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A 65-year-old man comes to the office due to 4 weeks of persistent epigastric pain and nausea. The pain is constant and does not improve or worsen with activities, position, or diet. The patient lost approximately 4.5 kg (9.9 lb) over this period. He has no fever, vomiting, constipation, or diarrhea. He was diagnosed with type 2 diabetes mellitus 6 months ago, which is controlled with a low-carbohydrate diet. The patient has never had surgery and has no other chronic medical conditions. He has a 45-pack-year history of smoking. He does not use alcohol or illicit drugs. Temperature is 36.5 C (97.7 F), blood pressure is 122/72 mm Hg, pulse is 68/min, and respirations are 16/min. BMI is 24 kg/m^2. Mucous membranes are moist. No lymphadenopathy is present in the cervical or axillary chains. Bowel sounds are present, and the abdomen is soft with mild epigastric tenderness to deep palpation. No hepatosplenomegaly or shifting dullness is present. The remainder of the examination is normal. Complete blood count, serum chemistry, and liver function studies is all normal except a fasting blood sugar of 130 mg/dL. Which of the following is the most appropriate next step in management of this patient?

A. Abdominal ultrasound
B. CT scan of the abdomen
C. *Helicobacter pylori* stool antigen
D. Nuclear gastric emptying scan
E. Upper gastrointestinal endoscopy

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A 65-year-old man comes to the office due to 4 weeks of persistent epigastric pain and nausea. The pain is constant and does not improve or worsen with activities, position, or diet. The patient lost approximately 4.5 kg (9.9 lb) over this period. He has no fever, vomiting, constipation, or diarrhea. He was diagnosed with type 2 diabetes mellitus 6 months ago, which is controlled with a low-carbohydrate diet. The patient has never had surgery and has no other chronic medical conditions. He has a 45-pack-year history of smoking. He does not use alcohol or illicit drugs. Temperature is 36.5 C (97.7 F), blood pressure is 122/72 mm Hg, pulse is 68/min, and respirations are 16/min. BMI is 24 kg/m^2. Mucous membranes are moist. No lymphadenopathy is present in the cervical or axillary chains. Bowel sounds are present, and the abdomen is soft with mild epigastric tenderness to deep palpation. No hepatosplenomegaly or shifting dullness is present. The remainder of the examination is normal. Complete blood count, serum chemistry, and liver function studies is all normal except a fasting blood sugar of 130 mg/dL. Which of the following is the most appropriate next step in management of this patient?

- A. Abdominal ultrasound (7%)
- ✓ B. CT scan of the abdomen (54%)
- C. *Helicobacter pylori* stool antigen (3%)
- D. Nuclear gastric emptying scan (2%)
- E. Upper gastrointestinal endoscopy (31%)

Omitted
Correct answer
B

54%
Answered correctly

03 mins, 24 secs
Time Spent

04/08/2020
Last Updated

Explanation

This patient's older age, weight loss, constant epigastric pain, smoking history, and recent diagnosis of **diabetes mellitus** (DM) raise strong

This patient's older age, weight loss, constant epigastric pain, smoking history, and recent diagnosis of **diabetes mellitus** (DM) raise strong concern for **pancreatic cancer**, the fourth most common cause of cancer-related death in the United States. Major risk factors include **cigarette smoking**, chronic pancreatitis, and disorders of glucose metabolism such as insulin resistance and DM.

Approximately 25% of patients with pancreatic cancer are diagnosed with DM **<2 years prior** to discovery of the tumor. In particular, **atypical DM** (eg, DM presenting in a thin, older patient) should raise suspicion for pancreatic cancer, particularly when accompanied by other suggestive findings (eg, pain, weight loss). It is unclear whether DM promotes carcinogenesis or whether DM occurs as a consequence of a paraneoplastic syndrome from adrenomedullin secretion, leading to pancreatic beta cell dysfunction.

Screening for pancreatic cancer is not recommended in adults with new-onset diabetes because the incidence of DM is much greater than pancreatic cancer. However, those who have symptoms of pancreatic cancer such as gnawing, **constant epigastric pain** and weight loss require further evaluation with **CT scan of the abdomen**. Abdominal ultrasound is used in the initial evaluation of patients with painless jaundice, anorexia, or weight loss. However, it is not the preferred modality for screening patients who have abdominal pain without jaundice; it often misses smaller (potentially resectable) tumors; and it does not delineate tumor extension as well as CT does **(Choice A)**.

(Choices C and E) Patients with gastric/duodenal ulcers or gastric tumors often have gnawing epigastric pain that is worse several hours after meals (when the food buffer is cleared). These conditions are generally diagnosed by esophagogastroduodenoscopy followed by *Helicobacter pylori* stool antigen testing. However, peptic ulcers rarely cause constant epigastric pain or weight loss. Gastric cancer typically causes anemia (due to tumor bleeding into the stomach) and is not linked to recent-onset diabetes mellitus.

(Choice D) A nuclear gastric emptying scan can diagnose gastroparesis, which is common in patients with poorly controlled diabetes mellitus and generally presents with postprandial bloating, nausea, and early satiety. Constant abdominal pain would be atypical, and this patient's diabetes mellitus is controlled with diet.

Educational objective:
Approximately 25% of pancreatic cancer is heralded by a recent (<2 years) diagnosis of diabetes mellitus. Although screening for pancreatic cancer is not recommended for patients with new-onset diabetes mellitus, those who have symptoms (eg, constant abdominal pain, weight loss) of pancreatic cancer should undergo abdominal CT scan.

References

- Prevalence of diabetes mellitus in pancreatic cancer compared to common cancers.

findings (eg, pain, weight loss). It is unclear whether DM promotes carcinogenesis or whether DM occurs as a consequence of a paraneoplastic syndrome from adrenomedullin secretion, leading to pancreatic beta cell dysfunction.

Screening for pancreatic cancer is not recommended in adults with new-onset diabetes because the incidence of DM is much greater than pancreatic cancer. However, those who have symptoms of pancreatic cancer such as gnawing, **constant epigastric pain** and weight loss require further evaluation with **CT scan of the abdomen**. Abdominal ultrasound is used in the initial evaluation of patients with painless jaundice, anorexia, or weight loss. However, it is not the preferred modality for screening patients who have abdominal pain without jaundice; it often misses smaller (potentially resectable) tumors; and it does not delineate tumor extension as well as CT does **(Choice A)**.

(Choices C and E) Patients with gastric/duodenal ulcers or gastric tumors often have gnawing epigastric pain that is worse several hours after meals (when the food buffer is cleared). These conditions are generally diagnosed by esophagogastroduodenoscopy followed by *Helicobacter pylori* stool antigen testing. However, peptic ulcers rarely cause constant epigastric pain or weight loss. Gastric cancer typically causes anemia (due to tumor bleeding into the stomach) and is not linked to recent-onset diabetes mellitus.

(Choice D) A nuclear gastric emptying scan can diagnose gastroparesis, which is common in patients with poorly controlled diabetes mellitus and generally presents with postprandial bloating, nausea, and early satiety. Constant abdominal pain would be atypical, and this patient's diabetes mellitus is controlled with diet.

Educational objective:

Approximately 25% of pancreatic cancer is heralded by a recent (<2 years) diagnosis of diabetes mellitus. Although screening for pancreatic cancer is not recommended for patients with new-onset diabetes mellitus, those who have symptoms (eg, constant abdominal pain, weight loss) of pancreatic cancer should undergo abdominal CT scan.

References

- Prevalence of diabetes mellitus in pancreatic cancer compared to common cancers.

Surgery	Gastrointestinal & Nutrition	Pancreatic cancer
Subject	System	Topic

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A 22-year-old soccer player comes to the emergency department for evaluation of a knee injury. During practice earlier that day, the patient felt her knee buckle when planting her right foot to kick the ball. Other players on the field recalled hearing an audible pop as she fell to the ground. The patient was able to limp off the field with help and immediately placed ice on her right knee. Vital signs are normal. BMI is 22 kg/m^2. On physical examination, the right knee is grossly swollen with limited range of motion due to pain. She is guarding on examination and has increased anterior translation of the tibia on the femur as compared to the contralateral side. Which of the following is the most likely diagnosis in this patient?

A. Anterior cruciate ligament injury
B. Medial collateral ligament injury
C. Meniscal injury
D. Popliteal cyst rupture
E. Posterior cruciate ligament injury
F. Stress fracture of the tibial plateau

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- A. Anterior cruciate ligament injury (92%)
- B. Medial collateral ligament injury (0%)
- C. Meniscal injury (2%)
- D. Popliteal cyst rupture (0%)
- E. Posterior cruciate ligament injury (3%)
- F. Stress fracture of the tibial plateau (0%)

Omitted
Correct answer
A

92%
Answered correctly

01 sec
Time Spent

01/28/2020
Last Updated

Explanation

Features of anterior cruciate ligament injury	
	• Rapid deceleration or direction changes

Features of anterior cruciate ligament injury	
Injury mechanisms	• Rapid deceleration or direction changes • Pivoting on lower extremity with foot planted
Symptoms	• Pain: rapid onset, may be severe • A **"popping"** sensation at the time of injury • Significant swelling **(effusion/hemarthrosis)** • **Joint instability**
Examination findings	• Anterior laxity of tibia relative to femur (anterior drawer test, Lachman test)
Diagnosis	• Magnetic resonance imaging
Treatment	• RICE (rest, ice, compression, elevation) measures • ± Surgery

Anterior cruciate ligament (ACL) tears are common in young athletes, especially women participating in sports requiring rapid direction changes or **pivots on the lower extremity** (eg, soccer, basketball, tennis). ACL tears can also occur following a blow to the knee or significant twisting force. Patients with ACL tears typically experience an acute **"popping" sensation** in the knee, followed by **rapid onset** of effusion due to **hemarthrosis** and a feeling of instability when bearing weight.

Examination in an ACL tear shows **laxity of anterior motion** of the tibia relative to the femur. Two such maneuvers—the Lachman and anterior drawer tests—are highly sensitive (>90%) and specific for ACL injuries. The diagnosis can be confirmed on MRI.

(Choice B) Medial collateral ligament (MCL) tears may also occur in pivoting/twisting injuries or if the knee is struck from the lateral side with the foot planted. Examination shows medial knee tenderness and laxity when the foot is gently forced into abduction with the knee stationary (valgus stress test). However, MCL injuries are not usually associated with a significant joint effusion or hemarthrosis unless there is a concurrent ACL injury.

(Choice C) Meniscal tears are characterized by a subacute or chronic locking or popping sensation in the knee. However, immediate symptoms

Anterior cruciate ligament (ACL) tears are common in young athletes, especially women participating in sports requiring rapid direction changes or **pivots on the lower extremity** (eg, soccer, basketball, tennis). ACL tears can also occur following a blow to the knee or significant twisting force. Patients with ACL tears typically experience an acute **"popping" sensation** in the knee, followed by **rapid onset** of effusion due to **hemarthrosis** and a feeling of instability when bearing weight.

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(Choice C) Meniscal tears are characterized by a subacute or chronic locking or popping sensation in the knee. However, immediate symptoms may be mild, effusions typically develop slowly, and rapid hemarthrosis formation is rare.

(Choice D) Rupture of a popliteal (Baker) cyst may cause acute knee pain. However, this is more common in older adults with osteoarthritis of the knee. Patients may have swelling at the posterior knee and calf, but joint effusions and hemarthrosis are usually not present.

(Choice E) Posterior cruciate ligament injuries are often caused by hyperextension or by a blow to the anterior aspect of the proximal tibia. They are less common than ACL tears and are usually associated with little pain or alteration in range of motion.

(Choice F) Stress fractures of the tibial plateau may occur in female athletes, especially following abrupt initiation or changes in exercise regimen. However, stress fractures typically present with subacute pain and are much less common than ligament injuries.

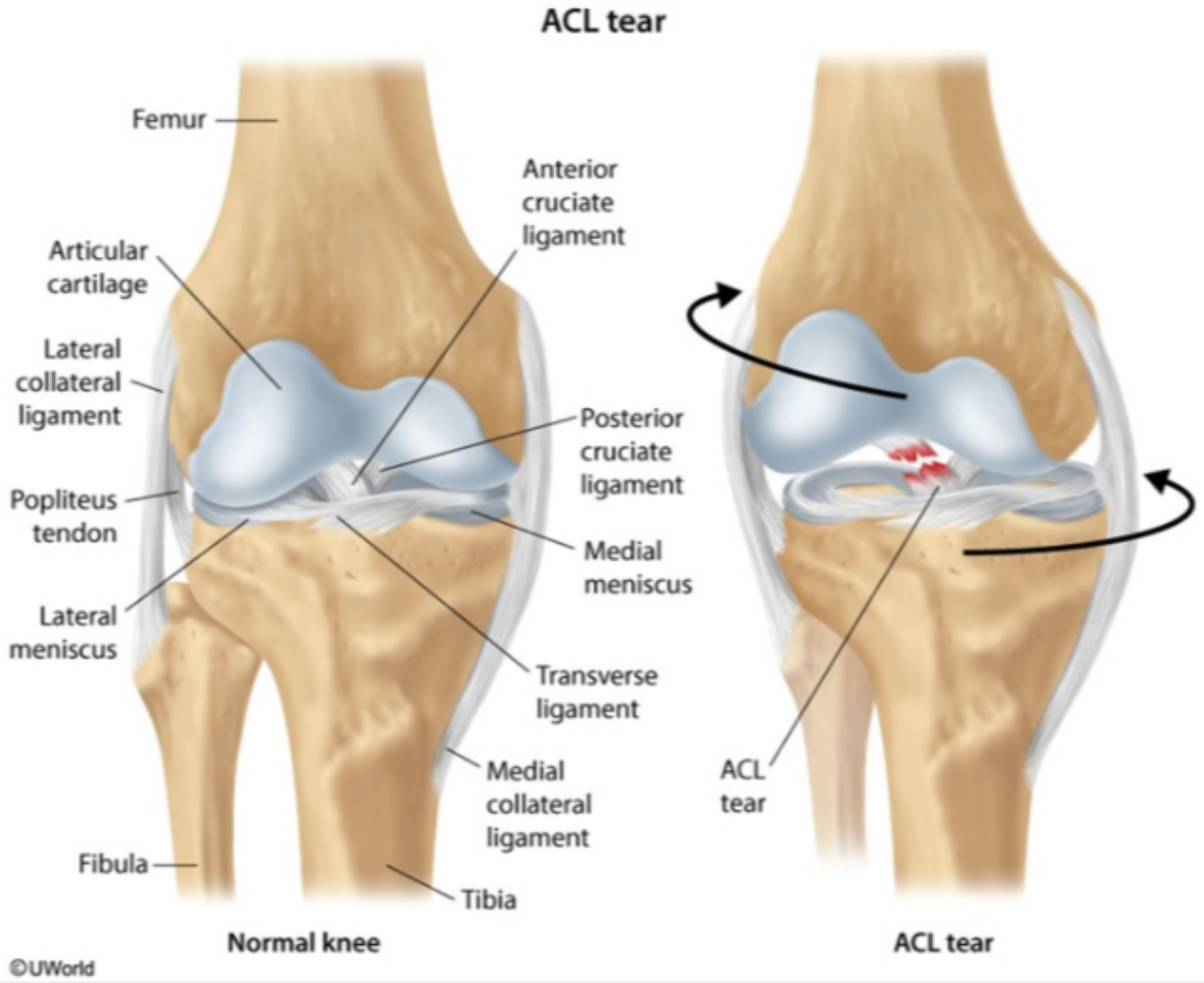
Educational objective:
Anterior cruciate ligament injuries are common in sports requiring rapid direction changes or twisting movements of the lower extremity. They usually present with rapid onset of pain and swelling with hemarthrosis. Examination findings include laxity of anterior motion of the tibia relative to the femur.

References

- Anterior cruciate ligament rupture: differences between males and females.

Anterior cruciate ligament (ACL) tears are common in young athletes, especially women participating in sports requiring rapid direction changes

Exhibit Display

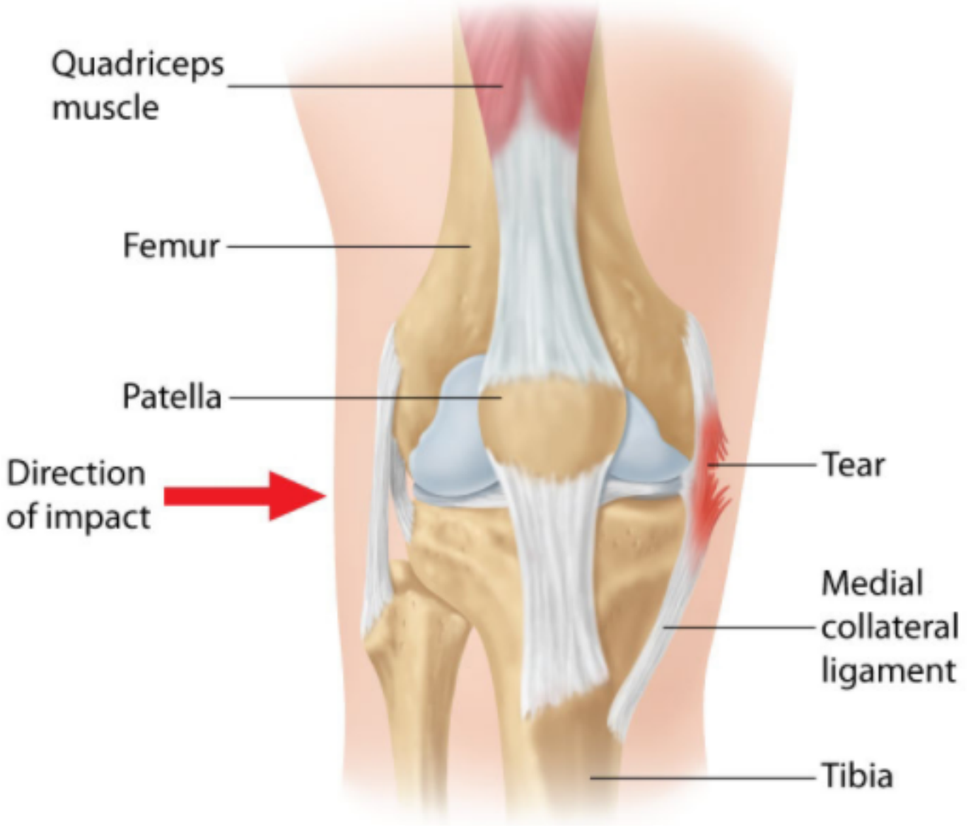


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Anterior cruciate ligament (ACL) tears are common in young athletes, especially women participating in sports requiring rapid direction changes

Exhibit Display

Medial collateral ligament injury



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Anterior cruciate ligament (ACL) tears are common in young athletes, especially women participating in sports requiring rapid direction changes or **pivots on the lower extremity** (eg, soccer, basketball, tennis). ACL tears can also occur following a blow to the knee or significant twisting force. Patients with ACL tears typically experience an acute **"popping" sensation** in the knee, followed by **rapid onset** of effusion due to **hemarthrosis** and a feeling of instability when bearing weight.

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(Choice F) Stress fractures of the tibial plateau may occur in female athletes, especially following abrupt initiation or changes in exercise regimen. However, stress fractures typically present with subacute pain and are much less common than ligament injuries.

Educational objective:
Anterior cruciate ligament injuries are common in sports requiring rapid direction changes or twisting movements of the lower extremity. They usually present with rapid onset of pain and swelling with hemarthrosis. Examination findings include laxity of anterior motion of the tibia relative to the femur.

References

- Anterior cruciate ligament rupture: differences between males and females.

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A 65-year-old man comes to the office due to 4 months of abdominal pain, nausea, and occasional emesis. The pain is deep, mid-epigastric, persistent, and non-radiating. There is no consistent relationship between the pain and food intake. He has no difficulty swallowing, hematemesis, black stools, blood in the stool, or diarrhea. The patient thinks he may have lost weight recently. He emigrated to the United States from China 20 years ago but frequently travels to China to visit family. He has no significant medical or surgical history. The patient does not use tobacco, alcohol, or illicit drugs. Temperature is 36.9 C (98.4 F), blood pressure is 110/78 mm Hg, pulse is 78/min, and respirations are 16/min. BMI is 20 kg/m^2. Heart and lung sounds are normal. The upper abdomen is mildly tender to palpation but nondistended. Hepatomegaly is present. Bowel sounds are normoactive. Laboratory results are as follows:

Complete blood count	
Hemoglobin	7.8 g/dL
Mean corpuscular volume	72 µm^3
Platelets	380,000/mm^3
Leukocytes	8,100/mm^3
Neutrophils	60%
Eosinophils	1%
Lymphocytes	29%
Liver function studies	
Total bilirubin	0.6 g/dL
Albumin	2.8 g/dL
Alkaline phosphatase	182 U/L
Aspartate aminotransferase (SGOT)	74 U/L

Lymphocytes	29%

Liver function studies

Total bilirubin	0.6 g/dL
Albumin	2.8 g/dL
Alkaline phosphatase	182 U/L
Aspartate aminotransferase (SGOT)	74 U/L
Alanine aminotransferase (SGPT)	64 U/L
Lipase	55 U/L (normal: 5-70 U/L)

Laboratory testing last year was normal. Which of the following is most likely causing this patient's symptoms?

A. Chronic pancreatitis
B. Chronic viral hepatitis
C. Duodenal peptic ulcer
D. Gastric cancer
E. Hookworm infection
F. Pancreatic cancer

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Lymphocytes	29%

Liver function studies

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Alkaline phosphatase	182 U/L
Aspartate aminotransferase (SGOT)	74 U/L
Alanine aminotransferase (SGPT)	64 U/L
Lipase	55 U/L (normal: 5-70 U/L)

Laboratory testing last year was normal. Which of the following is most likely causing this patient's symptoms?

A. Chronic pancreatitis (3%)
B. Chronic viral hepatitis (21%)
C. Duodenal peptic ulcer (2%)
✓ D. Gastric cancer (41%)
E. Hookworm infection (16%)
F. Pancreatic cancer (14%)

Omitted
Correct answer

41%
Answered correctly

06 secs
Time Spent

04/26/2020
Last Updated

This patient's persistent mid-epigastric abdominal pain, nausea/vomiting, weight loss, and microcytic anemia (likely iron deficiency) raises concern for **gastric cancer**. Risk is greatest in those from Eastern Asia (eg, **China**), Eastern Europe, and the Andean portion of South America due to diets rich in salt-preserved food and nitroso compounds, which promote gastric injury and carcinogenesis. *Helicobacter pylori* infection, pernicious anemia, and smoking also increase risk.

Most cases present late in the disease course when tumors have grown large enough to cause progressive **epigastric abdominal pain**, weight loss due to early satiety, and dysphagia or nausea/vomiting due to proximal stomach obstruction. Because friable tumor vessels often ooze blood into the gastric lumen, many patients develop **iron deficiency anemia** without overt signs of gastrointestinal bleeding ("slow bleed"). Metastases to the liver can also cause **hepatomegaly**, elevated alkaline phosphatase/transaminases, and signs of liver failure (eg, hypoalbuminemia).

Workup generally begins with esophagogastroduodenoscopy to visualize the stomach and to biopsy suspicious lesions. Staging imaging (eg, CT abdomen) is then usually required to evaluate for metastatic disease.

(Choice A) Chronic pancreatitis often causes epigastric pain and nausea/vomiting, but the pain usually radiates to the back and is worse after eating. Most cases arise in those who abuse alcohol or have structural abnormalities in the pancreas. Hepatomegaly and microcytic anemia are rare.

(Choice B) Chronic viral hepatitis is endemic in Asia and often causes nausea, weight loss, and mild transaminitis. However, epigastric pain, emesis, and microcytic anemia are atypical.

(Choice C) Duodenal ulcers often cause epigastric pain and nausea and vomiting (when they obstruct the gastric outlet). However, pain typically occurs 2-5 hours after a meal (when acid is secreted and no food is present to buffer its effects). Furthermore, hepatomegaly and elevated alkaline phosphatase/transaminases would be atypical.

(Choice E) Hookworm infections often cause abdominal pain, nausea/vomiting, and microcytic anemia due to chronic gastrointestinal blood loss. However, hepatomegaly and elevated alkaline phosphatase/transaminases are uncommon. In addition, most cases are associated with peripheral eosinophilia (total peripheral eosinophils >7% or >500/mm^3).

(Choice F) Pancreatic cancer often presents with subacute epigastric pain that radiates to the flanks/back, weight loss, and nausea. Although pancreatic head tumors can obstruct biliary drainage and lead to elevated transaminases and alkaline phosphatase, most obstructions also cause hyperbilirubinemia and jaundice. Furthermore, microcytic (iron deficiency) anemia in an elderly patient is more likely due to colon or gastric cancer

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(Choice E) Hookworm infections often cause abdominal pain, nausea/vomiting, and microcytic anemia due to chronic gastrointestinal blood loss. However, hepatomegaly and elevated alkaline phosphatase/transaminases are uncommon. In addition, most cases are associated with peripheral eosinophilia (total peripheral eosinophils >7% or >500/mm^3).

(Choice F) Pancreatic cancer often presents with subacute epigastric pain that radiates to the flanks/back, weight loss, and nausea. Although pancreatic head tumors can obstruct biliary drainage and lead to elevated transaminases and alkaline phosphatase, most obstructions also cause hyperbilirubinemia and jaundice. Furthermore, microcytic (iron deficiency) anemia in an elderly patient is more likely due to colon or gastric cancer than to pancreatic cancer, which does not typically bleed into the gastrointestinal tract.

Educational objective:
Gastric cancer is common in those from Eastern Asia, Eastern Europe, and South America. It generally presents with progressive epigastric pain and weight loss. Friable tumor vessels can bleed into the stomach lumen, leading to iron deficiency anemia. Metastasis to the liver can result in hepatomegaly and elevated transaminases and alkaline phosphatase.

References

- Cancer of the stomach. A patient care study by the American College of Surgeons.
- Cancer statistics in China, 2015.
- Metastatic spread in patients with gastric cancer.

Surgery	Gastrointestinal & Nutrition	Gastric cancer
Subject	System	Topic

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A 20-year-old college football player is brought to the emergency department due to fever and worsening abdominal and right flank pain. The day prior, he received a direct blow to the central upper abdomen during a tackle and had to sit out the rest of practice. The patient also has nausea but no emesis or diarrhea. He has no chronic medical conditions. Temperature is 39.4 C (102.9 F). Blood pressure is 100/64 mm Hg, pulse is 112/min, and respirations are 18/min. Heart and lung sounds are normal. The abdomen is diffusely tender with guarding over the epigastrium. Abdominal imaging reveals free air in the retroperitoneum. Which of the following is the most likely diagnosis for this patient?

A. Duodenal tear
B. Gastric rupture
C. Renal pelvis laceration
D. Transverse colon perforation
E. Traumatic pancreatitis

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- ✓ A. Duodenal tear (54%)
- B. Gastric rupture (5%)
- C. Renal pelvis laceration (9%)
- D. Transverse colon perforation (12%)
- E. Traumatic pancreatitis (18%)

Omitted
Correct answer
A

54%
Answered correctly

01 sec
Time Spent

01/31/2020
Last Updated

Explanation

Approximately 1 day after sustaining blunt abdominal trauma (BAT), this patient has fever, diffuse abdominal tenderness with epigastric guarding, and **retroperitoneal free air** on imaging. This delayed presentation is concerning for a **perforated viscus** within the retroperitoneum, such as a duodenal tear.

When a hollow viscus (eg, duodenum, ascending or descending colon) perforates within the **retroperitoneum**, **gastrointestinal spillage** may be initially **sequestered** away from the intraperitoneal space (which is separated from the retroperitoneum by the posterior peritoneal lining). This

Approximately 1 day after sustaining blunt abdominal trauma (BAT), this patient has fever, diffuse abdominal tenderness with epigastric guarding, and **retroperitoneal free air** on imaging. This delayed presentation is concerning for a **perforated viscus** within the retroperitoneum, such as a duodenal tear.

When a hollow viscus (eg, duodenum, ascending or descending colon) perforates within the **retroperitoneum**, **gastrointestinal spillage** may be initially **sequestered** away from the intraperitoneal space (which is separated from the retroperitoneum by the posterior peritoneal lining). This may **delay** the development of classic **symptoms** and signs of perforation (eg, fever, diffuse abdominal pain), as in this patient. In addition, back or flank pain (eg, right flank pain) may be present due to retroperitoneal inflammation.

Aspects of **duodenal** anatomy that increase the duodenum's susceptibility to **perforation** include:

- Its location anterior to the vertebral column: compression against the vertebral column during BAT can rapidly increase intraluminal pressure, causing rupture.
- Its multiple attachments (eg, hepatoduodenal ligament, ligament of Treitz): abrupt force against the duodenum can cause duodenal tearing at fixed points of attachment rather than stretching.

Duodenal perforation is typically treated with surgical repair.

(Choices B and D) The stomach and transverse colon are also susceptible to rupture from rapid change in intraluminal pressure during BAT. However, both are intraperitoneal (vs retroperitoneal) structures. Therefore, intraperitoneal free air (eg, free air under the diaphragm on chest x-ray) would be expected on imaging (vs retroperitoneal free air seen in this patient).

(Choices C and E) BAT can injure the pancreas or kidney, causing spillage of pancreatic enzymes or urine into the retroperitoneal space. Although both renal pelvis laceration and traumatic pancreatitis could result in a delayed presentation of abdominal and right flank pain, they would typically cause free fluid rather than free air on imaging.

Educational objective:
Rapid compression of the bowel during blunt abdominal trauma can cause a perforated viscus. When viscus perforation occurs within the retroperitoneum (eg, duodenal tear), classic symptoms and signs (eg, fever, diffuse abdominal pain) may be delayed. Retroperitoneal free air may be present on abdominal imaging.

References

- Western Trauma Association critical decisions in trauma: diagnosis and management of duodenal injuries

Aspects of **duodenal** anatomy that increase the duodenum's susceptibility to **perforation** include:

- Its location anterior to the vertebral column: compression against the vertebral column during BAT can rapidly increase intraluminal pressure, causing rupture.
- Its multiple attachments (eg, hepatoduodenal ligament, ligament of Treitz): abrupt force against the duodenum can cause duodenal tearing at fixed points of attachment rather than stretching.

Duodenal perforation is typically treated with surgical repair.

(Choices B and D) The stomach and transverse colon are also susceptible to rupture from rapid change in intraluminal pressure during BAT. However, both are intraperitoneal (vs retroperitoneal) structures. Therefore, intraperitoneal free air (eg, free air under the diaphragm on chest x-ray) would be expected on imaging (vs retroperitoneal free air seen in this patient).

(Choices C and E) BAT can injure the pancreas or kidney, causing spillage of pancreatic enzymes or urine into the retroperitoneal space. Although both renal pelvis laceration and traumatic pancreatitis could result in a delayed presentation of abdominal and right flank pain, they would typically cause free fluid rather than free air on imaging.

Educational objective:
Rapid compression of the bowel during blunt abdominal trauma can cause a perforated viscus. When viscus perforation occurs within the retroperitoneum (eg, duodenal tear), classic symptoms and signs (eg, fever, diffuse abdominal pain) may be delayed. Retroperitoneal free air may be present on abdominal imaging.

References

- Western Trauma Association critical decisions in trauma: diagnosis and management of duodenal injuries.
- Diagnosis and management of duodenal perforations: a narrative review.

Surgery	Gastrointestinal & Nutrition	Blunt abdominal trauma
Subject	System	Topic

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Aspects of **duodenal** anatomy that increase the duodenum's susceptibility to **perforation** include:

- Its location anterior
  pressure, causing r
- Its multiple attachm
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Duodenal perforation is ty

(Choices B and D) The s
However, both are intrape
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Educational objective:
Rapid compression of the
retroperitoneum (eg, duod
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References

- Western Trauma Asso
- Diagnosis and manag

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Exhibit Display

Retroperitoneal abdominal organs

- **S**uprarenal (adrenal) glands
- **A**orta & inferior vena cava
- **D**uodenum* (except 1st part)
- **P**ancreas* (head & body)
- **U**reters
- **C**olon* (ascending & descending)
- **K**idneys
- **E**sophagus
- **R**ectum (mid-distal)

Mnemonic: **SAD PUCKER**

*Secondarily retroperitoneal (developed intraperitoneal & migrated retroperitoneal).

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An 18-year-old football player is brought to the emergency department due to persistent pain following a hard tackle. The patient had just caught a pass when he was tackled from the front, with the opponent landing all his weight on the patient's abdomen. Immediately afterward, he began to experience abdominal discomfort and nausea. Blood pressure is 92/64 mm Hg, pulse is 118/min, and respirations are 24/min. The patient is alert but appears anxious. Bilateral breath sounds are clear and equal. Heart sounds are normal without murmur. The abdomen is mildly distended and tender to palpation diffusely. Chest x-ray and pelvic x-ray are normal. Focused Assessment with Sonography for Trauma reveals intraperitoneal free fluid. Further evaluation of this patient is most likely to reveal which of the following?

A. Abdominal aortic tear
B. Bladder rupture
C. Diaphragmatic tear
D. Duodenal hematoma
E. Pancreatic transection
F. Splenic laceration

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A. Abdominal aortic tear (4%)
B. Bladder rupture (4%)
C. Diaphragmatic tear (0%)
D. Duodenal hematoma (7%)
E. Pancreatic transection (4%)
✓ F. Splenic laceration (78%)

Omitted
Correct answer
F

78%
Answered correctly

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Time Spent

04/28/2020
Last Updated

Explanation

This patient with blunt abdominal trauma (BAT) now has a distended and diffusely tender abdomen, **intraperitoneal free fluid** on Focused Assessment with Sonography for Trauma (FAST), and signs of hypovolemic **shock** (eg, tachycardia, hypotension). This presentation is concerning for **intraabdominal hemorrhage**, most likely due to splenic laceration.

This patient with blunt abdominal trauma (BAT) now has a distended and diffusely tender abdomen, **intraperitoneal free fluid** on Focused Assessment with Sonography for Trauma (FAST), and signs of hypovolemic **shock** (eg, tachycardia, hypotension). This presentation is concerning for **intraabdominal hemorrhage**, most likely due to splenic laceration.

The **spleen** is one of the most frequently injured organs in BAT, with the spectrum of injury ranging from contusion or subcapsular hematoma to **laceration** with life-threatening, intraperitoneal bleeding (due to the spleen's high vascularity). Management depends on the patient's hemodynamic status following resuscitation.

In patients who are hemodynamically stable enough to undergo further imaging, CT scan of the abdomen and pelvis with intravenous contrast is ideal for visualizing the extent of injury and diagnosing ongoing bleeding (eg, contrast extravasation). Often, blunt splenic injury can be managed nonoperatively (eg, observation with serial hemoglobin measurement, embolization). However, continued hemodynamic instability (eg, despite initial resuscitation) or frank peritonitis are indications for exploratory laparotomy and potential splenectomy.

(Choice A) Abdominal aortic injuries due to BAT are rare (<1%). Many patients with traumatic aortic injury die from exsanguination before reaching the hospital. Those who survive (because bleeding has been contained within the retroperitoneum) typically would not have a large amount of intraperitoneal free fluid on FAST.

(Choice B) Urinary bladder rupture from BAT can cause intraperitoneal free fluid (ie, urine) on FAST. However, shock is uncommon, and difficulty voiding and/or gross hematuria are typically present.

(Choice C) Diaphragmatic tearing can occur from BAT due to a sudden increase in intraabdominal pressure. However, this does not typically cause significant bleeding (eg, shock, intraperitoneal free fluid). In addition, chest x-ray often reveals elevated hemidiaphragm or intrathoracic migration of abdominal contents.

