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Item 1 of 40
Question Id: 1738

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A 48-year-old man is evaluated for abdominal pain and diarrhea. The patient characterizes his stool as voluminous and foul smelling. He has no significant past medical history. The patient drinks 6 cans of beer daily. On examination, he has normal bowel sounds and mild epigastric tenderness. A 72-hour stool collection shows excessive excretion of fecal fat. A CT scan of the abdomen is shown in the image below. Involvement of which of the following structures is most likely causing this patient's symptoms?

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Item 1 of 40
Question Id: 1738

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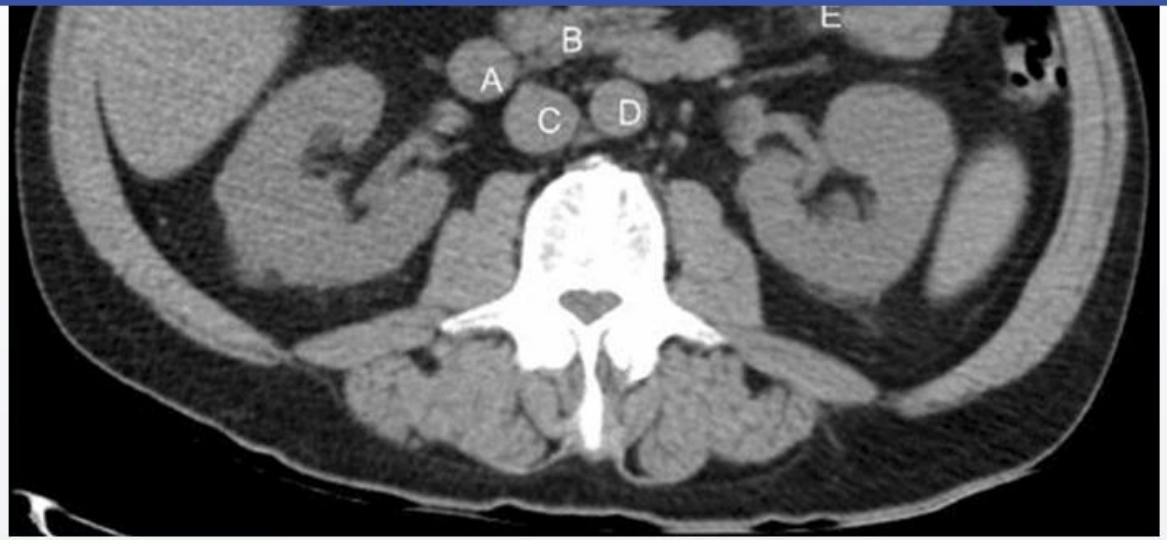

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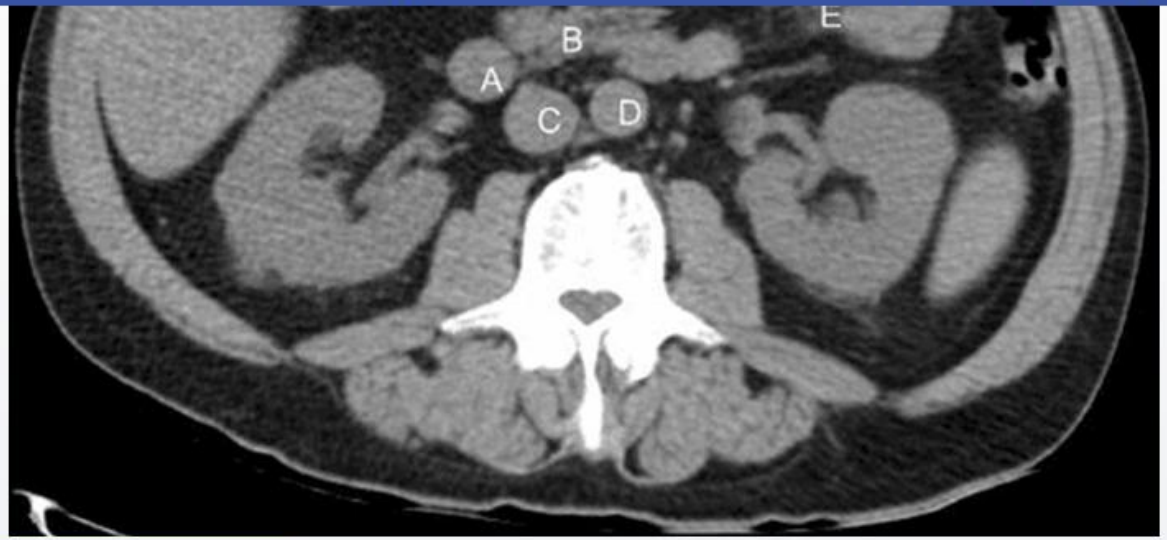

- A. A [1%]
- ✔ B. B [91%]
- C. C [0%]
- D. D [0%]
- E. E [5%]

Omitted

91%

24 Seconds

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Item 1 of 40
Question Id: 1738

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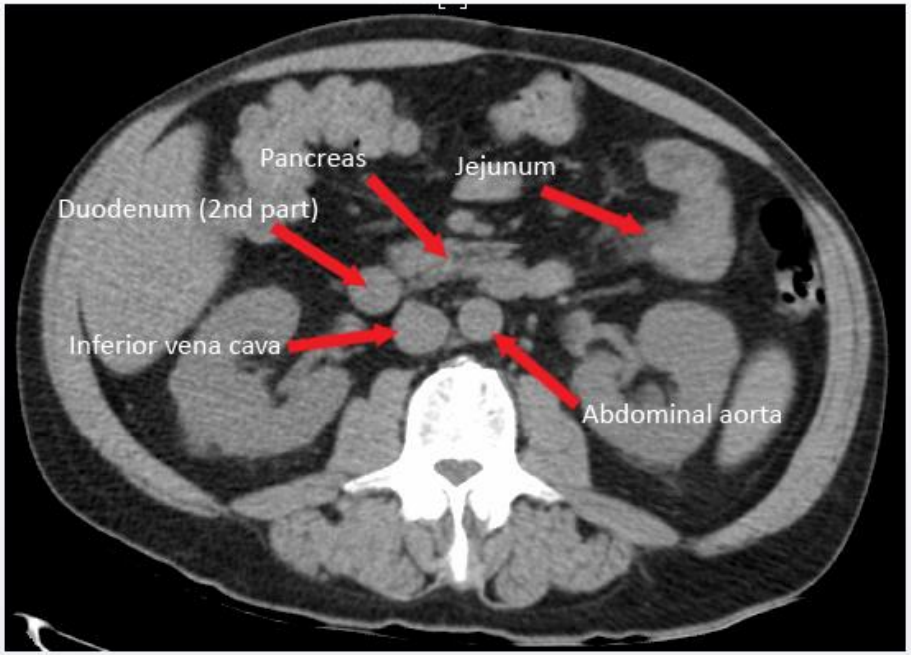
Explanation



This patient with excessive alcohol use, **epigastric pain**, and **steatorrhea** likely has **chronic pancreatitis** with exocrine insufficiency. Atrophy and fibrosis of pancreatic acinar cells result in failed secretion of adequate amounts of digestive enzymes (eg, lipase). Consequently, patients may develop **fat malabsorption** with greasy, malodorous stools that are difficult to flush. A 72-hour stool collection can confirm excessive excretion of fecal fat.

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The head, neck, and body of the pancreas are retroperitoneal, whereas the tail is peritoneal. The head of the pancreas lies in the curve of the duodenum and overlies the L2 vertebra, with a portion extending behind the superior mesenteric vessels (uncinate process). The neck connects the head to the body and lies anterior to the portal vein and superior mesenteric vessels. The pancreas body overlies the L1 and L2 vertebrae and makes contact posteriorly with the aorta, left adrenal gland, left kidney, and renal vessels. The tail of the pancreas courses within the splenorenal ligament alongside the splenic vessels.

(Choice A) This structure is the second (descending) part of the duodenum.

(Choice C) This structure is the inferior vena cava, which lies on the right side of the vertebrae in a retroperitoneal position.

(Choice D) This structure is the abdominal aorta, which lies on the left side of the vertebrae in a retroperitoneal position.

(Choice E) At this level in the abdominal cavity, these loops of small bowel represent jejunum. If this CT slice were lower in the abdomen, these loops would more likely represent ileum.

Educational objective:
Chronic pancreatitis often presents with epigastric pain and pancreatic exocrine insufficiency resulting in fat malabsorption/steatorrhea. On abdominal CT scan, the pancreas can be identified by its head in close association with the second part of the duodenum; its body overlying the aorta, left kidney, and renal vessels; and its tail lying within the splenorenal ligament.

References

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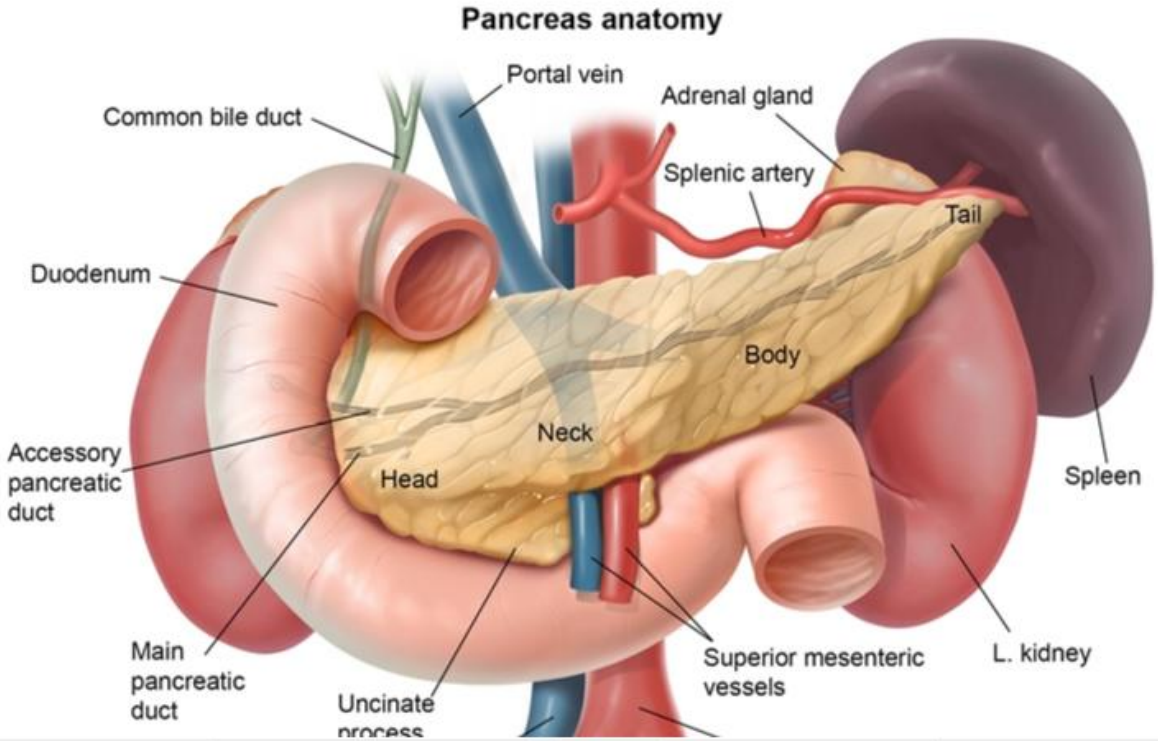

