**(Choice A)** Amniotic fluid embolism can cause sudden hypoxemic respiratory failure and hypotensive shock. The pathogenesis involves amniotic fluid entering into the maternal circulation during labor or delivery. This patient is not in labor, and the crackles and generalized edema are more consistent with pulmonary edema.

**(Choice B)** Bronchospasm may cause dyspnea and hypoxemia, but it usually causes wheezing instead of crackles and would likely be relieved by corticosteroids. In addition, bronchospasm is less likely to occur without a preexisting history of asthma.

**(Choice C)** Excessive magnesium sulfate can cause neuromuscular depression. Toxicity is characterized by decreased respiratory effort/apnea, muscle paralysis, somnolence, visual disturbances, and decreased or absent deep-tendon reflexes. Although pulmonary edema can occur from magnesium sulfate toxicity, the normal deep-tendon reflexes and increased respiratory effort make this etiology less likely.

**(Choice D)** Pregnant women are at increased risk for both community-acquired pneumonia from decreased cell-mediated immunity and aspiration pneumonia from increased intraabdominal pressure and a relaxed lower esophageal sphincter. Pneumonia in these settings can cause crackles and dyspnea but is usually accompanied by fever. In addition, it would not cause lower-extremity edema.

**(Choice F)** The risk for pulmonary embolus is increased in pregnancy due to increased thrombotic effects of estrogen. However, in the setting of severe preeclampsia crackles, and peripheral pitting edema, pulmonary edema is more likely.

**Educational objective:**

Pulmonary edema is a life-threatening complication of severe preeclampsia. It is caused by increased systemic vascular resistance, capillary permeability, pulmonary capillary hydrostatic pressure, and decreased albumin.