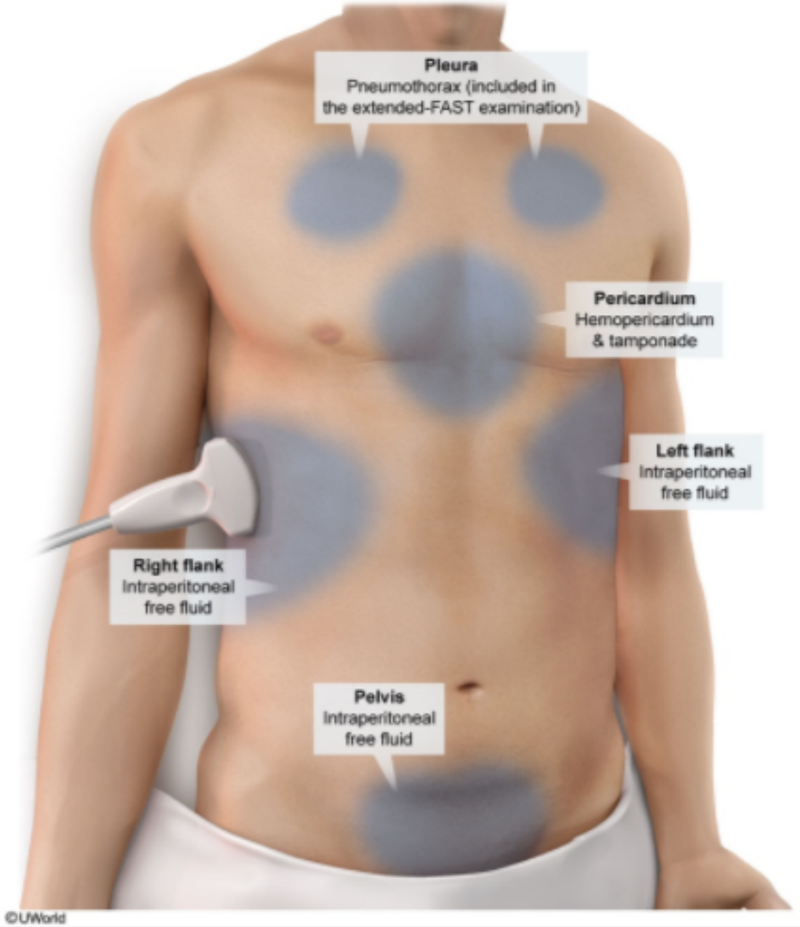
(Choices D and E) Rapid compression of the upper abdomen against the vertebral column can crush the duodenum or pancreas, potentially causing duodenal hematoma or pancreatic transection. However, duodenal hematoma does not cause intraperitoneal free fluid because bleeding remains confined within the duodenal wall. Likewise, pancreatic transection does not cause an acute effusion of intraperitoneal fluid; even with leakage of pancreatic juice (ie, ductal injury), formation of a large, ultrasound-detectable peripancreatic fluid collection (eg, pseudocyst) typically takes days to weeks.

Educational objective:

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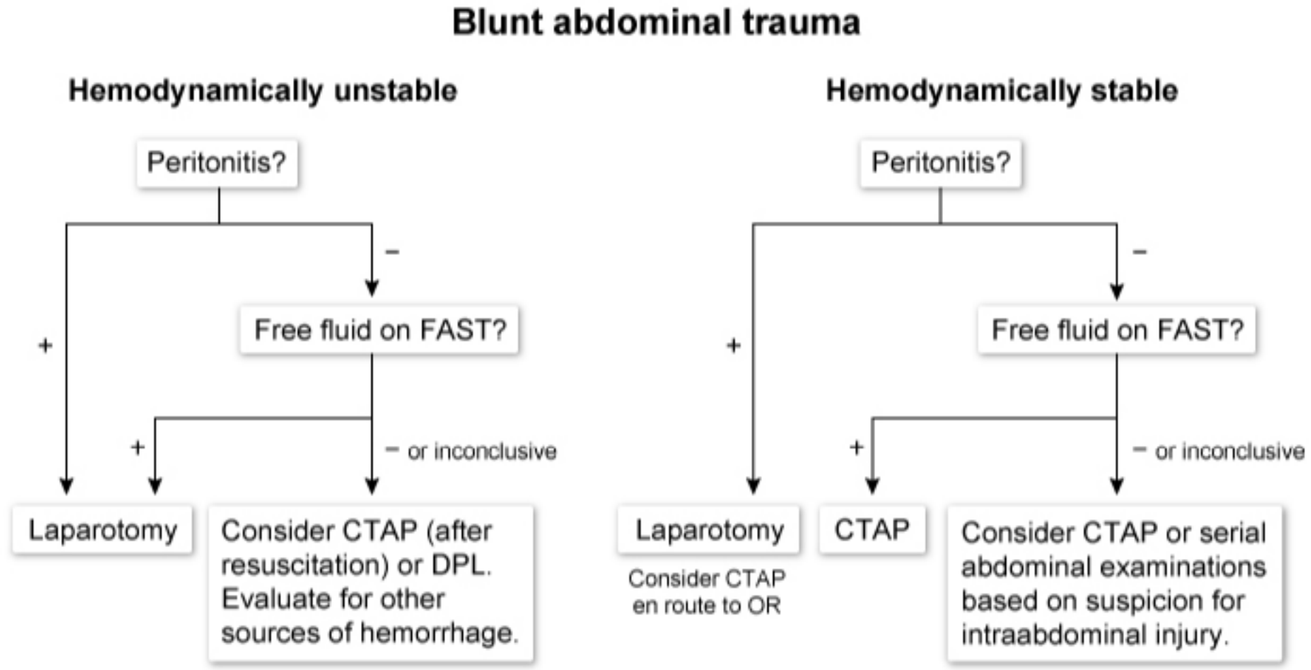
Focused Assessment with Sonography for Trauma (FAST)



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Educational objective:

Exhibit Display



CTAP = CT scan of the abdomen & pelvis; **DPL** = diagnostic peritoneal lavage;
FAST = Focused Assessment with Sonography for Trauma; **OR** = operating room.

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Educational objective:

In patients who are hemodynamically stable enough to undergo further imaging, CT scan of the abdomen and pelvis with intravenous contrast is ideal for visualizing the extent of injury and diagnosing ongoing bleeding (eg, contrast extravasation). Often, blunt splenic injury can be managed nonoperatively (eg, observation with serial hemoglobin measurement, embolization). However, continued hemodynamic instability (eg, despite initial resuscitation) or frank peritonitis are indications for exploratory laparotomy and potential splenectomy.

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(Choices D and E) Rapid compression of the upper abdomen against the vertebral column can crush the duodenum or pancreas, potentially causing duodenal hematoma or pancreatic transection. However, duodenal hematoma does not cause intraperitoneal free fluid because bleeding remains confined within the duodenal wall. Likewise, pancreatic transection does not cause an acute effusion of intraperitoneal fluid; even with leakage of pancreatic juice (ie, ductal injury), formation of a large, ultrasound-detectable peripancreatic fluid collection (eg, pseudocyst) typically takes days to weeks.

Educational objective:
The spleen is one of the most commonly injured organs in blunt abdominal trauma. Patients with severe splenic laceration causing intraabdominal hemorrhage may have shock and intraperitoneal free fluid on Focused Assessment with Sonography for Trauma.

References

- Splenic trauma: WSES classification and guidelines for adult and pediatric patients.
- An update on nonoperative management of the spleen in adults.

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A 64-year-old man undergoes an emergency colonic resection for extensive ischemic colitis. He lives alone and consumes large amounts of alcohol. His family history is noncontributory. The patient is extubated on the 4th postoperative day. After extubation, he has episodes of confusion and agitation treated with lorazepam and haloperidol. He is also receiving piperacillin with tazobactam. The patient has had nothing by mouth since the surgery. On postoperative day 7, the nurse notices bleeding from a venipuncture site. His temperature is 36.7 C (98 F), blood pressure is 121/76 mm Hg, pulse is 80/min, and respirations are 16/min. Laboratory results are as follows:

Hemoglobin	11.5 g/dL
Mean corpuscular volume	88 fL
Platelets	160,000/μL
Leukocytes	7,500/μL
Segmented neutrophils	68%
Bands	1%
Eosinophils	1%
Lymphocytes	24%
Monocytes	6%
Prothrombin time	24 sec (INR 2.2)
Partial thromboplastin time	44 sec (normal 25-40)

Which of the following is the most likely cause of this patient's current condition?

A. Acute disseminated intravascular coagulation
B. Factor V Leiden

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Segmented neutrophils	68%
Bands	1%
Eosinophils	1%
Lymphocytes	24%
Monocytes	6%
Prothrombin time	24 sec (INR 2.2)
Partial thromboplastin time	44 sec (normal 25-40)

Which of the following is the most likely cause of this patient's current condition?

A. Acute disseminated intravascular coagulation
B. Factor V Leiden
C. Factor VIII deficiency
D. Hypersplenism
E. Lupus anticoagulant
F. Thrombotic thrombocytopenic purpura
G. Vitamin K deficiency
H. von Willebrand disease

Submit

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Bands	1%
Eosinophils	1%
Lymphocytes	24%
Monocytes	6%
Prothrombin time	24 sec (INR 2.2)
Partial thromboplastin time	44 sec (normal 25-40)

Which of the following is the most likely cause of this patient's current condition?

A. Acute disseminated intravascular coagulation (28%)
B. Factor V Leiden (2%)
C. Factor VIII deficiency (2%)
D. Hypersplenism (0%)
E. Lupus anticoagulant (0%)
F. Thrombotic thrombocytopenic purpura (2%)
✓ G. Vitamin K deficiency (60%)
H. von Willebrand disease (2%)

Omitted
Correct answer

60%
Answered correctly

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This patient's clinical presentation suggests an acquired bleeding disorder, most likely due to **vitamin K deficiency**. Vitamin K is a fat-soluble vitamin that plays an important role in hemostasis by serving as a cofactor in the enzymatic carboxylation of glutamic acid residues on prothrombin complex proteins. The body obtains vitamin K exogenously from intestinal absorption of dietary Vitamin K and endogenously from bacterial production of vitamin K in the intestine. Vitamin K deficiency is most commonly due to inadequate dietary intake, intestinal malabsorption, or hepatocellular disease causing loss of storage sites. The liver can normally store a 30-day supply of vitamin K, but an acutely ill person with underlying liver disease can become vitamin K deficient in as little as 7-10 days.

This patient received no enteral nutrition postoperatively and was given a broad-spectrum antibiotic, and so both natural sources of vitamin K were compromised. In addition, he also likely has alcoholic liver disease, further limiting his vitamin K stores. Vitamin K deficiency decreases plasma levels of all the prothrombin complex proteins (factors 2, 7, 9, 10, and protein C and S). This initially increases the prothrombin time (PT), followed by prolongation of the partial thromboplastin time (PTT). Administration of vitamin K rapidly replenishes the stores in 8-10 hours, and fresh frozen plasma may be used for the management of acute hemorrhage in the interim.

(Choice A) Disseminated intravascular coagulation causes depletion of clotting factors and secondary fibrinolysis. This causes bleeding, acute kidney and liver injury, hypotension, and tachycardia. Testing shows thrombocytopenia, prolonged PT and PTT, decreased fibrinogen, and schistocytes on peripheral smear. Although this patient's PT and PTT are prolonged, he is hemodynamically stable and has a normal platelet count.

(Choices B and E) Lupus anticoagulant (LAC) is an antiphospholipid antibody that prolongs the PTT during diagnostic testing. However, patients with LAC are actually hypercoagulable with increased risk for venous thrombosis. Factor V Leiden causes a hypercoagulable state due to activated protein C resistance. This patient's increased bleeding makes these unlikely.

(Choice C) Factor VIII deficiency is an X-linked inherited plasma coagulation disorder that primarily prolongs the PTT. It would usually be apparent earlier in life.

(Choice D) Hypersplenism can occur in patients with cirrhosis, portal hypertension, and splenomegaly. Splenic sequestration leads to thrombocytopenia, and patients rarely develop clinical bleeding or prolonged PT/PTT.

(Choice F) Thrombotic thrombocytopenic purpura is a rare form of consumptive thrombocytopenia caused by widespread platelet thrombi that form in the microcirculation. It typically presents with thrombocytopenia, microangiopathic hemolytic anemia, fever, and neurologic findings (eg,

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(Choice H) von Willebrand disease is the most frequently diagnosed inherited bleeding disorder in adults. Laboratory testing usually shows increased bleeding time and PTT. However, the PT will be normal.

Educational objective:
Vitamin K deficiency is usually due to inadequate dietary intake, intestinal malabsorption, or hepatocellular disease. An acutely ill patient with underlying liver disease can become vitamin K deficient in 7-10 days. Laboratory studies usually show prolonged prothrombin time followed by prolonged partial thromboplastin time.

Surgery	Hematology & Oncology	Vitamin k deficiency
Subject	System	Topic

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The following vignette applies to the next 2 items

A 34-year-old male immigrant from Mexico is brought to the emergency department after coughing up foamy sputum with a "significant" amount of bright-red blood. His clothes are stained red, but he is not currently having any coughing spells. He has no recent trauma and no other medical problems. He takes no medications. His blood pressure is 112/63 mm Hg, pulse is 97/min, and respirations are 16/min. Pulse oximetry shows 95% on room air. The patient is mildly agitated. Breath sounds are audible bilaterally with some expiratory wheezing on the right side. Intravenous fluids are initiated, and the patient is placed on supplemental oxygen. Portable chest x-ray shows a dense opacity in the right upper lobe.

Item 1 of 2

Which of the following is the best initial step in management of this patient?

- A. Administer broad-spectrum antibiotics
- B. Obtain bronchoscopic evaluation
- C. Order CT scan of the chest with contrast
- D. Perform endotracheal intubation
- E. Place the patient in respiratory isolation

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Item 1 of 2

Which of the following is the best initial step in management of this patient?

A. Administer broad-spectrum antibiotics (3%)
B. Obtain bronchoscopic evaluation (6%)
C. Order CT scan of the chest with contrast (9%)
D. Perform endotracheal intubation (1%)
✓ E. Place the patient in respiratory isolation (78%)

Omitted
Correct answer
E

78%
Answered correctly

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Explanation

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Although there are several possible etiologies for the presence of hemoptysis, this patient's presentation (coming from an endemic area, symptoms, and upper-lobe involvement) is suggestive of **pulmonary tuberculosis**. Tuberculosis typically has radiographic abnormalities (eg, patchy or nodular opacity, multiple nodules, cavity) involving the apical-posterior segments of the upper lobes of the lungs. This patient is now stable, and the next step is to place him in complete **respiratory isolation** to avoid further exposure to healthcare professionals and other individuals. Respiratory isolation should be continued until the diagnosis of tuberculosis can be confirmed or refuted by additional testing (eg, acid-fast bacilli smear and culture).

(Choice A) Broad-spectrum antibiotics are indicated for the treatment of pneumonia, but this patient's abnormal chest x-ray and presentation are more concerning for tuberculosis. The most appropriate next step should be to place him in respiratory isolation.

(Choice B) Bronchoscopy should be performed to directly visualize and control the site of bleeding in patients with massive hemoptysis (>600 mL/day or 100 mL/hr). This patient is stable, and sputum analysis would be the next appropriate step.

(Choice C) Chest CT scan is useful in subsequent diagnostic workup and therapeutic planning for evaluation of other possible causes. However, this patient first needs respiratory isolation and sputum analysis to confirm the diagnosis of pulmonary tuberculosis.

(Choice D) Endotracheal intubation should be performed to protect the airway in patients with hemoptysis who are hemodynamically unstable or have poor gas exchange, severe dyspnea, or massive hemoptysis. It is not indicated in this patient at this time.

Educational objective:
Patients with hemoptysis and high clinical suspicion for pulmonary tuberculosis should be placed in respiratory isolation to prevent the spread of infection before further diagnostic evaluation and treatment.

References

- Changing spectrum of hemoptysis. Underlying causes in 148 patients undergoing diagnostic flexible fiberoptic bronchoscopy.
- Massive hemoptysis. Assessment and management.

Surgery	Pulmonary & Critical Care	Hemoptysis
Subject	System	Topic

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(Choice B) Bronchoscop mL/day or 100 mL/hr). Th

(Choice C) Chest CT sca this patient first needs res

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Educational objective:
Patients with hemoptysis a infection before further dia

References

- Changing spectrum of
- Massive hemoptysis. A

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Causes of hemoptysis	
Pulmonary	• Bronchitis • Lung cancer • Bronchiectasis
Cardiac	• Mitral stenosis/acute pulmonary edema
Infectious	• Tuberculosis • Lung abscess • Bacterial pneumonia • Aspergillosis
Hematologic	• Coagulopathy
Vascular	• Pulmonary embolism • Arteriovenous malformation
Systemic disease	• Granulomatosis with polyangiitis • Goodpasture syndrome
Other	• Trauma • Cocaine use (inhalation)

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- Massive hemoptysis. Assessment and management.

Surgery	Pulmonary & Critical Care	Hemoptysis
Subject	System	Topic

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Item 2 of 2

The patient's initial laboratory results are as follows:

Leukocytes	12,500/mm^3
Hemoglobin	10.5 g/dL
Platelets	225,000/mm^3
Creatinine	1.2 mg/dL
International Normalized Ratio	1.1

While in the emergency department, the patient has an episode of coughing and shortness of breath. He brings up approximately 600 mL of blood. His blood pressure is 105/61 mm Hg and pulse is 122/min. He is intubated, and fresh blood fills the endotracheal tube. Which of the following is the most appropriate next step in management of this patient?

A. Bronchoscopy
B. CT scan of the chest with contrast
C. Fresh frozen plasma infusion
D. Pulmonary arteriography
E. Urgent thoracotomy

Submit

Item 2 of 2

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Hemoglobin	10.5 g/dL
Platelets	225,000/mm^3
Creatinine	1.2 mg/dL
International Normalized Ratio	1.1

While in the emergency department, the patient has an episode of coughing and shortness of breath. He brings up approximately 600 mL of blood. His blood pressure is 105/61 mm Hg and pulse is 122/min. He is intubated, and fresh blood fills the endotracheal tube. Which of the following is the most appropriate next step in management of this patient?

- ✓ A. Bronchoscopy (46%)
- B. CT scan of the chest with contrast (4%)
- C. Fresh frozen plasma infusion (8%)
- D. Pulmonary arteriography (8%)
- E. Urgent thoracotomy (32%)

Omitted
Correct answer
A

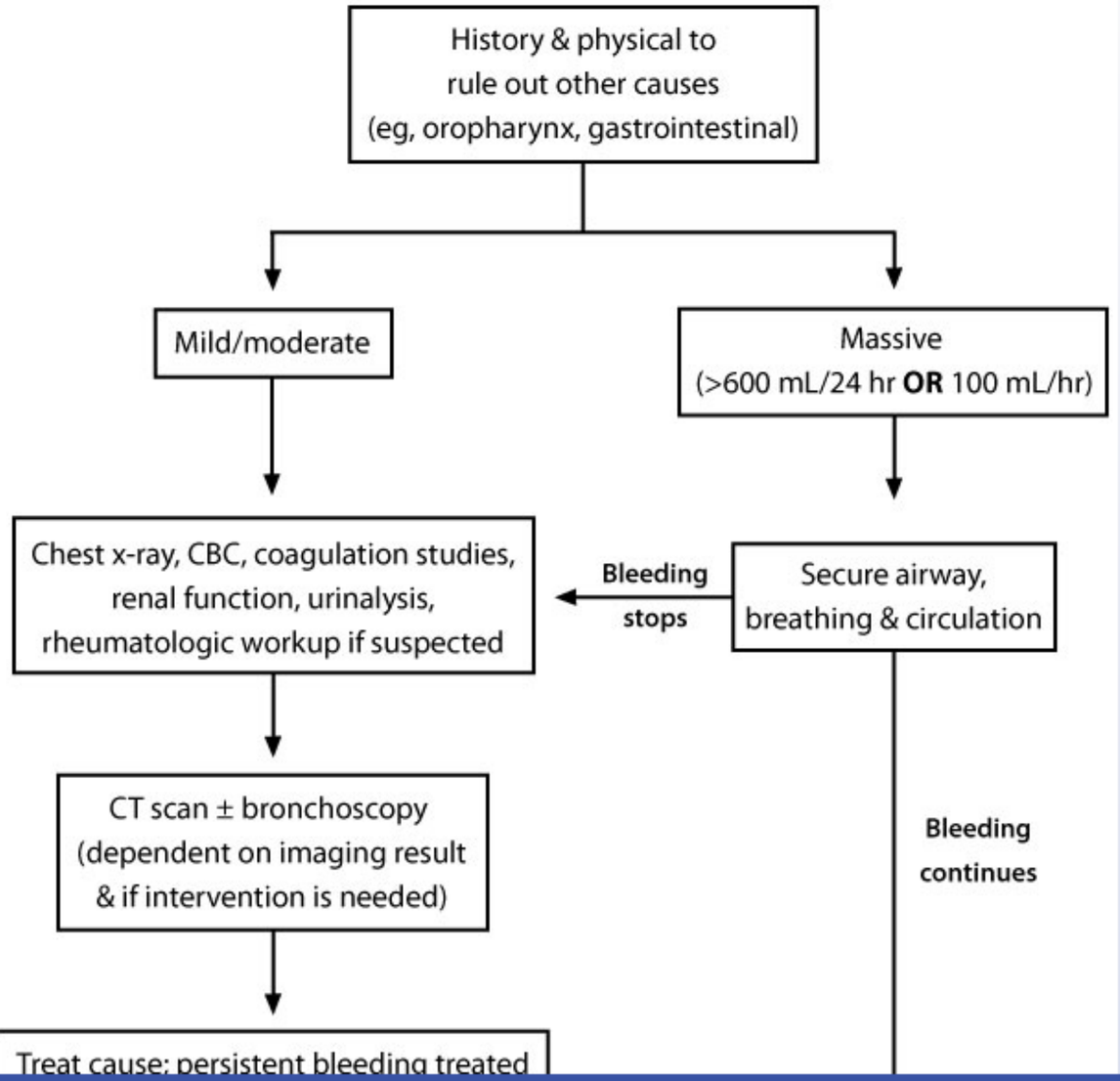
46%
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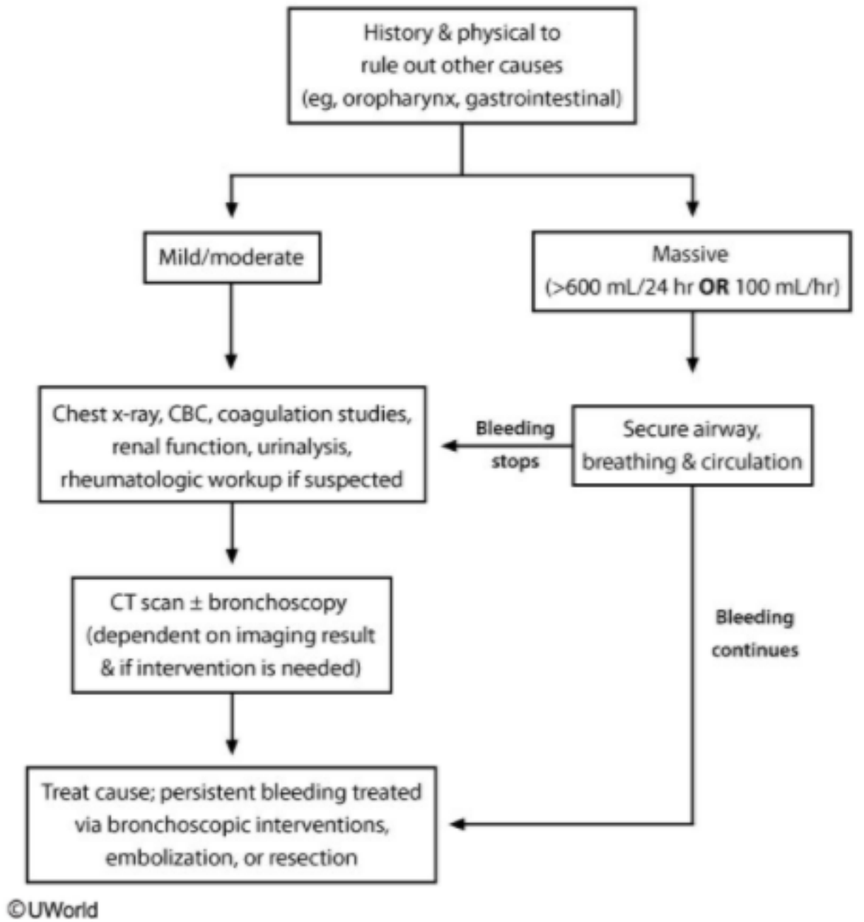
Evaluation of hemoptysis



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Exhibit Display

Evaluation of hemoptysis



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Treat cause; persistent bleeding treated

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This patient has an episode of massive hemoptysis, defined as >600 mL of expectorated blood over a 24-hour period or a bleeding rate >100 mL/hour. The greatest danger in massive hemoptysis is not exsanguination but asphyxiation due to the airway flooding with blood. Initial management involves establishing an **adequate patent airway**, maintaining adequate ventilation and gas exchange, and ensuring hemodynamic stability. The patient should be placed with the **bleeding lung in the dependent position** (lateral position) to avoid blood collection in the airways of the opposite lung.

Bronchoscopy is the initial procedure of choice in such patients as it can localize the bleeding site, provide suctioning ability to improve visualization, and include other therapeutic interventions (eg, balloon tamponade, electrocautery).

(Choice B) High-resolution CT scan of the chest can be used in patients with mild-to-moderate hemoptysis to better visualize the underlying lung pathology. However, this patient is actively bleeding and needs a therapeutic procedure first.

(Choice C) Fresh frozen plasma should be given to patients with known or suspected coagulopathy (eg, International Normalized Ratio >1.5) as the cause of hemoptysis. There is no such indication in this patient.

(Choice D) Pulmonary arteriography should be performed when there is persistent bleeding and the initial bronchoscopy is unable to localize the source. It can precisely identify the bleeding vessels and be used for therapeutic embolization to stop the bleeding.

(Choice E) Urgent thoracotomy and surgical intervention are reserved for patients with unilateral bleeding who continue to bleed despite initial bronchoscopy and/or pulmonary artery embolization.

Educational objective:
Initial management in hemoptysis involves establishing adequate patent airway, maintaining adequate ventilation and gas exchange, and ensuring hemodynamic stability. Patients should be placed with the bleeding lung in the dependent position (lateral position). Bronchoscopy is the procedure of choice to identify the site and attempt early therapeutic intervention.

References

- Massive hemoptysis. Assessment and management.

Surgery	Pulmonary & Critical Care	Hemoptysis
Subject	System	Topic

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References

- Massive hemoptysis. Assessment and management.

Surgery	Pulmonary & Critical Care	Hemoptysis
Subject	System	Topic

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A 65-year-old man comes to the physician with a 4-week history of weakness and vague postprandial epigastric pain. His past medical history is insignificant. He does not take any medications. The patient smokes 1 pack of cigarettes daily and drinks alcohol occasionally. Fecal occult blood test is positive. Gastroduodenoscopy shows an antral ulcer. Four of seven biopsies taken from the margins of the ulcer are consistent with adenocarcinoma. Which of the following is the most appropriate next step in management?

A. CT scan
B. Exploratory laparotomy
C. *Helicobacter pylori* testing
D. Laparoscopy
E. Serologic markers

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- A. CT scan (56%) ✓
- B. Exploratory laparotomy (4%)
- C. *Helicobacter pylori* testing (31%)
- D. Laparoscopy (4%)
- E. Serologic markers (2%)

Omitted
Correct answer
A

56%
Answered correctly

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Time Spent

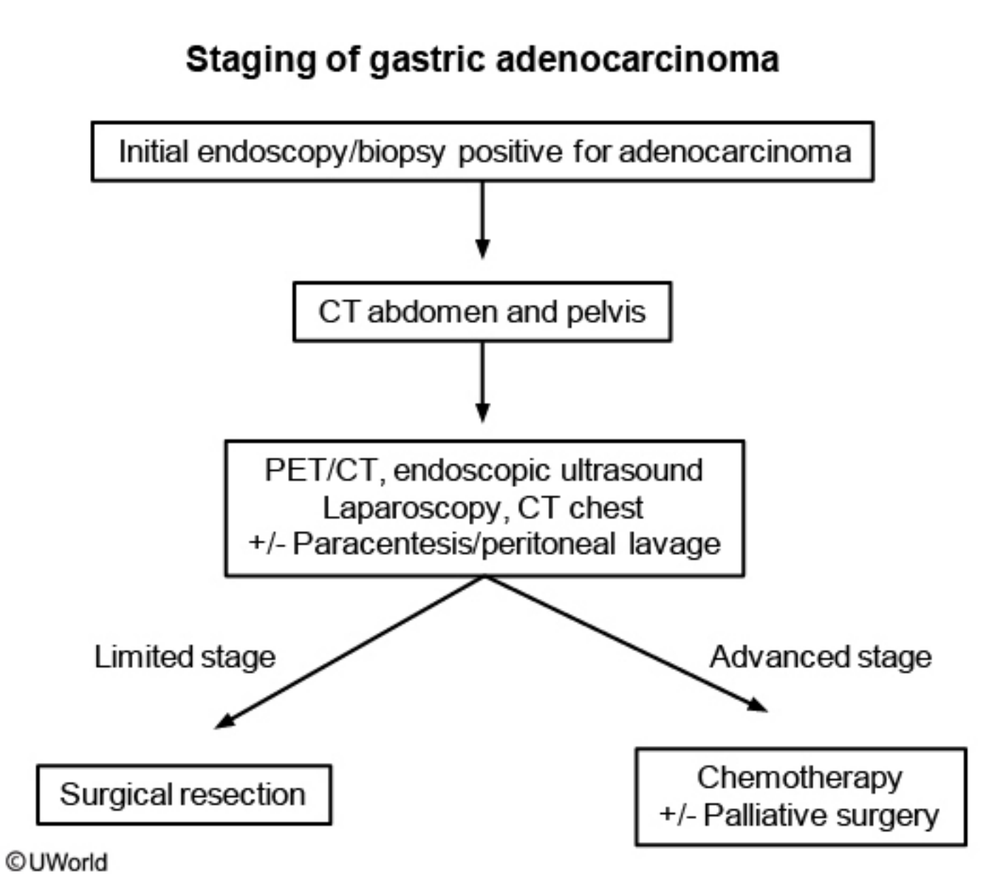
01/18/2020
Last Updated

Explanation

Staging of gastric adenocarcinoma

Initial endoscopy/biopsy positive for adenocarcinoma

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For adenocarcinoma of the stomach, treatment options and prognosis are determined primarily by the disease stage at the time of diagnosis. Surgical removal of the affected tissues is the mainstay of therapy, therefore early detection of gastric cancer improves the chances of successful management. However, almost 90% of patients with gastric cancer are diagnosed at advanced stages (III-IV), at which point radical resection is very complicated or impossible. For this reason, evaluation of the extent of the cancer is the most important objective following initial histologic diagnosis.

A CT scan of the abdomen and pelvis is commonly employed for disease staging and is sensitive for revealing metastases (especially in the

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A CT scan of the abdomen and pelvis is commonly employed for disease staging and is sensitive for revealing metastases (especially in the liver). Depending on CT findings, additional staging procedures, such as laparoscopy **(Choice D)**, endoscopic ultrasound, chest CT, or positron emission tomography/CT (PET/CT) may be necessary. Patients diagnosed with limited-stage disease may be considered for curative resection, but those with more advanced disease staging are generally referred for palliative interventions.**(Choice B)** Laparotomy is eventually required for curative or palliative management in most patients, but initial CT imaging is needed to plan the appropriate next steps in evaluation.

(Choice C) *Helicobacter pylori* infection is a significant risk factor for gastric adenocarcinoma and lymphoma (mucosa-associated lymphoid tissue [MALT] lymphoma). Eradication is recommended for patients with resectable disease to reduce the risk of developing a second cancer. Eradication of *H pylori* causes remission in some patients with gastric MALT lymphoma, but it is not curative for adenocarcinoma.

(Choice E) A number of serologic markers have been proposed for use in gastric cancer staging, including carcinoembryonic antigen and cancer antigen (CA) 125. These tumor markers are often elevated in patients with advanced disease, but studies have not found them to have any significant clinical utility.

Educational objective:
In gastric adenocarcinoma, tumor stage at the time of diagnosis determines prognosis and treatment options. A CT scan is the initial staging modality.

References

- Modern surgical considerations for gastric cancer.
- Modern oncological approaches to gastric adenocarcinoma.
- Preoperative serum tumor marker levels in gastric cancer

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A 56-year-old man is evaluated for fever on postoperative day 3. He had undergone coronary artery bypass surgery for multivessel coronary artery disease, requiring 4 grafts. The patient is still intubated and is receiving mechanical ventilation. He has a history of type 2 diabetes mellitus, hypercholesterolemia, and hypertension. Temperature is 38.9 C (102 F), blood pressure is 130/80 mm Hg, and pulse is 90/min. BMI is 28 kg/m^2. Examination reveals coarse breath sounds bilaterally. Heart sounds are normal. The patient grimaces during palpation of the right upper quadrant. Bowel sounds are decreased. Laboratory results are as follows:

Hemoglobin	10.8 g/dL
Platelets	150,000/mm^3
Leukocytes	17,000/mm^3
Total bilirubin	1.0 mg/dL
Alkaline phosphatase	100 U/L
Aspartate aminotransferase	32 U/L
Alanine aminotransferase	34 U/L
Amylase	110 U/L

Chest x-ray reveals postoperative changes but no new infiltrate. Which of the following is the most likely diagnosis in this patient?

A. Acalculous cholecystitis
B. Acute cholangitis
C. Acute pancreatitis
D. Right lower lobe pneumonia
E. Right-sided pyelonephritis

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C. Acute pancreatitis
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E. Right-sided pyelonephritis
F. Subphrenic abscess

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Chest x-ray reveals postoperative changes but no new infiltrate. Which of the following is the most likely diagnosis in this patient?

- A. Acalculous cholecystitis (54%)
- B. Acute cholangitis (11%)
- C. Acute pancreatitis (6%)
- D. Right lower lobe pneumonia (8%)
- E. Right-sided pyelonephritis (3%)
- F. Subphrenic abscess (15%)

Omitted
Correct answer

54%
Answered correctly

04 secs
Time Spent

02/18/2020
Last Updated

Acalculous cholecystitis	
Risk factors	• Severe trauma or recent surgery • Prolonged fasting or TPN • Critical illness (eg, sepsis, ICU)
Clinical presentation	• Fever, leukocytosis, ↑ LFTs, RUQ pain • Jaundice & RUQ mass less common
Diagnosis	• Abdominal ultrasound (preferred) • HIDA or CT scan if needed
Treatment	• Enteric antibiotic coverage • Cholecystostomy for initial drainage • Cholecystectomy once clinically stable

HIDA = hepatobiliary iminodiacetic acid; **ICU** = intensive care unit; **LFTs** = liver function tests; **RUQ** = right upper quadrant; **TPN** = total parenteral nutrition.

This patient's presentation suggests **acalculous cholecystitis**, an acute inflammation of the gallbladder in the absence of gallstones. Acalculous cholecystitis is most often seen in hospitalized patients who are **critically ill**. Common predisposing conditions include recent **surgery** (particularly cardiopulmonary, aortic, or abdominal), severe trauma, extensive burns, sepsis or shock, prolonged fasting or total parenteral nutrition, or critical illness requiring mechanical intubation. These conditions likely cause gallbladder stasis or ischemia with local inflammation that can lead to gallbladder distension, necrosis, and secondary bacterial infection.

Acalculous cholecystitis can present with **unexplained fever** and diffuse or right upper quadrant (RUQ) abdominal pain. Other findings can include jaundice, RUQ mass, **leukocytosis**, or abnormal liver function tests (normal results do not exclude the diagnosis). Therefore, the diagnosis requires a high degree of suspicion. Complications include gangrene, perforation, and emphysematous cholecystitis. Abdominal ultrasound is usually preferred for diagnosis and can reveal signs of acute cholecystitis without gallstones. Patients with unclear ultrasound findings may need an abdominal CT scan or cholescintigraphy (hepatobiliary iminodiacetic acid) scans, which are more sensitive and specific for

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(Choice B) Acute cholangitis is usually due to common bile duct obstruction by a gallstone or malignancy. It typically presents with fever, jaundice, RUQ abdominal pain, and elevated alkaline phosphatase. Therefore, acute cholangitis is less likely given this patient's normal alkaline phosphatase and absence of jaundice.

(Choice C) Acute pancreatitis can occur postoperatively in patients with hypotension (similar to acalculous cholecystitis). However, acute pancreatitis is less likely due to this patient's RUQ, rather than epigastric, tenderness and normal amylase levels.

(Choice D) Right lower lobe pneumonia can present with fever, cough, and sometimes RUQ pain. However, pneumonia is less likely given the absence of new infiltrate on this patient's chest x-ray.

(Choice E) Right-sided pyelonephritis usually presents with fever, nausea, and right flank (not RUQ) pain.