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Question Id: 1738

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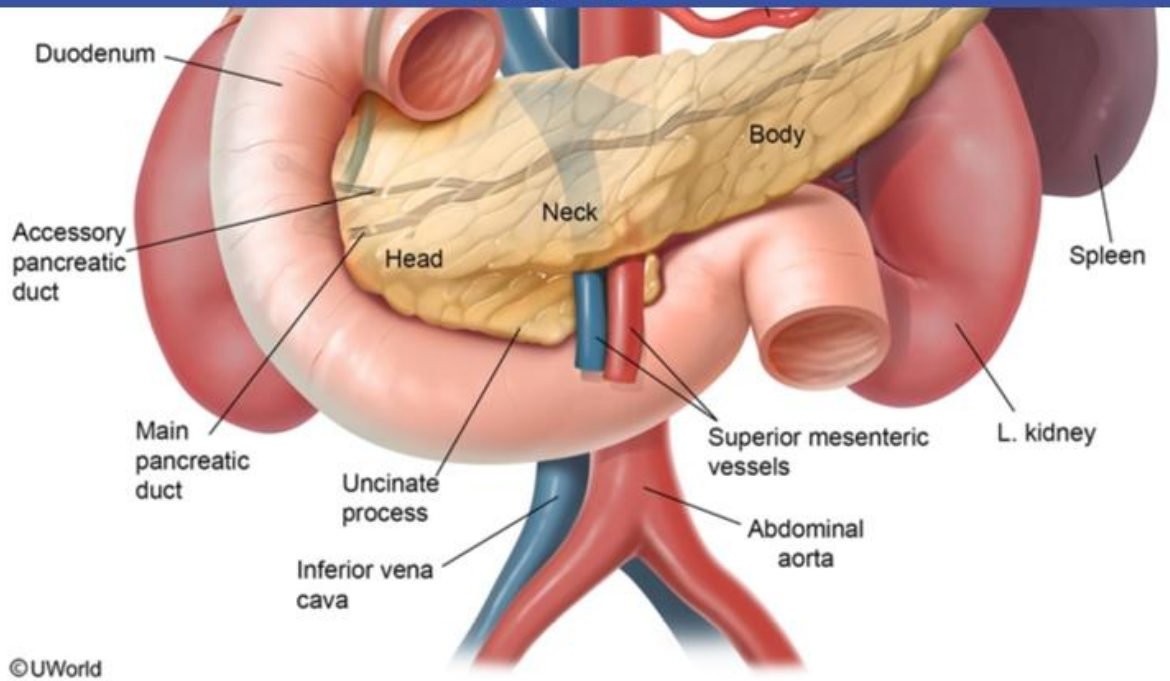

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Item 2 of 40
Question Id: 1832

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A 65-year-old man is evaluated in the clinic due to several months of abdominal pain and vomiting. The pain starts 2 to 3 hours after meals, is characterized as crampy, and is often associated with bilious vomiting. Lately, the patient has been tolerating only liquids and has consequently lost 12 lbs in the past 4 months. On physical examination, he has mild epigastric tenderness on deep palpation. Contrast-enhanced CT scan of the abdomen shows an irregular mass in the third portion of the duodenum that is infiltrating beyond the gut wall. If this mass continues to enlarge, which of the following structures is most likely to be compromised in this patient?

A. Common bile duct
B. Gastroduodenal artery
C. Portal vein
D. Superior mesenteric artery
E. Ureter

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Item 2 of 40
Question Id: 1832

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A. Common bile duct [12%]
B. Gastroduodenal artery [18%]
C. Portal vein [6%]
✔ D. Superior mesenteric artery [58%]
E. Ureter [3%]

Omitted
Correct answer
D

58%
Answered correctly

5 Seconds
Time Spent

12/05/2018
Last Updated

Explanation

The first part of the duodenum emerges from the pylorus of the stomach and is horizontally oriented over the first lumbar vertebra. It is the only part of the duodenum that is not retroperitoneal. The second part of the duodenum courses inferiorly from the level of L1 to L3. This part of the

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The first part of the duodenum emerges from the pylorus of the stomach and is horizontally oriented over the first lumbar vertebra. It is the only part of the duodenum that is not retroperitoneal. The second part of the duodenum courses inferiorly from the level of L1 to L3. This part of the duodenum is in close relation to the head of the pancreas and contains the ampulla of Vater, the site where pancreatic and common bile duct secretions are released.

The **third part** of the **duodenum** courses horizontally over L3, the abdominal aorta, and the inferior vena cava. It is in close association with the uncinate process of the pancreas and the **superior mesenteric artery** and vein. Small bowel malignancies are rare; if they occur in the third part of the duodenum, anterior tumor invasion could compromise the superior mesenteric vessels. The fourth part of the duodenum courses superiorly and to the left of the L2 and L3 vertebrae and becomes the jejunum past the ligament of Treitz.

(Choice A) The common bile duct is formed when the common hepatic duct and cystic duct join in the porta hepatis region of the hepatoduodenal ligament. The common bile duct courses inferiorly, posterior to the first part of the duodenum and within the head of the pancreas, to drain into the second part of the duodenum.

(Choice B) The gastroduodenal artery arises from the common hepatic artery and courses inferiorly, posterior to the first part of the duodenum, where it then splits into the anterior superior pancreaticoduodenal artery and the right gastroepiploic artery. Peptic ulcers involving the posterior duodenal bulb can erode into the gastroduodenal artery and cause bleeding.

(Choice C) The portal vein is formed by the union of the superior mesenteric and splenic veins in the retroperitoneum. It is located posterior to the pancreas at the level of the first lumbar vertebra and makes no contact with the duodenum.

(Choice E) The left ureter has no relation to the duodenum. The right ureter courses retroperitoneally, posterior to the second part of the duodenum, for a short length.

Educational objective:
The third part of the duodenum courses horizontally across the abdominal aorta and inferior vena cava at the level of the third lumbar vertebra. The superior mesenteric vessels lie anterior to the duodenum at this location.

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Item 3 of 40
Question Id: 319

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A 3-day-old girl is brought to the emergency department by her parents due to persistent vomiting and refusal to feed. The vomiting began early in the morning and has been a greenish-yellow color. The emesis does not contain blood. The infant appears dehydrated. Her heart rate is 175/min and blood pressure is within normal limits. After initial evaluation is complete, the infant undergoes laparotomy. Findings include a normal-appearing duodenum, the absence of a large segment of jejunum and ileum, and the remainder of the distal ileum winding around a thin vascular stalk. Which of the following intrauterine processes is most likely responsible for this patient's condition?

A. Abnormal rotation
B. Cell migration failure
C. Failure of partitioning
D. Recanalization failure
E. Vascular occlusion

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- A. Abnormal rotation [32%]
- B. Cell migration failure [11%]
- C. Failure of partitioning [5%]
- D. Recanalization failure [21%]
- ✔ E. Vascular occlusion [28%]

Omitted
Correct answer
E

28%
Answered correctly

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02/04/2019
Last Updated

Explanation

Bilious emesis in a neonate is a sign of intestinal **obstruction below** the second part of the duodenum. The differential diagnosis includes midgut volvulus, which is a surgical emergency and must be excluded definitively. Other causes include **intestinal stenosis** and **atresia**. The

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Bilious emesis in a neonate is a sign of intestinal **obstruction below** the second part of the duodenum. The differential diagnosis includes midgut volvulus, which is a surgical emergency and must be excluded definitively. Other causes include **intestinal stenosis** and **atresia**. The more distal the atresia, the more likely it is to present with abdominal distension rather than bilious emesis. The absence of a segment of jejunum and ileum in this case confirms that the infant's condition is due to intestinal atresia.

Intestinal atresias of the midgut (eg, jejunum, ileum, proximal colon) are the result of **vascular occlusion** in utero. Diminished intestinal perfusion leads to ischemia of a segment of bowel, with subsequent narrowing (stenosis) or obliteration (atresia) of the lumen. If a major vessel (eg, the superior mesenteric artery) is occluded, the area of intestinal necrosis is large. The result is a proximal segment that ends in a blind pouch; followed by an area of absent small bowel and associated dorsal mesentery; and, finally, a distal segment of ileum that assumes a **spiral configuration** around an ileocolic vessel. This specific pattern is known as an "apple-peel" or "Christmas tree" deformity.

(Choice A) Improper rotation of the developing gut and the mesentery can lead to malrotation and subsequent midgut volvulus. The presentation of midgut volvulus (bilious emesis) is similar to intestinal atresia. However, the surgical findings in this case (atresia rather than malrotation) rule out midgut volvulus.

(Choice B) Hirschsprung disease results from the failure of neural crest cells to migrate into the distal colonic wall. Without neural crest cells, submucosal and myenteric plexi do not develop and the distal colon becomes nonfunctional. Affected infants have intestinal obstruction and failure to pass stool.

(Choice C) Failure of the tracheoesophageal septum to partition the foregut into the esophagus and the trachea during the 4th-5th week of gestation leads to tracheoesophageal fistula.

(Choice D) Duodenal atresia occurs when the duodenal lumen fails to recanalize after endothelial proliferation during the 8th-10th week of gestation. Recanalization failure is not the cause of atresia or stenosis in the distal gut; distal atresias are due to vascular injury.

Educational objective:
Intestinal atresia distal to the duodenum occurs due to vascular accidents in utero. "Apple-peel" atresia occurs when the superior mesenteric

midgut volvulus, which is a surgical emergency and must be excluded definitively. Other causes include **intestinal stenosis** and **atresia**. The more distal the atresia, the more likely it is to present with abdominal distension rather than bilious emesis. The absence of a segment of jejunum and ileum in this case confirms that the infant's condition is due to intestinal atresia.

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Educational objective:
Intestinal atresia distal to the duodenum occurs due to vascular accidents in utero. "Apple-peel" atresia occurs when the superior mesenteric artery is obstructed. The result is a blind-ending proximal jejunum; a length of absent bowel and mesentery; and, finally, a terminal ileum spiraled around an ileocolic vessel.

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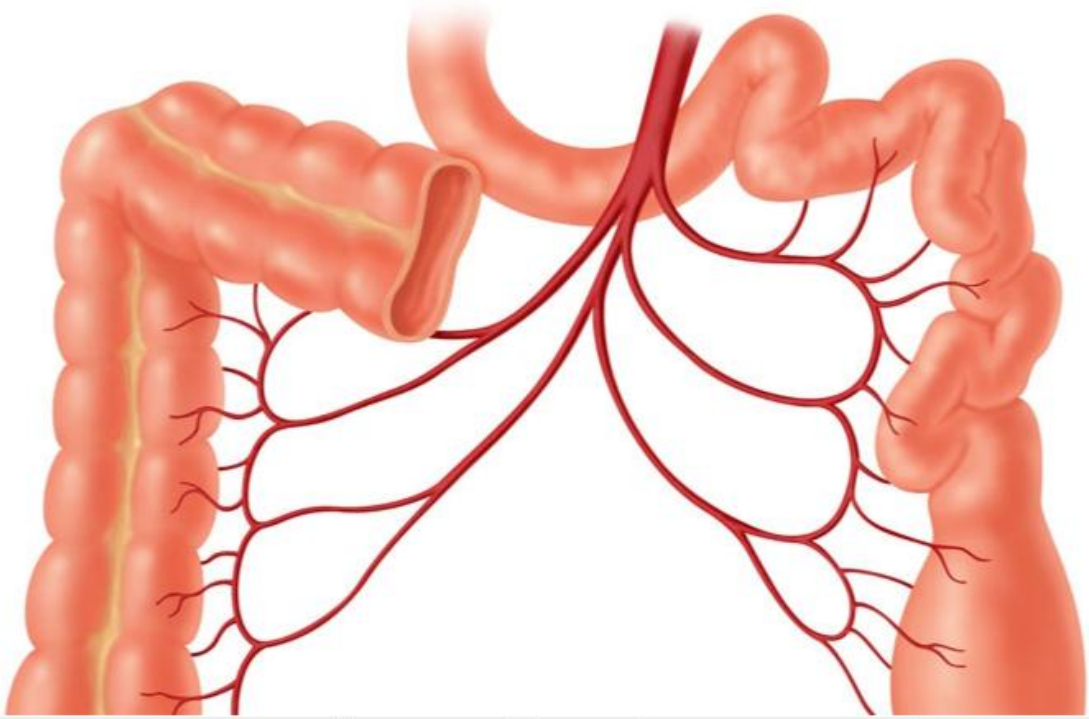

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artery is obstructed. The result is a blind-ending proximal jejunum; a length of absent bowel and mesentery; and, finally, a terminal ileum spiraled

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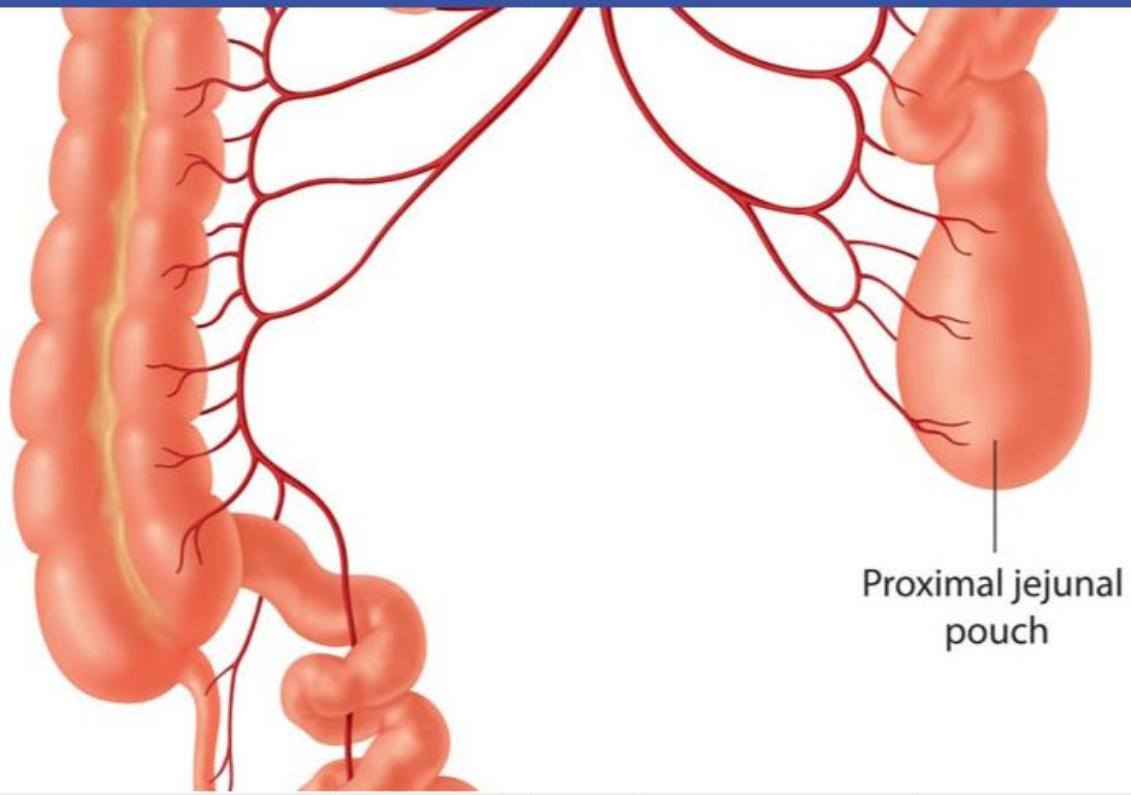

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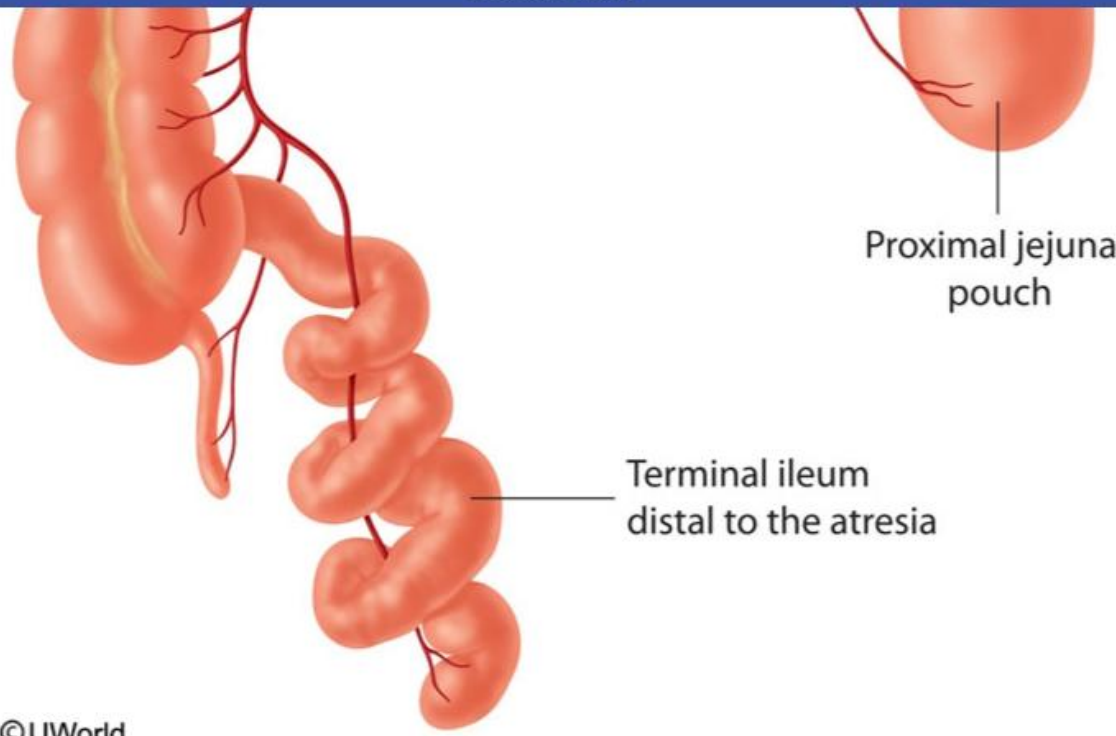

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Item 4 of 40
Question Id: 8547

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A 52-year-old man is brought to the emergency department for hematemesis that began an hour earlier. He has regularly consumed large amounts of alcohol for the last 20 years and has been hospitalized numerous times due to ethanol intoxication. Temperature is 36.7 C (98 F), blood pressure is 90/60 mm Hg, pulse is 106/min, and respirations are 22/min. Physical examination shows jaundice and scleral icterus. Examination of the abdomen reveals a palpable spleen and moderate ascites. Endoscopy reveals bleeding esophageal varices. This patient's current condition most likely resulted from chronic shunting of blood through which of the following veins?

A. Left gastric
B. Middle colic
C. Paraumbilical
D. Right gastroepiploic
E. Splenic
F. Superficial epigastric

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Item 4 of 40
Question Id: 8547

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- ✔ A. Left gastric [71%]
- B. Middle colic [0%]
- C. Paraumbilical [5%]
- D. Right gastroepiploic [5%]
- E. Splenic [10%]
- F. Superficial epigastric [6%]

Omitted
Correct answer
A

71%
Answered correctly

5 Seconds
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12/14/2018
Last Updated

Explanation

This patient has numerous cirrhotic stigmata including ascites, jaundice, and splenomegaly. An important cause of cirrhosis-related morbidity and

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A

Explanation

This patient has numerous cirrhotic stigmata including ascites, jaundice, and splenomegaly. An important cause of cirrhosis-related morbidity and mortality is the development of **variceal hemorrhaging** as a direct consequence of portal hypertension.

Cirrhosis (of any type) represents the end stage of progressive hepatic fibrosis. It is characterized by distortion of the hepatic architecture and formation of regenerative nodules. Cirrhosis is the most common cause of **portal hypertension**, which arises from increased resistance to portal flow at the hepatic sinusoids. Chronic portal hypertension leads to dilation of small, pre-existing vascular channels between the portal and systemic circulations. These dilated collateral vessels (**portosystemic anastomoses**) commonly form in the anterior abdomen (caput medusae), lower rectum (anorectal varices), and **inferior end of the esophagus** (esophageal varices).

Treatment sometimes includes inserting a transjugular intrahepatic portosystemic shunt (TIPS) between the portal vein and hepatic vein percutaneously, relieving portal hypertension by shunting blood to the systemic circulation.

(Choice B) The middle colic vein drains the transverse colon.

(Choices C and F) In cirrhosis, the paraumbilical veins can shunt blood from the portal system to superficial epigastric veins in the abdominal wall, causing **caput medusae**.

(Choice D) The right gastroepiploic vein drains venous blood from the inferior portions of the stomach. It runs along the greater curvature of the stomach.

(Choice E) The splenic vein drains blood from the spleen. It joins with the superior mesenteric vein to form the hepatic portal vein. Patients with portal hypertension can develop splenomegaly due to congestion of the splenic red pulp.

Educational objective:

This patient has numerous cirrhotic stigmata including ascites, jaundice, and splenomegaly. An important cause of cirrhosis-related morbidity and mortality is the development of **variceal hemorrhaging** as a direct consequence of portal hypertension.

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(Choice E) The splenic vein drains blood from the spleen. It joins with the superior mesenteric vein to form the hepatic portal vein. Patients with portal hypertension can develop splenomegaly due to congestion of the splenic red pulp.

Educational objective:
In cirrhosis, portal hypertension arises from increased resistance to portal flow at the hepatic sinusoids. This causes increased pressure in the portosystemic collateral veins within the lower end of the esophagus, anterior abdomen, and lower rectum. Dilation of these collateral vessels is responsible for the esophageal varices, caput medusae, and anorectal varices commonly seen in patients with cirrhosis.

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Question Id: 8547

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F. Superficial epigastric [6%]

Omitted
Correct answer
A

Explanation

This patient has numerous cirrh ...idity and mortality is the development of

Cirrhosis (of any type) represe ...re and formation of regenerative nodul ...to portal flow at the hepatic sinusoids. C ...d systemic circulations. These di ...edusae), lower rectum (anorectal varices

Treatment sometimes includes percutaneously, relieving portal

(Choice B) The middle colic ve

(Choices C and F) In cirrhosis, the paraumbilical veins can shunt blood from the portal system to superficial epigastric veins in the abdominal wall, causing **caput medusae**.

(Choice D) The right gastroepiploic vein drains venous blood from the inferior portions of the stomach. It runs along the greater curvature of the

Exhibit Display

Portacaval anastomoses		
Clinical manifestation	**Portal circulation**	**Systemic circulation**
Esophageal varices	Left gastric vein	Esophageal vein
Anorectal varices	Superior rectal vein	Middle & inferior rectal veins
Caput medusae	Paraumbilical veins	Superficial & inferior epigastric veins

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Item 5 of 40
Question Id: 438

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A 4-week-old boy is hospitalized with persistent vomiting, fussiness, and feeding intolerance. The emesis was initially clear but became bilious in the last few hours. The infant had been breastfeeding exclusively. His temperature is 37.2 C (99.0 F). Blood pressure and pulse are normal. Physical examination shows a normal abdomen with no rebound or guarding. An upper gastrointestinal series is obtained urgently to evaluate for malrotation and volvulus and shows normal rotation but constriction of the duodenum. An abdominal CT scan reveals pancreatic tissue encircling the duodenum. Which of the following is the most likely cause of this patient's condition?

A. Aberrant differentiation of the midgut structures
B. Abnormal migration of the ventral pancreatic bud
C. Ectopic rests not connected to the pancreas
D. Failure of apoptosis in the dorsal pancreatic bud
E. Failure of the ventral and dorsal pancreatic bud to fuse

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Item 5 of 40
Question Id: 438

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A 4-week-old boy is hospitalized with persistent vomiting, fussiness, and feeding intolerance. The emesis was initially clear but became bilious in the last few hours. The infant had been breastfeeding exclusively. His temperature is 37.2 C (99.0 F). Blood pressure and pulse are normal. Physical examination shows a normal abdomen with no rebound or guarding. An upper gastrointestinal series is obtained urgently to evaluate for malrotation and volvulus and shows normal rotation but constriction of the duodenum. An abdominal CT scan reveals pancreatic tissue encircling the duodenum. Which of the following is the most likely cause of this patient's condition?