(Choice F) Subphrenic abscess (rare) can cause fever and abdominal pain. However, it usually develops due to peritonitis (eg, perforated ulcer, appendicitis, abdominal surgery) and is unlikely in this patient who did not undergo an abdominal procedure.

Educational objective:
Acute acalculous cholecystitis is an acute inflammation of the gallbladder in the absence of gallstones that is most commonly seen in hospitalized and critically ill patients.

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Educational objective:
Acute acalculous cholecystitis is an acute inflammation of the gallbladder in the absence of gallstones that is most commonly seen in hospitalized and critically ill patients.

References

- Acute acalculous cholecystitis: a review.

Surgery	Gastrointestinal & Nutrition	Cholecystitis
Subject	System	Topic

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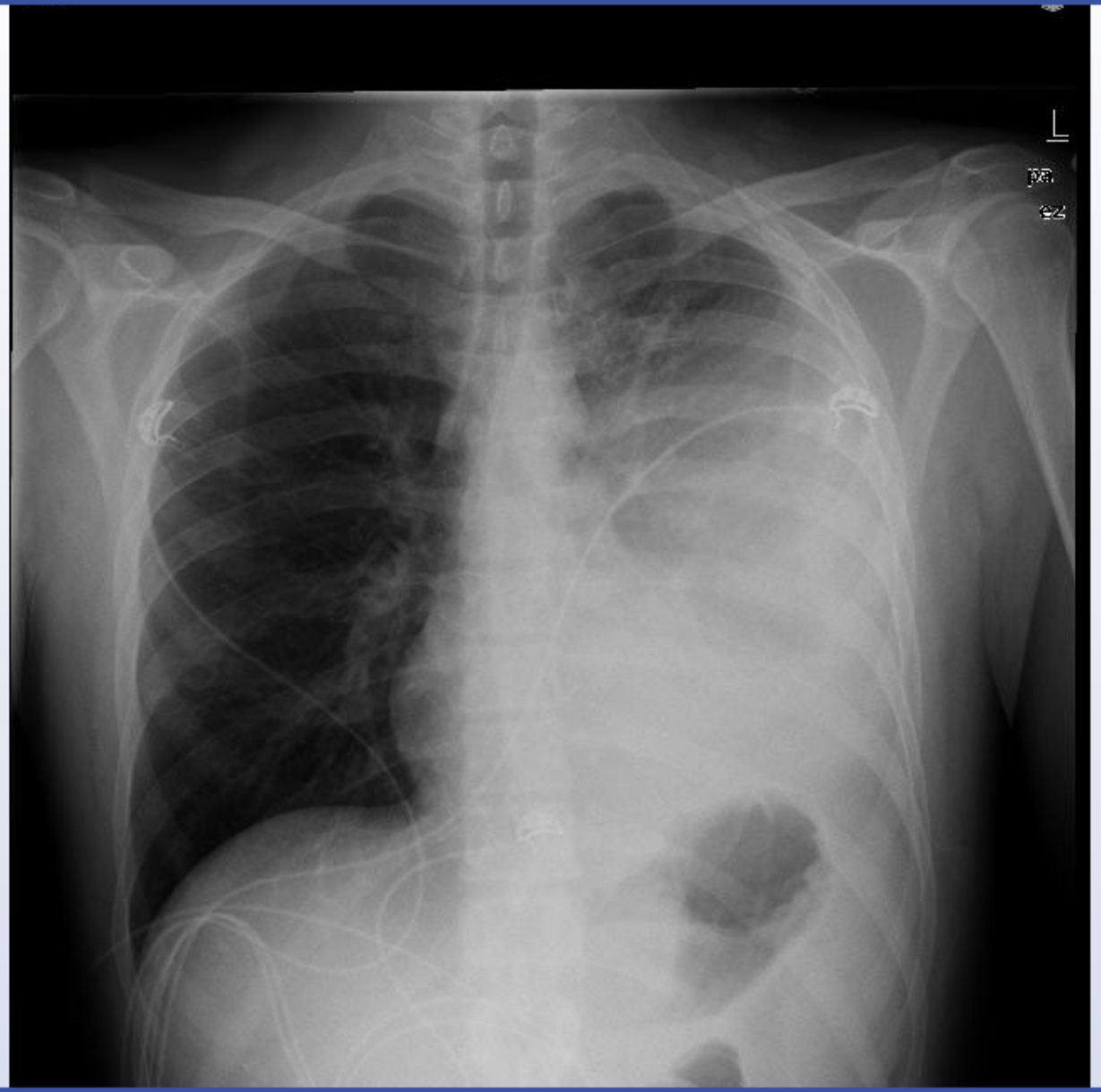
A 45-year-old man with HIV comes to the emergency department due to increasing shortness of breath, left-sided chest pain, chills, and productive cough. The symptoms began 7 days ago. At first, the patient thought he had the flu, but after 3 days he began coughing up green phlegm and developed left-sided chest pain. The pain is worse with deep breaths or cough. CD4 count is unknown. He smokes cigarettes and drinks alcohol regularly. Temperature is 38.9 C (102 F), blood pressure is 110/70 mm Hg, pulse is 110/min, and respirations are 26/min. Physical examination shows poor dentition and decreased breath sounds over the left lung base. Chest x-ray is shown below.

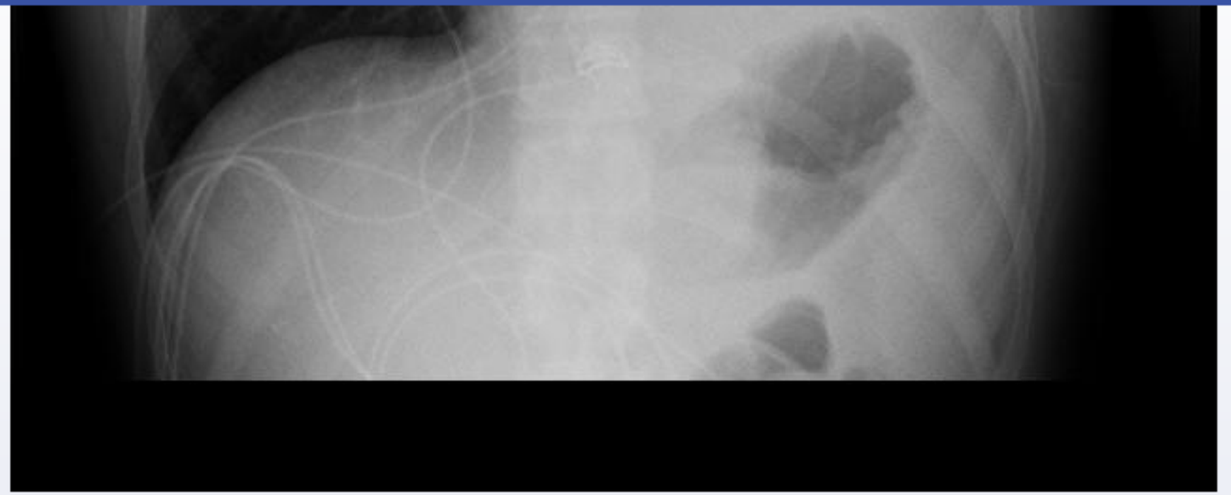
Which of the following is the most likely cause of this patient's current symptoms?

A. Acute pericarditis
B. Bronchopleural fistula
C. Empyema
D. Lung abscess
E. *Pneumocystis jiroveci* pneumonia
F. Pneumothorax
G. Viral myocarditis

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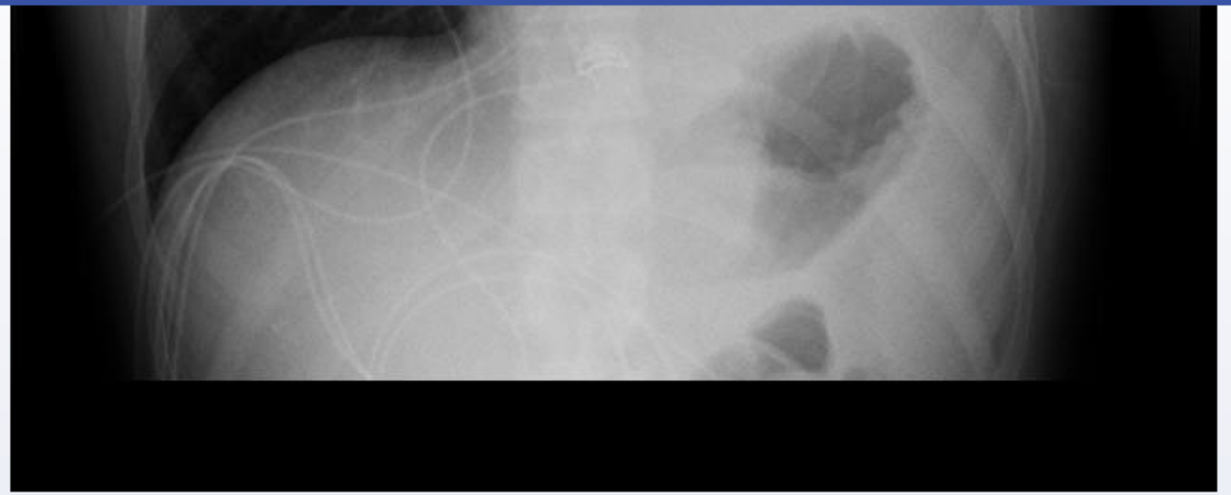


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Which of the following is the most likely cause of this patient's current symptoms?

- A. Acute pericarditis (0%)
- B. Bronchopleural fistula (3%)
- ✓ C. Empyema (58%)
- D. Lung abscess (14%)
- E. *Pneumocystis jiroveci* pneumonia (18%)
- F. Pneumothorax (4%)
- G. Viral myocarditis (0%)

Omitted
Correct answer

58%
Answered correctly

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04/15/2020
Last Updated

Parapneumonic effusions

	Uncomplicated	Complicated
Etiology	Sterile exudate in pleural space	Bacterial invasion of pleural space
Pleural fluid analysis	• pH ≥7.2 • Glucose ≥60 mg/dL • WBC ≤50,000/mm^3	• pH <7.2 • Glucose <60 mg/dL • WBC >50,000/mm^3
Pleural fluid Gram stain & culture	Negative	Negative*
Treatment	Antibiotics	Antibiotics + drainage

*Gram stain & culture are typically false negative due to low bacterial count. Both are typically positive in empyema.

WBC = white blood cells.

Approximately 40% of **pneumonias** are associated with **pleural effusions**. Most are small, free-flowing, sterile, and resolve with antibiotics (ie, **uncomplicated** parapneumonic effusion). However, if bacteria persistently cross from the infected pulmonary parenchyma into the pleural space, a complicated parapneumonic effusion or an empyema can develop. Both empyemas and **complicated** parapneumonic effusions are marked by **large**, (often) loculated effusions and typical thoracentesis abnormalities (low pH, low glucose); unlike complicated parapneumonic effusions, **empyemas** also have frank **pus** or **bacteria** (by Gram stain) in the pleural space.

This patient likely has pneumonia (fever, productive cough), and the presence of **pleuritic chest pain** and a **large** left-sided pleural effusion suggests the pneumonia is likely complicated by an **empyema**. Risk for pneumonia complications such as empyema is greater in patients who are immunocompromised (eg, **HIV**, post-transplant). All empyemas (and many complicated parapneumonic effusions) require prolonged antibiotics (2-4 weeks) and drainage (usually with a chest tube).

(Choices A and G) Acute pericarditis presents with sharp, anterior chest pain. Viral myocarditis can cause chest pain and could be associated with upper respiratory symptoms. However, a cough productive of green phlegm would be unusual, and chest x-ray is typically normal.

(Choice B) Bronchopleural fistulas often occur with malignancy or trauma, or after surgical procedures involving the bronchi (eg, pneumonectomy). They can cause empyemas, but there is usually radiographic evidence of air in the pleural space as well.

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(Choice D) A lung abscess is marked by a cavity with air fluid level on chest x-ray. Aspiration pneumonia commonly causes lung abscesses and is frequently associated with foul-smelling sputum and symptoms that develop over days or weeks.

(Choice E) *Pneumocystis jiroveci* pneumonia is common in patients with HIV with a CD4 count <200/mm^3. Symptoms (eg, shortness of breath, nonproductive cough, fever) typically arise over several weeks. Chest x-ray can be normal but often reveals diffuse bilateral interstitial or alveolar infiltrates, not a large, unilateral effusion.

(Choice F) Pneumothorax typically presents with sudden pleuritic chest pain and shortness of breath. Chest x-ray reveals a radiolucent (black) region of extrapulmonary air. This patient has fever and upper respiratory symptoms that developed over days (and an effusion).

Educational objective:
Bacterial pneumonia commonly causes a pleural effusion. Often the effusion is small, sterile, and resolves with antibiotics (uncomplicated). However, if bacteria persistently cross into the pleural space, a complicated parapneumonic effusion or empyema can develop. Empyemas have frank pus or bacteria (by Gram stain) in the pleural space and require drainage (chest tube) in addition to prolonged antibiotics.

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Bacterial pneumonia commonly causes a pleural effusion. Often the effusion is small, sterile, and resolves with antibiotics (uncomplicated). However, if bacteria persistently cross into the pleural space, a complicated parapneumonic effusion or empyema can develop. Empyemas have frank pus or bacteria (by Gram stain) in the pleural space and require drainage (chest tube) in addition to prolonged antibiotics.

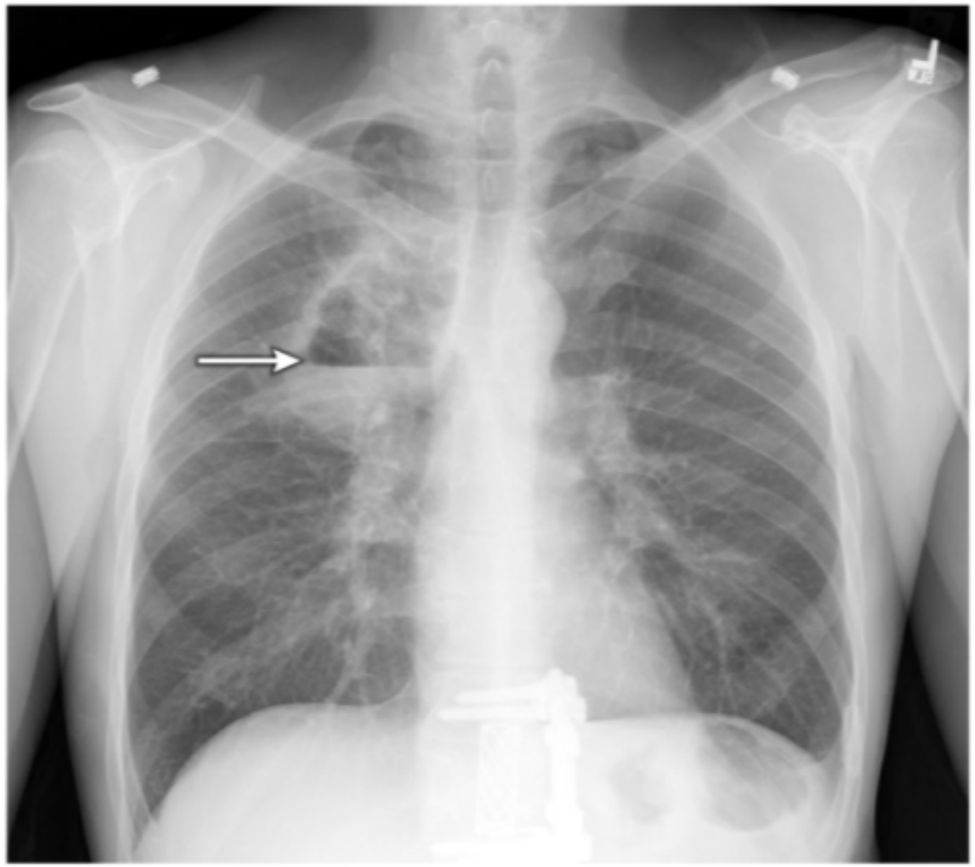
Surgery	Pulmonary & Critical Care	Empyema
Subject	System	Topic

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Exhibit Display

Lung abscess



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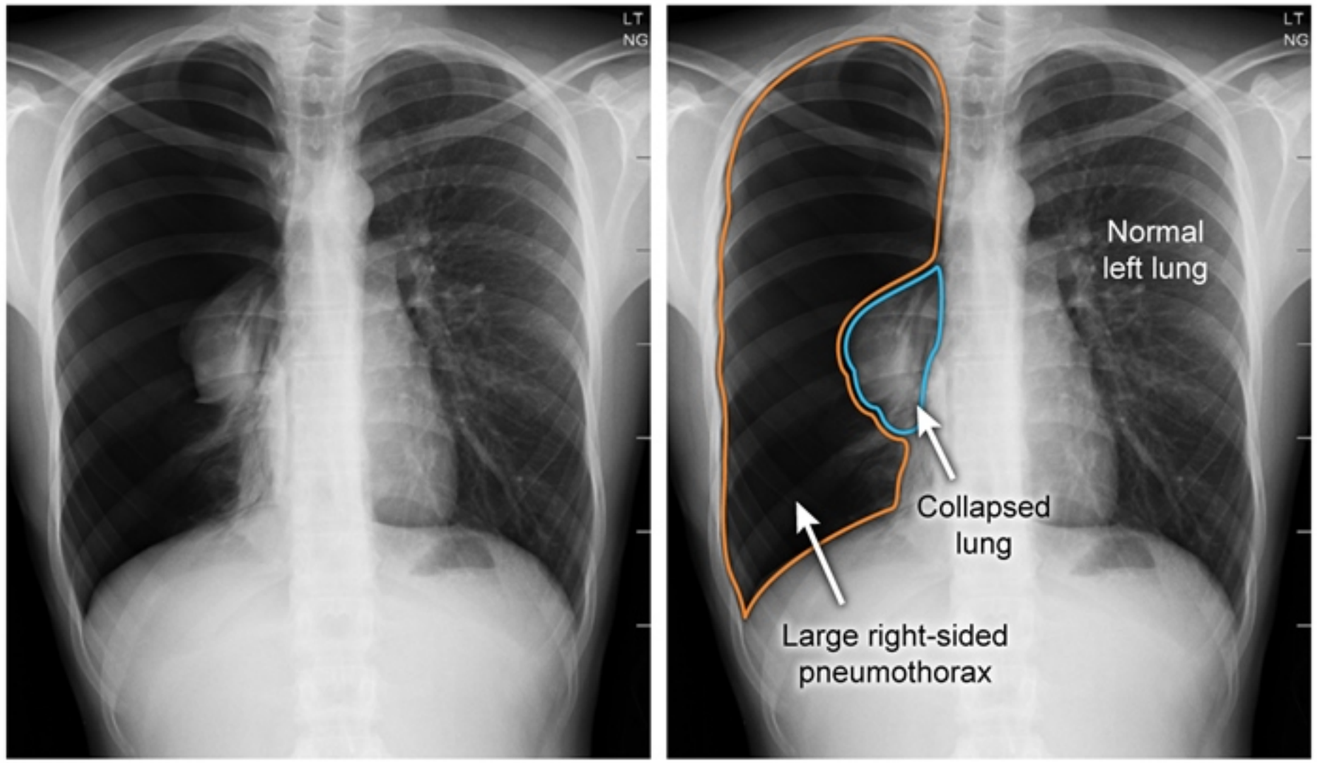


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Exhibit Display

Spontaneous pneumothorax



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A 34-year-old woman comes to the office due to fullness in her neck after noticing a difference in how jewelry rests around her neck as compared to before. The patient has no other symptoms. She has no medical issues and takes no medications. Family history includes thyroid surgery for an enlarged thyroid gland in her mother. Examination reveals a 1.4-cm firm, nontender, mobile nodule in her left thyroid lobe. The remainder of the physical examination is unremarkable. Laboratory evaluation shows serum TSH of 0.25 μU/mL, serum total thyroxine (T4) of 10 μg/dL, and serum triiodothyronine (T3) of 176 ng/dL. A thyroid ultrasound reveals a 1.4-cm left thyroid nodule with smooth margins and no microcalcifications or internal vascularity. Which of the following is the most appropriate next step?

A. CT scan of the neck
B. Fine-needle aspiration
C. Radionuclide thyroid scan
D. Serum anti-thyroid peroxidase measurement
E. Serum calcitonin measurement
F. Serum thyroid stimulating antibody measurement

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A. CT scan of the neck (0%)
B. Fine-needle aspiration (40%)
✓ C. Radionuclide thyroid scan (50%)
D. Serum anti-thyroid peroxidase measurement (2%)
E. Serum calcitonin measurement (1%)
F. Serum thyroid stimulating antibody measurement (5%)

Omitted
Correct answer
C

50%
Answered correctly

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Time Spent

02/11/2020
Last Updated

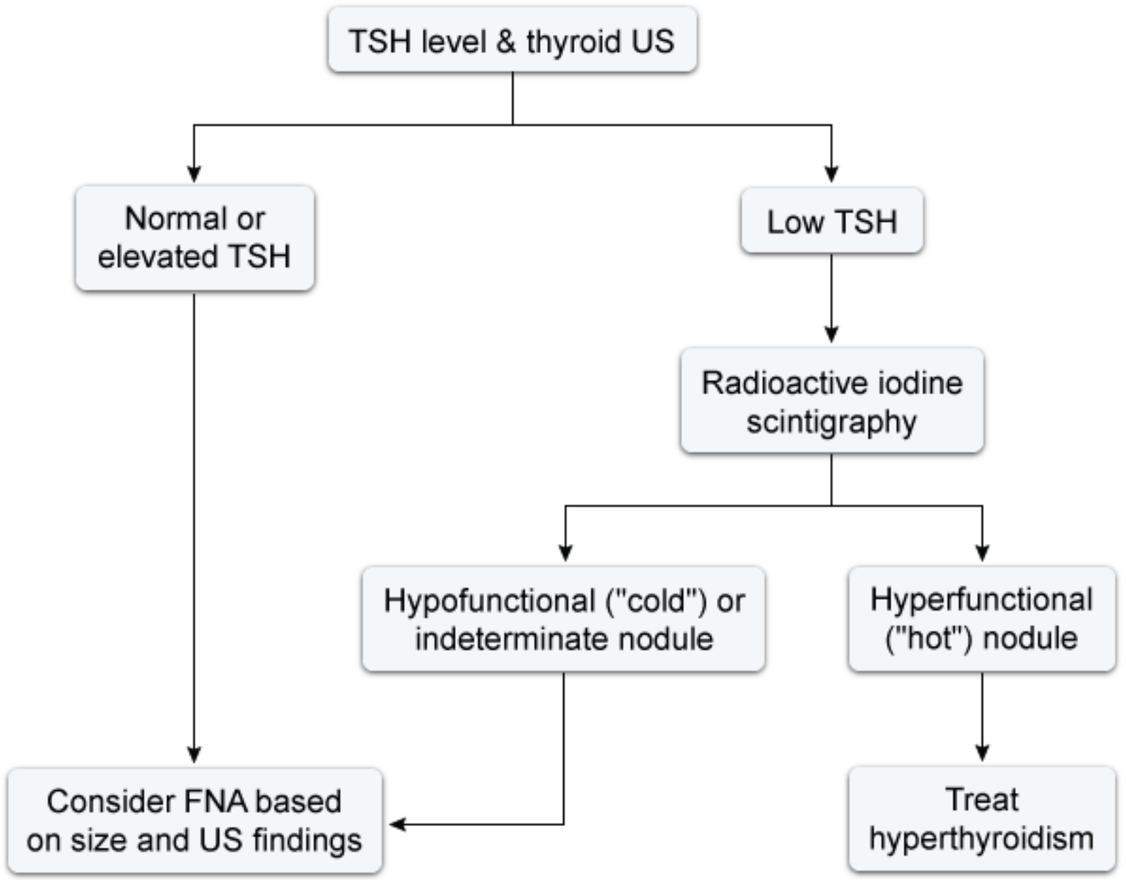
Explanation

Evaluation of thyroid nodules

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Explanation

Evaluation of thyroid nodules



FNA = fine-needle aspiration; **US** = ultrasound.

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Thyroid nodules are common and may be diagnosed on physical examination or noted incidentally when imaging studies are obtained for other reasons. Once a thyroid nodule is found, cancer risk factors (eg, family history, radiation exposure) should be assessed by history. Physical examination should evaluate the size, mobility, and firmness of the thyroid nodule and check for the presence of enlarged cervical lymph nodes.

Serum TSH levels should be obtained, along with a **thyroid ultrasound**, to determine nodule size and sonographic features. Certain sonographic features (eg, microcalcifications, irregular margins, internal vascularity) carry a much higher risk of malignancy than others (eg, cystic or spongiform lesions). Thyroid nodules >1 cm with these high-risk sonographic features—and all noncystic thyroid nodules >2 cm—should undergo fine-needle aspiration (FNA).

If the **TSH is low**, as seen here, the patient should be evaluated with **radionuclide thyroid scan** using iodine-123:

- A hypofunctioning ("cold") nodule (decreased isotope uptake compared to surrounding tissue) is associated with a higher risk of cancer.
- A hyperfunctioning ("hot") nodule (increased isotope uptake in the nodule with decreased surrounding uptake) is associated with a low cancer risk; therefore, FNA is not necessary **(Choice B)**.

This patient who has a thyroid nodule with no concerning sonographic features and a low TSH should receive a radionuclide thyroid scan.

(Choice A) A CT scan of the neck is inferior to ultrasound for characterizing thyroid nodules. Even if a thyroid nodule is detected on CT scan, a thyroid ultrasound is still needed.

(Choice D) Anti-thyroperoxidase antibody testing can identify chronic autoimmune (Hashimoto) thyroiditis, but it is used for patients with high TSH levels (eg, hypothyroid).

(Choice E) Calcitonin is an important tumor marker in medullary thyroid carcinoma (MTC). In patients with a thyroid nodule, testing for calcitonin should be performed if there is a family history of MTC or if cytologic examination (eg, FNA) of the nodule is consistent with MTC.

(Choice F) Thyroid stimulating antibodies are present in patients with Graves disease, which can result in hyperthyroidism. However, Graves disease typically causes a diffusely enlarged goiter rather than a focal nodule.

Educational objective:
The initial evaluation of thyroid nodules includes a serum TSH assay and thyroid ultrasound. Patients with a suppressed TSH should undergo thyroid scintigraphy. Small, hyperfunctioning nodules are rarely malignant and do not usually require fine-needle aspiration.

If the **TSH is low**, as seen here, the patient should be evaluated with **radionuclide thyroid scan** using iodine-123:

- A hypofunctioning ("cold") nodule (decreased isotope uptake compared to surrounding tissue) is associated with a higher risk of cancer.
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The initial evaluation of thyroid nodules includes a serum TSH assay and thyroid ultrasound. Patients with a suppressed TSH should undergo thyroid scintigraphy. Small, hyperfunctioning nodules are rarely malignant and do not usually require fine-needle aspiration.

References

- 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer: the American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer.

Surgery	Endocrine, Diabetes & Metabolism	Thyroid nodules
Subject	System	Topic

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

A 65-year-old man has a cardiac arrest in a shopping mall. Resuscitation is initiated in the field, and the patient is successfully defibrillated. In the emergency department, he is found to have ST segment elevations in the inferior leads and then has an episode of sustained ventricular tachycardia that is treated with intravenous amiodarone. The patient is taken to the cardiac catheterization lab and is found to have a thrombotic occlusion of the right coronary artery, which is successfully treated with percutaneous coronary intervention. On the second day of hospitalization he demonstrates full neurologic recovery and is asymptomatic. Laboratory results are as follows:

Liver function studies

Albumin	3.8 g/dL
Total bilirubin	1.3 mg/dL
Alkaline phosphatase	114 U/L
Aspartate aminotransferase (SGOT)	1355 U/L
Alanine aminotransferase (SGPT)	1124 U/L

The patient's laboratory results were within normal limits 1 week prior to admission. Which of the following is the most likely cause of the new findings?

A. Acalculous cholecystitis
B. Acute viral hepatitis
C. Hepatocyte ischemia
D. Medication-induced liver injury
E. Muscle injury

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Alanine aminotransferase (SGPT)	1124 U/L

The patient's laboratory results were within normal limits 1 week prior to admission. Which of the following is the most likely cause of the new findings?

A. Acalculous cholecystitis (2%)
B. Acute viral hepatitis (2%)
✓ C. Hepatocyte ischemia (55%)
D. Medication-induced liver injury (36%)
E. Muscle injury (3%)

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This patient has developed **ischemic hepatitis** (shock liver) resulting from **myocardial infarction**, ventricular tachycardia, and **cardiogenic shock**. Ischemic hepatitis usually occurs in the setting of global hypoperfusion and/or hypoxemia; in addition to cardiac insults, other common causes include hypovolemic and septic shock as well as respiratory failure. Histologically, **hepatocyte necrosis** is found predominantly in zone 3 of the liver lobule, ie, surrounding the central veins where cells are farthest from the oxygen supply coming from the hepatic artery (~40% of the liver's oxygen supply) and the portal vein (~60% of the liver's oxygen supply as partially deoxygenated blood).

Patients often develop **aminotransferase levels >1000 U/L** shortly after the inciting incident. Although the bilirubin level can be unaffected, it usually rises several days later. Prognosis is poor as patients are typically critically ill and often have accompanying multiorgan failure. In those who survive, the hepatic injury tends to be self-limited; aminotransferase elevations usually resolve within 7 days, and bilirubin levels normalize over the course of several weeks.

(Choice A) Acalculous cholecystitis usually occurs as a complication of shock or other critical illness. Mild elevations in total bilirubin, alkaline phosphatase, and aminotransferases are typical; however, aminotransferase elevation >1000 U/L would not be consistent.

(Choice B) Like ischemic hepatitis, acute viral hepatitis can cause elevations in aminotransferases >1000 U/L, most commonly from acute infection with hepatitis A or B. Acute hepatitis A, which is transmitted fecal-orally, tends to present with fever, nausea, and vomiting. Patients with acute hepatitis B often have identifiable risk factors, including intravenous drug use, recent blood transfusions, or unprotected sexual intercourse.

(Choice D) This patient was exposed to amiodarone, which can cause hepatic steatosis and cholestasis. This would cause a rise in bilirubin, but marked aminotransferase elevations >1000 U/L are not typical. Acute liver failure due to amiodarone toxicity is rare.

(Choice E) Aspartate aminotransferase (AST) is present in cardiac myocytes, skeletal myocytes, and intestinal smooth muscle, and serum levels can rise following injury to any of these tissues. However, alanine aminotransferase (ALT) is specific to hepatocytes and would not increase in the absence of hepatic injury.

Educational objective:
Ischemic hepatitis, characterized histologically by zone 3-predominant hepatocyte necrosis, occurs in the setting of global hypoperfusion and/or hypoxemia. Common causes include cardiac insults (eg, myocardial infarction, unstable arrythmias), respiratory failure, hypovolemia, and septic shock. Patients immediately develop severe aminotransferase elevations with bilirubin levels remaining unaffected or rising a few days later.

References

Patients often develop **aminotransferase levels >1000 U/L** shortly after the inciting incident. Although the bilirubin level can be unaffected, it usually rises several days later. Prognosis is poor as patients are typically critically ill and often have accompanying multiorgan failure. In those who survive, the hepatic injury tends to be self-limited; aminotransferase elevations usually resolve within 7 days, and bilirubin levels normalize over the course of several weeks.

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Ischemic hepatitis, characterized histologically by zone 3-predominant hepatocyte necrosis, occurs in the setting of global hypoperfusion and/or hypoxemia. Common causes include cardiac insults (eg, myocardial infarction, unstable arrythmias), respiratory failure, hypovolemia, and septic shock. Patients immediately develop severe aminotransferase elevations with bilirubin levels remaining unaffected or rising a few days later.

References

- Hepatic shock differential diagnosis and risk factors: a review article.

Surgery	Gastrointestinal & Nutrition	Ischemic hepatitis
Subject	System	Topic

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A 43-year-old man is found wandering in the street in winter and is brought to the emergency department by a passing motorist. The patient is confused and unable to provide any history. He has no previous hospital records. On examination, there is mild hypothermia (temperature 35 C [95 F]), but vital signs are otherwise normal. The patient appears disheveled and lethargic but follows commands. The oral mucosa is moist, and there are extensive dental caries. The patient has no cervical lymphadenopathy, but there is bilateral, nontender swelling of the cheeks consistent with salivary gland enlargement. Which of the following is the most likely cause of this latter finding?

A. Alcoholism
B. Mumps
C. Pleomorphic adenoma
D. Salivary gland stone
E. Sjögren syndrome
F. Vitamin A deficiency

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- ✓ A. Alcoholism (60%)
- B. Mumps (7%)
- C. Pleomorphic adenoma (6%)
- D. Salivary gland stone (7%)
- E. Sjögren syndrome (6%)
- F. Vitamin A deficiency (11%)

Omitted
Correct answer
A

60%
Answered correctly

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04/26/2020
Last Updated

Explanation

This patient has nontender, bilateral enlargement of the parotid glands, which is consistent with **sialadenosis**. Sialadenosis is a benign, **noninflammatory** swelling of the salivary glands. It can result from overaccumulation of secretory granules in acinar cells (possibly due to abnormal autonomic innervation) in patients with **chronic alcohol use**, bulimia, or **malnutrition**. It can also result from fatty infiltration of the glands in patients with **diabetes mellitus** or liver disease.

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Sialadenosis presents with gradual enlargement of the glands that does not fluctuate and is not associated with eating. Recognition of this condition should prompt an investigation for underlying disease. Control of the underlying disease may improve (but usually not fully resolve) the glandular enlargement.

(Choice B) Parotitis due to mumps can present with parotid swelling. However, it is typically painful and presents a few days after the onset of systemic symptoms (eg, fever, headache, myalgias).

(Choice C) A pleomorphic adenoma is a benign salivary neoplasm that can present with painless enlargement of the parotid gland. However, the enlargement would be unilateral, and a distinct mass is typically palpated.

(Choice D) Salivary stones (sialolithiasis) can block the flow of saliva out of the duct and lead to swelling due to increased fluid in the gland. However, swelling due to sialolithiasis is usually fluctuating, painful, and associated with eating (which stimulates saliva secretion).

(Choice E) Sjögren syndrome can lead to bilateral swelling of the parotid glands due to lymphocytic infiltration. However, in contrast to this patient, it typically presents in women and is associated with dry mouth on examination (whereas this patient's mucous membranes are moist).

(Choice F) Vitamin A deficiency often coexists with malnutrition, which can lead to sialadenosis. However, sialadenosis in these patients is probably related to protein malnutrition rather than vitamin A deficiency. Vitamin A deficiency most notably causes ocular manifestations, including impaired night vision, dry eyes, and keratinization of the conjunctivae and corneas.

Educational objective:
Sialadenosis is a benign, noninflammatory enlargement of the salivary glands, often caused by chronic alcohol use.

References

- Sialadenosis in patients with advanced liver disease.

glands in patients with **diabetes mellitus** or liver disease.

Sialadenosis presents with gradual enlargement of the glands that does not fluctuate and is not associated with eating. Recognition of this condition should prompt an investigation for underlying disease. Control of the underlying disease may improve (but usually not fully resolve) the glandular enlargement.

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Sialadenosis is a benign, noninflammatory enlargement of the salivary glands, often caused by chronic alcohol use.

References

- Sialadenosis in patients with advanced liver disease.

Surgery	Ear, Nose & Throat (ENT)	Salivary gland tumors
Subject	System	Topic

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A 45-year-old man comes to the clinic for suture removal. Two weeks ago, he was brought to the emergency department due to alcohol intoxication and was found to have a left leg laceration. The laceration was cleaned and sutured, and he received a tetanus toxoid vaccine and a prescription for oral antibiotics, which he completed. The patient has a history of alcohol use disorder and had been hospitalized on several occasions due to alcohol intoxication and acute alcoholic pancreatitis. The patient currently takes no medications, does not use tobacco, and smokes marijuana occasionally. He is homeless and has had difficulty staying in homeless shelters regularly due to alcohol abuse. Temperature is 36.7 C (98.1 F), pulse is 82/min, blood pressure is 124/76 mm Hg, and respirations are 14/min. BMI is 18.8 kg/m^2. Physical examination shows a disheveled man who appears older than his stated age. Dentition is poor with multiple dental caries. The gingiva is receded and bleeds easily to touch. Cardiopulmonary auscultation reveals clear lungs and normal heart sounds. The abdomen is soft and nontender with no hepatosplenomegaly. Left lower extremity examination shows scant serosanguineous discharge on the wound dressing. The surgical sutures are intact, but the wound margins are poorly approximated. There is mild erythema at the wound borders with no tenderness or warmth. Mild, bilateral, lower-extremity pitting edema is present, and distal pulses are 2+. Skin examination shows scattered ecchymoses. Laboratory results are as follows:

Hemoglobin	10.4 g/dL
Mean corpuscular volume	92 µm^3
Platelets	120,000/mm^3
Leukocytes	8,200/mm^3
Creatinine	0.8 mg/dL
Glucose	92 mg/dL

Which of the following is the most likely cause of this patient's impaired wound healing?