A. Aberrant differentiation of the midgut structures [0%]
✔ B. Abnormal migration of the ventral pancreatic bud [74%]
C. Ectopic rests not connected to the pancreas [1%]
D. Failure of apoptosis in the dorsal pancreatic bud [6%]
E. Failure of the ventral and dorsal pancreatic bud to fuse [16%]

Omitted
Correct answer
B

74%
Answered correctly

3 Seconds
Time Spent

01/01/2019
Last Updated

Explanation

This patient has acute pancreatitis and radiographic evidence of **annular pancreas**, which results from abnormal migration of the ventral pancreatic bud. This bud is a **foregut** derivative that appears by the fifth week of gestation and **rotates behind** the duodenum during the seventh

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This patient has acute pancreatitis and radiographic evidence of **annular pancreas**, which results from abnormal migration of the ventral pancreatic bud. This bud is a **foregut** derivative that appears by the fifth week of gestation and **rotates behind** the duodenum during the seventh week of fetal development. The ventral bud moves toward the midline, where it fuses with the dorsal pancreatic bud during the eighth week. The ventral pancreatic bud gives rise to the **uncinate process** portion of the head and the **main pancreatic duct** (of Wirsung). The pancreatic tail, body, and the remainder of head derive from the dorsal bud.

Abnormal migration of the ventral pancreatic bud can be caused by adherence to either the dorsal bud or duodenum before the rotation begins. This abnormal migration leads to **annular pancreas**, a rare congenital anomaly in which pancreatic tissue completely surrounds the second part of the duodenum. Annular pancreas can compress the duodenal lumen (causing **obstruction**) or result in obstructed pancreatic drainage (acute or chronic **pancreatitis**). However, the majority of patients with annular pancreas are **asymptomatic**.

(Choice A) The pancreas is not derived from the midgut. Both ventral and dorsal pancreatic buds form from the duodenal portion of the foregut.

(Choice C) Ectopic rests, or fragments of embryonic tissue that persist beyond the fetal period, can be found throughout the gastrointestinal tract. However, the pancreatic tissue in annular pancreas is contiguous with the rest of the pancreas by definition.

(Choice D) Neither the dorsal nor ventral pancreatic bud undergoes apoptosis in normal development.

(Choice E) Incomplete fusion of the ventral and dorsal pancreatic buds (pancreas divisum) is usually asymptomatic and much more common than annular pancreas. Pancreas divisum does not cause obstruction as the duodenum is not completely encircled but may predispose to the development of acute or chronic pancreatitis.

Educational objective:
Annular pancreas, or pancreatic tissue encircling the descending duodenum, is caused by failure of the ventral pancreatic bud to properly migrate and fuse with the dorsal bud during the seventh and eighth week of fetal development. Annular pancreas is usually asymptomatic but may present with duodenal obstruction or pancreatitis.

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Item 6 of 40
Question Id: 329

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A previously healthy 4-year-old girl is brought to the office because her parents noticed dark red blood on her toilet tissue. She has no abdominal pain or discomfort with stooling. Her temperature is 36.7 C (98 F), blood pressure is 100/40 mm Hg, and pulse is 112/min. Physical examination shows a soft and nontender abdomen, and bowel sounds are present. Her hemoglobin is 8 g/dL and platelet count is 215,000/mm^3. Coagulation profile is normal. Sequential imaging using ^{99m}Tc-pertechnetate scintigraphy demonstrates focal radiotracer accumulation in the right lower quadrant. Which of the following embryologic processes most likely failed in this patient?

A. Ascent of the kidneys into the abdomen
B. Closure of lateral body folds at the umbilicus
C. Hindgut descent along the inferior mesenteric artery
D. Midgut rotation around the superior mesenteric artery
E. Neural crest cell migration into the bowel wall
F. Obliteration of the omphalomesenteric (vitelline) duct

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Item 6 of 40
Question Id: 329

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A. Ascent of the kidneys into the abdomen [4%]
B. Closure of lateral body folds at the umbilicus [1%]
C. Hindgut descent along the inferior mesenteric artery [6%]
D. Midgut rotation around the superior mesenteric artery [13%]
E. Neural crest cell migration into the bowel wall [6%]
✔ F. Obliteration of the omphalomesenteric (vitelline) duct [66%]

Omitted
Correct answer
F

66%
Answered correctly

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09/16/2018
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Explanation

Meckel diverticulum is an ileal outgrowth that results from failed obliteration of the vitelline (omphalomesenteric) duct. When patients are

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Explanation

Meckel diverticulum is an ileal outgrowth that results from failed obliteration of the vitelline (omphalomesenteric) duct. When patients are symptomatic, the most common manifestation of Meckel diverticulum is spontaneous but **painless** lower gastrointestinal (GI) **bleeding**. Meckel diverticulum is also a potential lead point for intussusception, which can present with colicky abdominal pain and "**currant jelly**" (strawberry jam appearance) stools.

Ectopic gastric mucosa in the Meckel diverticulum secretes acid and causes local ulceration and bleeding. The radioisotope ^{99m}Tc-pertechnetate has an affinity for **parietal cells** of the gastric mucosa (including ectopic sites) and is used in a nuclear medicine procedure called the **^{99m}Tc-pertechnetate scan**. Increased uptake of ^{99m}Tc-pertechnetate in the periumbilical/right lower quadrant (RLQ) is characteristic of Meckel diverticulum.

(Choice A) If the lower poles of the kidney fuse, a horseshoe kidney forms and is unable to ascend past the inferior mesenteric artery from the pelvis to the abdomen. Some patients may have hematuria but most are asymptomatic.

(Choice B) The midgut normally herniates into the yolk sac during the 6th week of gestation and returns to the abdominal cavity in the 10th week. If lateral body folds do not develop and close, abdominal contents herniate through the **ventral wall defect**. Omphalocele and gastroschisis do not commonly present with GI bleeding.

(Choice C) The hindgut gives rise to the distal third of the transverse colon, descending and sigmoid colon, rectum, and upper part of the anal canal. Failure of proper descent during development can lead to imperforate anus, which does not bleed.

(Choice D) Abnormal midgut rotation around the superior mesenteric artery leads to intestinal malrotation. The intestine is fixed by fibrous adhesive bands and can cause obstruction and painful bilious emesis in the newborn.

(Choice E) Neural crest cells migrate in a craniocaudal direction to the internal anal sphincter. If this process fails, then the myenteric plexus does not form, and the aganglionic sigmoid colon/rectum segments become inactive and narrow. **Hirschsprung disease** manifests as intestinal obstruction in the neonate and presents with delayed passage of meconium, bilious vomiting, and abdominal distension.

diverticulum.

(Choice A) If the lower poles of the kidney fuse, a horseshoe kidney forms and is unable to ascend past the inferior mesenteric artery from the pelvis to the abdomen. Some patients may have hematuria but most are asymptomatic.

(Choice B) The midgut normally herniates into the yolk sac during the 6th week of gestation and returns to the abdominal cavity in the 10th week. If lateral body folds do not develop and close, abdominal contents herniate through the **ventral wall defect**. Omphalocele and gastroschisis do not commonly present with GI bleeding.

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Educational objective:
Meckel diverticulum results from failed obliteration of the vitelline (omphalomesenteric) duct and usually presents with spontaneous but painless lower gastrointestinal bleeding. ^{99m}Tc-pertechnetate localizes ectopic gastric mucosa, and its increased uptake is diagnostic for Meckel diverticulum.

References

- Clinical Features of Symptomatic Meckel's Diverticulum in Children: Comparison of Scintigraphic and Non-scintigraphic Diagnosis
- Meckel's scan in children: a review of 183 cases referred to two paediatric surgery specialist centres over 18 years.

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E. Neural crest cell migration into the bowel wall [0%]

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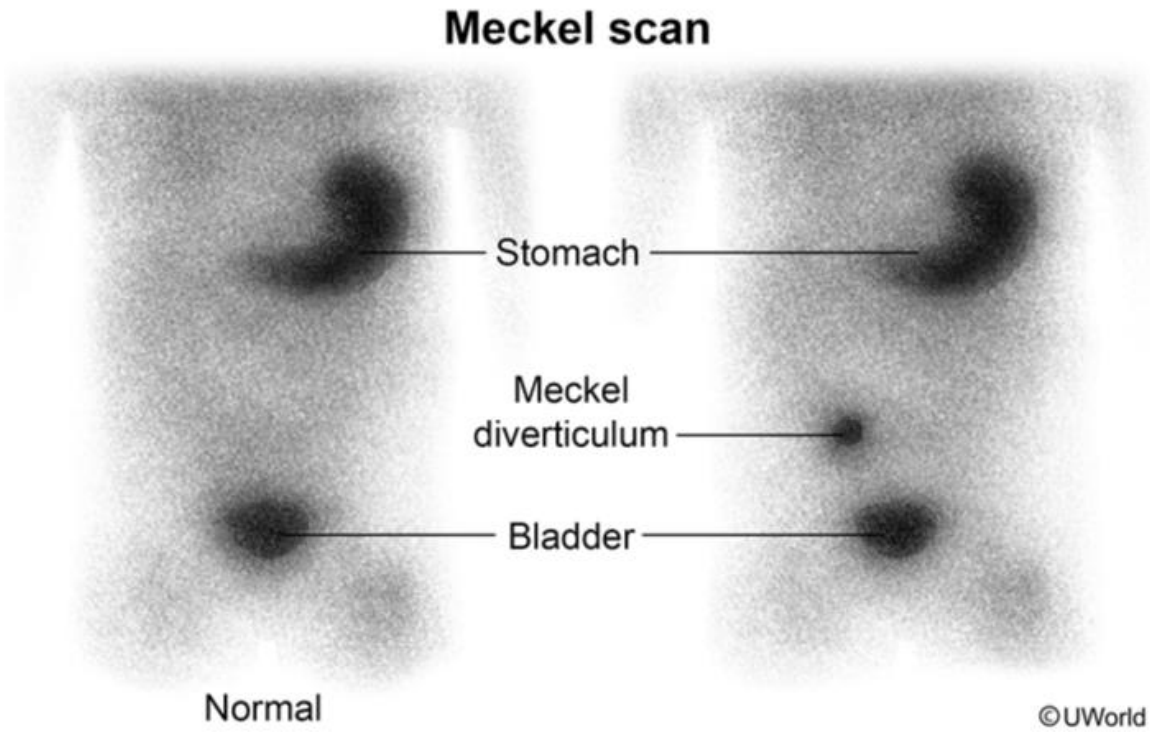

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gastroschisis do not commonly present with GI bleeding

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Item 7 of 40
Question Id: 328

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A 3-year-old boy is brought to the physician's office by his parents because of abdominal pain. Physical examination reveals rectal bleeding, and the patient undergoes an appropriate diagnostic workup. Laparotomy is then performed. Surgical findings include a blind pouch connected to the ileum, with a fibrous band seen attaching the end of the pouch to the umbilicus. The walls of this pouch are most likely composed of which of the following?

A. Fibrous tissue
B. Granulation tissue and peritoneum
C. Mucosa and submucosa layers
D. Omentum and adipose tissue
E. Mucosa, submucosa, and muscular layers

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Item 7 of 40
Question Id: 328

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A. Fibrous tissue [3%]
B. Granulation tissue and peritoneum [3%]
C. Mucosa and submucosa layers [17%]
D. Omentum and adipose tissue [2%]
✔ E. Mucosa, submucosa, and muscular layers [72%]

Omitted
Correct answer
E

72%
Answered correctly

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Explanation

During early embryogenesis, the lumen of the midgut and yolk sac cavity are connected via the omphalomesenteric (vitelline) duct. This duct normally obliterates during the 7th week of fetal life. Partial failure of this duct to obliterate leads to the formation of Meckel's diverticulum. Meckel's diverticulum may present with rectal bleeding or intestinal obstruction; however, most cases are asymptomatic. Remember the rule of 2's

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Explanation

During early embryogenesis, the lumen of the midgut and yolk sac cavity are connected via the omphalomesenteric (vitelline) duct. This duct normally obliterates during the 7th week of fetal life. Partial failure of this duct to obliterate leads to the formation of Meckel's diverticulum. Meckel's diverticulum may present with rectal bleeding or intestinal obstruction; however, most cases are asymptomatic. Remember the rule of 2's with Meckel's diverticulum: 2% of the population, 2 feet from the ileocecal valve, 2 inches in length, 2% are symptomatic, and males are 2 times more likely to be affected.