A. Alcohol-induced bone marrow suppression
B. Chronic liver disease
C. Chronic venous insufficiency

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Which of the following is the most likely cause of this patient's impaired wound healing?

A. Alcohol-induced bone marrow suppression
B. Chronic liver disease
C. Chronic venous insufficiency
D. Nutritional deficiency
E. Persistent wound infection

Submit

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Creatinine	0.8 mg/dL
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Which of the following is the most likely cause of this patient's impaired wound healing?

A. Alcohol-induced bone marrow suppression (2%)
B. Chronic liver disease (16%)
C. Chronic venous insufficiency (3%)
✓ D. Nutritional deficiency (76%)
E. Persistent wound infection (1%)

Omitted
Correct answer

76%
Answered correctly

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01/07/2020
Last Updated

Scurvy (vitamin C deficiency)	
Epidemiology	• Due to insufficient dietary intake (lack of citrus fruits/vegetables) • Most common in alcoholics, drug abusers & severely malnourished
Manifestations	• Cutaneous: petechiae, follicular hemorrhage, bruising, coiled hairs • Gingival: bleeding/receding gums & dental caries • Constitutional: arthralgias, weakness, malaise, depression • Impaired wound healing • Vasomotor instability (if severe/prolonged)
Treatment	• Oral/injectable vitamin C resolves most symptoms within days • Toxicity (eg, abdominal pain, diarrhea, nausea) can occur with excessive supplementation

This patient's history of alcohol abuse, gingival bleeding, gingival recession, and ecchymosis suggest his poorly healing wound is due to **scurvy** (vitamin C deficiency). Vitamin C is an **essential dietary nutrient** found in citrus fruits and vegetables that acts as a reversible reducing agent and plays a crucial role in fatty acid transport and collagen synthesis. Most cases of vitamin C deficiency arise in the setting of severe malnutrition, which is frequently due to **alcoholism**, drug abuse, or psychiatric illness.

Manifestations of scurvy usually occur within 3 months of a diet deficient in vitamin C. Common findings include:

- **Cutaneous manifestations** – follicular hyperkeratosis, perifollicular hemorrhage, ecchymosis, petechiae, coiled hairs
- **Gingivitis** – receded gums that bleed easily and dental caries
- **Impaired wound healing**
- Systemic symptoms – arthralgias, malaise, weakness

As the syndrome progresses, hemolytic anemia and edema also commonly occur. Diagnosis is made by plasma or leukocyte vitamin C levels. Treatment with oral or injectable vitamin C rapidly improves constitutional symptoms, but gingival changes may take up to 2 weeks to resolve.

(Choice A) Approximately 80% of alcoholics have thrombocytopenia due to alcohol-induced bone marrow suppression. Anemia and leukopenia can also occur. However, myelosuppression is unlikely to account for this patient's poor wound healing or gingivitis.

	• Toxicity (eg, abdominal pain, diarrhea, nausea) can occur with excessive supplementation

This patient's history of alcohol abuse, gingival bleeding, gingival recession, and ecchymosis suggest his poorly healing wound is due to **scurvy** (vitamin C deficiency). Vitamin C is an **essential dietary nutrient** found in citrus fruits and vegetables that acts as a reversible reducing agent and plays a crucial role in fatty acid transport and collagen synthesis. Most cases of vitamin C deficiency arise in the setting of severe malnutrition, which is frequently due to **alcoholism**, drug abuse, or psychiatric illness.

Manifestations of scurvy usually occur within 3 months of a diet deficient in vitamin C. Common findings include:

- **Cutaneous manifestations** – follicular hyperkeratosis, perifollicular hemorrhage, ecchymosis, petechiae, coiled hairs
- **Gingivitis** – receded gums that bleed easily and dental caries
- **Impaired wound healing**
- Systemic symptoms – arthralgias, malaise, weakness

As the syndrome progresses, hemolytic anemia and edema also commonly occur. Diagnosis is made by plasma or leukocyte vitamin C levels. Treatment with oral or injectable vitamin C rapidly improves constitutional symptoms, but gingival changes may take up to 2 weeks to resolve.

(Choice A) Approximately 80% of alcoholics have thrombocytopenia due to alcohol-induced bone marrow suppression. Anemia and leukopenia can also occur. However, myelosuppression is unlikely to account for this patient's poor wound healing or gingivitis.

(Choice B) Although chronic liver disease can cause thrombocytopenia, anemia, ecchymosis, and lower-extremity edema, it is not typically associated with poor wound healing and gingival changes. In addition, there are no other common signs of liver disease (eg, ascites, jaundice, muscle cramps, spider hemangiomas, splenomegaly).

(Choice C) Chronic venous insufficiency is marked by edema, pain, skin changes, and ulceration. Although this condition can cause poor wound healing, it is not typically associated with gingivitis or scattered ecchymosis.

(Choice E) This patient completed his course of antibiotics and does not currently have local (eg, warmth, pain, purulent discharge) or systemic (eg, fever, leukocytosis) signs of infection. The mild erythema at the border of the wound (without warmth or tenderness) is much more likely to represent healing tissue than infection.

Educational objective:
Scurvy (vitamin C deficiency) typically occurs in the setting of severe malnutrition due to alcoholism, drug abuse, or psychiatric illness. Common

- Systemic symptoms – arthralgias, malaise, weakness

As the syndrome progresses, hemolytic anemia and edema also commonly occur. Diagnosis is made by plasma or leukocyte vitamin C levels. Treatment with oral or injectable vitamin C rapidly improves constitutional symptoms, but gingival changes may take up to 2 weeks to resolve.

(Choice A) Approximately 80% of alcoholics have thrombocytopenia due to alcohol-induced bone marrow suppression. Anemia and leukopenia can also occur. However, myelosuppression is unlikely to account for this patient's poor wound healing or gingivitis.

(Choice B) Although chronic liver disease can cause thrombocytopenia, anemia, ecchymosis, and lower-extremity edema, it is not typically associated with poor wound healing and gingival changes. In addition, there are no other common signs of liver disease (eg, ascites, jaundice, muscle cramps, spider hemangiomas, splenomegaly).

(Choice C) Chronic venous insufficiency is marked by edema, pain, skin changes, and ulceration. Although this condition can cause poor wound healing, it is not typically associated with gingivitis or scattered ecchymosis.

(Choice E) This patient completed his course of antibiotics and does not currently have local (eg, warmth, pain, purulent discharge) or systemic (eg, fever, leukocytosis) signs of infection. The mild erythema at the border of the wound (without warmth or tenderness) is much more likely to represent healing tissue than infection.

Educational objective:
Scurvy (vitamin C deficiency) typically occurs in the setting of severe malnutrition due to alcoholism, drug abuse, or psychiatric illness. Common manifestations include prominent cutaneous findings (eg, follicular hyperkeratosis, perifollicular hemorrhage, ecchymosis, petechiae), gingivitis (eg, recessed gums that bleed easily, dental caries), and impaired wound healing. Diagnosis is made with plasma or leukocyte vitamin C levels.

References

- Scurvy: reemergence of nutritional deficiencies.

Surgery	Gastrointestinal & Nutrition	Vitamin C deficiency
Subject	System	Topic

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A 54-year-old woman comes to the office due to fatigue, anorexia, and weight loss. Over the past 3 months, she has lost 10 kg (22 lb) but has not changed her diet or activity level. The patient has a history of hypertension and type 2 diabetes mellitus. She does not use tobacco, alcohol, or illicit drugs. Temperature is 36.9 C (98.4 F), blood pressure is 120/80 mm Hg, pulse is 80/min, and respirations are 16/min. BMI is 31 kg/m^2. Mild temporal wasting is noted. The abdomen is soft, the flanks are full, and shifting dullness is present. There is hepatomegaly and a single palpable liver nodule. Trace edema is present in the bilateral lower extremities. Laboratory results are as follows:

Complete blood count		
Hemoglobin	11.6 g/dL	
Platelets	125,000/mm^3	
Leukocytes	9,000/mm^3	
Liver function studies		
Albumin	2.5 g/dL	
Total bilirubin	2.3 mg/dL	
Alkaline phosphatase	370 U/L	
Aspartate aminotransferase (SGOT)	134 U/L	
Alanine aminotransferase (SGPT)	124 U/L	
Blood, plasma, and serum		
Alpha-fetoprotein, serum	12 ng/mL	(normal: 0-20)

Which of the following is the most likely diagnosis?

A. Focal nodular hyperplasia

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Leukocytes	9,000/mm^3	
Liver function studies		
Albumin	2.5 g/dL	
Total bilirubin	2.3 mg/dL	
Alkaline phosphatase	370 U/L	
Aspartate aminotransferase (SGOT)	134 U/L	
Alanine aminotransferase (SGPT)	124 U/L	
Blood, plasma, and serum		
Alpha-fetoprotein, serum	12 ng/mL	(normal: 0-20)

Which of the following is the most likely diagnosis?

A. Focal nodular hyperplasia
B. Hepatic adenoma
C. Hepatocellular carcinoma
D. Hydatid cyst
E. Pyogenic liver abscess

Submit

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Leukocytes	9,000/mm^3	
Liver function studies		
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Alanine aminotransferase (SGPT)	124 U/L	
Blood, plasma, and serum		
Alpha-fetoprotein, serum	12 ng/mL	(normal: 0-20)

Which of the following is the most likely diagnosis?

- A. Focal nodular hyperplasia (15%)
- B. Hepatic adenoma (20%)
- ✓ C. Hepatocellular carcinoma (58%)
- D. Hydatid cyst (4%)
- E. Pyogenic liver abscess (1%)

Omitted
Correct answer

58%
Answered correctly

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This patient's ascites (shifting abdominal dullness), hypoalbuminemia, mildly elevated liver function tests, thrombocytopenia, and hyperbilirubinemia are consistent with underlying **cirrhosis**. Most cases are caused by alcohol abuse, chronic viral hepatitis, or **nonalcoholic fatty liver disease** (as is likely in this patient with a history of diabetes mellitus and obesity).

Patients with cirrhosis are often unaware of the diagnosis until they develop complications such as variceal bleeding or **hepatocellular carcinoma** (HCC), a primary liver tumor. Risk of HCC in patients with cirrhosis is 1%-8% per year. In these patients, HCC usually presents with **decompensated liver failure** (eg, ascites, jaundice, hypoalbuminemia), weight loss, cachexia (eg, temporal wasting), possible hepatomegaly, and a **palpable liver nodule**.

Alpha-fetoprotein (AFP), a glycoprotein produced by the fetal liver and yolk sac, is elevated in ~50% of cases; therefore, AFP can serve as an important diagnostic clue (when elevated) but cannot be used to rule out the diagnosis. Triple phase arterial contrast CT scan of the abdomen is diagnostic in most cases.

(Choice A) Focal nodular hyperplasia is a benign liver lesion that usually arises in young women. Although a minority develop a palpable liver nodule, most are asymptomatic; the lesion does not usually rupture, undergo malignant transformation, cause liver failure, or result in weight loss/cachexia.

(Choice B) Hepatic adenoma is a benign liver lesion common in young women on oral contraception. Some lesions undergo malignant transformation (to HCC), which may result in cachexia, weight loss, and anorexia. However, decompensated liver failure is uncommon (because the rest of the liver has preserved function).

(Choice D) Hydatid cyst is an *Echinococcus* tapeworm infection. Most cases are asymptomatic, but large hydatid cysts can cause hepatomegaly, right upper quadrant pain, or nausea/vomiting. Decompensated liver failure and cachexia/weight loss would be uncommon.

(Choice E) Pyogenic liver abscess is most common in the setting of biliary infection or bowel perforation. Although weight loss, anorexia, fatigue, transaminitis, hepatomegaly, and hyperbilirubinemia commonly occur, almost all patients have fever, abdominal pain, and leukocytosis.

Educational objective:
Patients with cirrhosis are often unaware of the condition until they develop complications. One major complication is hepatocellular carcinoma, a primary liver tumor that often presents with decompensated liver failure, weight loss, and a palpable liver lesion. Alpha-fetoprotein is elevated in ~50% of cases; therefore, it can be a useful diagnostic clue but cannot be used to rule out the disease.

(HCC), a primary liver tumor. Risk of HCC in patients with cirrhosis is 1%-8% per year. In these patients, HCC usually presents with **decompensated liver failure** (eg, ascites, jaundice, hypoalbuminemia), weight loss, cachexia (eg, temporal wasting), possible hepatomegaly, and a **palpable liver nodule**.

Alpha-fetoprotein (AFP), a glycoprotein produced by the fetal liver and yolk sac, is elevated in ~50% of cases; therefore, AFP can serve as an important diagnostic clue (when elevated) but cannot be used to rule out the diagnosis. Triple phase arterial contrast CT scan of the abdomen is diagnostic in most cases.

(Choice A) Focal nodular hyperplasia is a benign liver lesion that usually arises in young women. Although a minority develop a palpable liver nodule, most are asymptomatic; the lesion does not usually rupture, undergo malignant transformation, cause liver failure, or result in weight loss/cachexia.

(Choice B) Hepatic adenoma is a benign liver lesion common in young women on oral contraception. Some lesions undergo malignant transformation (to HCC), which may result in cachexia, weight loss, and anorexia. However, decompensated liver failure is uncommon (because the rest of the liver has preserved function).

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(Choice E) Pyogenic liver abscess is most common in the setting of biliary infection or bowel perforation. Although weight loss, anorexia, fatigue, transaminitis, hepatomegaly, and hyperbilirubinemia commonly occur, almost all patients have fever, abdominal pain, and leukocytosis.

Educational objective:
Patients with cirrhosis are often unaware of the condition until they develop complications. One major complication is hepatocellular carcinoma, a primary liver tumor that often presents with decompensated liver failure, weight loss, and a palpable liver lesion. Alpha-fetoprotein is elevated in ~50% of cases; therefore, it can be a useful diagnostic clue but cannot be used to rule out the disease.

Surgery	Gastrointestinal & Nutrition	Hepatocellular cancer
Subject	System	Topic

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A 37-year-old hospitalized man is evaluated for acute onset of intense periumbilical abdominal pain associated with nausea and vomiting. He has had 2 bowel movements since the pain started. The patient has a history of alcohol and intravenous heroin abuse. He was admitted 4 days ago for fever, chills, and shortness of breath and was diagnosed with acute bacterial endocarditis. His blood cultures grew *Staphylococcus aureus*, and an echocardiogram showed vegetations on the mitral valve. He is currently being treated with intravenous vancomycin. On examination, the patient appears in significant distress and is restless. Temperature is 37.5 C (99.5 F), blood pressure is 150/90 mm Hg, pulse is 110/min and regular, and respirations are 18/min. Pupils are equal, round, and 3 mm in size. Lungs are clear to auscultation. A 3/6 holosystolic murmur is present over the apex. There is no third heart sound. On abdominal palpation, mild diffuse tenderness is present. There is no rigidity or rebound. Bowel sounds are decreased. Extremities are warm with normal pulses. There is no tremor. Abdominal x-rays reveal no free air or obstruction. Which of the following is the most likely diagnosis?

A. Acalculous cholecystitis
B. Acute pancreatitis
C. Alcohol withdrawal
D. Intraabdominal abscess
E. Mesenteric ischemia
F. Opioid withdrawal
G. Papillary muscle rupture

Submit

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

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- A. Acalculous cholecystitis (2%)
- B. Acute pancreatitis (8%)
- C. Alcohol withdrawal (5%)
- D. Intraabdominal abscess (5%)
- ✓ E. Mesenteric ischemia (54%)
- F. Opioid withdrawal (23%)
- G. Papillary muscle rupture (1%)

Omitted
Correct answer
E

54%
Answered correctly

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Acute mesenteric ischemia	
Presentation	• Rapid onset of periumbilical pain (often severe) • Pain **out of proportion** to examination findings • Hematochezia (late complication)
Risk factors	• **Atherosclerosis** (acute or chronic) • Embolic source (thrombus, vegetations) • Hypercoagulable disorders
Laboratory findings	• Leukocytosis • Elevated amylase & phosphate levels • **Metabolic acidosis** (elevated **lactate**)
Diagnosis	• **CT** (preferred) or MR angiography • Mesenteric angiography if diagnosis is unclear

This patient most likely has **acute mesenteric ischemia** (AMI) due to embolism from a cardiac valve vegetation. AMI is most commonly due to abrupt arterial occlusion from either of the following:

- **Cardiac embolic events** in the setting of atrial fibrillation, valvular disease (eg, infective endocarditis), or cardiovascular aneurysms
- Acute thrombosis due to peripheral arterial disease or low cardiac output states

AMI typically presents with sudden-onset, severe, poorly localized (visceral) midabdominal pain accompanied by nausea and vomiting. In early-stage ischemia, physical examination is typically unremarkable (eg, mild diffuse tenderness) despite patients having severe pain **out of proportion** to the examination findings. If bowel infarction occurs, patients may develop more focal abdominal tenderness (due to local inflammation/infarction), peritoneal signs (eg, guarding, rebound tenderness), rectal bleeding, and sepsis. Leukocytosis, elevated hemoglobin (hemoconcentration), elevated amylase, and **metabolic acidosis** (lactate) are frequently seen on laboratory testing.

(Choice A) Acalculous cholecystitis usually occurs in critically ill, hospitalized patients. Patients often have jaundice as well as pain and/or a mass in the upper right quadrant.

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- Mesenteric angiography if diagnosis is unclear

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(Choice A) Acalculous cholecystitis usually occurs in critically ill, hospitalized patients. Patients often have jaundice as well as pain and/or a mass in the upper right quadrant.

(Choice B) Acute pancreatitis commonly produces nausea, vomiting, and epigastric pain radiating to the back. This patient's minimal abdominal tenderness, urge to defecate (common with AMI), and history of endocarditis make AMI a more likely diagnosis.

(Choice C) Alcohol withdrawal frequently presents with restlessness, diaphoresis, and tachycardia. In moderate-to-severe cases, it may also present with seizures, hallucinations, and altered mental status. Acute, severe abdominal pain is less likely.

(Choice D) Intraabdominal abscesses usually present subacutely with fever, focal abdominal tenderness, and weight loss.

(Choice F) Opioid withdrawal commonly presents with gastrointestinal manifestations. However, these are also usually accompanied by flulike symptoms and signs of sympathetic nervous system activation (eg, mydriasis, agitation, anxiety); bowel sounds are typically increased rather than decreased.

(Choice G) Papillary muscle rupture is a serious mechanical complication of acute myocardial infarction characterized by acute-onset hypotension and pulmonary edema with respiratory distress.

Educational objective:
Acute mesenteric ischemia classically presents with acute-onset, severe, midabdominal pain out of proportion to physical examination findings.

(hemoconcentration), elevated amylase, and **metabolic acidosis** (lactate) are frequently seen on laboratory testing.

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Educational objective:
Acute mesenteric ischemia classically presents with acute-onset, severe, midabdominal pain out of proportion to physical examination findings. Progression to bowel infarction causes focal pain, peritoneal signs, rectal bleeding and sepsis.

References

- Mesenteric ischemia: Pathogenesis and challenging diagnostic and therapeutic modalities.
- The diagnosis of acute mesenteric ischemia: A systematic review and meta-analysis.
- Acute mesenteric ischemia: A vascular emergency.

Surgery	Gastrointestinal & Nutrition	Mesenteric ischemia
Subject	System	Topic

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A 27-year-old woman, gravida 1 para 0 at 30 weeks gestation, comes to the office due to increasing difficulty hearing, especially on the right side. She has had no ear pain or discharge. The patient has no prior medical conditions; the pregnancy has been uncomplicated other than an episode of acute cystitis 8 weeks ago, which was treated with antibiotics. She takes no medications aside from a multivitamin. The patient eats a balanced diet and does not use tobacco or alcohol. Vital signs are within normal limits. Bilateral tympanic membranes are normal with no middle ear effusion. A tuning fork held over the middle of the forehead sounds louder in the right ear. Tuning fork sounds are better heard with bone conduction on the right side and with air conduction on the left. The remainder of the neurologic examination shows no abnormalities. Which of the following is the most likely cause of this patient's current symptoms?

A. Chronic otitis media
B. Medication ototoxicity
C. Ménière disease
D. Otosclerosis
E. Presbycusis
F. Vestibular schwannoma (acoustic neuroma)

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A. Chronic otitis media (2%)
B. Medication ototoxicity (42%)
C. Ménière disease (2%)
✓ D. Otosclerosis (44%)
E. Presbycusis (2%)
F. Vestibular schwannoma (acoustic neuroma) (5%)

Omitted
Correct answer
D

44%
Answered correctly

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Last Updated

Explanation

Interpretation of Rinne & Weber tests

Interpretation of Rinne & Weber tests		
	Rinne result	**Weber result**
Normal	AC > BC in **both** ears	Midline
Conductive hearing loss	BC > AC in **affected** ear, AC > BC in **unaffected** ear	Lateralizes to **affected** ear
Sensorineural hearing loss	AC > BC in **both** ears	Lateralizes to **unaffected** ear, **away** from affected ear
Mixed hearing loss	BC > AC in **affected** ear, AC > BC in **unaffected** ear	Lateralizes to **unaffected** ear, **away** from affected ear

AC = air conduction; **BC** = bone conduction.

Hearing loss is classified as either **conductive** (impaired transmission of sound to the inner ear) or **sensorineural** (involving the cochlea or auditory nerve), which can be distinguished with tuning fork examination. The **Rinne** test compares air conduction (tuning fork near the ear) versus bone conduction (tuning fork on the mastoid bone). With normal hearing, air-conducted sound is perceived as louder than bone-conducted sound. The **Weber** test is performed by placing the tuning fork on the middle of the forehead equidistant from both ears. The sound carried by bone conduction in this manner is normally heard equally in both ears; vibration heard louder in one ear is abnormal.

- **Sensorineural hearing loss** causes lateralization to the **unaffected ear** because the inner ear is unimpaired on that side and therefore can better hear the sound.
- **Conductive hearing loss** causes lateralization to the **affected ear** because the conductive deficit masks the ambient noise in the room, allowing the sound to be better heard.

Conductive hearing loss can be caused by disorders of the external auditory canal (eg, cerumen impaction, otitis externa), tympanic membrane (eg, perforation), middle ear space (eg, otitis media, cholesteatoma), or the ossicular chain (eg, otosclerosis).

This young woman with conductive hearing loss and a normal otoscopic examination likely has **otosclerosis**. Otosclerosis results from an imbalance of bone resorption and deposition that leads to stiffening and ultimately fixation of the stapes, which dampens the transmission of sound

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This young woman with conductive hearing loss and a normal otoscopic examination likely has **otosclerosis**. Otosclerosis results from an imbalance of bone resorption and deposition that leads to stiffening and ultimately fixation of the stapes, which dampens the transmission of sound energy from the tympanic membrane to the cochlea. Otosclerosis may progress during pregnancy. It is inherited in an autosomal dominant pattern with incomplete penetrance. Treatment involves hearing amplification or surgical reconstruction of the stapes.

(Choice A) Although chronic otitis media may cause conductive hearing loss, it is typically accompanied by ear pain and/or fullness, which were not reported by this patient. Examination of the tympanic membranes would show retraction of the tympanic membrane or fluid in the middle ear.

(Choice B) Aminoglycoside antibiotics can cause sensorineural (rather than conductive) hearing loss. In addition, they are more commonly used in pyelonephritis rather than cystitis.

(Choices C, E, and F) Although Ménière disease (episodic vertigo, fluctuating hearing loss), presbycusis (progressive hearing loss in advanced age), and vestibular schwannoma (CN VIII tumor) would all have normal otoscopic examinations, they would cause sensorineural hearing loss rather than conductive.

Educational objective:
Otosclerosis causes fixation of the stapes, which results in conductive hearing loss. It often presents in young women and may progress during pregnancy.

allowing the sound to be better heard.

Conductive hearing loss can be caused by disorders of the external auditory canal (eg, cerumen impaction, otitis externa), tympanic membrane (eg, perforation), middle ear space (eg, otitis media, cholesteatoma), or the ossicular chain (eg, otosclerosis).

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Educational objective:
Otosclerosis causes fixation of the stapes, which results in conductive hearing loss. It often presents in young women and may progress during pregnancy.

References

- The etiology of otosclerosis: a combination of genes and environment.
- Controversies in the evaluation and management of otosclerosis.

Surgery	Ear, Nose & Throat (ENT)	Otosclerosis
Subject	System	Topic

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A 54-year-old woman comes to the emergency department due to 2 days of abdominal pain. She has also had anorexia, nausea, hiccups, and shortness of breath. The patient was diagnosed with acute appendicitis and underwent a laparoscopic appendectomy 10 days ago. She had been recovering well until the abdominal pain returned. The patient has a history of type 2 diabetes mellitus and prior cholecystectomy for choleliths. Temperature is 39.3 C (102.8 F), blood pressure is 120/70 mm Hg, pulse is 94/min, and respirations are 24/min. BMI is 30 kg/m^2. No scleral icterus or skin rash is present. Breath sounds are decreased at the right base. The abdomen is mildly distended, and palpation of the right upper quadrant elicits pain. The abdominal surgical incisions are mildly tender without surrounding erythema or discharge. Bowel sounds are decreased. Leukocyte count is 24,000/mm^3, and chest x-ray reveals a right pleural effusion. Which of the following is the most likely cause of this patient's current condition?

A. Choledocholithiasis
B. Hospital-acquired pneumonia
C. Intra-abdominal abscess
D. Mechanical bowel obstruction
E. Postoperative atelectasis
F. Pulmonary embolism

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- A. Choledocholithiasis (5%)
- B. Hospital-acquired pneumonia (14%)
- ✓ C. Intra-abdominal abscess (61%)
- D. Mechanical bowel obstruction (8%)
- E. Postoperative atelectasis (7%)
- F. Pulmonary embolism (2%)

Omitted
Correct answer
C

61%
Answered correctly

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06/14/2020
Last Updated

Explanation

This patient underwent a **laparoscopic appendectomy** 10 days ago and now has right upper quadrant pain, fever, leukocytosis, and pulmonary

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This patient underwent a **laparoscopic appendectomy** 10 days ago and now has right upper quadrant pain, fever, leukocytosis, and pulmonary manifestations (shortness of breath, hiccups, right-sided effusion), suggesting a **subphrenic abscess**.

Infections are the most common complication of appendectomy, and risk of **intra-abdominal abscess** is significantly greater with laparoscopic appendectomy than laparotomy. Manifestations typically include recurrent fever and abdominal symptoms (eg, pain, vomiting) several days after an abdominal operation. Diagnosis usually requires CT scan of the abdomen. Most patients are treated with drainage and intravenous antibiotics.

(Choice A) Choledocholithiasis can cause fever, right upper quadrant pain, and leukocytosis: however, most patients are jaundiced (not anicteric), and a pleural effusion/hiccups would be atypical.

(Choice B) Hospital-acquired pneumonia (HAP) is associated with fever, leukocytosis, and pulmonary infiltrate; however, most cases occur ≤5 days postoperatively. In addition, abdominal pain, abdominal distension, and reduced bowel sounds are not typical features of HAP.

(Choice D) Mechanical bowel obstructions are more common in individuals who have abdominal adhesions from previous abdominal surgery; however, adhesions typically take months to form, and bowel obstruction is not typically associated with pleural effusion and hiccups.

(Choice E) Postoperative atelectasis is common up to 5 days after abdominal procedures and often presents with hypoxemia and dyspnea. Fever, significant leukocytosis, abdominal pain, and reduced bowel sounds are not typically associated with this condition.

(Choice F) Pulmonary embolism is a common postoperative complication and may cause shortness of breath, pleural effusion, and fever. Abdominal pain, abdominal distension, and decreased bowel sounds are not typical.

Educational objective:
Patients who receive a laparoscopic appendectomy are at much greater risk for intra-abdominal abscess than those receiving laparotomy. Intra-abdominal abscess should be suspected when fever and abdominal symptoms (eg, pain, vomiting) return several days after an abdominal operation.

Surgery	Gastrointestinal & Nutrition	Intraabdominal abscess
Subject	System	Topic

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A 20-year-old man was stabbed in the chest during a street fight. Blood pressure is 90/58 mm Hg, pulse is 124/min, and respirations are 30/min. The patient is in severe respiratory distress. Breath sounds are present on the left and absent on the right. Heart sounds are normal. The neck veins are distended. The patient becomes obtunded during examination. Which of the following is the best next step in management?

A. Cricothyroidotomy
B. Emergency department thoracotomy
C. Endotracheal intubation
D. Needle thoracostomy
E. Pericardiocentesis
F. Rapid volume resuscitation

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- A. Cricothyroidotomy (0%)
- B. Emergency department thoracotomy (8%)
- C. Endotracheal intubation (21%)
- ✓ D. Needle thoracostomy (63%)
- E. Pericardiocentesis (4%)
- F. Rapid volume resuscitation (2%)

Omitted
Correct answer
D

63%
Answered correctly

02 secs
Time Spent

06/27/2020
Last Updated

Explanation

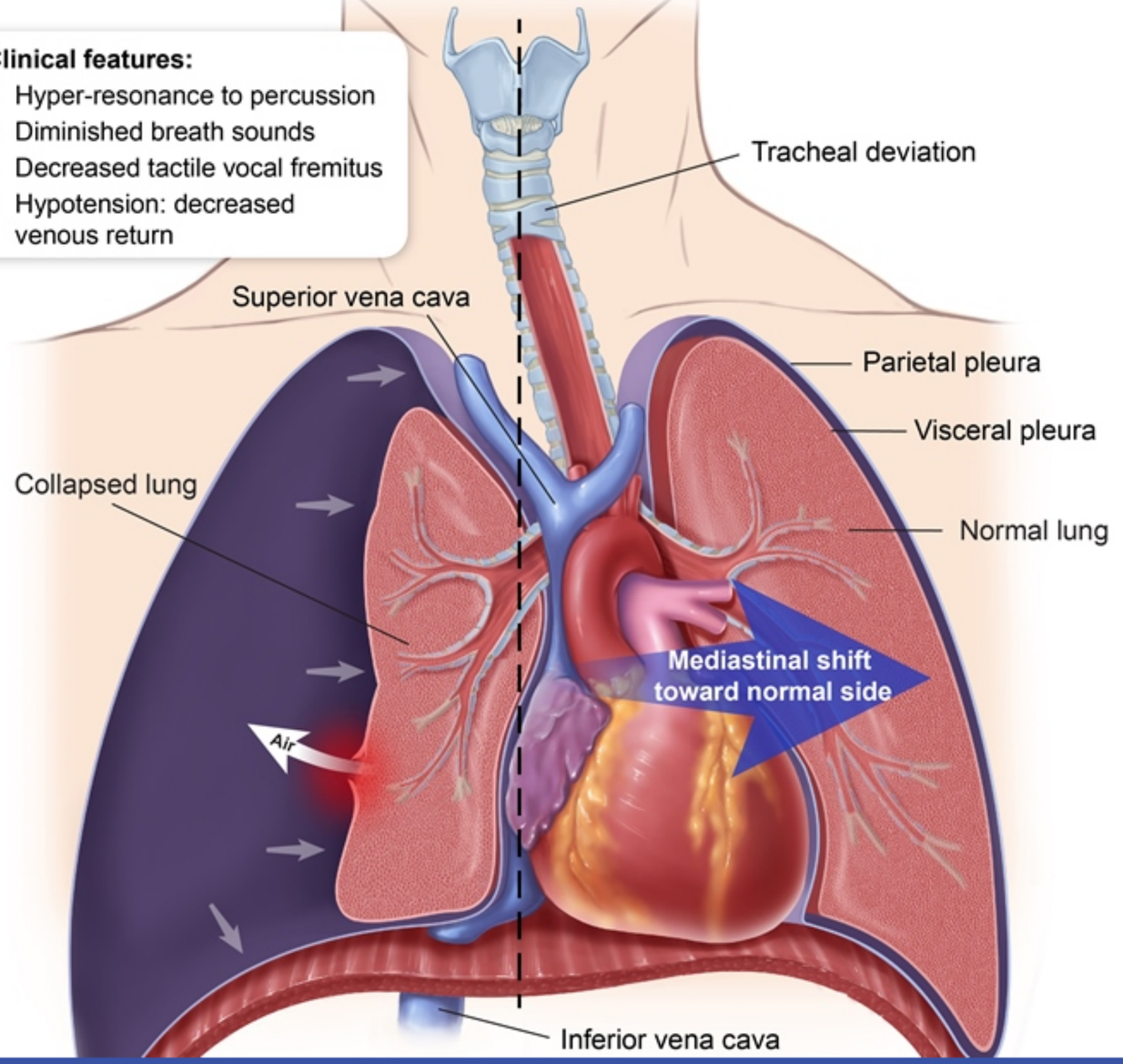


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Pneumothorax

Clinical features:

- Hyper-resonance to percussion
- Diminished breath sounds
- Decreased tactile vocal fremitus
- Hypotension: decreased venous return



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This patient who was stabbed in the chest has respiratory distress and right-sided absent breath sounds accompanied by hypotension and distended neck veins. This is concerning for **tension pneumothorax** (TP). TP develops when accumulated air (due to injured lung tissue) causes **high intrathoracic pressure** that compresses the vena cava and **impedes cardiac venous return**, resulting in decreased cardiac output and hypotension. This occurs when a one-way valve has formed, allowing air to flow into the pleural space during inspiration but trapping it during expiration.

When TP is suspected, **decompression** (eg, needle thoracostomy) should be performed immediately to **prevent cardiovascular collapse**. Needle thoracostomy can be performed quickly and should **precede intubation**. This is an important exception to the typical order of establishing the airway first (ie, airway, breathing, circulation) but is necessary because positive-pressure ventilation (eg, intubation and mechanical ventilation) rapidly increases accumulated air and intrathoracic pressure, exacerbating TP and causing cardiovascular collapse **(Choice C)**. Following needle decompression, tube thoracostomy is required for definitive pneumothorax management.

(Choice A) Needle decompression precedes establishing a means of further ventilation in the specific case of TP. In addition, although cricothyroidotomy is sometimes used to establish an emergency airway (eg, upper airway obstruction or hemorrhage), this patient can likely undergo endotracheal intubation once the TP is decompressed.

(Choice B) Emergency department thoracotomy (ie, rapidly gaining intrathoracic access) is a heroic measure to resuscitate penetrating trauma patients with witnessed or imminent cardiac arrest (eg, via open cardiac massage, aortic clamping). Although this patient may be on the verge of cardiovascular collapse from TP, needle decompression is a more appropriate and less invasive next step.

(Choice E) Although cardiac tamponade (which can be treated by pericardiocentesis) may cause hypotension with distended neck veins, TP is more likely given this patient's absent right-sided breath sounds and normal (rather than muffled) heart sounds.

(Choice F) This patient may eventually require rapid volume resuscitation, but the TP (rather than bleeding) may be primarily responsible for his hypotension. Decompression of the TP should occur first to restore normal cardiac venous return and prevent cardiovascular collapse, after which it will be easier to determine the degree of fluid resuscitation required.

Educational objective:
Positive-pressure ventilation can rapidly exacerbate tension pneumothorax (TP) and cause cardiovascular collapse. Therefore, decompression (eg, needle thoracostomy) should be performed prior to intubation for patients with TP who also need airway protection—an important exception to

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This patient who was stabbed in the chest has respiratory distress and right-sided absent breath sounds accompanied by hypotension and distended neck veins. This is concerning for **tension pneumothorax** (TP). TP develops when accumulated air (due to injured lung tissue) causes **high intrathoracic pressure** that compresses the vena cava and **impedes cardiac venous return**, resulting in decreased cardiac output and hypotension. This occurs when a one-way valve has formed, allowing air to flow into the pleural space during inspiration but trapping it during expiration.

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References

- Penetrating trauma.
- Pneumothorax: from definition to diagnosis and treatment.

Surgery	Pulmonary & Critical Care	Pneumothorax
Subject	System	Topic

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A 19-year-old college student is brought to the emergency department by his friends due to severe retrosternal and upper abdominal pain. The patient was out with his friends drinking alcohol and celebrating the end of final exam week. An hour before arrival, he had several episodes of emesis, which is when he began experiencing the pain. He has had no medical issues other than ankle sprains while playing basketball. The patient has smoked cigarettes on several occasions and drinks alcohol on the weekends. His father died of a myocardial infarction at the age of 45. Temperature is 38.3 C (101 F), blood pressure is 95/56 mm Hg, pulse is 120/min, and respirations are 30/min. Pulse oximetry is 97% on room air. Height is 201 cm (6 ft 7 in), and weight is 90 kg (198.4 lb). On physical examination, the patient appears intoxicated and diaphoretic. Oral mucous membranes are dry, and there is no pharyngeal erythema. Cervical lymph nodes are not enlarged, but there is palpable crepitus in the suprasternal notch. Lung auscultation reveals bilateral symmetric breath sounds. Heart sounds are normal. There is mild epigastric tenderness without guarding or rebound. There is no extremity edema or cyanosis. Which of the following is the most likely cause of this patient's current condition?

A. Alcohol-induced pancreatitis
B. Aortic dissection
C. Aspiration pneumonitis
D. Esophageal perforation
E. Mallory-Weiss syndrome
F. Ruptured subpleural bleb

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- A. Alcohol-induced pancreatitis (1%)
- B. Aortic dissection (4%)
- C. Aspiration pneumonitis (0%)
- ✓ D. Esophageal perforation (79%)
- E. Mallory-Weiss syndrome (10%)
- F. Ruptured subpleural bleb (3%)

Omitted
Correct answer
D

79%
Answered correctly

02 secs
Time Spent

04/05/2020
Last Updated

Explanation

Characteristics of gastroesophageal mural injury

	Mallory-Weiss syndrome	Boerhaave syndrome
Etiology	• Forceful retching • **Mucosal** tear • Submucosal venous or arterial plexus bleeding	• Forceful retching • **Transmural** tear • Spillage of esophageal air/fluid into surrounding tissues
Clinical presentation	• Epigastric/back pain • **Hematemesis** (bright red or coffee-ground) • Possible hypovolemia	• Chest/back/epigastric pain • **Crepitus, crunching sound** (Hamman sign) • Odynophagia, dyspnea, fever, sepsis
Studies	• **Upper GI endoscopy** confirms diagnosis (& can treat persistent bleeding)	• Chest x-ray: pneumothorax, pneumomediastinum, pleural effusion • **Esophagography or CT scan with water-soluble contrast** confirms diagnosis
Management	• Acid suppression • **Most heal spontaneously**	• Acid suppression, antibiotics, NPO • **Emergency surgical consultation**

GI = gastrointestinal.

This patient with retrosternal pain, fever, and crepitus in the setting of protracted vomiting likely has a full thickness rupture of the esophagus **(esophageal perforation)**.

Forceful retching may increase intraesophageal pressure enough to cause a **full-thickness** effort **rupture** of the esophagus (Boerhaave syndrome), which may allow efflux of esophageal fluid and air into the mediastinum. The leaked gastrointestinal contents cause severe **chest/abdominal pain** and a systemic inflammatory response (eg, **fever**, tachycardia) that can quickly progress to septic shock and death; the leaked air **(pneumomediastinum)** may be palpated as **suprasternal crepitus** (subcutaneous emphysema).

These features distinguish esophageal perforation from Mallory-Weiss syndrome, which can be due to a similar etiology (eg, retching) but leads only to a partial-thickness tear classically associated with hematemesis (from submucosal plexus bleeding) **(Choice E)**.

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Visualization of contrast extravasating from the esophagus into surrounding tissues, either by esophagography or CT scan with water-soluble contrast (barium is more inflammatory), confirms the diagnosis of esophageal perforation. Intravenous broad-spectrum antibiotics and proton pump inhibitors should be administered, all oral intake restricted, and **emergent surgical consultation** obtained. Most perforations will require operative debridement and repair.

(Choice A) This patient's upper abdominal pain in the setting of heavy alcohol consumption is concerning for acute pancreatitis. However, acute pancreatitis does not cause suprasternal crepitus and—except in severe cases (eg, multiorgan failure)—is not typically associated with fever.

(Choice B) Aortic dissection should always be considered with acute-onset, severe chest pain, especially if risk factors are present (eg, Marfan syndrome in a tall, thin patient). However, crepitus and fever in the setting of protracted vomiting make esophageal perforation much more likely.

(Choice C) Aspiration of inflammatory gastric acid can occur with protracted vomiting, potentially inciting pneumonitis. This can cause chest pain and fever but would typically present as abrupt-onset respiratory distress with diffuse lung field crackles (due to inflammatory edema) on auscultation. It would not cause crepitus.

(Choice F) Primary spontaneous pneumothorax can occur in tall, thin young men from rupture of a subpleural bleb. Pneumothorax might cause dyspnea and subcutaneous emphysema, but decreased breath sounds would be expected on the affected side. Fever is uncommon.

Educational objective:
Effort rupture of the esophagus (Boerhaave syndrome) can occur with vomiting. Leakage of esophageal air through the full-thickness perforation

contrast (barium is more inflammatory), confirms the diagnosis of esophageal perforation. Intravenous broad-spectrum antibiotics and proton pump inhibitors should be administered, all oral intake restricted, and **emergent surgical consultation** obtained. Most perforations will require operative debridement and repair.

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Educational objective:
Effort rupture of the esophagus (Boerhaave syndrome) can occur with vomiting. Leakage of esophageal air through the full-thickness perforation may cause pneumomediastinum, evidenced by suprasternal crepitus on examination. Confirmation with esophagography or CT scan using water-soluble contrast should prompt emergent surgical consultation.

References

- Esophageal perforation.
- Esophageal perforation: diagnostic work-up and clinical decision-making in the first 24 hours.

Surgery	Gastrointestinal & Nutrition	Esophageal rupture
Subject	System	Topic

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A 75-year-old woman comes to the emergency department due to fever, chills, abdominal pain, nausea, and vomiting for the past 2 days. She did not eat anything unusual, and no one else at her home is sick. The patient has no diarrhea, dysuria, or urinary frequency. Medical issues include type 2 diabetes mellitus, hypertension, obstructive sleep apnea, and coronary artery disease. Temperature is 38.9 C (102 F), blood pressure is 130/80 mm Hg, pulse is 104/min, and respirations are 18/min. Oxygen saturation is 94% on room air. BMI is 32 kg/m^2. On physical examination, the patient appears acutely unwell. The oropharynx has dry mucous membranes, and dentition is poor. Cardiopulmonary examination shows normal lung and heart sounds. Abdomen is mildly distended. There is marked tenderness over the epigastrium and right upper quadrant with guarding. Bowel sounds are decreased. The extremities have no cyanosis or edema. Laboratory studies are as follows.

Hemoglobin	10.9 g/dL
Leukocytes	18,700/mm^3 (10% bands)
Total bilirubin	2.0 mg/dL
Indirect bilirubin	1.4 mg/dL
Lipase	normal
Blood urea nitrogen	34 mg/dL
Creatinine	1.4 mg/dL
Blood sugar	340 mg/dL

Abdominal ultrasonogram reveals thickening of the gallbladder wall, pericholecystic fluid, and multiple hyperechoic calculi. Air is noted within the gallbladder wall, and the common bile duct is not dilated. Intravenous fluids, insulin, analgesics, and broad-spectrum antibiotics are initiated. Which of the following additional intervention is most appropriate in the management of this patient?

A. Delayed cholecystectomy prior to the hospital discharge
B. Elective cholecystectomy 2 weeks after complete recovery
C. Urgent cholecystectomy now

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A. Delayed cholecystectomy prior to the hospital discharge
B. Elective cholecystectomy 2 weeks after complete recovery
C. Urgent cholecystectomy now
D. Urgent endoscopic retrograde cholangiopancreatography now
E. Urgent percutaneous gallbladder drainage now

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A. Delayed cholecystectomy prior to the hospital discharge (9%)
B. Elective cholecystectomy 2 weeks after complete recovery (6%)
✓ C. Urgent cholecystectomy now (65%)
D. Urgent endoscopic retrograde cholangiopancreatography now (4%)
E. Urgent percutaneous gallbladder drainage now (12%)

Omitted
Correct answer

65%
Answered correctly

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Last Updated

Emphysematous cholecystitis	
Risk factors	• Diabetes mellitus • Vascular compromise • Immunosuppression
Clinical presentation	• Fever, right upper quadrant pain, nausea/vomiting • Crepitus in abdominal wall adjacent to gallbladder
Diagnosis	• Air-fluid levels in gallbladder, gas in gallbladder wall • Cultures with gas-forming *Clostridium*, *Escherichia coli* • Unconjugated hyperbilirubinemia, mildly elevated aminotransferases
Treatment	• Emergency cholecystectomy • Broad-spectrum antibiotics with *Clostridium* coverage (eg, piperacillin-tazobactam)

This patient has **emphysematous cholecystitis** (EC), characterized by fever, right upper quadrant (RUQ) pain, and gas in the gallbladder wall or surrounding tissue. Unlike uncomplicated acute cholecystitis, EC is a surgical emergency and warrants immediate intervention. In addition to **emergency cholecystectomy**, management involves broad-spectrum antibiotics (eg, piperacillin-tazobactam, ertapenem) and bile culture.

EC occurs when **gas-forming organisms** such as *Clostridium* infect damaged or ischemic tissue in the gallbladder wall, with bacterial exotoxins resulting in hemolysis, tissue necrosis, and septic shock; if untreated, EC progresses to gangrenous cholecystitis and gallbladder perforation in most patients. Risk factors include relative immunosuppression (eg, age >50, diabetes mellitus) and vascular disease (eg, compromised cystic artery blood supply, atherosclerosis). In addition to pain and guarding, **crepitus** in the RUQ may occasionally be present.

Typical laboratory findings include leukocytosis with left shift and small elevations in aminotransferases. With clostridial infection, a mild to moderate **unconjugated hyperbilirubinemia** can occur secondary to **hemolysis**, as is likely in this patient. Imaging may demonstrate **pneumobilia** (air within the hepatobiliary system), air-fluid levels in the gallbladder, and **gas within the gallbladder wall** or surrounding tissue. Unlike other forms of acute cholecystitis, ultrasound is less sensitive due to the modality's poor visualization of air-filled structures, and extensive gas in the gallbladder wall may be falsely interpreted as being due to bowel loops. CT imaging is preferred due to the improved ability to delineate

Emphysematous cholecystitis	
Risk factors	• Diabetes mellitus • Vascular compromise • Immunosuppression
Clinical presentation	• Fever, right upper quadrant pain, nausea/vomiting • Crepitus in abdominal wall adjacent to gallbladder
Diagnosis	• Air-fluid levels in gallbladder, gas in gallbladder wall • Cultures with gas-forming *Clostridium*, *Escherichia coli* • Unconjugated hyperbilirubinemia, mildly elevated aminotransferases
Treatment	• Emergency cholecystectomy • Broad-spectrum antibiotics with *Clostridium* coverage (eg, piperacillin-tazobactam)

This patient has **emphysematous cholecystitis** (EC), characterized by fever, right upper quadrant (RUQ) pain, and gas in the gallbladder wall or surrounding tissue. Unlike uncomplicated acute cholecystitis, EC is a surgical emergency and warrants immediate intervention. In addition to **emergency cholecystectomy**, management involves broad-spectrum antibiotics (eg, piperacillin-tazobactam, ertapenem) and bile culture.

EC occurs when **gas-forming organisms** such as *Clostridium* infect damaged or ischemic tissue in the gallbladder wall, with bacterial exotoxins resulting in hemolysis, tissue necrosis, and septic shock; if untreated, EC progresses to gangrenous cholecystitis and gallbladder perforation in most patients. Risk factors include relative immunosuppression (eg, age >50, diabetes mellitus) and vascular disease (eg, compromised cystic artery blood supply, atherosclerosis). In addition to pain and guarding, **crepitus** in the RUQ may occasionally be present.

Typical laboratory findings include leukocytosis with left shift and small elevations in aminotransferases. With clostridial infection, a mild to moderate **unconjugated hyperbilirubinemia** can occur secondary to **hemolysis**, as is likely in this patient. Imaging may demonstrate **pneumobilia** (air within the hepatobiliary system), air-fluid levels in the gallbladder, and **gas within the gallbladder wall** or surrounding tissue. Unlike other forms of acute cholecystitis, ultrasound is less sensitive due to the modality's poor visualization of air-filled structures, and extensive gas in the gallbladder wall may be falsely interpreted as being due to bowel loops. CT imaging is preferred due to the improved ability to delineate air-filled structures.

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(Choices A, B, and E) Cholecystectomy prior to discharge and ideally within 72 hours is the standard of care in low-risk patients with acute (nonemphysematous) cholecystitis. In high-risk patients (eg, severe systemic illness) with cholecystitis, cholecystectomy may be delayed until after recovery, with patients managed with antibiotic therapy and possible gallbladder drainage. Some patients with EC who cannot tolerate surgery undergo gallbladder (eg, percutaneous) drainage only.

(Choice D) Endoscopic retrograde cholangiopancreatography (with stone extraction/stent placement) is recommended for acute cholangitis, which is due to ascending biliary tract infection (eg, due to biliary obstruction) and may cause fever, RUQ pain, and jaundice (Charcot triad); if endoscopy is unsuccessful, percutaneous drainage may facilitate biliary drainage. However, acute cholangitis does not usually cause gas within the gallbladder wall and would be accompanied by common bile duct dilation and a more marked hyperbilirubinemia that is typically conjugated (due to biliary stasis).

Educational objective:
Emphysematous cholecystitis is characterized by fever, right upper quadrant pain, and gas in the gallbladder wall, surrounding tissue, or hepatobiliary system. It occurs when gas-forming organisms such as *Clostridium* infect damaged or ischemic tissue but, unlike uncomplicated acute cholecystitis, it is a surgical emergency and warrants immediate cholecystectomy.

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References

- Emphysematous cholecystitis.
- Emphysematous cholecystitis: a case report.

Surgery Gastrointestinal & Nutrition Cholecystitis

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Diagnosis

- Cultures with gas-forming *Clostridium*, *Escherichia coli*

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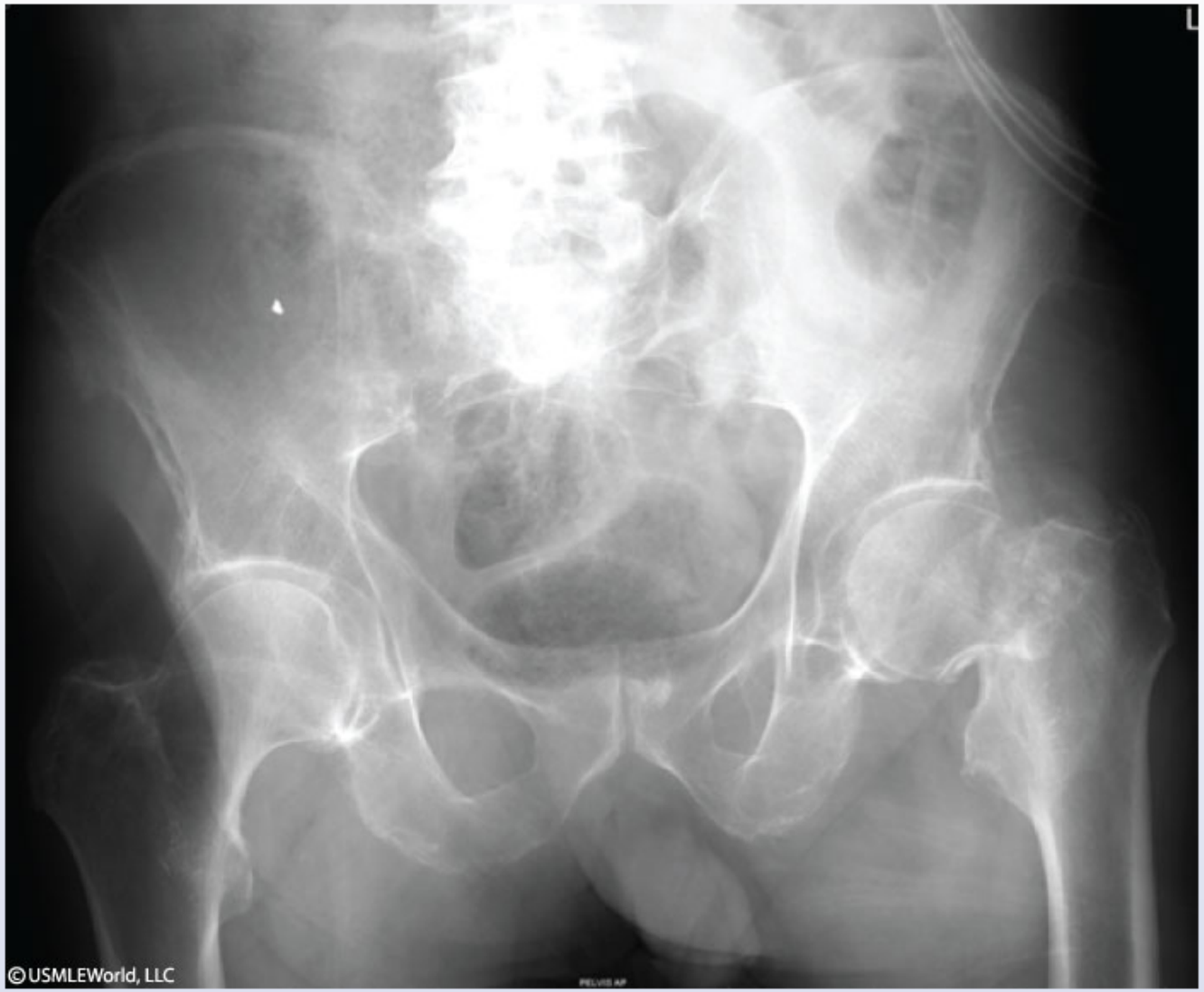
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A 73-year-old man is brought to the emergency department after his daughter found him on the floor. The patient says that he fell and now his left hip "hurts a lot," but he does not recall any details of the fall. Over the past several days, he has felt short of breath with a cough and intermittent palpitations that he attributed to "coming down with the flu." His other medical problems include hypertension, type 2 diabetes mellitus, chronic obstructive pulmonary disease, and benign prostatic hyperplasia. His temperature is 37.3 C (99.2 F), blood pressure is 118/76 mm Hg, pulse is 116/min, and respirations are 24/min. Pulse oximetry shows 95% on 2 L/min of oxygen by nasal cannula. Breath sounds are decreased at the right lung base, and crackles are present at the left lung base. The left lower extremity is shortened and externally rotated. Initial laboratory studies, including complete blood count, glucose, and serum chemistries, are normal. The pain improves with a dose of hydromorphone. X-ray findings are shown below.



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Which of the following is the best next step in management of this patient?

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Which of the following is the best next step in management of this patient?

A. Electrocardiogram, cardiac markers, and chest x-ray
B. Hemiarthroplasty for femoral neck fracture
C. Intravenous crystalloids
D. Lower-extremity skeletal traction
E. Skilled nursing care, with hip surgery after the viral syndrome resolves

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Which of the following is the best next step in management of this patient?

- ✓ A. Electrocardiogram, cardiac markers, and chest x-ray (49%)
- B. Hemiarthroplasty for femoral neck fracture (28%)
- C. Intravenous crystalloids (5%)
- D. Lower-extremity skeletal traction (6%)
- E. Skilled nursing care, with hip surgery after the viral syndrome resolves (9%)

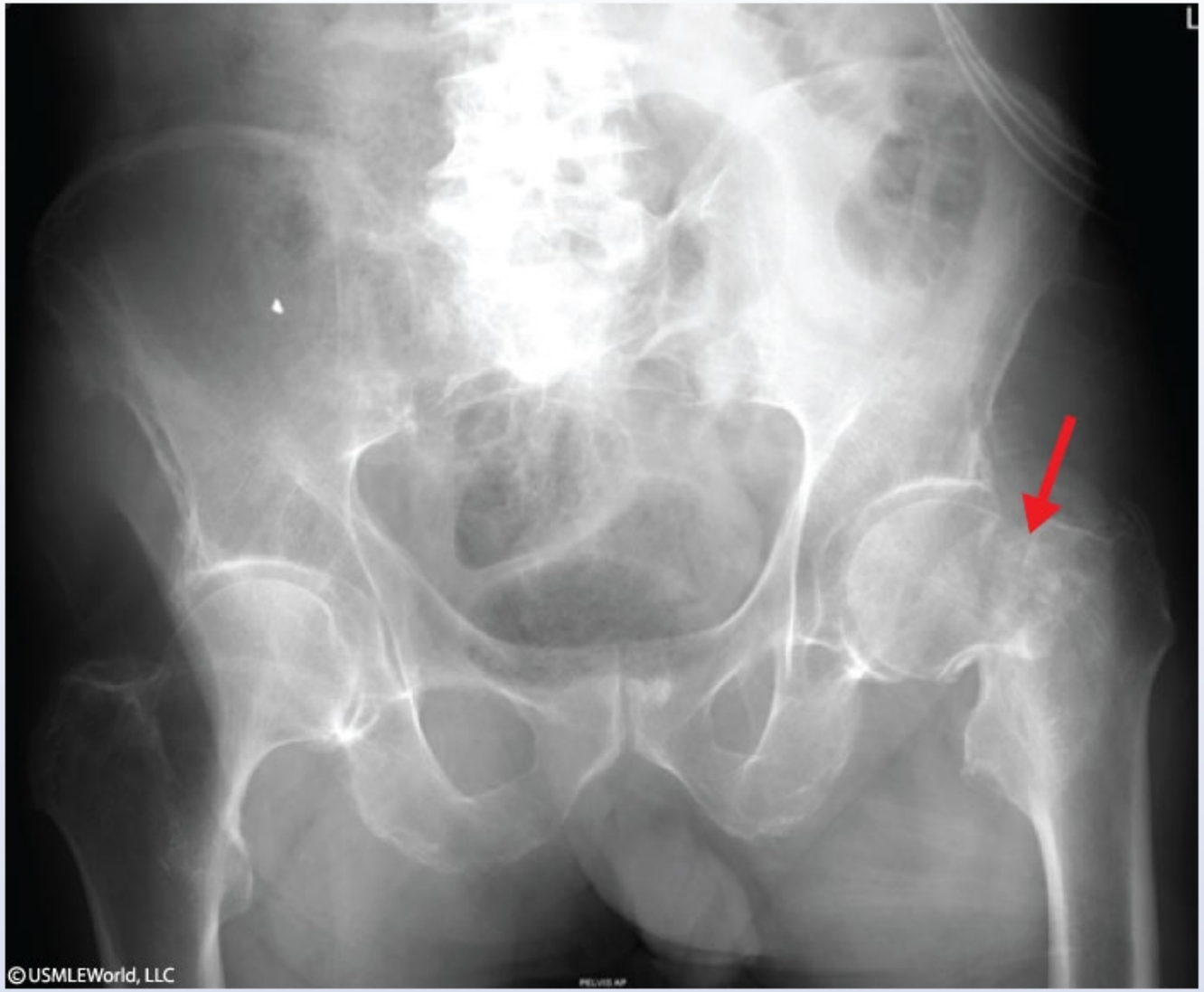
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This patient presents after a fall with a left femoral neck fracture. Hip fractures are classified by anatomic location and fracture type into either

This patient presents after a fall with a left femoral neck fracture. Hip fractures are classified by anatomic location and fracture type into either intracapsular (eg, femoral neck and head) or extracapsular (eg, intertrochanteric, subtrochanteric). Intracapsular fractures have a higher chance of avascular necrosis; extracapsular fractures have a greater need for implant devices (eg, nails, rods). The specific surgical intervention required depends largely on the details of the individual case.

In general, surgical repair should be done as soon as feasible to relieve pain, minimize complications, and reduce length of hospital stay. However, surgery may be delayed **up to 72 hours** if needed to address **unstable** medical comorbidity. This patient has a number of concerning features. The uncertain details surrounding his fall suggest a possible syncopal episode. His tachycardia and palpitations can be due to arrhythmia (atrial fibrillation); decreased breath sounds on the right side could be due to pleural effusion; cough, dyspnea, and left basilar crackles also suggest pulmonary edema or pneumonia. The patient should therefore be evaluated with chest x-ray, electrocardiogram, and cardiac markers to determine the etiology of his fall and assess preoperative risk prior to surgical correction of his fracture. If there is evidence of pulmonary edema and pleural effusion, an echocardiogram is needed. Once it is determined that he is otherwise medically stable, he may be cleared for surgical intervention **(Choice B)**.

(Choice C) Before starting intravenous fluids, pulmonary edema (heart failure) and pleural effusion should be ruled out with chest x-ray. This patient is not hypotensive and likely has an intracapsular fracture, which has a relatively low risk of acute blood loss and need for intravenous fluids.

(Choice D) Skeletal traction has been advocated as an interim measure for patients with hip fracture who require delayed surgical repair. However, recent studies have found that traction does not relieve pain or improve surgical outcomes.

(Choice E) Surgery may reasonably be delayed up to 72 hours to allow for stabilization of acute medical problems, but longer delays increase the risk of medical complications and prolong the return to premorbid functional status.

Educational objective:
Older patients with hip fracture should undergo definitive surgical correction as soon as reasonably possible. However, surgery may be delayed up to 72 hours to evaluate surgical risk and ensure medical stability.

References

- Screening for acute myocardial infarction in elderly patients with collapse, confusion and falls.

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A 62-year-old woman comes to the office due to upper extremity weakness and numbness. Three days ago, the patient was involved in a motor vehicle collision in which a truck rear-ended her vehicle. The patient did not hit her head or lose consciousness but experienced a tingling and burning sensation in all extremities, which she attributed to the stress of the accident. Since then, she has had numbness in her upper extremities and clumsiness of her hands. She reports difficulty picking up objects but has had no leg weakness or bowel or bladder disturbance. The patient is upset that the other driver refused to accept fault but reports no other ongoing stressors. She has a history of hypertension and osteoarthritis. Vital signs are within normal limits. Neck and back examination show no deformity or tenderness. There is weakness of hand grip bilaterally, and the triceps reflex is decreased on both sides. Decreased pinprick sensation is present on the fingers. The remainder of the neurologic examination is normal. Cervical spine x-ray reveals no vertebral dislocation or fracture, but diffuse spondylotic changes are present. Which of the following is the most likely cause of this patient's symptoms?

A. Acute stress disorder
B. Brachial plexus injury
C. Malingering
D. Postconcussion syndrome
E. Spinal cord injury

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- A. Acute stress disorder (3%)
- B. Brachial plexus injury (16%)
- C. Malingering (9%)
- D. Postconcussion syndrome (5%)
- ✓ E. Spinal cord injury (65%)

Omitted
Correct answer
E

65%
Answered correctly

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Explanation

This patient with cervical spine spondylosis (ie, nonspecific, degenerative cervical spine joint changes) was involved in a rear-end collision and

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This patient with cervical spine spondylosis (ie, nonspecific, degenerative cervical spine joint changes) was involved in a rear-end collision and developed subsequent upper extremity weakness, reflex loss, and sensation changes, raising strong suspicion for **central cord syndrome**, an incomplete **acute spinal cord injury**. Most cases arise when an older individual with a **stenotic cervical spinal canal** (eg, due to cervical spondylosis) experiences a **hyperextension** injury to the neck (eg, whiplash due to rear-end collision); this compresses the spinal cord between a hypertrophied ligamentum flavum posteriorly and a bulging disc/osteophyte complex anteriorly, leading to damage to the central spinal cord (grey matter).

Patients primarily develop **upper extremity manifestations**, including:

- **Weakness** due to damage to the alpha motor neuron cell bodies in the anterior horn of the spinal cord
- Pain, temperature, and **sensory loss** in dermatomes at and surrounding the level of injury due to damage to the posterior grey column
- **Reflex loss** (eg, tricep reflex) at the level of injury due to damage to fibers as they cross from the dorsal to ventral horn

Due to the more central location of the lesion, the lateral spinal tracts running to the sacrum (eg, bowel, bladder) and lower limbs are generally spared.

Workup begins with spinal imaging; x-ray is often normal but may show cervical spondylosis. Cervical myelogram is generally diagnostic and often demonstrates persistent cord compression; treatment with glucocorticoids and/or surgery is usually required.

(Choice A) Acute stress disorder is common after severe motor vehicle collisions and is generally characterized by agitation, anxiety, and fear. Numbness, weakness, and loss of reflexes in the upper extremities would be atypical.

(Choice B) Brachial plexus injury (nerve roots C5-T1) is generally characterized by shoulder or arm pain, upper extremity muscle weakness, atrophy (after weeks), and sensory loss; however, most cases are unilateral. In addition, traumatic injury to the brachial plexus usually occurs when there is downward traction on the shoulder and the neck is forced to the contralateral side (not during hyperextension injury).

(Choice C) Malingering is when a patient simulates an illness to obtain obvious external benefit (eg, money, medications, work benefits). This patient's reflex, motor, and sensory abnormalities on physical examination make malingering less likely.

(Choice D) Postconcussion syndrome is generally marked by headache, dizziness, cognitive impairment (eg, loss of concentration/memory), irritability, anxiety, and noise sensitivity. Although it can occur following whiplash injury, upper extremity weakness, sensory loss, and reflex abnormalities would be atypical.

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Educational objective:
Central cord syndrome is common after whiplash-type injuries in older adults with underlying cervical spondylosis. Damage to the central cervical spinal cord causes upper extremity motor, sensory, and reflex abnormalities; sacral (eg, bowel/bladder) and lower extremity function is generally preserved.

Surgery	Nervous System	Spinal cord injury
Subject	System	Topic

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A 64-year-old man comes to the office for evaluation of leg pain. The patient underwent a below-the-knee amputation 3 months ago due to a nonhealing plantar ulcer associated with osteomyelitis. He has been trying to be fitted for a walking prosthesis but bearing weight on the stump has caused significant pain. The patient describes the pain as an intermittent burning sensation that has not improved with pain medication. Medical history is notable for type 2 diabetes mellitus, hypertension, and peripheral vascular disease. The patient smokes a pack of cigarettes a day and has 1-2 drinks every night. On physical examination, the amputation incision is well healed, and the distal flap has no areas of blanching. There is slight bogginess over the end of the skin flap. Gentle pressure over the flap reproduces the pain, which radiates up the leg. Which of the following is the most likely cause of this patient's leg pain?

A. Heterotopic ossification
B. Neuroma
C. Osteomyelitis
D. Phantom pain syndrome
E. Stump hematoma

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- A. Heterotopic ossification (4%)
- ✓ B. Neuroma (36%)
- C. Osteomyelitis (3%)
- D. Phantom pain syndrome (30%)
- E. Stump hematoma (24%)

Omitted
Correct answer
B

36%
Answered correctly

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Explanation

Post-amputation pain	
Acute stump pain	• Tissue & nerve injury

Post-amputation pain	
Acute stump pain	• Tissue & nerve injury • Severe pain lasting 1-3 weeks
Ischemic pain	• Swelling, skin discoloration • Wound breakdown • ↓ Transcutaneous oxygen tension
Post-traumatic neuroma	• Weeks to months after amputation • Focal tenderness, altered local sensation • ↓ Pain with anesthetic injection
Phantom limb pain	• Onset usually within 1 week • Increased risk in patients with severe acute pain • Intermittent cramping, burning felt in distal limb

This patient has intermittent stump pain despite good wound healing following lower extremity amputation. The pain is elicited by **focal palpation** near the operative site, which suggests a **post-traumatic neuroma**. Post-traumatic neuromas are initiated by the transection of nerve fibers, which leads to an inflammatory reaction and formation of a tangled mass of unmyelinated nerve endings. These nerve endings have decreased depolarization thresholds that cause pain signals spontaneously or in response to nonpainful stimuli.

Post-traumatic neuromas form over several **weeks to months** following injury or amputation. Because the pain is worsened by local pressure, neuromas can complicate fittings for prosthetic devices. The diagnosis is based primarily on clinical grounds, but injection of a **local anesthetic** can provide transient pain relief and confirm the diagnosis. Management typically involves excision of the neuroma; tricyclic antidepressants and antiepileptic medications can be used for pain management prior to surgical intervention.

(Choice A) Heterotopic ossification is characterized by abnormal soft tissue calcification. It is more common in traumatic amputation, in which the amputation line passes through a region of damaged tissue, than in surgical amputation. Common associated findings include swelling, erythema, fever, and skin ulceration.

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(Choice C) Chronic osteomyelitis is a common complication of amputation, especially in patients with comorbid diabetes. It is typically associated with swelling, chronic wounds, or formation of weeping sinus tracts. However, minor bogginess at the amputation site is normal, and this patient has no other signs of osteomyelitis.

(Choice D) Phantom limb pain is common following amputation and has a highly variable presentation. However, it is typically apparent in the first week following amputation, causes sensations felt in the distal amputated limb, and is less likely than neuroma to be elicited by point palpation.

(Choice E) Stump hematoma typically presents with swelling, ecchymosis, and skin breakdown in the first several days following amputation. Formation of a chronic, expanding hematoma may occur but is rare and would not cause point tenderness with only minor soft tissue swelling.

Educational objective:
Post-traumatic neuromas are due to the transection of nerve fibers and form over several weeks to months following injury or amputation. They cause pain with local pressure that can complicate fittings for amputational prosthetics. Injection of a local anesthetic can provide transient pain relief and confirm the diagnosis. Management typically involves excision of the neuroma.

References

- Mechanisms and treatment of painful neuromas.

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References

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neuromas can complicate fittings for prosthetic devices. The diagnosis is based primarily on clinical grounds, but injection of a **local anesthetic** can provide transient pain relief and confirm the diagnosis. Management typically involves excision of the neuroma; tricyclic antidepressants and antiepileptic medications can be used for pain management prior to surgical intervention.

(Choice A) Heterotopic ossification is characterized by abnormal soft tissue calcification. It is more common in traumatic amputation, in which the amputation line passes through a region of damaged tissue, than in surgical amputation. Common associated findings include swelling, erythema, fever, and skin ulceration.

(Choice C) Chronic osteomyelitis is a common complication of amputation, especially in patients with comorbid diabetes. It is typically associated with swelling, chronic wounds, or formation of weeping sinus tracts. However, minor bogginess at the amputation site is normal, and this patient has no other signs of osteomyelitis.

(Choice D) Phantom limb pain is common following amputation and has a highly variable presentation. However, it is typically apparent in the first week following amputation, causes sensations felt in the distal amputated limb, and is less likely than neuroma to be elicited by point palpation.

(Choice E) Stump hematoma typically presents with swelling, ecchymosis, and skin breakdown in the first several days following amputation. Formation of a chronic, expanding hematoma may occur but is rare and would not cause point tenderness with only minor soft tissue swelling.

Educational objective:
Post-traumatic neuromas are due to the transection of nerve fibers and form over several weeks to months following injury or amputation. They cause pain with local pressure that can complicate fittings for amputational prosthetics. Injection of a local anesthetic can provide transient pain relief and confirm the diagnosis. Management typically involves excision of the neuroma.

References

- Mechanisms and treatment of painful neuromas.

Surgery	Rheumatology/Orthopedics & Sports	Amputation
Subject	System	Topic

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A previously healthy 19-year-old man comes to the emergency department (ED) due to persistent abdominal discomfort. The patient previously came to the ED 3 days ago after he fell while mountain biking. He did not lose consciousness and recalls hitting the handlebars prior to flipping and landing on his back. His trauma workup—which included CT scan of the chest, abdomen, and pelvis—was negative, and he was discharged. Since then, the patient has had persistent upper abdominal discomfort and nausea, along with an episode of nonbilious emesis. Temperature is 38.1 C (100.6 F), blood pressure is 104/62 mm Hg, and pulse is 108/min. The lungs are clear to auscultation, and heart sounds are normal. Ecchymosis is present across the upper abdomen, which is tender to palpation with voluntary guarding. Bowel sounds are decreased. Bedside ultrasonography reveals a large amount of free fluid in the upper abdomen. Which of the following is the most likely cause of this patient's condition?