In contrast to false diverticula, which contain mucosa and submucosa only, Meckel's diverticulum is a true diverticulum, consisting of all three parts of the intestinal wall: mucosa, submucosa, and muscularis. It also often contains ectopic mucosa–gastric epithelium being the most common (pancreatic tissue is the next most common). This ectopic gastric tissue secretes gastric acid that can cause ulceration of adjacent mucosa and lower GI bleeding (melena/hematochezia).

(Choice C) False diverticula contain only mucosa and submucosa. These layers herniate through defects in the muscular layer. Colonic and Zenker (upper esophageal) diverticula are examples of false (pulsion) diverticula.

(Choices A, B,& D) Fibrous tissue, granulation tissue, and omentum are not histologically present in Meckel's diverticulum. In addition to containing all three portions of the intestinal wall, Meckel's diverticulum may also contain ectopic tissue, such as gastric or pancreatic tissue.

Educational objective:
Meckel's diverticulum is a remnant of the omphalomesenteric (vitelline) duct. It is connected to the ileum and is located 2 feet proximal to the ileocecal valve. It often contains acid-secreting ectopic gastric tissue, which may cause ulceration of the adjacent mucosa and lower GI bleeding (melena/hematochezia). Meckel's diverticulum is a true diverticulum and consists of all parts of the intestinal wall.

References

- Meckel diverticulum: the Mayo Clinic experience with 1476 patients (1950-2002)

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Item 8 of 40
Question Id: 12198

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A 23-year-old man comes to the office with a 2-week history of malaise, loss of appetite, and vague abdominal pain. The patient has had no nausea, vomiting, changes in his bowel habits, dysuria, urinary frequency, or hematuria. He had an appendectomy for acute appendicitis at age 15; his medical history is otherwise unremarkable. He does not use tobacco or alcohol and has had no recent travel. His father was diagnosed with colon cancer at age 60. Physical examination reveals normal bowel sounds and no guarding or rebound tenderness. Abdominal CT scan obtained as part of this patient's evaluation is shown in the image below.

The anatomical structure indicated by the arrow originates from which of the following embryologic divisions?

A. Ectoderm
B. Endoderm
C. Mesoderm
D. Neural crest
E. Notochord

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Question Id: 12198

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with colon cancer at age 60. Physical examination reveals normal bowel sounds and no guarding or rebound tenderness. Abdominal CT scan obtained as part of this patient's evaluation is shown in the image below.

The anatomical structure indicated by the arrow originates from which of the following embryologic divisions?

A. Ectoderm [2%]

B. Endoderm [18%]

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Item 8 of 40
Question Id: 12198

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The anatomical structure indicated by the arrow originates from which of the following embryologic divisions?

A. Ectoderm
B. Endoderm
C. Mesoderm
D. Neural crest
E. Notochord

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Item 8 of 40
Question Id: 12198

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A 23-year-old man comes to the office with a 2-week history of malaise, loss of appetite, and vague abdominal pain. The patient has had no nausea, vomiting, changes in his bowel habits, dysuria, urinary frequency, or hematuria. He had an appendectomy for acute appendicitis at age 15; his medical history is otherwise unremarkable. He does not use tobacco or alcohol and has had no recent travel. His father was diagnosed with colon cancer at age 60. Physical examination reveals normal bowel sounds and no guarding or rebound tenderness. Abdominal CT scan obtained as part of this patient's evaluation is shown in the image below.

The anatomical structure indicated by the arrow originates from which of the following embryologic divisions?

- A. Ectoderm [2%]
- B. Endoderm [18%]
- ✔ C. Mesoderm [74%]
- D. Neural crest [4%]
- E. Notochord [0%]

Omitted
Correct answer
C

74%
Answered correctly

3 Seconds
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Explanation

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Embryological derivatives		
Ectoderm	Surface ectoderm	• Anterior pituitary (Rathke pouch) • Lens & cornea • Inner ear sensory organs, olfactory epithelium • Nasal & oral epithelial linings, salivary glands • Epidermis, sweat & mammary glands
	Neural tube	• Brain & spinal cord • Posterior pituitary, pineal gland • Retina
	Neural crest	• Neural ganglia, adrenal medulla • Schwann cells; pia & arachnoid mater • Aorticopulmonary septum & endocardial cushions • Branchial arches (bones & cartilage) • Skull bones • Melanocytes
Mesoderm		• Muscles (skeletal, cardiac & smooth) • Connective tissue, bone & cartilage • Serosal linings (eg, peritoneum) • Cardiovascular & lymphatic system • Spleen & hemopoietic cells • Kidney & ureters, internal genitalia • Adrenal cortex

	Neural crest	• Aorticopulmonary septum & endocardial cushions • Branchial arches (bones & cartilage) • Skull bones • Melanocytes
Mesoderm		• Muscles (skeletal, cardiac & smooth) • Connective tissue, bone & cartilage • Serosal linings (eg, peritoneum) • Cardiovascular & lymphatic system • Spleen & hemopoietic cells • Kidney & ureters, internal genitalia • Adrenal cortex
Endoderm		• Gastrointestinal tract, liver, pancreas • Lungs • Thymus, parathyroids, thyroid follicular cells • Middle ear epithelium • Bladder & urethra • Parafollicular (C) cells*

*Formerly thought to be of neural crest origin.

The arrow in this patient's abdominal CT scan is pointing to the **spleen**, a large, wedge-shaped lymphatic organ that is situated in the **posterior superior** portion of the **left abdominal cavity**. While most gut tissue is endodermal in origin, the spleen is unique as it is derived from condensed mesenchymal tissue in the dorsal mesentery during embryonic development. Mesenchymal tissue arises from the **mesoderm germ layer** and is characterized by loosely associated cells surrounded by the extracellular matrix.

(Choice E) The notochord is a mesodermally derived structure that almost completely regresses in humans, and its only major derivative is the

Endoderm	• Gastrointestinal tract, liver, pancreas • Lungs • Thymus, parathyroids, thyroid follicular cells • Middle ear epithelium • Bladder & urethra • Parafollicular (C) cells*

*Formerly thought to be of neural crest origin.

The arrow in this patient's abdominal CT scan is pointing to the **spleen**, a large, wedge-shaped lymphatic organ that is situated in the **posterior superior** portion of the **left abdominal cavity**. While most gut tissue is endodermal in origin, the spleen is unique as it is derived from condensed mesenchymal tissue in the dorsal mesentery during embryonic development. Mesenchymal tissue arises from the **mesoderm germ layer** and is characterized by loosely associated cells surrounded by the extracellular matrix.

(Choice E) The notochord is a mesodermally derived structure that almost completely regresses in humans, and its only major derivative is the nucleus pulposus of the intervertebral disc. Other major derivatives of the mesoderm germ layer include muscle, bone, lymphatics, the cardiovascular system, and kidneys/ureters.

Educational objective:
The spleen is a large, wedge-shaped lymphatic organ that is situated in the posterior superior portion of the left abdominal cavity. It is derived from mesoderm in the dorsal mesentery during embryonic development.

References

- Embryonic origins of spleen asymmetry.

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Item 9 of 40
Question Id: 291

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A 52-year-old man is brought to the emergency department due to repeated vomiting that began 2 hours ago. His vomit is dark brown and has a granular consistency. The patient has a history of dyspepsia, for which he takes over-the-counter antacids as needed and degenerative knee arthritis, for which he takes naproxen regularly. He drinks 2-3 beers daily. Temperature is 36.7 C (98 F), blood pressure is 114/62 mm Hg, pulse is 102/min, and respirations are 14/min. Physical examination reveals mild epigastric tenderness with no rebound or guarding. Hemoglobin is 9 g/dL. Endoscopy shows a deep, bleeding ulcer on the posterior wall of the duodenal bulb. This patient's ulcer has most likely penetrated which of the following arteries?

A. Common hepatic
B. Gastroduodenal
C. Inferior pancreaticoduodenal
D. Left gastroepiploic
E. Right gastric
F. Splenic
G. Superior mesenteric

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Question Id: 291

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A 52-year-old man is brought to the emergency department due to repeated vomiting that began 2 hours ago. His vomit is dark brown and has a granular consistency. The patient has a history of dyspepsia, for which he takes over-the-counter antacids as needed and degenerative knee arthritis, for which he takes naproxen regularly. He drinks 2-3 beers daily. Temperature is 36.7 C (98 F), blood pressure is 114/62 mm Hg, pulse is 102/min, and respirations are 14/min. Physical examination reveals mild epigastric tenderness with no rebound or guarding. Hemoglobin is 9 g/dL. Endoscopy shows a deep, bleeding ulcer on the posterior wall of the duodenal bulb. This patient's ulcer has most likely penetrated which of the following arteries?

- A. Common hepatic [2%]
- ✔ B. Gastroduodenal [76%]
- C. Inferior pancreaticoduodenal [11%]
- D. Left gastroepiploic [2%]
- E. Right gastric [3%]
- F. Splenic [2%]
- G. Superior mesenteric [2%]

Omitted
Correct answer
B

76%
Answered correctly

3 Seconds
Time Spent

09/02/2018
Last Updated

Explanation

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Explanation

Bleeding peptic ulcer disease should be considered in patients who develop acute epigastric pain, unstable vital signs, or hematemesis, particularly in the setting of prior dyspepsia. Most peptic ulcers are caused by *Helicobacter pylori* infection or nonsteroidal anti-inflammatory drug use; other risk factors include smoking, older age, and glucocorticoid use.

Duodenal ulcers are more common than gastric ulcers and tend to occur anteriorly. Ulcers located on the anterior wall of the duodenal bulb are more prone to perforation; those on the posterior wall are more likely to cause hemorrhage. These complications are explained by the relationship of the duodenal bulb to adjacent organs. The duodenal bulb is approximately 5 cm long, beginning at the pylorus and ending at the neck of the gallbladder. The gallbladder and liver lie anterior to the duodenal bulb within the intraperitoneal space; the gastroduodenal artery, common biliary duct, and portal vein are posterior to the bulb; and the head of the pancreas is located inferiorly.

When an ulcer penetrates the **posterior duodenal wall**, it is likely to erode into the **gastroduodenal artery**, which perfuses both the pylorus and the proximal part of the duodenum. Damage to the gastroduodenal artery can cause significant **upper gastrointestinal bleeding**.

(Choice A) The common hepatic artery arises from the celiac trunk and bifurcates into the proper hepatic and gastroduodenal arteries. It passes superior to the duodenal bulb.

(Choice C) The inferior pancreaticoduodenal artery is a branch of the superior mesenteric artery. It supplies blood to the lower duodenum and to the head of the pancreas. This artery has no close relation to the duodenal bulb.

(Choices D, E, and F) The left gastroepiploic and right gastric arteries supply blood to the greater and lesser curves of the stomach, respectively. The short gastric arteries arise off the splenic artery and supply the upper portions of the greater curvature. These vessels do not lie in close proximity to the duodenal bulb.

(Choice G) The superior mesenteric artery lies anterior to the transverse part of the duodenum. It arises from the anterior surface of the abdominal aorta and supplies the intestine from the duodenum to the proximal two-thirds of the transverse colon.

use; other risk factors include smoking, older age, and glucocorticoid use.

Duodenal ulcers are more common than gastric ulcers and tend to occur anteriorly. Ulcers located on the anterior wall of the duodenal bulb are more prone to perforation; those on the posterior wall are more likely to cause hemorrhage. These complications are explained by the relationship of the duodenal bulb to adjacent organs. The duodenal bulb is approximately 5 cm long, beginning at the pylorus and ending at the neck of the gallbladder. The gallbladder and liver lie anterior to the duodenal bulb within the intraperitoneal space; the gastroduodenal artery, common biliary duct, and portal vein are posterior to the bulb; and the head of the pancreas is located inferiorly.

When an ulcer penetrates the **posterior duodenal wall**, it is likely to erode into the **gastroduodenal artery**, which perfuses both the pylorus and the proximal part of the duodenum. Damage to the gastroduodenal artery can cause significant **upper gastrointestinal bleeding**.

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(Choices D, E, and F) The left gastroepiploic and right gastric arteries supply blood to the greater and lesser curves of the stomach, respectively. The short gastric arteries arise off the splenic artery and supply the upper portions of the greater curvature. These vessels do not lie in close proximity to the duodenal bulb.

(Choice G) The superior mesenteric artery lies anterior to the transverse part of the duodenum. It arises from the anterior surface of the abdominal aorta and supplies the intestine from the duodenum to the proximal two-thirds of the transverse colon.

Educational objective:
The gastroduodenal artery lies along the posterior wall of the duodenal bulb and is likely to be eroded by posterior duodenal ulcers. Ulceration into the gastroduodenal artery can be a source of life-threatening hemorrhage.

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Item 10 of 40
Question Id: 11803

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A boy is examined in the newborn nursery shortly after birth. He was born full term by vaginal delivery to a 40-year-old woman who did not receive prenatal care. His temperature is 36.7 C (98 F), pulse is 132/min, and respirations are 38/min. Examination shows slanted palpebral fissures, epicanthal folds, thick nuchal folds, and a single palmar crease. The patient has a large, reducible midline abdominal protrusion covered by skin that is more pronounced when he cries. The umbilical stump is at the center of the protrusion. Which of the following is the most likely cause of this patient's abdominal finding?

A. Failure of the extraembryonic gut to return to the abdominal cavity
B. Incomplete closure of the umbilical ring
C. Incomplete recanalization of the fetal intestinal tract
D. Incomplete rotation of the midgut in utero
E. Persistent processus vaginalis

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Item 10 of 40
Question Id: 11803

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A boy is examined in the newborn nursery shortly after birth. He was born full term by vaginal delivery to a 40-year-old woman who did not receive prenatal care. His temperature is 36.7 C (98 F), pulse is 132/min, and respirations are 38/min. Examination shows slanted palpebral fissures, epicanthal folds, thick nuchal folds, and a single palmar crease. The patient has a large, reducible midline abdominal protrusion covered by skin that is more pronounced when he cries. The umbilical stump is at the center of the protrusion. Which of the following is the most likely cause of this patient's abdominal finding?

- A. Failure of the extraembryonic gut to return to the abdominal cavity [35%]
- ✔ B. Incomplete closure of the umbilical ring [44%]
- C. Incomplete recanalization of the fetal intestinal tract [10%]
- D. Incomplete rotation of the midgut in utero [6%]
- E. Persistent processus vaginalis [3%]

Omitted
Correct answer
B

44%
Answered correctly

3 Seconds
Time Spent

12/04/2018
Last Updated

Explanation

Congenital umbilical hernia	
Pathophysiology	• Incomplete closure of abdominal muscles

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Explanation

Congenital umbilical hernia	
Pathophysiology	• Incomplete closure of abdominal muscles
Clinical features	• Soft, nontender bulge at umbilicus • Protrudes with increased abdominal pressure • Typically reducible
Management	• Observe for spontaneous closure • Elective surgery around age 5

This patient's examination is consistent with **Down syndrome** and an **umbilical hernia**. Normally, the umbilical ring, or the congenital fascial opening for the umbilical cord, closes and forms the linea alba, a midline band of fibrous tissue. **Umbilical hernias** are caused by an **incomplete closure of the umbilical ring**, thereby allowing protrusion of bowel through the abdominal musculature. Most umbilical hernias are **reducible**, **asymptomatic**, and **resolve spontaneously** in the first few years of life.

(Choice A) During midgut development in the first trimester, the abdominal contents undergo physiologic herniation, followed by a rotation of the midgut and physiologic reduction. Failure of this reduction can result in **omphalocele or gastroschisis**. Omphalocele presents as a midline herniation of abdominal contents contained within a thin, membranous sac. Gastroschisis is a full-thickness abdominal wall defect that presents as an evisceration of exposed abdominal contents at birth.

(Choice C) Midgut development in the first trimester involves a physiologic occlusion of the intestinal lumen followed by recanalization. Failure of recanalization results in duodenal atresia, which presents with vomiting, often bilious, in the first 24 hours of life. Duodenal atresia is associated with Down syndrome.

(Choice D) Malrotation results from an incomplete rotation of the midgut prior to physiologic reduction into the abdominal cavity. Malrotation

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(Choice A) During midgut development in the first trimester, the abdominal contents undergo physiologic herniation, followed by a rotation of the midgut and physiologic reduction. Failure of this reduction can result in **omphalocele or gastroschisis**. Omphalocele presents as a midline herniation of abdominal contents contained within a thin, membranous sac. Gastroschisis is a full-thickness abdominal wall defect that presents as an evisceration of exposed abdominal contents at birth.

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(Choice D) Malrotation results from an incomplete rotation of the midgut prior to physiologic reduction into the abdominal cavity. Malrotation alone is asymptomatic. Its main complication is ischemia and subsequent small bowel necrosis due to volvulus, which twists and constricts the blood supply. Volvulus typically presents with bilious emesis in the first month of life.

(Choice E) Congenital inguinal hernias are formed when the processus vaginalis, an outpouching of the peritoneum, fails to obliterate, leaving a path to allow bowel contents into the inguinal canal. The hernias present as a mass in the groin and are more common in preterm male infants. Like umbilical hernias, congenital inguinal hernias are more prominent with increased abdominal pressure.

Educational objective:
Umbilical hernias are caused by a defect in the linea alba and present as protrusions at the umbilicus that are soft, reducible, and benign. They can occur in isolation or in association with other conditions, such as Down syndrome.

References

- Fetal abdominal wall defects.
- Congenital and acquired umbilical hernias: examination and treatment.

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Item 10 of 40
Question Id: 11803

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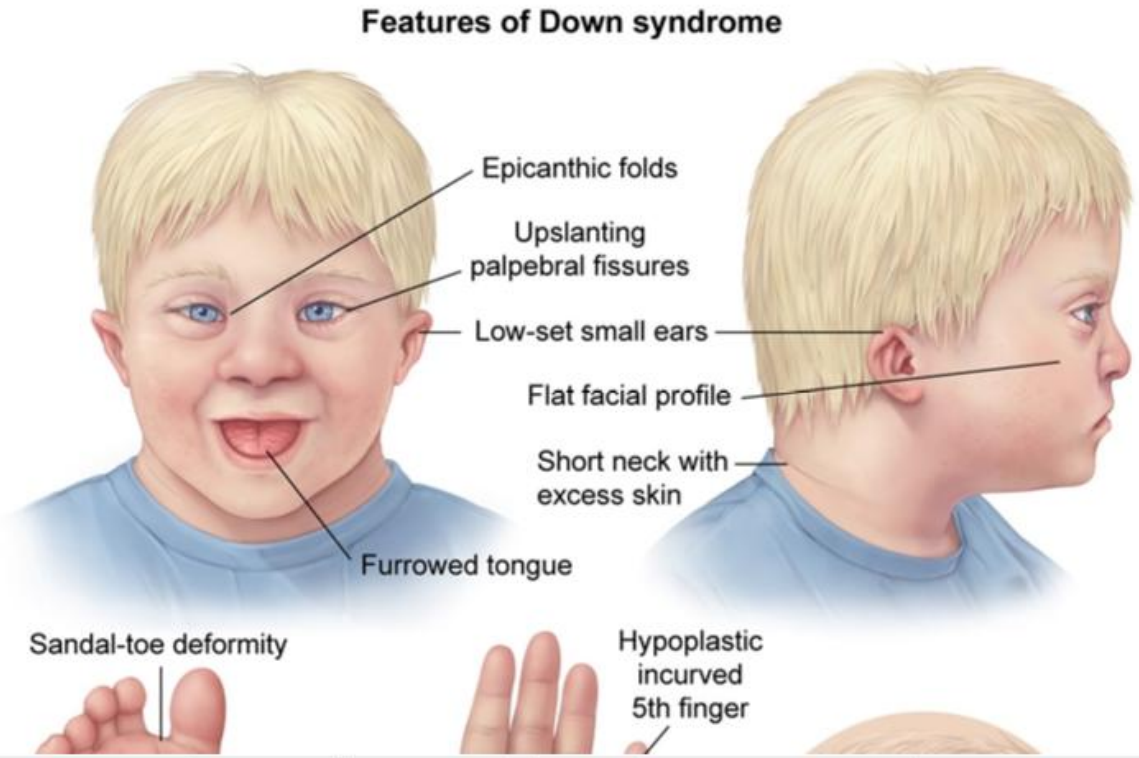

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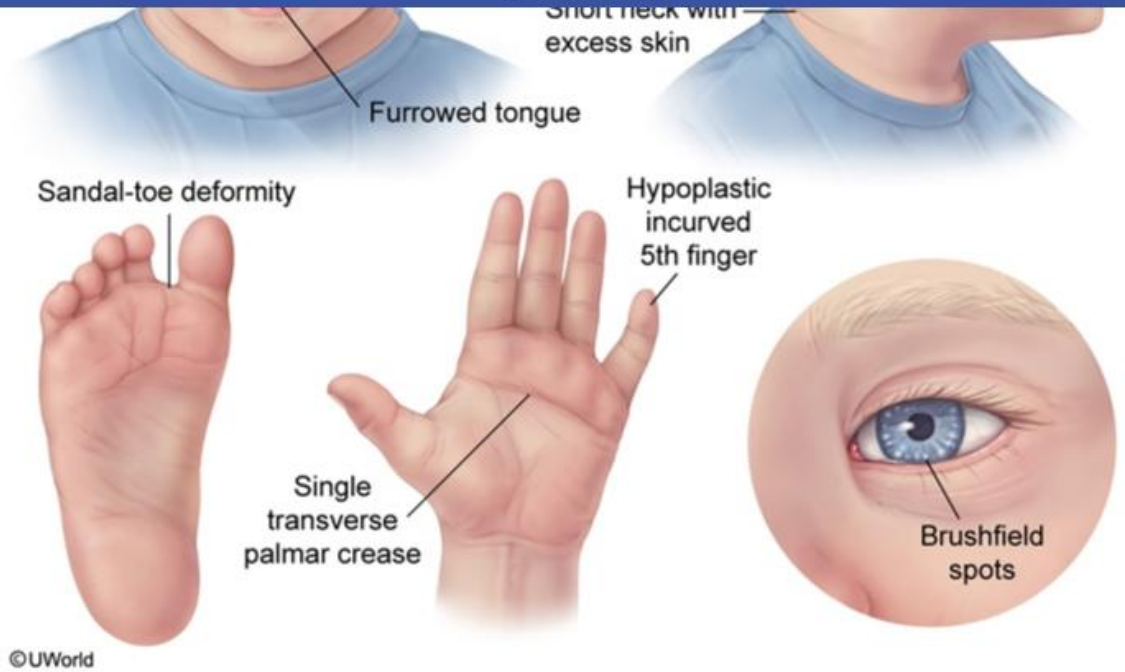

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Item 10 of 40
Question Id: 11803