A. Abdominal aortic tear
B. Diaphragmatic rupture
C. Hepatic laceration
D. Splenic rupture
E. Pancreatic duct injury

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A. Abdominal aortic tear (3%)
B. Diaphragmatic rupture (4%)
C. Hepatic laceration (24%)
D. Splenic rupture (29%)
✓ E. Pancreatic duct injury (38%)

Omitted
Correct answer
E

38%
Answered correctly

02 secs
Time Spent

06/09/2020
Last Updated

Explanation

This patient with a negative abdominal CT scan following **blunt abdominal trauma** (BAT) (eg, handlebar impact) now has persistent upper abdominal discomfort and nausea accompanied by a low-grade fever and a large upper abdominal fluid collection. This presentation is most

This patient with a negative abdominal CT scan following **blunt abdominal trauma** (BAT) (eg, handlebar impact) now has persistent upper abdominal discomfort and nausea accompanied by a low-grade fever and a large upper abdominal fluid collection. This presentation is most concerning for pancreatic duct injury, with resulting leakage of inflammatory pancreatic juice leading to accumulation of peripancreatic fluid.

Pancreatic injuries may result from BAT that **rapidly compresses** the **fixed**, **retroperitoneal pancreas** against the vertebral column. **Pancreatic injury** is often difficult to diagnose immediately following trauma because physical examination is nonspecific, initial serum amylase and lipase levels are unreliable markers, and abdominal CT scan has variable (~50%-80%) sensitivity. Therefore, the development of the following symptoms and signs in patients with recent BAT should raise suspicion for undiagnosed pancreatic injury:

- **Persistent abdominal discomfort**/tenderness
- Persistent **nausea**/emesis
- Increasing amylase over serial measurements
- **Peripancreatic fluid collection** (due to pancreatic duct injury)

Ductal injury may require cholangiopancreatography for diagnosis. Some (eg, low-grade) pancreatic injuries can be managed nonoperatively, but most ductal injuries require surgical intervention.

(Choice A) Abdominal aortic injuries due to BAT are rare (<1%). Many patients with traumatic aortic injury die from exsanguination before reaching the hospital. Those who survive (because bleeding has been initially contained within the retroperitoneum) would be extremely unlikely to have a large amount of free fluid on FAST without accompanying significant hemodynamic instability (eg, systolic blood pressure <90 mm Hg).

(Choice B) Diaphragmatic rupture, which can occur after BAT due to a sudden increase in intraabdominal pressure, may result in herniation of abdominal organs into the thoracic cavity. This may trap the stomach or small bowel and cause obstructive symptoms (eg, nausea, emesis). However, it does not typically cause significant intraabdominal free fluid and is unlikely to cause a low-grade fever.

(Choices C and D) The liver and spleen are the most commonly injured solid organs in blunt abdominal trauma. Although both hepatic laceration and splenic rupture can generate intraabdominal free fluid (ie, blood), injuries severe enough to cause a large amount of intraabdominal bleeding (eg, large amount of free fluid) are nearly always detected on initial abdominal CT scan.

Educational objective:
Blunt trauma that rapidly compresses the upper abdomen against the vertebral column can injure the pancreas. Pancreatic injury can be difficult

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Educational objective:
Blunt trauma that rapidly compresses the upper abdomen against the vertebral column can injure the pancreas. Pancreatic injury can be difficult to diagnose immediately following trauma; persistent abdominal discomfort or nausea, increasing amylase, or peripancreatic fluid collection should raise suspicion for an undiagnosed injury.

References

- Pancreatic trauma: a concise review.
- Blunt pancreatic trauma: a persistent diagnostic conundrum?
- Clinical update on management of pancreatic trauma.

Surgery	Gastrointestinal & Nutrition	Blunt abdominal trauma
Subject	System	Topic

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A 68-year-old man is recovering in the intensive care unit after coronary artery bypass graft surgery. Two weeks ago, he was seen in the office for progressive exertional angina and shortness of breath. The patient underwent coronary angiography, which indicated severe extensive coronary artery disease. After discussion about the risks and benefits, he agreed to proceed with open heart surgery. The patient has a family history of coronary artery disease but no sudden cardiac death, heart failure, or bleeding. On postoperative day 1, the nurses report that the patient is confused and has had reduced urine output. Temperature is 35.6 C (96 F), blood pressure is 80/50 mm Hg, pulse is 118/min and regular, and respirations are 22/min. There is no drainage from his sternal wound, and there has been no drainage in the chest tube over the last 4 hours. The lung fields are clear. No heart murmurs are appreciated. The abdomen is soft. His extremities are cool. ECG shows sinus tachycardia and nonspecific T-wave changes. Pulmonary artery catheter readings are as follows: Right atrium 20 mm Hg (normal: 2-8 mm Hg), right ventricle 35/20 mm Hg (normal: 15-30 mm Hg / 2-8 mm Hg), and pulmonary capillary wedge pressure 20 mm Hg (normal: 6-12 mm Hg). Which of the following is the most appropriate next step in management of this patient?

- A. Blood cultures
- B. Coronary angiogram
- C. CT pulmonary angiogram
- D. CT scan of the head
- E. Dobutamine infusion
- F. Echocardiogram

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- A. Blood cultures (3%)
- B. Coronary angiogram (6%)
- C. CT pulmonary angiogram (21%)
- D. CT scan of the head (0%)
- E. Dobutamine infusion (25%)
- ✓ F. Echocardiogram (42%)

Omitted
Correct answer
F

42%
Answered correctly

02 secs
Time Spent

03/29/2020
Last Updated

Explanation

Cardiac tamponade	
Etiology	• Aortic aneurysm or postmyocardial infarction • Malignancy or radiation therapy • Infection (eg, viral, tuberculosis) • Connective tissue disease (eg, SLE) • Cardiovascular surgery
Clinical signs	• Beck triad: Hypotension, JVD, ↓ heart sounds • Pulsus paradoxus (SBP ↓ >10 mm Hg with inspiration)
Diagnosis	• ECG: Low-voltage QRS, electrical alternans • Chest x-ray: Enlarged cardiac silhouette, clear lungs • Echocardiogram: Right atrial & ventricular collapse, plethora of the IVC

IVC = inferior vena cava; **JVD** = jugular venous distension; **SBP** = systolic blood pressure; **SLE** = systemic lupus erythematosus.

This patient most likely has postoperative **cardiac tamponade**, a relatively rare but important early complication of coronary artery bypass grafting. Rapid accumulation of blood in the limited pericardial space leads to increased diastolic pressure in the chambers of the heart and severe **impairment in venous return**. Patients typically have evidence of cardiogenic shock (eg, hypotension, reduced urine output, cool extremities); the classic finding is the triad of hypotension, elevated jugular venous pressure, and distant heart sounds (Beck triad). Characteristically, there is **elevation and equalization of intracardiac diastolic pressures** (right atrial, right ventricular, and pulmonary capillary wedge pressure suggestive of left atrial pressure), as shown on this patient's pulmonary artery catheterization.

Cardiac tamponade can rapidly lead to cardiac arrest if left untreated. **Urgent echocardiography** confirms the diagnosis and can identify moderate or large pericardial effusion, right atrial diastolic collapse, right ventricular diastolic collapse (highly specific for tamponade), and bowing of the interventricular septum into the left ventricle during inspiration. Immediate percutaneous or surgical (pericardial window) drainage of pericardial fluid relieves elevated intrapericardial pressures and leads to rapid improvement in symptoms and hemodynamic status.

(Choice A) Blood cultures followed by empiric antibiotics are appropriate in patients with suspected septic shock; however, intracardiac pressures are typically low or normal (rather than elevated) due to the loss of intravascular volume that occurs in sepsis.

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(Choices B and E) Acute myocardial infarction due to failure of a bypass graft can lead to a similar presentation with cardiogenic shock and may necessitate coronary angiography for diagnosis or dobutamine infusion for inotropic left ventricular support. However, acute heart failure due to myocardial infarction does not typically cause equalization of intracardiac diastolic pressures and also is less likely in the absence of significant ECG changes.

(Choice C) CT pulmonary angiography is used to diagnose acute pulmonary embolism; however, low or normal (rather than elevated) pulmonary capillary wedge pressure is expected in acute pulmonary embolism due to impaired blood flow through the pulmonary circulation to the left atrium.

(Choice D) This patient's altered mental status is best explained by hypotension and shock (rather than stroke), and CT scan of the head is not indicated.

Educational objective:
Cardiac catheterization in patients with cardiac tamponade typically reveals elevated and equilibrated intracardiac diastolic pressures. Urgent echocardiography should be performed in patients with suspected cardiac tamponade for definitive diagnosis and management.

References

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References

- Postoperative cardiac tamponade in the modern surgical era.

Surgery	Cardiovascular System	Cardiac tamponade
Subject	System	Topic

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A 63-year-old man comes to the emergency department due to 8 hours of constant epigastric pain, which has become more severe and diffuse over the past 2 hours. He also has nausea and has had one episode of vomiting containing bile but no blood. The patient has been having episodic upper abdominal discomfort that occasionally awakens him from sleep but is relieved by antacids. Other medical conditions include hypertension, hyperlipidemia, type 2 diabetes mellitus, persistent atrial fibrillation, and chronic kidney disease. Medications include atorvastatin, lisinopril, metoprolol, warfarin, insulin lispro, and glargine. Temperature is 38.2 C (100.9 F), blood pressure is 110/70 mm Hg, and pulse is 100/min and irregular. BMI is 36 kg/m^2. The patient is in moderate distress due to pain. The abdomen is diffusely tender to palpation with rigidity, guarding, and rebound tenderness. Bowel sounds are absent. Laboratory findings are as follows:

Hemoglobin	9.5 g/dL
Leukocytes	14,000/mm^3
Platelets	108,000/mm^3
Serum chemistry	
Sodium	137 mEq/L
Potassium	4.5 mEq/L
Chloride	101 mEq/L
Bicarbonate	21 mEq/L
Glucose	210 mg/dL
Creatinine	1.8 mg/dL
International normalized ratio	2.1 (normal: 0.8-1.2)

An upright chest x-ray shows a small amount of free air under the right diaphragm. Nasogastric suction, intravenous crystalloid, and antibiotics are started, and an urgent surgery is planned. Which of the following additional interventions is most appropriate at present?

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Serum chemistry	
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A. Intravenous colloid infusion
B. Intravenous desmopressin
C. Packed red blood cell transfusion
D. Prothrombin complex concentrate
E. Single-donor platelet transfusion

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A. Intravenous colloid infusion (7%)
B. Intravenous desmopressin (4%)
C. Packed red blood cell transfusion (10%)
✓ D. Prothrombin complex concentrate (70%)
E. Single-donor platelet transfusion (6%)

Omitted
Correct answer

70%
Answered correctly

03 secs
Time Spent

04/22/2020
Last Updated

This patient has an acute abdomen (guarding, rebound tenderness) with subdiaphragmatic (intraperitoneal) free air. This presentation suggests perforation of a hollow abdominal viscus, likely due to a duodenal or gastric ulcer (given the patient's history of intermittent upper abdominal pain relieved with antacids), which requires nasogastric tube decompression, intravenous fluids, antibiotics, and urgent surgical evaluation. In addition, this patient takes warfarin for atrial fibrillation, and his **warfarin-induced anticoagulation** should be **reversed**. Indeed, therapeutic anticoagulation with an international normalized ratio (INR) between 2 and 3 (eg, 2.1 in this patient) is appropriate for the chronic management of atrial fibrillation; however, if not corrected preoperatively, therapeutic anticoagulation can predispose patients to intra- and postoperative bleeding complications.

Patients taking warfarin who require anticoagulation reversal (eg, urgent surgery with a high risk of bleeding, significant hemorrhage) should be managed as follows:

- Warfarin should be discontinued immediately.
- Patients (particularly those with an INR >2) should receive **prothrombin complex concentrate** (PCC), a concentrate of **vitamin K-dependent cofactors**. Three-factor PCC contains factors II, IX, and X with small amounts of protein C and S, whereas 4-factor PCC, the preferred agent, also contains therapeutic quantities of factor VII. PCC rapidly normalizes the INR, typically in ≤10 minutes; however, the effects are **transient** (hours).
- **Intravenous vitamin K** should also be administered to provide substrate for synthesis of new vitamin K-dependent clotting factors by the liver (particularly given the transient effects of PCC).

If PCC is unavailable, fresh frozen plasma (FFP) can be administered; however, it is less effective and typically requires transfusion of multiple units, increasing the risk of volume overload.

(Choice A) Colloids include FFP and albumin. FFP can be used if PCC is unavailable, whereas albumin is indicated in the treatment of hepatorenal syndrome or spontaneous bacterial peritonitis.

(Choice B) Desmopressin is given preoperatively to patients with mild hemophilia A to prevent excessive bleeding. It indirectly increases factor VIII levels by causing von Willebrand factor release from endothelial cells.

(Choice C) The decision to transfuse patients preoperatively is based on underlying risk factors for ischemic heart disease and anticipated blood loss during surgery. In general, tissue oxygen delivery does not become deficient until the hemoglobin drops below 7 g/dL. Although preparations

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(Choice E) Platelet counts greater than 50,000/mm^3 provide adequate hemostasis for most invasive procedures.

Educational objective:
Patients on warfarin who require urgent surgery with a high risk of bleeding, or those who are experiencing significant hemorrhage, should receive prothrombin complex concentrate (PCC) and intravenous vitamin K. If PCC is unavailable, fresh frozen plasma can be given.

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Surgery	Gastrointestinal & Nutrition	Anticoagulants
Subject	System	Topic

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A 55-year-old man comes to the office due to left-sided facial numbness. His symptoms began a month ago with tingling over his left mid-face and have progressively worsened to complete numbness on that side. The patient has also had 2 months of headaches, nasal congestion with intermittent epistaxis, and left ear fullness. He has had no fever, rhinorrhea, or purulent nasal discharge. The patient has taken over-the-counter allergy medications, but these have provided no relief. He has no other medical problems and does not use tobacco, alcohol, or illicit drugs. He recently immigrated to the United States from southern China to be closer to his son. Temperature is 37 C (98.6 F), blood pressure is 126/80 mm Hg, and pulse is 84/min. Examination reveals sensory loss to touch and pain on the left side of the face. No facial muscle weakness or other neurological findings are present. Enlarged, nontender, and mobile cervical lymph nodes are palpable bilaterally. No oropharyngeal or nasal lesions are visualized. Otoscopy of the left ear demonstrates clear fluid behind the retracted tympanic membrane, but the right ear is normal. Nasopharyngoscopy reveals a soft-tissue mass in the nasopharynx. Which of the following is the most likely diagnosis?

A. Granulomatosis with polyangiitis
B. Mucormycosis
C. Nasal polyposis
D. Nasopharyngeal carcinoma
E. Tertiary syphilis

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A 55-year-old man comes to the office due to left-sided facial numbness. His symptoms began a month ago with tingling over his left mid-face and have progressively worsened to complete numbness on that side. The patient has also had 2 months of headaches, nasal congestion with intermittent epistaxis, and left ear fullness. He has had no fever, rhinorrhea, or purulent nasal discharge. The patient has taken over-the-counter allergy medications, but these have provided no relief. He has no other medical problems and does not use tobacco, alcohol, or illicit drugs. He recently immigrated to the United States from southern China to be closer to his son. Temperature is 37 C (98.6 F), blood pressure is 126/80 mm Hg, and pulse is 84/min. Examination reveals sensory loss to touch and pain on the left side of the face. No facial muscle weakness or other neurological findings are present. Enlarged, nontender, and mobile cervical lymph nodes are palpable bilaterally. No oropharyngeal or nasal lesions are visualized. Otoscopy of the left ear demonstrates clear fluid behind the retracted tympanic membrane, but the right ear is normal. Nasopharyngoscopy reveals a soft-tissue mass in the nasopharynx. Which of the following is the most likely diagnosis?

A. Granulomatosis with polyangiitis (4%)
B. Mucormycosis (2%)
C. Nasal polyposis (4%)
✓ D. Nasopharyngeal carcinoma (87%)
E. Tertiary syphilis (1%)

Omitted
Correct answer
D

87%
Answered correctly

02 secs
Time Spent

01/23/2020
Last Updated

Explanation

Nasopharyngeal carcinoma

Nasopharyngeal carcinoma	
Epidemiology	• Endemic to **Asia** • Linked with **Epstein-Barr virus** reactivation • Risk factors: Diet (salty fish), smoking, genetics
Manifestations	• Obstruction: **Nasal congestion**, **epistaxis**, headache • Mass effect: **Cranial nerve palsy**, otitis media • Spread: Neck mass (cervical lymphadenopathy)
Diagnosis	• Endoscope-guided biopsy
Treatment	• Radiation therapy • Chemotherapy

Nasopharyngeal carcinoma (NPC) is a tumor associated with **Epstein-Barr virus** reactivation that is rare in the United States but endemic in **southern China**. Risk is likely increased in this region due to a nitrosamine-rich diet (eg, salt-cured food, early exposure to salted fish) and genetic predisposition.

The nasopharynx links the nasal cavity and the oropharynx. NPC tumors obstruct this passage and invade adjacent tissues, often resulting in **nasal congestion with epistaxis**, headache, **facial numbness** (para-cavernous sinus tumor invasion), and/or serous otitis media (eustachian tube obstruction). Early metastasis to the bilateral cervical lymph nodes is common.

Diagnosis is made with endoscope-guided biopsy of the primary tumor, and treatment usually involves a combination of radiation therapy and chemotherapy. Survival is excellent if the neoplasm is discovered early, but most patients present with advanced disease.

(Choice A) Granulomatosis with polyangiitis is a vasculitis that commonly causes ear (otitis) and nasal (rhinorrhea, bloody discharge) symptoms. However, patients usually have systemic manifestations (eg, fever, malaise, weight loss) and ulcerative lesions, not a soft-tissue mass.

(Choice B) Mucormycosis is a fungal infection primarily seen in patients with diabetes mellitus or significant immunocompromise. Manifestations typically include a pan-sinusitis with fever and purulent rhinorrhea (unlike in this patient). Necrotic destruction of bone may occur, and examination

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(Choice C) Nasal polyps are usually seen in patients with chronic sinusitis, asthma, or aspirin sensitivity and may obstruct the nasal cavity, resulting in congestion and thick rhinorrhea. However, cranial nerve involvement is unlikely and examination would reveal a grey mass with inflammatory material.

(Choice E) Tertiary syphilis may cause meningitis or meningovasculitis with headache and cranial nerve deficits; however, nasal congestion and a soft-tissue mass are unlikely.

Educational objective:
Nasopharyngeal carcinoma is a tumor associated with Epstein-Barr virus reactivation that most commonly affects individuals living in southern China. Manifestations are due to nasopharyngeal obstruction or invasion of adjacent tissues and include nasal congestion with epistaxis, headache, diplopia, cranial nerve deficits (eg, facial numbness), and otitis media. Early metastasis to the cervical lymph nodes is common.

Surgery	Ear, Nose & Throat (ENT)	Nasopharyngeal carcinoma
Subject	System	Topic

The nasopharynx links the nasal cavity and the oropharynx. NPC tumors obstruct this passage and invade adjacent tissues, often resulting in **nasal congestion with epistaxis**, headache, **facial numbness** (para-cavernous sinus tumor invasion), and/or serous otitis media (eustachian tube obstruction). Early metastasis to the bilateral cervical lymph nodes is common.

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Surgery	Ear, Nose & Throat (ENT)	Nasopharyngeal carcinoma
Subject	System	Topic

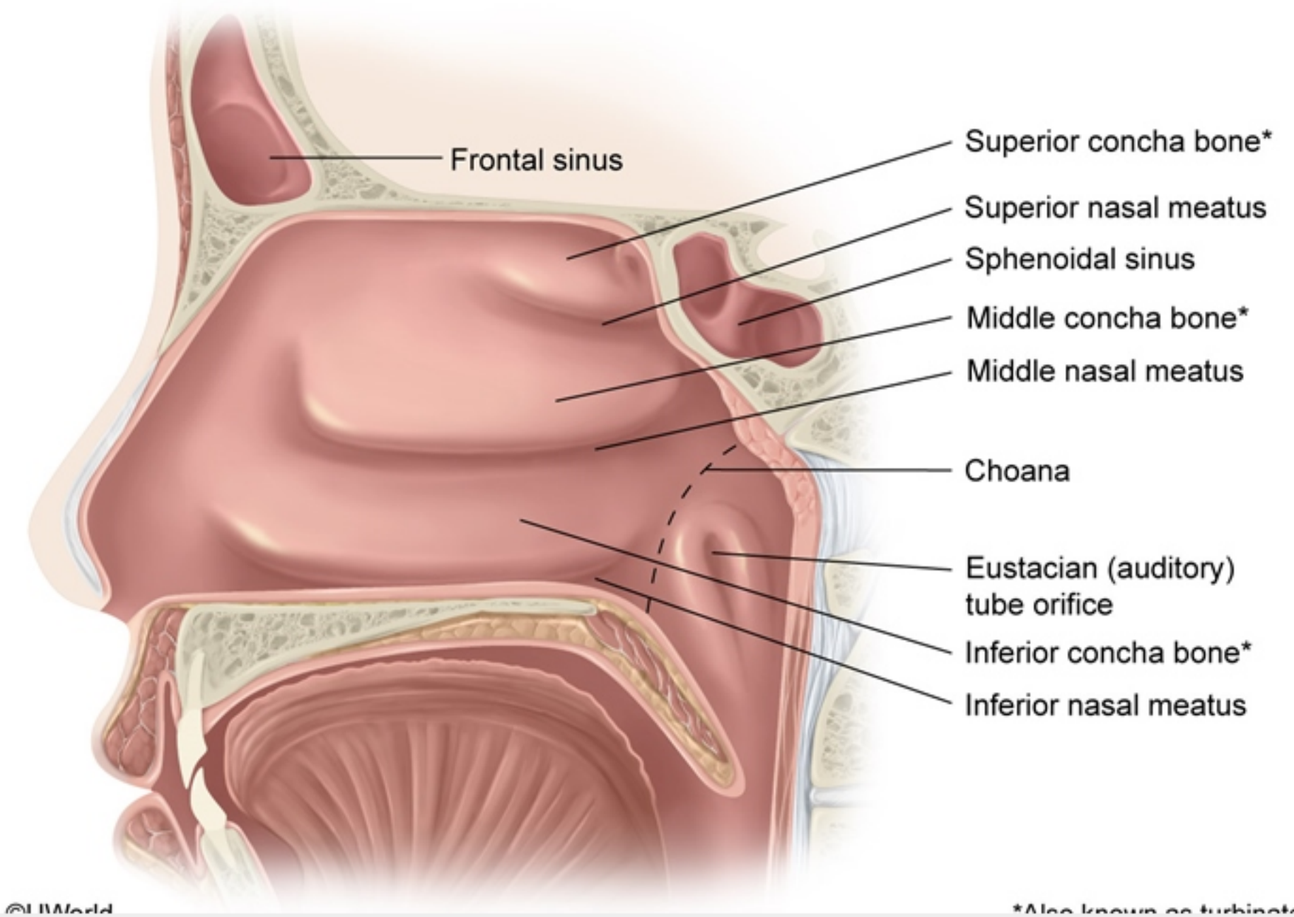
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Nasopharyngeal carcinoma

Exhibit Display

Anatomy of lateral wall
of nasal cavity and nasal pharynx



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*Also known as turbinate

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often reveals black eschars.

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A 36-year-old man comes to the emergency department due to a week of progressive right upper quadrant abdominal pain, malaise, anorexia, and fever. Three months ago, he returned from a vacation in Nepal, where he hiked in the mountains. During his trip, the patient had several self-resolving episodes of diarrhea. He also had unprotected sexual intercourse with a woman he met during the trip. The patient drinks 1 or 2 cans of beer daily but stopped after his recent symptoms began. Temperature is 38.5 C (101.3 F), blood pressure is 120/70 mm Hg, and pulse is 96/min. Breath sounds are decreased in the right lung base. The liver is palpable 3 cm below the right costal margin with a tender, smooth edge. Laboratory results are as follows:

Leukocytes	13,000/mm^3
Neutrophils	67%
Eosinophils	2%
Lymphocytes	31%
Liver function studies	
Total bilirubin	1.3 mg/dL
Alkaline phosphatase	320 U/L
Aspartate aminotransferase	87 U/L
Alanine aminotransferase	99 U/L

Abdominal ultrasonography reveals a solitary hypoechoic lesion on the right lobe of the liver. Which of the following is the most likely cause of this patient's condition?

A. Alcohol-induced liver inflammation
B. Gonococcal perihepatitis
C. Hepatotropic virus infection

Neutrophils	67%
Eosinophils	2%
Lymphocytes	31%

Liver function studies

Total bilirubin	1.3 mg/dL
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A. Alcohol-induced liver inflammation
B. Gonococcal perihepatitis
C. Hepatotropic virus infection
D. Polymicrobial liver infection
E. Protozoal infection
F. Tapeworm infection

Submit

Neutrophils	67%
Eosinophils	2%
Lymphocytes	31%

Liver function studies

Total bilirubin	1.3 mg/dL
Alkaline phosphatase	320 U/L
Aspartate aminotransferase	87 U/L
Alanine aminotransferase	99 U/L

Abdominal ultrasonography reveals a solitary hypoechoic lesion on the right lobe of the liver. Which of the following is the most likely cause of this patient's condition?

- A. Alcohol-induced liver inflammation (0%)
- B. Gonococcal perihepatitis (3%)
- C. Hepatotropic virus infection (9%)
- D. Polymicrobial liver infection (5%)
- ✓ E. Protozoal infection (69%)
- F. Tapeworm infection (12%)

Omitted
Correct answer

69%
Answered correctly

04 secs
Time Spent

01/19/2020
Last Updated

Entamoeba histolytica	
Risk factors	• **Developing nations** (travel/residence) • Contaminated food/water • Fecal-oral, sexual transmission (rare)
Manifestations	• 90% of patients asymptomatic • **Colitis** (diarrhea, bloody stool with mucus, abdominal pain) • **Liver abscess** (RUQ pain, fever) ◦ Complications: rupture to pleura/peritoneum
Diagnosis	• **Stool ova & parasites**, stool antigen testing (colitis) • *E histolytica* serology (liver abscess)
Treatment	• **Metronidazole** & intraluminal antibiotic (eg, paromomycin)

RUQ = right upper quadrant.

Entamoeba histolytica is a **protozoan** common in developing countries and is transmitted through consumption of contaminated food and water. Approximately 10% of patients have clinical manifestations of colitis or extraintestinal (liver, pleura, brain) disease. **Amebic liver abscess** develops when *E histolytica* spreads from the colonic mucosa to the liver via the portal vein.

Symptoms are subacute and include **right upper quadrant (RUQ) pain** and **fever**, sometimes with recent or concurrent bloody diarrhea (colitis). The pain is often dull and can be referred to the right chest wall or shoulder. Systemic symptoms (eg, anorexia, weight loss, cough) can occur, and **hepatomegaly** and elevations in leukocyte count, alkaline phosphatase, and transaminases are common. As with other protozoal infections (eg, giardiasis), peripheral eosinophilia is **not** a frequent finding (in contrast to many helminthic infections, which can stimulate IL-5 production). A characteristic imaging finding is a **single, subcapsular, low-density lesion** in the **right lobe** of the liver (due to greater portal blood supply compared with the left). Diagnosis is made with **serology**; needle aspiration is generally unnecessary.

(Choice A) Alcoholic hepatitis can cause fever, jaundice, and RUQ pain. However, it usually develops following years of heavy use and is

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(Choice A) Alcoholic hepatitis can cause fever, jaundice, and RUQ pain. However, it usually develops following years of heavy use and is characterized by a ≥2:1 ratio of aspartate aminotransferase to alanine aminotransferase.

(Choice B) Gonococcal perihepatitis (Fitz-Hugh–Curtis syndrome) occurs in ~10% of women with pelvic inflammatory disease and is marked by RUQ abdominal pain, fever, pleurisy, and mild elevations in aminotransferases.

(Choice C) Hepatotropic viruses (eg, hepatitis A) are often acquired while traveling. However, acute infections manifest with vomiting, RUQ pain, jaundice, and elevated aminotransferases (often >1,000 U/L).

(Choice D) Polymicrobial pyogenic (bacterial) abscesses share similar clinical and radiographic appearances with amebic abscesses. However, pyogenic abscesses are associated with jaundice and are more common in patients with diabetes or underlying hepatobiliary or pancreatic disease. This patient's recent travel to an endemic *E histolytica* region also makes amebic abscess more likely.

(Choice F) *Echinococcus granulosis* can cause a hydatid liver cyst with symptoms of RUQ pain, nausea, vomiting, and hepatomegaly. However, fever is rare in the absence of cyst rupture and diarrhea is uncommon. In addition, most patients are asymptomatic for years.

Educational objective:
Entamoeba histolytica is a protozoan that can cause colitis or extraintestinal (liver, pleura, brain) illness in patients who live in or travel to developing countries. Amebic liver abscess is characterized by right upper quadrant pain, fever, and (usually) a single subcapsular lesion in the right lobe. Diagnosis is made with serology; needle aspiration is usually unnecessary.

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References

- A review of amoebic liver abscess for clinicians in a nonendemic setting.

Surgery	Infectious Diseases	Liver abscess
Subject	System	Topic

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A 65-year-old man is brought to the hospital due to sudden-onset shortness of breath. He could not lie flat due to breathing difficulty. There is no associated chest pain. Six months ago, the patient was hospitalized with similar symptoms and responded well to diuretic therapy. Medical history is significant for hypertension, coronary artery disease, and transient ischemic attacks. The patient has undergone several percutaneous coronary interventions for stable angina in the past and had a right carotid endarterectomy 2 years ago. He has good adherence to his daily medication regimen but smokes a pack of cigarettes daily. Blood pressure is 210/100 mm Hg, pulse is 104/min and regular, and respirations are 22/min. Oxygen saturation is 86% on room air. Examination shows distended neck veins and bilateral lung crackles. The abdomen is soft, obese, and nontender. The extremities have no edema. Laboratory results are as follows:

Complete blood count	
Hemoglobin	13 g/dL
Platelets	240,000/mm^3
Leukocytes	8,200/mm^3
Serum chemistry	
Potassium	3.1 mEq/L
Bicarbonate	30 mEq/L
Blood urea nitrogen	30 mg/dL
Creatinine	2.0 mg/dL
Calcium	8.4 mg/dL
Glucose	100 mg/dL
Liver function studies	
Total protein	6 g/dL

Serum chemistry	
Potassium	3.1 mEq/L
Bicarbonate	30 mEq/L
Blood urea nitrogen	30 mg/dL
Creatinine	2.0 mg/dL
Calcium	8.4 mg/dL
Glucose	100 mg/dL
Liver function studies	
Total protein	6 g/dL
Albumin	4.3 g/dL
Aspartate aminotransferase (SGOT)	12 U/L
Alanine aminotransferase (SGPT)	24 U/L
Urinalysis	
Protein	trace
Blood	negative
Glucose	negative
White blood cells	1-2/hpf
Red blood cells	1-2/hpf

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Urinalysis

Protein	trace
Blood	negative
Glucose	negative
White blood cells	1-2/hpf
Red blood cells	1-2/hpf
Casts	none
Crystals	none

Cardiac troponin I levels are not elevated. ECG shows sinus tachycardia with left ventricular (LV) hypertrophy. Echocardiogram reveals LV hypertrophy, preserved LV ejection fraction, and no regional wall motion abnormalities. The patient improves markedly with diuresis and antihypertensive therapy. Which of the following is the next best step in management?

A. Dexamethasone suppression test
B. Kidney biopsy
C. Plasma metanephrines
D. Renal ultrasound with Doppler
E. Serum parathyroid hormone level
F. Urine light chain assay

Submit

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A. Dexamethasone suppression test (5%)
B. Kidney biopsy (4%)
C. Plasma metanephrines (9%)
✓ D. Renal ultrasound with Doppler (73%)
E. Serum parathyroid hormone level (1%)
F. Urine light chain assay (5%)

Omitted
Correct answer

73%
Answered correctly

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Time Spent

06/14/2020
Last Updated

Clinical clues to renovascular disease	
HTN-related symptoms	• Resistant HTN (uncontrolled despite 3-drug regimen) • Malignant HTN (with end-organ damage) • Onset of severe HTN (>180/120 mm Hg) after age 55 • Severe HTN with diffuse atherosclerosis • Recurrent flash pulmonary edema with severe HTN
Supportive evidence	**Physical examination** • Asymmetric renal size (>1.5 cm) • Abdominal bruit **Laboratory results** • Unexplained rise in serum creatinine (>30%) after starting ACE inhibitors or ARBs **Imaging results** • Unexplained atrophic kidney

ARBs = angiotensin II receptor blockers; **HTN** = hypertension.

This older patient with **diffuse atherosclerosis** (coronary intervention, carotid intervention) has **recurrent flash pulmonary edema** (eg, pulmonary crackles, distended neck veins, no lower extremity edema) despite a normal ejection fraction. In association with severe **hypertension**, this presentation suggests **renal artery stenosis** (RAS).

Renal ischemia (caused by limited blood supply to the poststenotic kidney) induces the activation of the renin-angiotensin-aldosterone system, resulting in sodium and water retention, generalized vasoconstriction, and hypertension. Laboratory abnormalities reflect **secondary hyperaldosteronism** (ie, hypokalemia, elevated serum bicarbonate). Unlike unilateral RAS, in which the unaffected kidney can typically compensate and the creatinine remains relatively normal, **bilateral RAS** can result in **chronic kidney disease** (CKD). Urinalysis is typically **bland**.

The diagnosis is confirmed with renal imaging (eg, **renal ultrasound with Doppler**, CT/MR angiography). Management includes blood pressure control, aggressive treatment of atherosclerotic disease (eg, statins, smoking cessation), and ACE inhibitors (with close monitoring of renal function) or revascularization.

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(Choice A) The dexamethasone suppression test is used to identify Cushing syndrome, which can cause hypertension but is typically associated with abnormal glucose tolerance, striae, easy bruising, obesity, and an enlarged dorsal fat pad; pulmonary edema is unexpected.

(Choice B) Kidney biopsy is indicated in a variety of diseases including many nephritic and nephrotic syndromes and unexplained acute renal failure. Although biopsy could be considered if further workup is unrevealing, this patient has bland urinary sediment (suggesting against nephritic/nephrotic syndrome), and noninvasive diagnostic tests should be performed first.

(Choice C) Plasma metanephrines are indicated to diagnose pheochromocytoma, which results in paroxysms of headache, tachycardia, sweating, and hypertension. Recurrent pulmonary edema is unexpected, and RAS is more likely in this elderly patient with diffuse atherosclerosis.

(Choice E) Patients with CKD are at risk for secondary hyperparathyroidism, and serum parathyroid hormone levels are routinely checked in patients with advanced disease. However, this patient does not have hypercalcemia or urinary crystals that would suggest that hypercalcemia is contributing to his renal failure.

(Choice F) A urine light chain assay tests for multiple myeloma, which causes CKD but is associated with hypercalcemia, bone pain, and anemia; in addition, a paraprotein gap (serum protein − serum albumin >4) is expected.

Educational objective:

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Educational objective:
Severe hypertension and recurrent flash pulmonary edema in the setting of diffuse atherosclerosis suggests renal artery stenosis. Associated findings can include chronic kidney disease and evidence of secondary hyperaldosteronism (hypokalemia, elevated serum bicarbonate); urinalysis is typically bland. The diagnosis is confirmed with renal imaging (eg, renal ultrasound with Doppler).

Surgery	Renal, Urinary Systems & Electrolytes	Renal artery stenosis
Subject	System	Topic

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A 24-year-old man is brought to the emergency department after being shot during a street fight. On the way to the hospital, the patient became obtunded and required intubation. He also received 2 L of normal saline. On arrival, blood pressure is 86/40 mm Hg and pulse is 130/min. The trachea is midline, and breath sounds are equal bilaterally. Heart sounds are normal. Two gunshot wounds are present: one in the left sixth intercostal space just lateral to the midclavicular line and another in the left seventh intercostal space posteriorly. Portable chest x-ray shows irregular opacities at the left lung base. Focused Assessment with Sonography for Trauma reveals no pericardial effusion and is equivocal for intraperitoneal free fluid. Transfusion of uncrossmatched blood is pending. Which of the following is the best next step in management of this patient?