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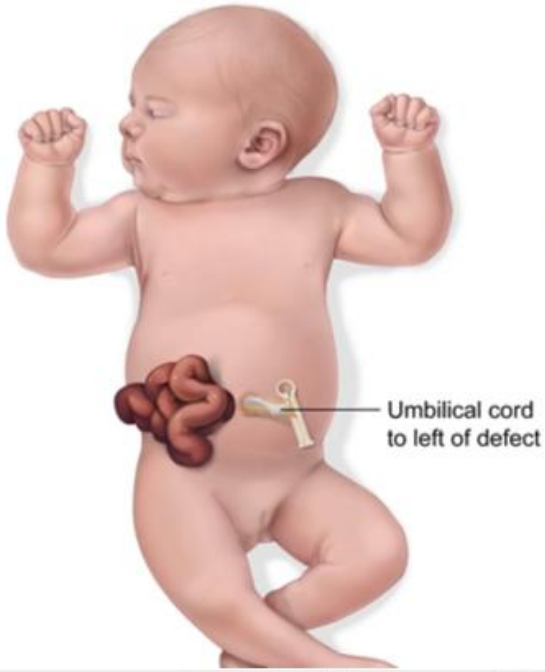
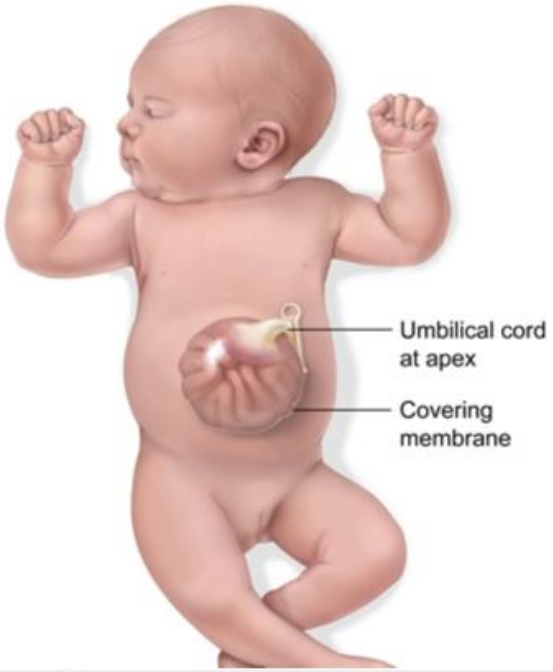
Gastroschisis
Eviscerated bowel with no covering membrane



Omphalocele
Sac containing multiple organs



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Item 11 of 40
Question Id: 11962

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A 6-hour-old boy is in the newborn nursery with feeding difficulties. The patient was born at 39 weeks gestation to a 33-year-old primigravida via cesarean delivery due to failure to progress and late decelerations seen on fetal heart tracing. Apgar scores were 8 and 9, but examination shows an infant with excessive drooling and occasional coughing. Cardiac, respiratory, and abdominal examinations are otherwise normal at rest. When the infant attempts to breastfeed, however, several bouts of coughing and perioral cyanosis develop with oxygen saturation of 85% on room air. Which of the following is the most likely cause of this patient's condition?

A. Atresia of small intestine
B. Collapse of supraglottic structures during respiration
C. Failure of primitive foregut to separate from airway
D. Obstruction of posterior nasal passages
E. Thoracic herniation of abdominal viscera

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Item 11 of 40
Question Id: 11962

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A. Atresia of small intestine [1%]
B. Collapse of supraglottic structures during respiration [6%]
✔ C. Failure of primitive foregut to separate from airway [80%]
D. Obstruction of posterior nasal passages [9%]
E. Thoracic herniation of abdominal viscera [1%]

Omitted
Correct answer
C

80%
Answered correctly

3 Seconds
Time Spent

10/13/2018
Last Updated

Explanation

This infant's presentation is concerning for **tracheoesophageal fistula with esophageal atresia (TEF/EA)**. Normally, the trachea develops from a diverticulum that forms from the **primitive foregut**. The tracheobronchial diverticulum lengthens and separates to form the respiratory tract,

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This infant's presentation is concerning for **tracheoesophageal fistula with esophageal atresia (TEF/EA)**. Normally, the trachea develops from a diverticulum that forms from the **primitive foregut**. The tracheobronchial diverticulum lengthens and separates to form the respiratory tract, while the foregut becomes the esophagus. Failure to separate most commonly leads to esophageal atresia with a remaining fistula between the trachea and esophagus.

Prenatal ultrasounds may demonstrate **polyhydramnios** due to the inability of the fetus to swallow amniotic fluid. After birth, infants typically present with significant **drooling** (due to inability to swallow saliva) and **choking**, **coughing**, and **cyanosis with feeds** (due to reflux of breastmilk/formula and aspiration into the trachea/lungs). The diagnosis of TEF/EA is confirmed by x-ray showing positioning of the nasogastric tube in the atretic esophageal pouch after an attempt to pass the tube into the stomach. X-ray will also **show** a **stomach** bubble, which results from air flow from the trachea through the fistula to the distal esophagus.

(Choice A) Atresia of the small intestine is a congenital defect that leads to complete obstruction of the gastrointestinal tract at the site of atresia. Neonates present with abdominal distension and bilious emesis.

(Choice B) Laryngomalacia presents with inspiratory stridor during infancy due to collapse of supraglottic structures during inspiration. Stridor is classically worse in the supine position and improves with upright positioning.

(Choice D) Choanal atresia is characterized by congenital obstruction of the posterior nasal passages. Infants with bilateral choanal atresia can present with upper airway obstruction and cyanosis with feeding, but not excessive drooling. Inability to pass a nasogastric tube through the nares is suggestive of the diagnosis.

(Choice E) Herniation of abdominal viscera into the thoracic cavity occurs in congenital diaphragmatic hernia. Infants typically exhibit respiratory distress shortly after birth due to pulmonary hypoplasia. The presence of abdominal viscera in the thorax results in a scaphoid abdomen and bowel sounds heard over the chest.

Educational objective:
Tracheoesophageal fistula with esophageal atresia results from failure of the primitive foregut to appropriately divide into separate trachea and

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from air flow from the trachea through the fistula to the distal esophagus.

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(Choice E) Herniation of abdominal viscera into the thoracic cavity occurs in congenital diaphragmatic hernia. Infants typically exhibit respiratory distress shortly after birth due to pulmonary hypoplasia. The presence of abdominal viscera in the thorax results in a scaphoid abdomen and bowel sounds heard over the chest.

Educational objective:
Tracheoesophageal fistula with esophageal atresia results from failure of the primitive foregut to appropriately divide into separate trachea and esophageal structures. Infants present shortly after birth with excessive secretions and choking/cyanosis during feeds. Diagnosis can be confirmed by x-ray after the inability to pass a nasogastric tube into the stomach.

References

- Oesophageal atresia and tracheo-oesophageal fistula.
- Current knowledge on esophageal atresia.
- Tracheo-oesophageal fistula (TOF) and oesophageal atresia (OA).

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Item 12 of 40
Question Id: 437

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A 32-year-old man presents to the emergency department with a one-day history of severe abdominal pain along with nausea and vomiting. His pain is constant and radiates to his back. He admits to "drinking a few beers" with some friends a couple days ago. Laboratory studies reveal significantly elevated amylase and lipase. An abdominal CT shows pancreas divisum, a common congenital anomaly that results from failure of the pancreatic ductal systems of the ventral and dorsal pancreatic primordia to fuse during embryogenesis. Which of the following pancreatic structures is derived from the ventral pancreatic primordium?

A. Tail
B. Body
C. Superior aspect of the head
D. Accessory pancreatic duct
E. Main pancreatic duct

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Settings

Item 12 of 40
Question Id: 437

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 32-year-old man presents to the emergency department with a one-day history of severe abdominal pain along with nausea and vomiting. His pain is constant and radiates to his back. He admits to "drinking a few beers" with some friends a couple days ago. Laboratory studies reveal significantly elevated amylase and lipase. An abdominal CT shows pancreas divisum, a common congenital anomaly that results from failure of the pancreatic ductal systems of the ventral and dorsal pancreatic primordia to fuse during embryogenesis. Which of the following pancreatic structures is derived from the ventral pancreatic primordium?

- A. Tail [7%]
- B. Body [5%]
- C. Superior aspect of the head [22%]
- D. Accessory pancreatic duct [15%]
- ✔ E. Main pancreatic duct [49%]

Omitted
Correct answer
E

49%
Answered correctly

3 Seconds
Time Spent

12/28/2018
Last Updated

Explanation

Early in fetal life, the duodenal portion of the foregut gives rise to the dorsal and ventral pancreatic buds. The dorsal pancreatic bud forms the pancreatic tail, body, most of the head, and the small accessory pancreatic duct. The smaller ventral bud gives rise to the uncinate process, a

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Explanation

Early in fetal life, the duodenal portion of the foregut gives rise to the dorsal and ventral pancreatic buds. The dorsal pancreatic bud forms the pancreatic tail, body, most of the head, and the small accessory pancreatic duct. The smaller ventral bud gives rise to the uncinate process, a portion of the pancreatic head, and the proximal portion of the main pancreatic duct. The dorsal and ventral pancreatic buds then fuse during the eighth week of fetal life. The proximal part of the dorsal (accessory) pancreatic duct often degenerates, although it may persist as a functional lesser pancreatic duct. The remainder of the accessory duct fuses with the ventral duct to form the main pancreatic duct (of Wirsung).

Pancreas divisum occurs when the ventral and dorsal pancreatic buds fail to fuse; the pancreatic secretions are instead drained via two separate duct systems. The dominant dorsal duct (of Santorini) opens into the duodenum via the minor papilla, and is responsible for draining the majority of the pancreas. The smaller ventral duct (of Wirsung) opens into the major papilla, and functions to drain the inferior/posterior portion of the head and uncinate process. Pancreas divisum is found in 5% of the population and is usually clinically silent. It is commonly detected as an incidental finding on imaging studies or at autopsy. In some, it may predispose to the development of recurrent pancreatitis.

(Choices A, B, C and D) The pancreatic tail, body, superior aspect of the head, and accessory pancreatic duct are derivatives of the dorsal pancreatic bud.

Educational objective:
The dorsal pancreatic bud forms the majority of pancreatic tissue (body, tail, and most of the head). The ventral pancreatic bud is a precursor of the uncinate process, inferior/posterior portion of the head, and major pancreatic duct (of Wirsung). Failure of the dorsal and ventral pancreatic buds to fuse leads to pancreas divisum. In this condition, the pancreatic ductal systems remain separate, with the accessory duct draining the majority of the pancreas.

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Item 13 of 40
Question Id: 8587

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A 47-year-old morbidly obese woman comes to the physician seeking advice regarding weight loss. She has tried diet and exercise a number of times without success. Her other medical problems include type 2 diabetes mellitus and obstructive sleep apnea. Her body mass index is 43 kg/m^2. After a discussion about available surgical options, she expresses interest in the adjustable gastric band, an inflatable silicone device that is placed around the cardiac part of the stomach. In order to encircle the stomach, the band must pass through which of the following structures?

A. Falciform ligament
B. Gastrocolic ligament
C. Greater omentum
D. Lesser omentum
E. Splenorenal ligament

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Item 13 of 40
Question Id: 8587

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A 47-year-old morbidly obese woman comes to the physician seeking advice regarding weight loss. She has tried diet and exercise a number of times without success. Her other medical problems include type 2 diabetes mellitus and obstructive sleep apnea. Her body mass index is 43 kg/m^2. After a discussion about available surgical options, she expresses interest in the adjustable gastric band, an inflatable silicone device that is placed around the cardiac part of the stomach. In order to encircle the stomach, the band must pass through which of the following structures?

- A. Falciform ligament [4%]
- B. Gastrocolic ligament [14%]
- C. Greater omentum [18%]
- ✔ D. Lesser omentum [60%]
- E. Splenorenal ligament [2%]

Omitted
Correct answer
D

60%
Answered correctly

3 Seconds
Time Spent

12/29/2018
Last Updated

Explanation

Adjustable gastric banding is a type of restrictive bariatric surgery designed for obese patients. The adjustable gastric band is an inflatable silicone device placed around the gastric cardia. It is intended to slow the passage of food, increasing satiety and limiting the amount of food consumed. To encircle the upper stomach, the gastric band must pass through the lesser omentum.