A. CT scan of the abdomen
B. Diagnostic peritoneal lavage
C. Exploratory laparotomy
D. Local wound exploration
E. Plain radiographs of the abdomen

Submit

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- A. CT scan of the abdomen (11%)
- B. Diagnostic peritoneal lavage (11%)
- ✓ C. Exploratory laparotomy (68%)
- D. Local wound exploration (5%)
- E. Plain radiographs of the abdomen (3%)

Omitted
Correct answer
C

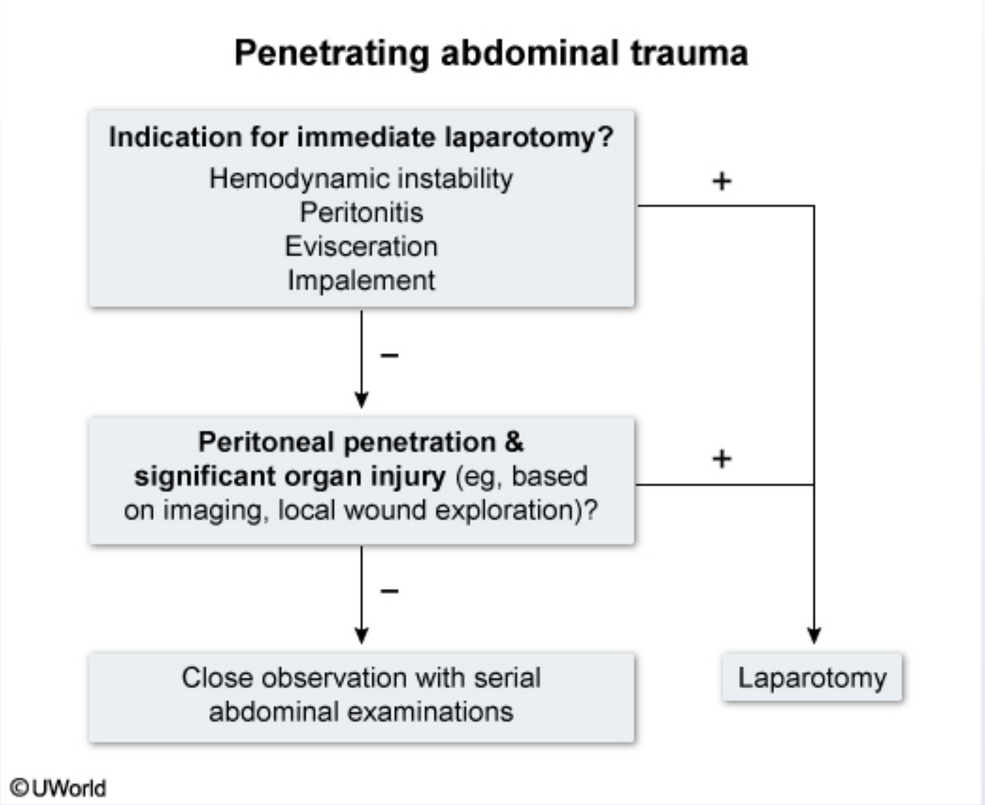
68%
Answered correctly

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Time Spent

03/05/2020
Last Updated

Explanation

Penetrating abdominal trauma



This patient with **gunshot wounds** to the left thoracoabdominal region has shock (ie, severe hypotension and tachycardia) despite initial crystalloid resuscitation. Based on the location of his wounds (left sixth and seventh intercostal spaces), both intrathoracic and intraabdominal causes of shock should be investigated because the **diaphragm** and intraabdominal contents can **rise as high** as approximately the fourth thoracic dermatome (ie, **nipple level**) on expiration.

In this patient, there is no evidence of cardiac tamponade (eg, no pericardial effusion) or hemothorax (eg, equal breath sounds, no pleural effusion), and the irregular opacities revealed on chest x-ray likely represent a pulmonary contusion that does not require immediate intervention. Given the absence of an intrathoracic source of shock, intraabdominal organ (eg, spleen) injury due to **penetrating abdominal trauma** (PAT) should be suspected. For patients with PAT, **immediate exploratory laparotomy** is indicated for:

This patient with **gunshot wounds** to the left thoracoabdominal region has shock (ie, severe hypotension and tachycardia) despite initial crystalloid resuscitation. Based on the location of his wounds (left sixth and seventh intercostal spaces), both intrathoracic and intraabdominal causes of shock should be investigated because the **diaphragm** and intraabdominal contents can **rise as high** as approximately the fourth thoracic dermatome (ie, **nipple level**) on expiration.

In this patient, there is no evidence of cardiac tamponade (eg, no pericardial effusion) or hemothorax (eg, equal breath sounds, no pleural effusion), and the irregular opacities revealed on chest x-ray likely represent a pulmonary contusion that does not require immediate intervention. Given the absence of an intrathoracic source of shock, intraabdominal organ (eg, spleen) injury due to **penetrating abdominal trauma** (PAT) should be suspected. For patients with PAT, **immediate exploratory laparotomy** is indicated for:

- **hemodynamic instability** (systolic blood pressure <90 mm Hg).
- peritonitis (eg, rigidity, rebound tenderness).
- evisceration (ie, externally exposed intestines).

Because this patient already has an indication for laparotomy, the abdominal portion of the Focused Assessment with Sonography for Trauma examination is not necessary as it does not change management. However, it is sometimes performed in practice (eg, immediately following the cardiac portion) because a positive result (ie, intraperitoneal free fluid) further confirms the need for laparotomy.

(Choices A, B, and E) CT scan of the abdomen (commonly used, noninvasive) and diagnostic peritoneal lavage (rarely used, invasive) can help detect intraabdominal injury and determine the need for laparotomy in hemodynamically stable patients with PAT. Plain radiographs of the abdomen may help determine the trajectory and resting location of a bullet. However, this patient requires immediate laparotomy rather than additional imaging or testing because of hemodynamic instability.

(Choice D) Local wound exploration to determine whether violation of the peritoneum has occurred is inappropriate in this patient with an indication for immediate exploratory laparotomy. In addition, this technique is rarely performed in patients with gunshot wounds (vs abdominal stab wounds) because tissue destruction makes following the wound tract difficult.

Educational objective:
Any penetrating wound below the fourth thoracic dermatome (ie, nipple level) can involve the intraabdominal organs. Patients with penetrating abdominal trauma and any of the following indications—hemodynamic instability, peritonitis, evisceration—should undergo immediate exploratory laparotomy.

- **hemodynamic instability** (systolic blood pressure <90 mm Hg).
- peritonitis (eg, rigidity, rebound tenderness).
- evisceration (ie, externally exposed intestines).

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Any penetrating wound below the fourth thoracic dermatome (ie, nipple level) can involve the intraabdominal organs. Patients with penetrating abdominal trauma and any of the following indications—hemodynamic instability, peritonitis, evisceration—should undergo immediate exploratory laparotomy.

References

- Evaluation and management of abdominal gunshot wounds: a Western Trauma Association critical decisions algorithm.
- Management guidelines for penetrating abdominal trauma.

Surgery	General Principles	Penetrating thoracic trauma
Subject	System	Topic

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

A 21-year-old man comes to the clinic for painless vision loss in the right eye and headaches. Blood pressure is 190/100 mm Hg and pulse is 96/min. Further evaluation reveals retinal and cerebellar hemangioblastomas. The patient's father had very high blood pressure and significant hearing impairment and died of an intracranial hemorrhage at age 48. Which of the following is the most likely cause of this patient's elevated blood pressure?

A. Aldosterone overproduction
B. Catecholamine overproduction
C. Cortisol overproduction
D. Polycystic kidney disease
E. Renal glomerular injury

Submit

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- A. Aldosterone overproduction (7%)
- ✓ B. Catecholamine overproduction (38%)
- C. Cortisol overproduction (1%)
- D. Polycystic kidney disease (40%)
- E. Renal glomerular injury (12%)

Omitted
Correct answer
B

38%
Answered correctly

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01/21/2020
Last Updated

Explanation

Von Hippel-Lindau disease	
Etiology	• Mutation in the *VHL* tumor suppressor gene on chromosome 3 • Autosomal dominant inheritance
Manifestations	• Cerebellar & retinal hemangioblastomas • Pheochromocytoma

Von Hippel-Lindau disease	
Etiology	• Mutation in the *VHL* tumor suppressor gene on chromosome 3 • Autosomal dominant inheritance
Manifestations	• Cerebellar & retinal hemangioblastomas • Pheochromocytoma • Renal cell carcinoma (clear cell subtype)
Management	• Surveillance for associated malignancies ◦ Eye/retinal examination ◦ Plasma or urine metanephrines ◦ MRI of the brain & spine ◦ MRI of the abdomen • Tumor resection

This patient has vision loss and headaches due to retinal and CNS **hemangioblastomas**, which are benign but heavily vascular tumors that can lead to hemorrhage or mass effect symptoms in the brain and spinal cord. Most hemangioblastomas are sporadic; however, this patient has multiple hemangioblastomas and a family history of intracranial hemorrhage, which suggests an inherited disorder, likely **von Hippel-Lindau disease** (vHL).

vHL is an autosomal dominant disorder associated with mutations in the *VHL* gene. Besides hemangioblastomas, vHL is associated with clear cell renal cell carcinoma, pancreatic neuroendocrine tumors, endolymphatic sac tumors of the middle ear (hearing loss), and **pheochromocytomas**. Pheochromocytomas (arising in the adrenal medulla) and paragangliomas (in the sympathetic ganglia) are neuroendocrine tumors associated with **excess production of catecholamines**, leading to headache, palpitations, and potentially **severe hypertension**.

As with hemangioblastomas, most pheochromocytomas and paragangliomas are sporadic. However, a significant minority occur as a manifestation of a familial disorder. In addition to vHL, major genetic syndromes associated with catecholamine-secreting tumors include multiple endocrine neoplasia type 2 (2A and 2B) and neurofibromatosis type 1.

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(Choice A) Primary hyperaldosteronism (Conn syndrome) can be caused by an adrenal adenoma or bilateral adrenal hyperplasia. It typically presents with hypertension but is not associated with hemangioblastomas.

(Choice C) Hypercortisolism (Cushing syndrome) can cause hypertension but typically presents with central obesity, easy bruising, proximal muscle weakness, and wide skin striae.

(Choice D) Autosomal dominant polycystic kidney disease can cause hypertension due to local renal ischemia and increased renin release. It is associated with an increased risk of intracranial hemorrhage due to cerebral aneurysms (not hemangioblastomas). Although vHL may be associated with the formation of renal cysts, this is not a major contributor to hypertension.

(Choice E) Glomerulonephritis (eg, acute poststreptococcal glomerulonephritis) can cause hypertension but is typically associated with gross hematuria (eg, tea-colored urine) and edema. Hemangioblastomas would not be seen and are more suggestive of vHL.

Educational objective:
Von Hippel-Lindau disease (vHL) is an inherited disorder caused by mutations in the *VHL* gene. It is associated with retinal and CNS hemangioblastomas, which are heavily vascular tumors that can lead to hemorrhage or mass effect symptoms in the brain and spinal cord. Other manifestations include clear cell renal cell carcinoma, pancreatic neuroendocrine tumors, endolymphatic sac tumors of the middle ear, and

cell renal cell carcinoma, pancreatic neuroendocrine tumors, endolymphatic sac tumors of the middle ear (hearing loss), and **pheochromocytomas**. Pheochromocytomas (arising in the adrenal medulla) and paragangliomas (in the sympathetic ganglia) are neuroendocrine tumors associated with **excess production of catecholamines**, leading to headache, palpitations, and potentially **severe hypertension**.

As with hemangioblastomas, most pheochromocytomas and paragangliomas are sporadic. However, a significant minority occur as a manifestation of a familial disorder. In addition to vHL, major genetic syndromes associated with catecholamine-secreting tumors include multiple endocrine neoplasia type 2 (2A and 2B) and neurofibromatosis type 1.

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Educational objective:
Von Hippel-Lindau disease (vHL) is an inherited disorder caused by mutations in the *VHL* gene. It is associated with retinal and CNS hemangioblastomas, which are heavily vascular tumors that can lead to hemorrhage or mass effect symptoms in the brain and spinal cord. Other manifestations include clear cell renal cell carcinoma, pancreatic neuroendocrine tumors, endolymphatic sac tumors of the middle ear, and pheochromocytomas.

References

- Pheochromocytoma and paraganglioma: an endocrine society clinical practice guideline
- Genotype-phenotype correlations in pheochromocytoma and paraganglioma

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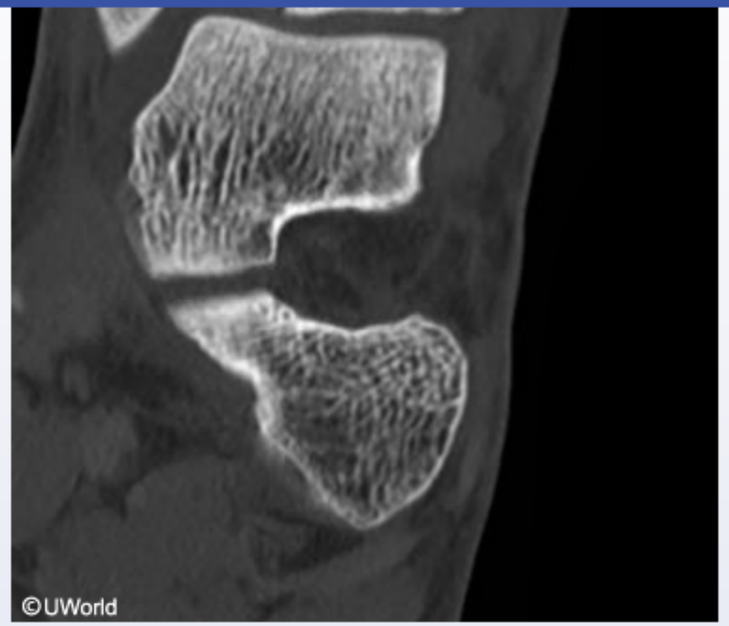
A 12-year-old boy is brought to the emergency department by his parents to evaluate pain and swelling in his right ankle. The boy was riding his skateboard when he attempted a jump and landed awkwardly on his foot. He has not been able to put weight on his leg since the injury. On examination, there is diffuse swelling of the right ankle with no visible deformity. Examination is limited as any attempted motion of the ankle causes severe pain. Bilateral distal pulses are normal. Sensation is intact. Radiographs of the ankle partially visualize a fracture of the distal tibia. A CT scan of the fracture is shown below:



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This patient's fracture places him at increased risk for which of the following complications?

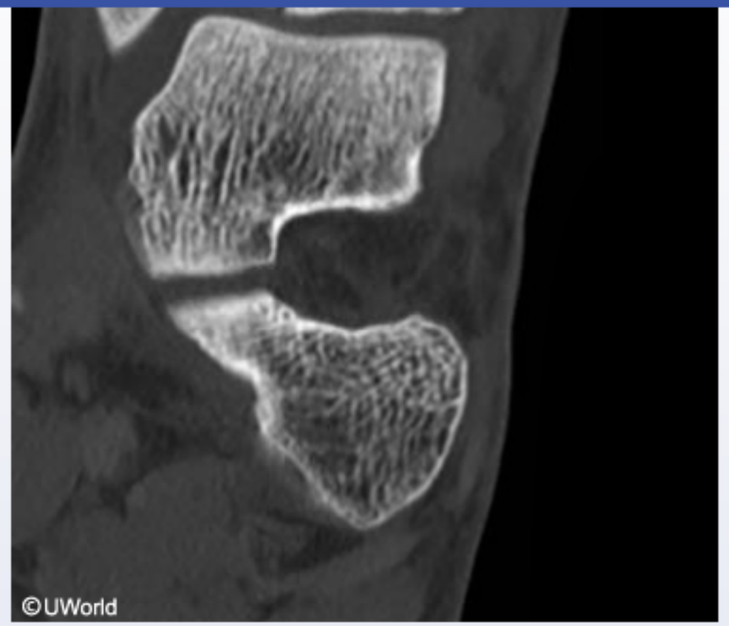


This patient's fracture places him at increased risk for which of the following complications?

A. Acute limb ischemia
B. Avascular necrosis
C. Compartment syndrome
D. Limb-length discrepancy
E. Persistent foot drop

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This patient's fracture places him at increased risk for which of the following complications?

- A. Acute limb ischemia (1%)
- B. Avascular necrosis (13%)
- C. Compartment syndrome (10%)
- ✓ D. Limb-length discrepancy (63%)
- E. Persistent foot drop (10%)

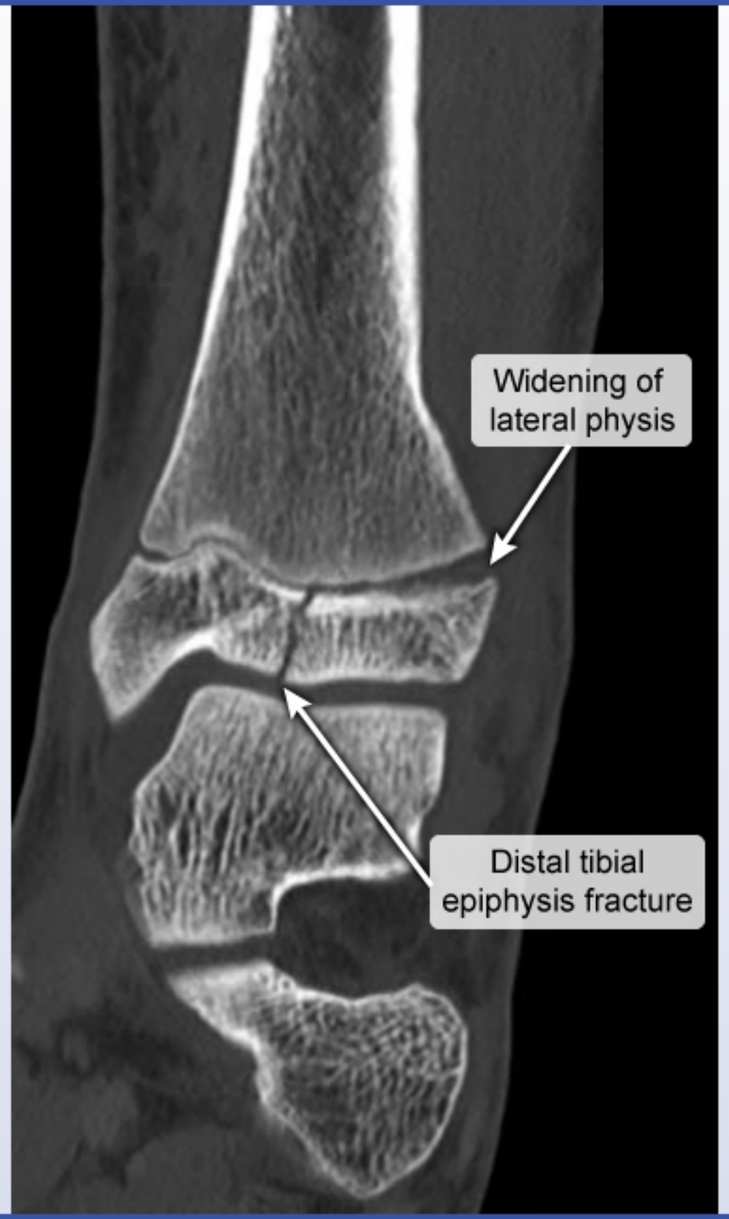
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Correct answer

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Answered correctly

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This patient has an ankle injury with diffuse swelling and an inability to bear weight; initial imaging with x-ray is appropriate, although a CT scan may be needed to fully visualize a fracture. The CT scan reveals a combination of: a **distal tibial epiphysis** fracture; and a **growth plate** (ie, physeal) fracture, as suggested by growth plate widening. This combination of fractures is known as a Salter-Harris type III (juvenile Tillaux fracture).

The distal tibial growth plate typically closes around age 14 in boys (age 12 in girls), and fractures involving the maturing, partially fused, physis (eg, Salter-Harris type III and IV fractures) carry an increased risk for long-term complications. In particular, injury to the growth plate can cause **growth arrest** and lead to persistent **limb-length discrepancy**. Other complications include formation of physeal bars (bony bridges across the growth plate), premature osteoarthritis, and decreased range of motion.

(Choice A) Acute limb ischemia is most often due to arterial occlusion. When seen with limb fractures, it typically occurs soon after high-velocity femoral fractures and would be accompanied by signs of vascular impairment (eg, loss of distal pulses, reduced sensation, pallor, cyanosis).

(Choice B) Post-fracture avascular necrosis is most common in areas of bone with limited blood supply such as the scaphoid, femoral head, or metadiaphyseal junction of the fifth metatarsal, but it is uncommon in distal tibia fractures.

(Choice C) Compartment syndrome results from increased pressure within nondistensible fascial planes. It is uncommon in ankle fractures because the bulk of the leg muscle bellies are proximal to the injury.

(Choice E) Traumatic foot drop is typically caused by injury to the common peroneal nerve where it wraps around the lateral neck of the proximal fibula. Distal fractures of the tibia or fibula would not cause foot drop.

Educational objective:
A Salter-Harris type III (juvenile Tillaux fracture) is characterized by fracture of the distal tibial epiphysis and lateral physis (ie, growth plate) and most commonly occurs in adolescents when the physis is partially fused. Injury to the growth plate can cause growth arrest and lead to persistent limb-length discrepancy.

References

- Treatment for displaced Tillaux fractures in adolescent age group.

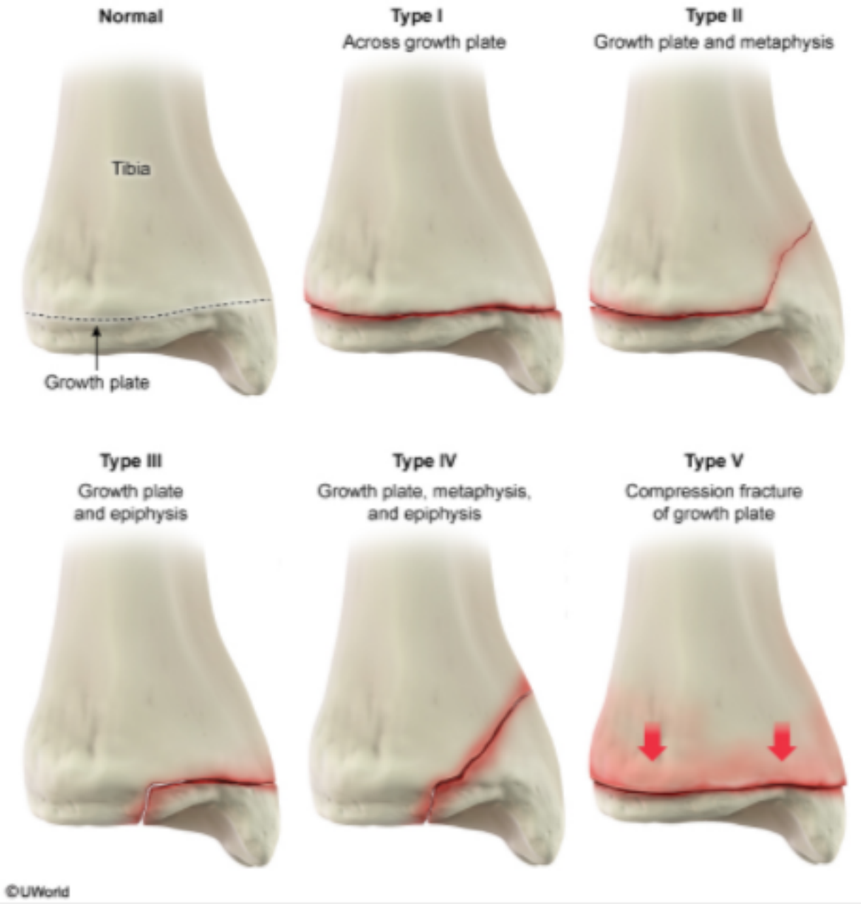
Surgery Rheumatology/Orthopedics & Sports Salter harris fracture

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

This patient has an ankle injury with diffuse swelling and an inability to bear weight; initial imaging with x-ray is appropriate, although a CT scan

Exhibit Display

Salter-Harris fracture classification

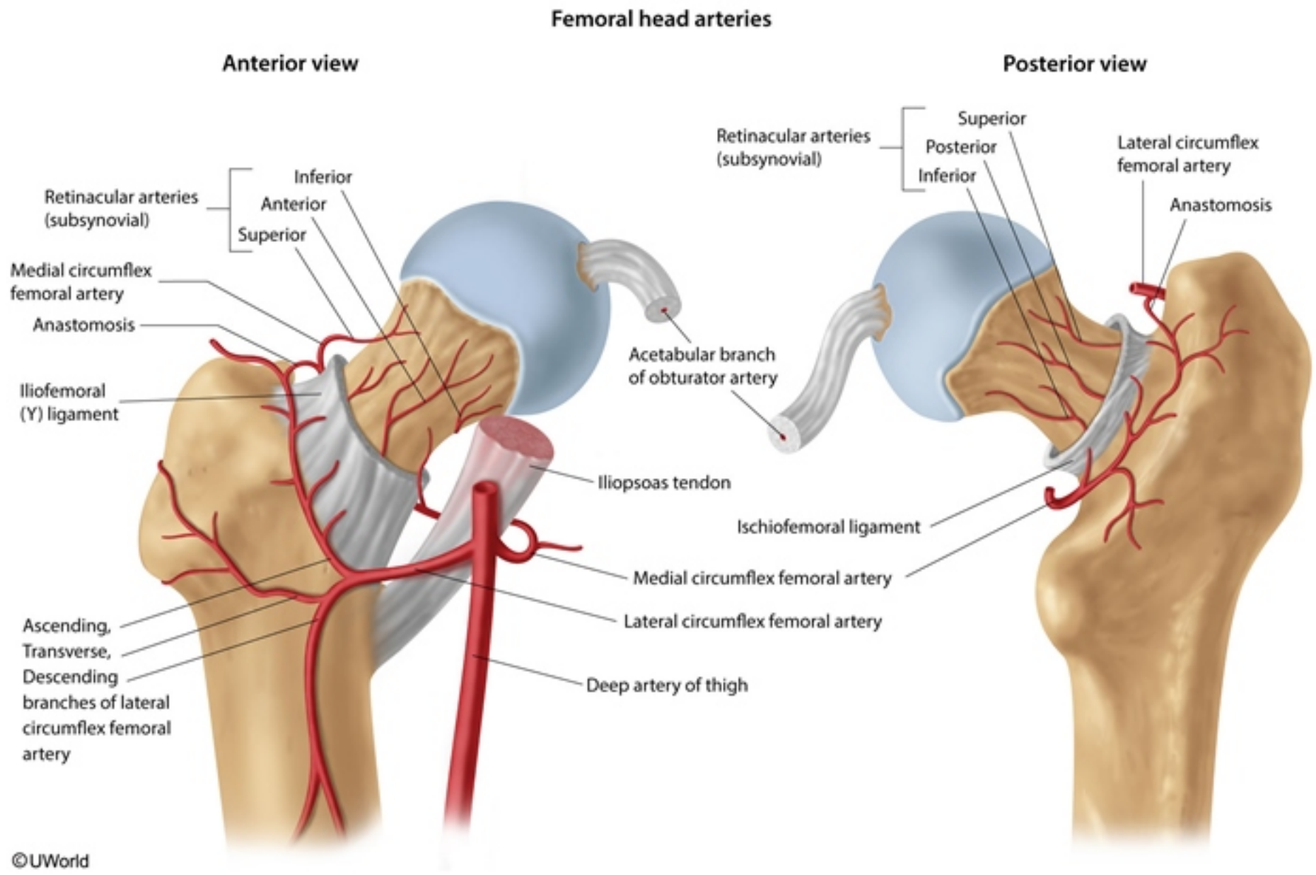


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Surgery | Rheumatology/Orthopedics & Sports | Salter harris fracture

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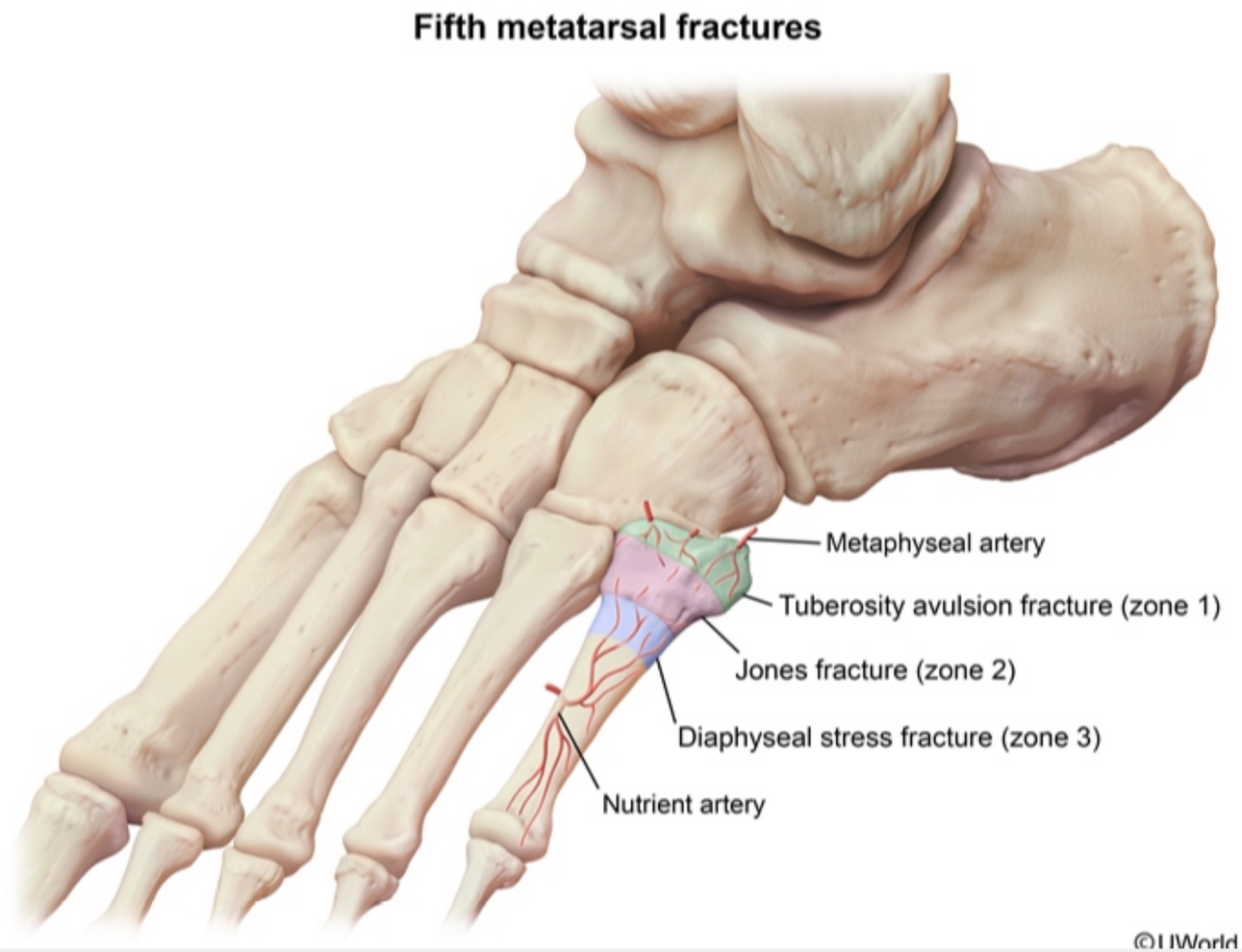
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Surgery | Rheumatology/Orthopedics & Sports | Salter harris fracture

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Surgery Rheumatology/Orthopedics & Sports Salter harris fracture

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A 54-year-old woman comes to the office due to left wrist pain 3 days after a fall. She was walking her dog when it suddenly ran after another dog, causing her to fall. She landed forcefully on her left palm. She had no other injuries. The patient has been taking acetaminophen, which provides partial relief. She does not use tobacco or illicit drugs and drinks alcohol socially. Blood pressure is 120/70 mm Hg and pulse is 84/min. Physical examination shows left wrist tenderness with maximal tenderness at the dorsoradial wrist lateral to the tendon of the extensor pollicis longus. Left wrist radiographs reveal a radiolucent line across the waist of the scaphoid bone. She is treated nonsurgically with analgesics and immobilization. This patient should be monitored closely during treatment due to which of the following potential complications?

A. Bacterial tenosynovitis
B. Fat embolism
C. Ganglion cyst
D. Nerve injury
E. Osteonecrosis

Submit

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

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- A. Bacterial tenosynovitis (0%)
- B. Fat embolism (0%)
- C. Ganglion cyst (1%)
- D. Nerve injury (9%)
- ✓ E. Osteonecrosis (88%)

Omitted
Correct answer
E

88%
Answered correctly

02 secs
Time Spent

06/25/2020
Last Updated

Explanation

This patient has a fracture of the scaphoid, the most commonly fractured carpal bone. **Scaphoid fractures** typically present with pain at the radial wrist proximal to the base of the thumb. Examination shows tenderness in the shallow depression at the dorsoradial wrist bounded medially by the tendon of the extensor pollicis longus and laterally by the tendons of the abductor pollicis longus and extensor pollicis brevis ("anatomic snuffbox"). Scaphoid fractures carry a significant risk of **osteonecrosis** because the blood supply enters at the distal pole and flows proximally,

This patient has a fracture of the scaphoid, the most commonly fractured carpal bone. **Scaphoid fractures** typically present with pain at the radial wrist proximal to the base of the thumb. Examination shows tenderness in the shallow depression at the dorsoradial wrist bounded medially by the tendon of the extensor pollicis longus and laterally by the tendons of the abductor pollicis longus and extensor pollicis brevis ("anatomic snuffbox"). Scaphoid fractures carry a significant risk of **osteonecrosis** because the blood supply enters at the distal pole and flows proximally, and can be disrupted by the fracture.

Initial x-rays can be normal in nondisplaced scaphoid fractures. If scaphoid fracture is suspected, CT scan or MRI can confirm the diagnosis, or repeat x-rays can be performed in 7-10 days. Displaced fractures should be considered for surgical intervention. Wrist immobilization with a cast can be considered for nondisplaced fractures, but patients should be monitored with serial x-ray to rule out osteonecrosis of the proximal segment and nonunion of the fracture.

(Choice A) Bacterial tenosynovitis typically occurs following penetrating injury to the hand (eg, cat bite) or from hematogenous spread of a distant infection (eg, *Neisseria gonorrhoeae*).

(Choice B) Fat embolism is most common following major fracture of long bones (eg, femur) or extensive soft-tissue injury (eg, burns).

(Choice C) Synovial cysts of the wrist (ganglion cysts) are most common in individuals age 15-40 and are thought to arise in most cases due to repetitive stress or inflammation.

(Choice D) Lunate dislocation following a fall on an outstretched hand can cause compressive neuropathy of the median nerve. Nerve injury is not common following scaphoid fracture.

Educational objective:
Displaced scaphoid fractures should be considered for surgical intervention. Wrist immobilization with a cast can be considered for nondisplaced fractures, but patients should be monitored with serial x-ray to rule out osteonecrosis of the proximal segment and nonunion of the fracture.

References

- Scaphoid fractures.

Surgery	Rheumatology/Orthopedics & Sports	Scaphoid fracture
Subject	System	Topic

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Exhibit Display

Anatomic snuffbox



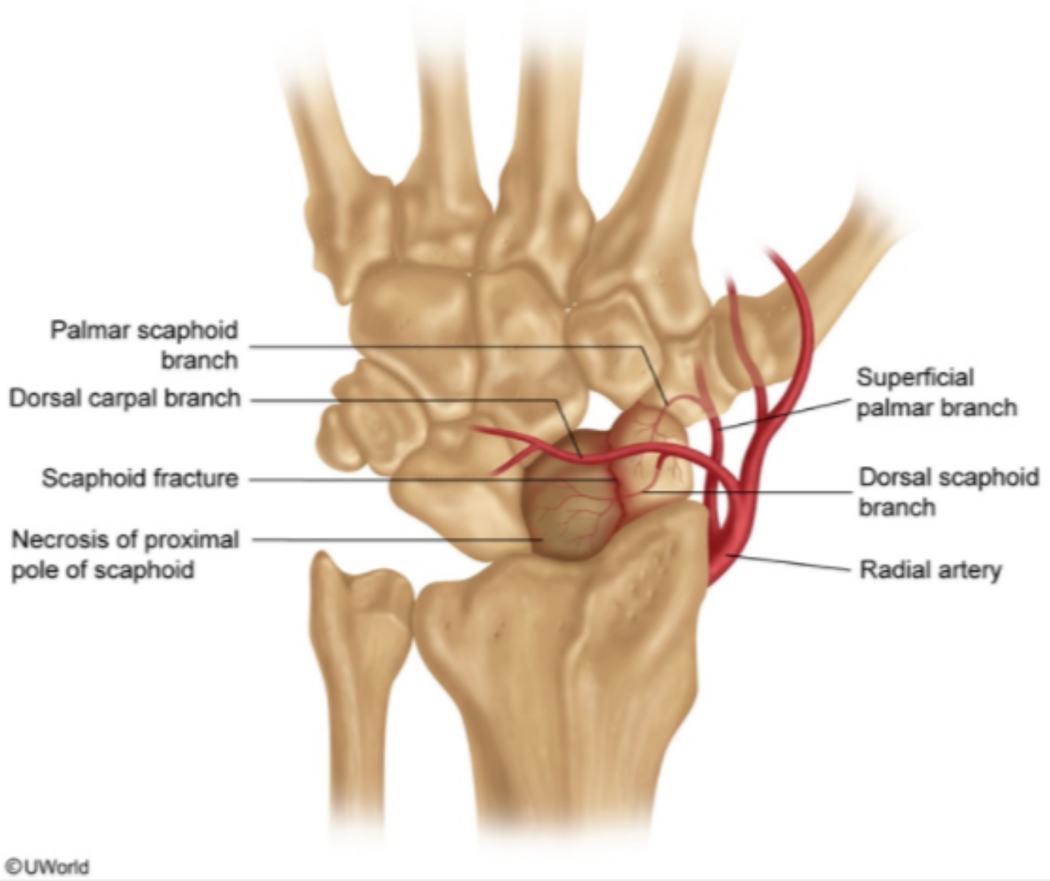
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Subject System Topic

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Exhibit Display

Scaphoid avascular necrosis



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Subject System Topic

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A 48-year-old man comes to the office for a routine medical evaluation and is found to have a skin lesion on his upper back. The patient is unsure when the lesion appeared but first noticed it several weeks ago during a shower. It is not painful, and he has no other symptoms. He has no chronic medical conditions and takes no medications. The patient drinks 1 or 2 beers nightly and does not use tobacco or illicit drugs. He works as a surfing instructor. Vital signs are within normal limits. Skin examination findings are shown in the exhibit. The remainder of the examination is normal. Which of the following is the most likely diagnosis?

A. Angiosarcoma
B. Basal cell carcinoma
C. Cherry hemangioma
D. Keratoacanthoma
E. Malignant melanoma
F. Seborrheic keratosis

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A. Angiosarcoma (8%)
B. Basal cell carcinoma (3%)
C. Cherry hemangioma (7%)
D. Keratoacanthoma (6%)
✓ E. Malignant melanoma (64%)
F. Seborrheic keratosis (9%)

Omitted
Correct answer
E

64%
Answered correctly

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Time Spent

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Last Updated

Explanation

This patient developed a nodular, hyperpigmented lesion on an area of skin that likely gets excessive sun exposure while he surfs, raising strong suspicion for **nodular malignant melanoma**.

In contrast to superficial spreading melanoma, which grows horizontally along the dermal layer, nodular melanoma grows **vertically**. Therefore, it often presents with few of the classic ABCDE criteria. Most cases are marked by a **darkly pigmented** lesion with uniform color and symmetric

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In contrast to superficial spreading melanoma, which grows horizontally along the dermal layer, nodular melanoma grows **vertically**. Therefore, it often presents with few of the classic ABCDE criteria. Most cases are marked by a **darkly pigmented** lesion with uniform color and symmetric borders; however, suspicion is generally raised due to the presence of ≥1 of the following features:

- The "**ugly duckling sign**" - patients with several pigmented cutaneous lesions (nevi) usually have lesions that all appear somewhat similar. When a single lesion looks significantly different from the others this is called the "ugly duckling sign"; it has a high sensitivity (up to 90%) for melanoma.
- **Elevation** from surrounding skin **(eg, nodular, pedunculated)**
- **Firm** to palpation
- **Continuous growth** over a month

The diagnosis is generally confirmed by full-thickness **excisional biopsy**.

(Choices A and C) Dermal angiosarcoma is a rare disorder that most commonly occurs in patients with prior radiation therapy. Cherry hemangioma is a common, benign lesion composed of congested capillaries and postcapillary venules in the papillary dermis. These disorders are usually heavily vascular (eg, bright red).

(Choice B) Basal cell carcinoma is a common skin malignancy that typically appears as an enlarging fleshy nodule with ulceration. It is associated with sun exposure and is most common on the face, neck, and extremities.

(Choice D) Keratoacanthomas are nonpigmented cutaneous tumors that usually present as dome-shaped nodules with a central keratinous plug.

(Choice F) Seborrheic keratosis is a benign pigmented lesion with a well-demarcated border and a velvety or greasy surface. It can be nearly flat, but thickened lesions are often described as having a "stuck-on" appearance.

Educational objective:
The ABCDE criteria can assist in evaluation of superficial spreading melanoma but are less sensitive for other types of melanoma (eg, nodular, atypical). Nodular melanomas, the second most common type of melanoma, usually grow vertically and have symmetric borders and a uniform,

This patient developed a nodular, hyperpigmented lesion on an area of skin that likely gets excessive sun exposure while he surfs, raising strong suspicion for **nodular mal**

In contrast to superficial s, it often presents with few of borders; however, suspici

- The "**ugly duckling** When a single lesio melanoma.
- **Elevation** from surr
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Exhibit Display

Clinical features of melanoma (ABCDE)
• **A**symmetry: When bisected, the 2 sides are not identical • **B**order irregularities: Uneven edges, pigment fading off • **C**olor variegation: Variable mixtures of brown, tan, black & red • **D**iameter: ≥6 mm • **E**volving: Lesion changing in size, shape, or color; new lesion

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- **Firm** to palpation
- **Continuous growth** over a month

The diagnosis is generally confirmed by full-thickness **excisional biopsy**.

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Educational objective:
The ABCDE criteria can assist in evaluation of superficial spreading melanoma but are less sensitive for other types of melanoma (eg, nodular, atypical). Nodular melanomas, the second most common type of melanoma, usually grow vertically and have symmetric borders and a uniform, dark color. Suspicion should be raised when the lesion appears different from other lesions on the patient ("ugly duckling sign") or the lesion grows continuously, is elevated, or is firm.

References

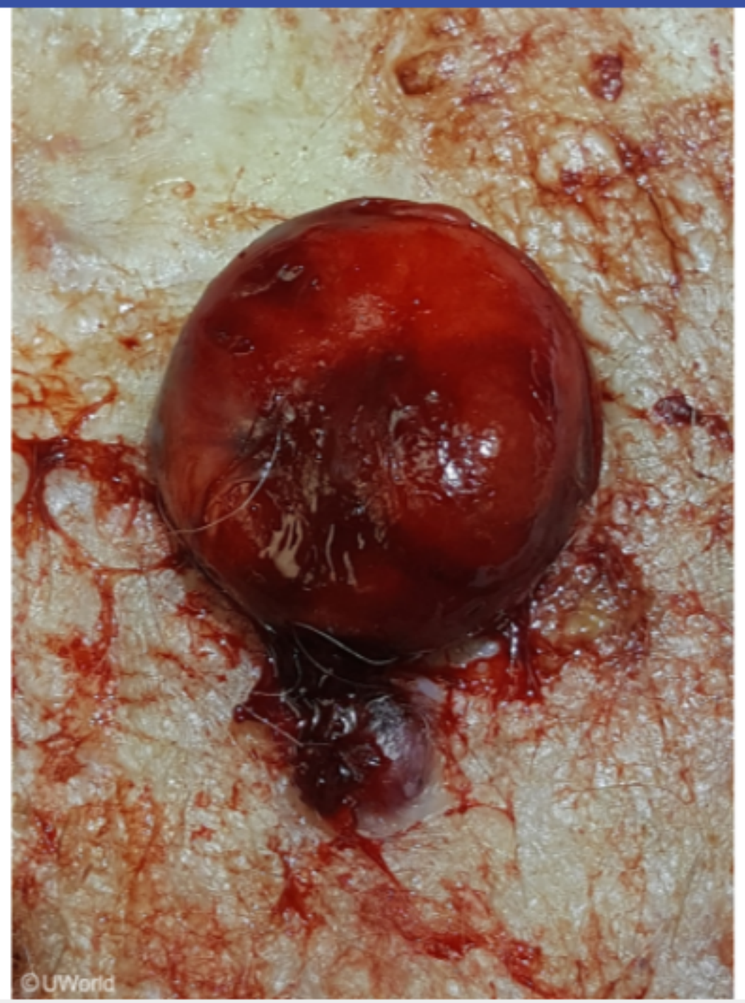
- Melanomas.
- Cutaneous malignant melanoma: a primary care perspective.

Surgery	Dermatology	Melanoma
Subject	System	Topic

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- **Firm** to palpation

Exhibit Display



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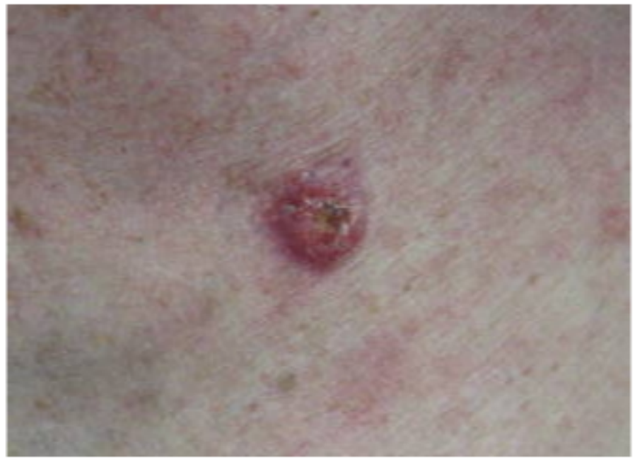


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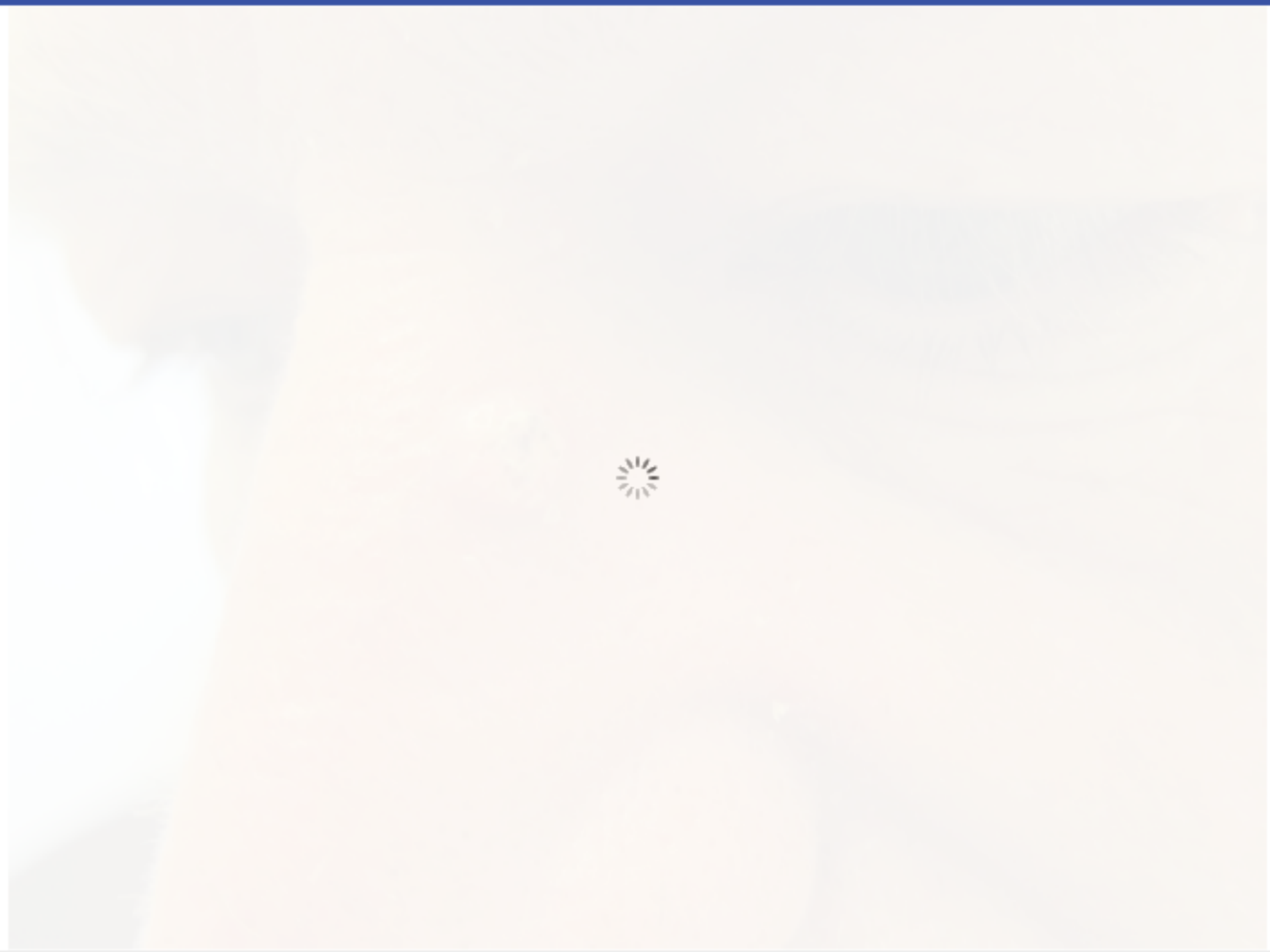


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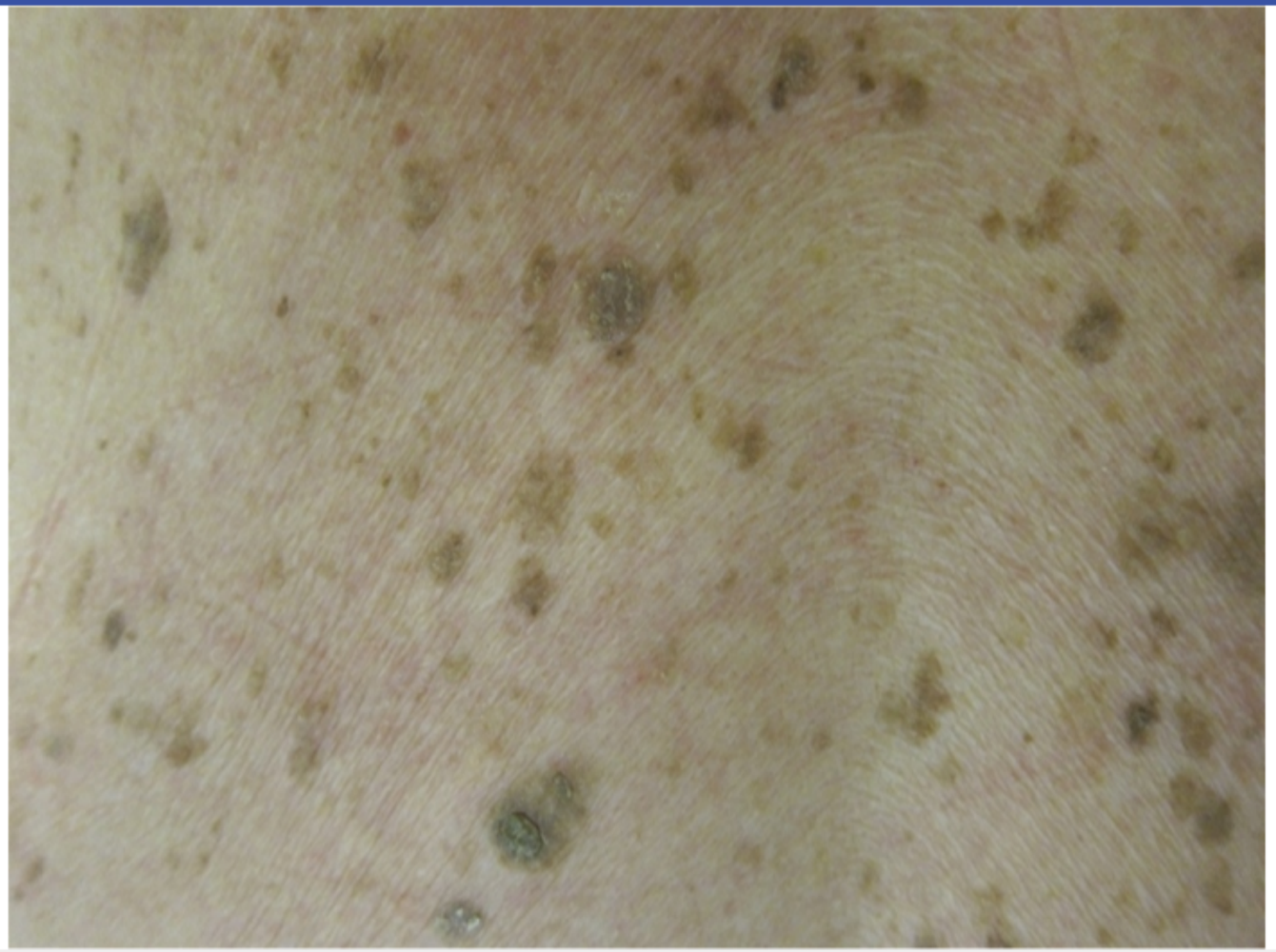


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- **Firm** to palpation

Exhibit Display



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A 65-year-old man comes to the office due to a week of low-grade fever and dull pain in his right foot. He developed a small ulcer on his right foot 2 months ago that slowly worsened and never healed. He does not recall any precipitating trauma. The patient has a history of type 2 diabetes mellitus, hypertension, hyperlipidemia, coronary artery disease, and peripheral artery disease. He smoked a pack of cigarettes daily for 35 years but quit 5 years ago. Temperature is 38.3 C (101 F), blood pressure is 130/80 mm Hg, and pulse is 88/min. Physical examination shows a 2x2 cm ulcer on the plantar surface of the right forefoot surrounded by a halo of erythema and edema. There is no visible bone at the base of the ulcer, and metal probing does not contact bone. Pedal pulses are decreased bilaterally. Right foot x-ray reveals cortical erosion of the first metatarsal. Which of the following is the most likely mechanism for bone infection in this patient?

A. Monomicrobial infection by contiguous spread
B. Monomicrobial infection by hematogenous spread
C. Monomicrobial infection by lymphatic spread
D. Polymicrobial infection by contiguous spread
E. Polymicrobial infection by hematogenous spread

Submit

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A. Monomicrobial infection by contiguous spread (12%)
B. Monomicrobial infection by hematogenous spread (6%)
C. Monomicrobial infection by lymphatic spread (1%)
✓ D. Polymicrobial infection by contiguous spread (69%)
E. Polymicrobial infection by hematogenous spread (10%)

Omitted
Correct answer
D

69%
Answered correctly

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Last Updated

Explanation

Foot infections are common in patients with **diabetes mellitus**. Risk is increased in those with poor glycemic control (impaired immunity), neuropathy (impaired recognition), and/or **peripheral artery disease** (impaired healing). Infections typically develop in areas of skin trauma or defect; less noticeable portals of entry such as skin cracks/fissures, fungal infections, or hangnails may make early recognition particularly

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Explanation

Foot infections are common in patients with **diabetes mellitus**. Risk is increased in those with poor glycemic control (impaired immunity), neuropathy (impaired recognition), and/or **peripheral artery disease** (impaired healing). Infections typically develop in areas of skin trauma or defect; less noticeable portals of entry such as skin cracks/fissures, fungal infections, or hangnails may make early recognition particularly problematic.

Symptoms usually start with localized skin erythema, warmth, tenderness, and edema. Deeper infections should be suspected in those with long-standing wounds (**>1-2 weeks**), **systemic symptoms** (fever, chills), large ulcer size (**≥2 cm**), elevated erythrocyte sedimentation rate, and the presence or palpation of bone in the ulcer base. Patients with any of these features almost always have **polymicrobial infections** with a mixture of gram-positive (eg, *Staphylococcus aureus*, *Streptococcus pyogenes*), gram-negative (eg, *Pseudomonas aeruginosa*), and anaerobic organisms.

This patient with a long-standing ulcer, fever, and x-ray evidence of osteomyelitis likely has a polymicrobial bone infection due to **contiguous spread** from the overlying ulcer. He requires wound debridement, evaluation of his arterial insufficiency, and empiric, intravenous antibiotics (eg, piperacillin-tazobactam plus vancomycin). Bone biopsy with microbial culture is sometimes performed prior to antibiotic therapy, but many patients are treated empirically.

(Choices A, B, C, and E) Superficial diabetic foot infections may be monomicrobial, but deeper infections are almost always polymicrobial. This patient has many signs (eg, size, chronicity, osteomyelitis) of deeper infection. In adults, underlying osteomyelitis with an overlying wound is almost always the result of contiguous spread. Hematogenous osteomyelitis accounts for 20% of osteomyelitis cases in adults (it is much more common in children) and primarily affects the vertebrae, pelvis, and hips. Lymphatic spread is not a common route for the development of osteomyelitis.

Educational objective:
Diabetic foot infections are common in patients with poor glycemic control, neuropathy, and peripheral vascular disease. Most deep, long-standing diabetic wounds are polymicrobial with a mixture of gram-positive, gram-negative, and anaerobic organisms. Underlying osteomyelitis is common due to contiguous spread from the wound.

Surgery Infectious Diseases Osteomyelitis

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A 25-year-old man comes to the office due to decreased force of the urinary stream and incomplete emptying of the bladder. He has no urgency, frequency, nocturia, dysuria, or fever. Bowel movements are regular. The patient has no chronic medical conditions and takes no medications. Vital signs are within normal limits. The abdomen is soft and nontender. External genitalia are normal; no penile discharge is noted. No inguinal lymphadenopathy is present. Neurologic examination shows no abnormalities. Urinalysis is normal. Postvoid residual volume is high. What is the most likely cause of this patient's current condition?

A. Abnormal detrusor overactivity
B. Benign prostatic hyperplasia
C. Ureterolithiasis
D. Urethral diverticulum
E. Urethral stricture

Submit

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

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A. Abnormal detrusor overactivity (21%)
B. Benign prostatic hyperplasia (6%)
C. Ureterolithiasis (2%)
D. Urethral diverticulum (7%)
✓ E. Urethral stricture (61%)

Omitted
Correct answer
E

61%
Answered correctly

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Explanation

Urethral stricture	
Etiology	• Male > female • Urethral trauma (eg, catheterization) • Urethritis

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Omitted
Correct answer
E

61%
Answered correctly

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Explanation

Urethral stricture	
Etiology	• Male > female • Urethral trauma (eg, catheterization) • Urethritis

Urethral stricture	
Etiology	• Male > female • Urethral trauma (eg, catheterization) • Urethritis • Radiotherapy
Symptoms	• Weak or spraying stream • Incomplete emptying • Irritative voiding (eg, dysuria, frequency)
Complications	• Acute urine retention • Recurrent urinary tract infection • Bladder stones
Diagnosis	• Postvoid residual, uroflowmetry • Urethrography • Cystourethroscopy
Management	• Dilation • Urethroplasty

This patient has decreased urinary flow and a sensation of incomplete emptying. In a young man, this is consistent with a urethral stricture. **Urethral stricture** is a common disorder characterized by fibrotic narrowing of the urethra and occurs most frequently in the bulbar portion. Strictures are commonly **idiopathic**, but secondary causes include urethral **trauma** (eg, pelvic fracture, iatrogenic instrumentation), **infection** (eg, sexually transmitted urethritis), and radiotherapy. In some cases, the inciting cause is temporally remote and may not be immediately remembered by the patient.

Urethral strictures can lead to acute **urine retention**, recurrent **urinary tract infection**, bladder stones, or, rarely, hydronephrosis and renal insufficiency. Patients typically have obstructive-type voiding symptoms (eg, weak urine stream, urinary spraying), although dysuria can occur. The diagnosis is suggested by an **elevated postvoid residual volume**. Urethrography (eg, **voiding cystourethrogram**) or **cystourethroscopy**

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(Choice A) Abnormal detrusor overactivity can cause similar symptoms but is more likely to cause urinary frequency and urgency, nocturia, or incontinence (storage-type symptoms related to bladder filling and urine storage), which are not seen in this patient. Obstructive symptoms (ie, decreased force of stream) and increased postvoid residual volume are more consistent with stricture.

(Choice B) Benign prostatic hyperplasia causes similar obstructive-type voiding symptoms due to impedance of urine flow in the prostatic urethra. However, although symptomatic benign prostatic hyperplasia is very common in older men, it is rare at age <40.

(Choice C) Although a stone in the lower ureter (eg, vesicoureteral junction) can cause symptoms of irritative voiding (eg, urgency, frequency), patients frequently have hematuria and severe, acute flank pain. Postvoid residual volume is normal.

(Choice D) Urethral diverticulum is a rare condition characterized by lateral extension of urethral mucosa into the surrounding tissues. Usually seen in women, it often presents as a painful mass in the anterior vaginal wall. Other symptoms include hematuria, incontinence, and recurrent infection.

Educational objective:
Urethral stricture is a fibrotic narrowing of the urethra. Common causes include urethral trauma, infection, and radiotherapy. Symptoms include weak or spraying urine flow and incomplete emptying. Postvoid residual volume is increased. The diagnosis is confirmed on urethrography or cystourethroscopy; treatment includes urethral dilation or surgical urethroplasty.

insufficiency. Patients typically have obstructive-type voiding symptoms (eg, weak urine stream, urinary spraying), although dysuria can occur. The diagnosis is suggested by an **elevated postvoid residual volume**. Urethrography (eg, **voiding cystourethrogram**) or **cystourethroscopy** can confirm the diagnosis. In addition to voiding problems, complications can include bladder stones, hydronephrosis, and fistulas. Mild strictures may be observed cautiously, but significant strictures typically require correction with either **urethral dilation** or surgical **urethroplasty**.

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Educational objective:

Urethral stricture is a fibrotic narrowing of the urethra. Common causes include urethral trauma, infection, and radiotherapy. Symptoms include weak or spraying urine flow and incomplete emptying. Postvoid residual volume is increased. The diagnosis is confirmed on urethrography or cystourethroscopy; treatment includes urethral dilation or surgical urethroplasty.

References

- Urethral stricture: etiology, investigation and treatments.

Surgery	Renal, Urinary Systems & Electrolytes	Urinary tract obstruction
Subject	System	Topic

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A 22-year-old man involved in a motor vehicle collision undergoes a prolonged surgery to repair a left tibial fracture and popliteal artery injury. The day after surgery he has increasing pain in the left leg and is treated with intravenous fluids and morphine. Two hours later, the patient continues to have pain that worsens with passive leg movement and has a "pins and needles" sensation. Examination shows tense, tender swelling of the left calf. There is sensory loss between the great and second left toes. The lower-extremity pulses are palpable bilaterally. Which of the following is the most important next step in management of this patient?

A. Elevate the leg and apply ice packs
B. Initiate patient-controlled analgesia
C. Obtain a Doppler ultrasound of the lower extremity
D. Obtain x-rays of the lower extremity
E. Return to the operating room for fasciotomy

Submit

A 22-year-old man involved in a motor vehicle collision undergoes a prolonged surgery to repair a left tibial fracture and popliteal artery injury. The day after surgery he has increasing pain in the left leg and is treated with intravenous fluids and morphine. Two hours later, the patient continues to have pain that worsens with passive leg movement and has a "pins and needles" sensation. Examination shows tense, tender swelling of the left calf. There is sensory loss between the great and second left toes. The lower-extremity pulses are palpable bilaterally. Which of the following is the most important next step in management of this patient?

- A. Elevate the leg and apply ice packs (2%)
- B. Initiate patient-controlled analgesia (0%)
- C. Obtain a Doppler ultrasound of the lower extremity (11%)
- D. Obtain x-rays of the lower extremity (0%)
- ✓ E. Return to the operating room for fasciotomy (83%)

Omitted
Correct answer
E

83%
Answered correctly

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04/23/2020
Last Updated

Explanation

Clinical features of compartment syndrome	
Common	• Pain out of proportion to injury • **Pain ↑ on passive stretch** • Rapidly increasing & tense swelling

Clinical features of compartment syndrome	
Common	• Pain out of proportion to injury • **Pain ↑ on passive stretch** • Rapidly increasing & tense swelling • **Paresthesia (early)**
Uncommon	• ↓ Sensation • Motor weakness (within hours) • Paralysis (late) • ↓ Distal pulses (uncommon)

Compartment syndrome (CS) can be caused by direct trauma or prolonged compression of an extremity or after revascularization of an acutely ischemic limb. Patients typically have **excruciating pain** that is worsened on passive range of motion and does not respond well to narcotics. There is considerable variation in associated signs and symptoms, and a high index of suspicion is needed to make a diagnosis. Paresthesia from sensory nerve ischemia is usually an early finding. Neurologic deficits (eg, sensory loss, motor weakness) may be present but develop later in the course of the disease. Pallor is the result of arterial occlusion but is uncommon and not required for diagnosis. Similarly, arterial pulses are present in a majority of patients, especially in early stages of CS.

Diagnosis can be confirmed by measuring **compartment pressures** in the affected extremity. However, in high-risk patients (eg, those with limb revascularization) who develop symptoms suggestive of CS (pain, swelling, sensory loss), the diagnosis may be made on clinical grounds alone. **Time to fasciotomy** is the most critical prognostic indicator and should be performed without delay.

(Choice A) Supportive measures should be taken to maintain perfusion pressure in the extremity, which includes keeping the leg at the level of the torso (not higher or lower). Leg elevation and ice would be recommended if leg edema were secondary to inflammation (eg, cellulitis).

(Choice B) Increased analgesic dosages may be needed to control increasing pain. However, surgical intervention is of utmost importance to preserve limb function. This patient's neurologic symptoms and tense swelling highly suggest developing CS rather than simple postsurgical changes.

(Choice C) Deep venous thrombosis (DVT) is diagnosed with Doppler ultrasonography. Like CS, DVT may also present with increasing pain and

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(Choice C) Deep venous thrombosis (DVT) is diagnosed with Doppler ultrasonography. Like CS, DVT may also present with increasing pain and swelling, but symptoms are more insidious in onset and less severe. The presence of neurologic symptoms makes CS more likely, especially in a patient who is predisposed.

(Choice D) X-rays of the lower extremity would be needed if there was evidence of fracture displacement (leg shortening, rotation, and angulation).

Educational objective:
Patients with compartment syndrome have severe pain, pain with passive range of motion, and paresthesia. Sensory and motor deficits occur in later stages. Pallor and loss of limb pulses are uncommon findings. Compartment pressures must be measured immediately if the index of suspicion is very high. Fasciotomy is the treatment of choice.

References

Diagnosis can be confirmed by measuring **compartment pressures** in the affected extremity. However, in high-risk patients (eg, those with limb revascularization) who develop symptoms suggestive of CS (pain, swelling, sensory loss), the diagnosis may be made on clinical grounds alone. **Time to fasciotomy** is the most critical prognostic indicator and should be performed without delay.

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(Choice D) X-rays of the lower extremity would be needed if there was evidence of fracture displacement (leg shortening, rotation, and angulation).

Educational objective:
Patients with compartment syndrome have severe pain, pain with passive range of motion, and paresthesia. Sensory and motor deficits occur in later stages. Pallor and loss of limb pulses are uncommon findings. Compartment pressures must be measured immediately if the index of suspicion is very high. Fasciotomy is the treatment of choice.

References

- Compartment syndrome of the lower leg and foot.

Surgery	Rheumatology/Orthopedics & Sports	Compartment syndrome
Subject	System	Topic

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

A 36-year-old woman undergoes an abdominal hysterectomy for symptomatic uterine fibroids. Medical history is otherwise unremarkable, and preoperative blood cell counts, serum chemistry, and coagulation studies are normal. There are no intraoperative complications and blood loss is minimal. She receives postoperative morphine sulfate by patient-controlled analgesia and an intravenous infusion of 5% dextrose in 0.45% saline. The following day, the patient experiences increasing global headache and severe nausea and is noted to be confused. Temperature is 36.7 C (98.1 F), blood pressure is 110/70 mm Hg, pulse is 88/min, and respirations are 14/min. Twenty-four-hour urine output is 1600 mL. On physical examination, the patient is lethargic and disoriented. The abdomen is soft with mild incisional tenderness and decreased bowel sounds. Neurologic examination shows no focal weakness or sensory loss. Laboratory results are as follows:

Serum chemistry

Sodium	119 mEq/L
Potassium	3.7 mEq/L
Creatinine	0.5 mg/dL
Glucose	78 mg/dL

Which of the following is the most appropriate intervention for this patient?

A. Administer intravenous (IV) hydrocortisone
B. Administer IV hypertonic (3%) saline
C. Administer vasopressin receptor antagonist
D. Change IV fluid to isotonic (0.9%) saline
E. Change IV fluid to lactated Ringer solution

Submit

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Which of the following is the most appropriate intervention for this patient?

A. Administer intravenous (IV) hydrocortisone (2%)
✓ B. Administer IV hypertonic (3%) saline (59%)
C. Administer vasopressin receptor antagonist (3%)
D. Change IV fluid to isotonic (0.9%) saline (30%)
E. Change IV fluid to lactated Ringer solution (3%)

Omitted
Correct answer

59%
Answered correctly

04 secs
Time Spent

04/04/2020
Last Updated

This patient has **symptomatic hyponatremia**, most likely due to the use of hypotonic intravenous fluids (ie, 0.45% saline) and to postoperative syndrome of inappropriate antidiuretic hormone (SIADH) release (which is stimulated by pain, nausea, or stress). Low serum tonicity results in the influx of water into brain cells, leading to swelling and cerebral edema. Symptoms reflect **elevated intracranial pressure**: mild/moderate symptoms include nausea, malaise, headache, and confusion, whereas severe symptoms include seizure, coma, and respiratory arrest. Adaptations to normalize brain volume (eg, extrusion of osmolytes from brain cells) typically take ~48 hours.

- **Acute hyponatremia** (present for **<48 hr**) is poorly tolerated, and patients are at high risk of brain herniation. Therefore, patients with serum sodium of <130 mEq/L with **any symptoms** of elevated intracranial pressure should be treated with **hypertonic 3% saline** boluses to rapidly correct serum sodium. Because neural adaptations have not occurred, patients are at relatively low risk of osmotic demyelination syndrome (ODS).
- **Chronic hyponatremia** (present for **≥48 hr**) is typically better tolerated; therefore, hypertonic saline is often reserved for those with severe hyponatremia (<120 mEq/ L), severe symptoms (eg, seizure), or concurrent intracranial pathology (eg, masses, hemorrhagic stroke).

The goal of hypertonic saline infusion is to raise serum sodium levels by **4-6 mEq/L** over a period of hours, which markedly reduces the risk of herniation. The maximum rate of correction is 8 mEq/L in 24 hours to prevent ODS.

(Choice A) Acute adrenal insufficiency may occur in the postoperative setting and requires rapid administration of hydrocortisone or dexamethasone. It causes nausea, weakness, confusion, and hyponatremia, but most patients also have hyperkalemia and severe hypotension.

(Choice C) Vasopressin receptor antagonists (eg, tolvaptan) may be used for patients with chronic hyponatremia due to SIADH; however, they have slower onset than hypertonic saline and are not indicated in the treatment of acute, symptomatic patients.

(Choices D and E) Patients with symptomatic hyponatremia require rapid correction of sodium levels to prevent herniation; this cannot be accomplished with isotonic solutions (eg, 0.9% saline, lactated Ringer), which slowly raise serum sodium. Additionally, the use of isotonic fluids in patients with SIADH will likely worsen hyponatremia.

Educational objective:
Hyponatremia can cause cellular swelling and cerebral edema. Symptoms reflect elevated intracranial pressure; mild/moderate symptoms include headache, nausea, and confusion, whereas severe symptoms include seizure, coma, and respiratory arrest. Acute hyponatremia (<48-hr duration) is poorly tolerated, and patients are at elevated risk of brain herniation; therefore, patients with any symptoms should receive hypertonic

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Surgery	Renal, Urinary Systems & Electrolytes	Hyponatremia
Subject	System	Topic

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