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Explanation

Adjustable gastric banding is a type of restrictive bariatric surgery designed for obese patients. The adjustable gastric band is an inflatable silicone device placed around the gastric cardia. It is intended to slow the passage of food, increasing satiety and limiting the amount of food consumed. To encircle the upper stomach, the gastric band must pass through the lesser omentum.

The lesser omentum is a double layer of peritoneum that extends from the liver to the lesser curvature of the stomach and the beginning of the duodenum. Anatomically, the lesser omentum is divided into 2 ligaments:

1. Hepatogastric ligament: the portion connecting to the lesser curvature of the stomach
2. Hepatoduodenal ligament: the portion connecting to the duodenum

Between the 2 layers of the lesser omentum, close to the right-sided free margin, lie the hepatic artery, common bile duct, portal vein, lymphatics, and hepatic plexus. The right and left gastric arteries and gastric veins also lie between the 2 layers, near where the lesser omentum attaches to the stomach.

(Choice A) The falciform ligament attaches the liver to the anterior body wall. It is a derivative of the embryonic ventral mesentery and contains the round ligament, the remnant of the fetal umbilical vein.

(Choices B and C) The greater omentum is a large fold of visceral peritoneum that extends from the greater curvature of the stomach, travels inferiorly over the small intestine, and then reflects on itself and ascends to encompass the transverse colon before reaching the posterior abdominal wall. The gastrocolic ligament is the section that stretches from the greater curvature of the stomach to the transverse colon. It forms part of the anterior wall of the lesser sac and is often divided during surgery to provide access to the anterior pancreas and posterior wall of the stomach.

(Choice E) The splenorenal ligament is derived from the peritoneum and lies between the left kidney and the spleen. It contains the splenic vessels and the tail of the pancreas.

consumed. To encircle the upper stomach, the gastric band must pass through the lesser omentum.

The lesser omentum is a double layer of peritoneum that extends from the liver to the lesser curvature of the stomach and the beginning of the duodenum. Anatomically, the lesser omentum is divided into 2 ligaments:

1. Hepatogastric ligament: the portion connecting to the lesser curvature of the stomach
2. Hepatoduodenal ligament: the portion connecting to the duodenum

Between the 2 layers of the lesser omentum, close to the right-sided free margin, lie the hepatic artery, common bile duct, portal vein, lymphatics, and hepatic plexus. The right and left gastric arteries and gastric veins also lie between the 2 layers, near where the lesser omentum attaches to the stomach.

(Choice A) The falciform ligament attaches the liver to the anterior body wall. It is a derivative of the embryonic ventral mesentery and contains the round ligament, the remnant of the fetal umbilical vein.

(Choices B and C) The greater omentum is a large fold of visceral peritoneum that extends from the greater curvature of the stomach, travels inferiorly over the small intestine, and then reflects on itself and ascends to encompass the transverse colon before reaching the posterior abdominal wall. The gastrocolic ligament is the section that stretches from the greater curvature of the stomach to the transverse colon. It forms part of the anterior wall of the lesser sac and is often divided during surgery to provide access to the anterior pancreas and posterior wall of the stomach.

(Choice E) The splenorenal ligament is derived from the peritoneum and lies between the left kidney and the spleen. It contains the splenic vessels and the tail of the pancreas.

Educational objective:
The lesser omentum is a double layer of peritoneum that extends from the liver to the lesser curvature of the stomach and the beginning of the duodenum. It is divided into the hepatogastric and hepatoduodenal ligaments.

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Item 13 of 40
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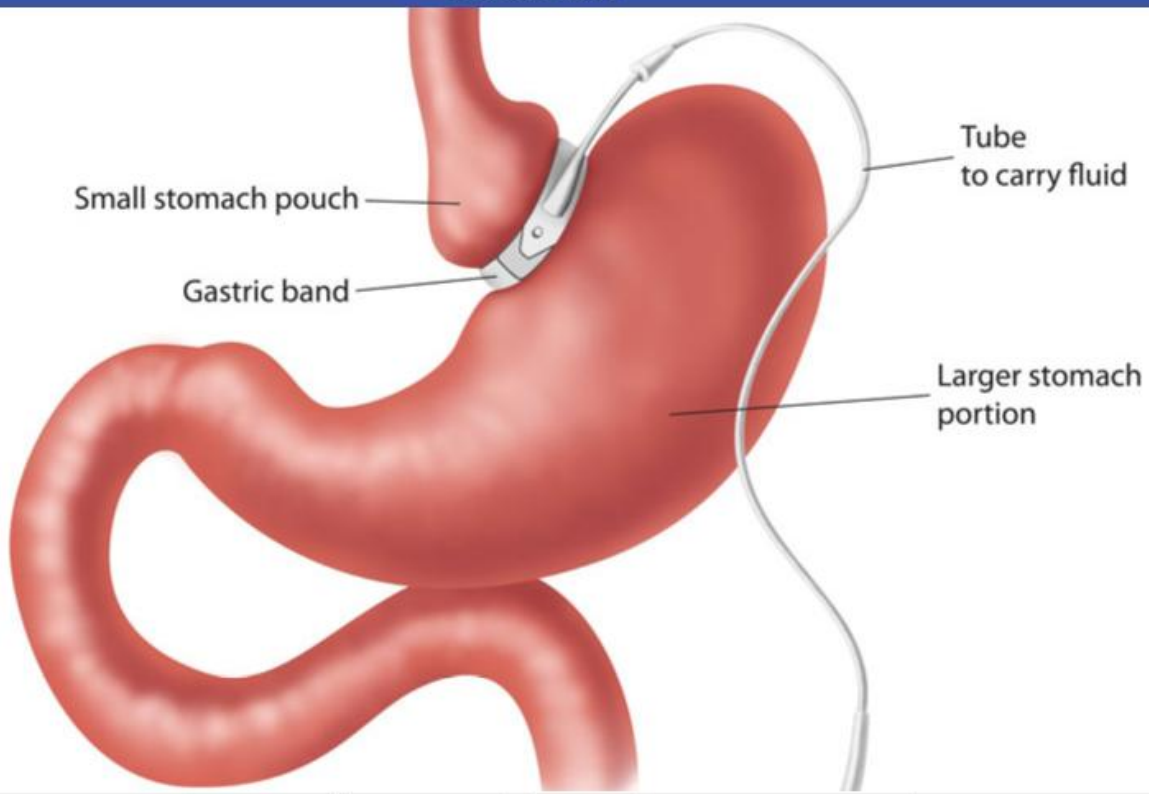

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and hepatic plexus. The right and left gastric arteries and gastric veins also lie between the 2 layers, near where the lesser omentum attaches to

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Item 13 of 40
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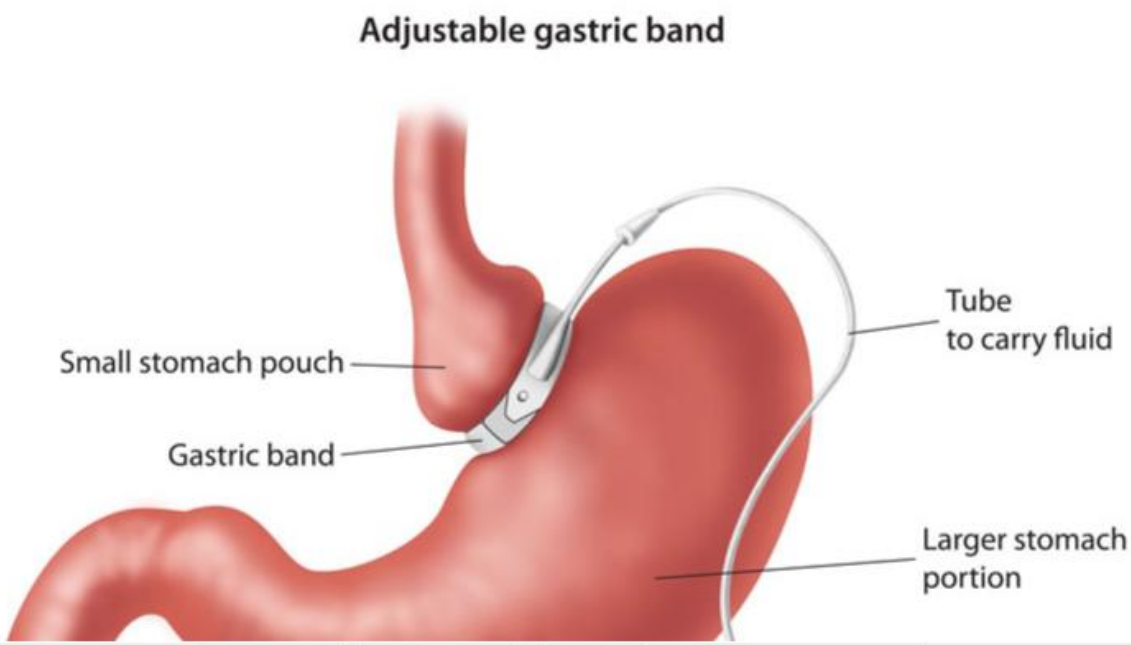

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Item 13 of 40
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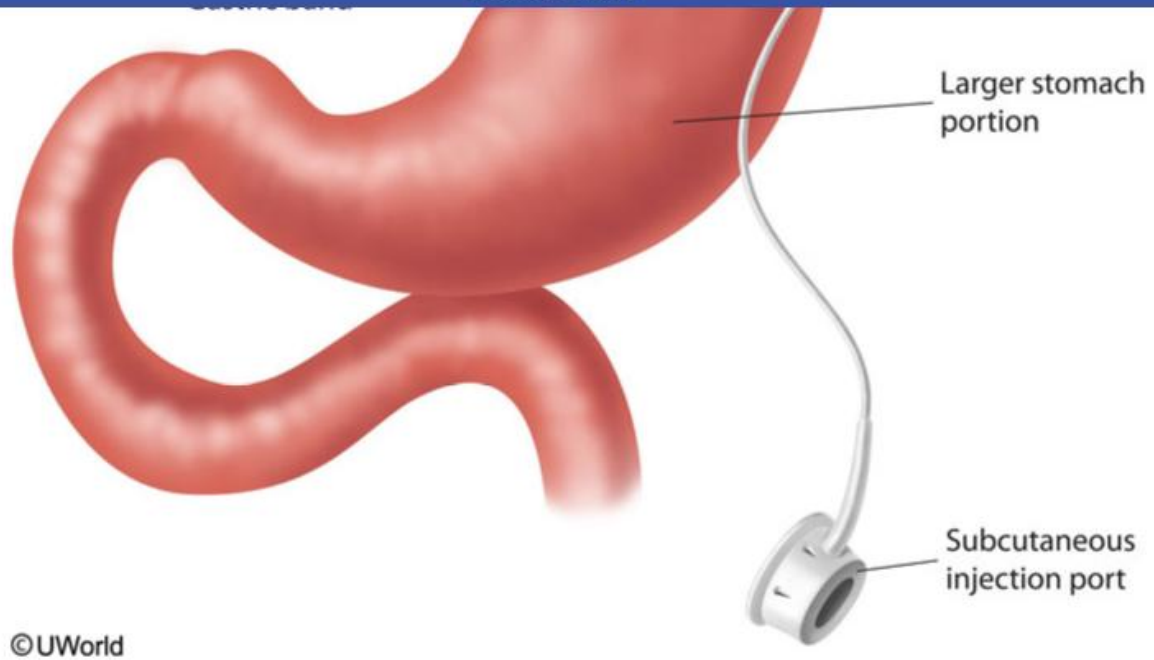

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Item 14 of 40
Question Id: 417

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A 65-year-old woman comes to the emergency department for nausea, vomiting, and abdominal pain that began about 6 hours ago. She also complains of vague pelvic pain over the last few months, but says her pain has never been this severe. Her temperature is 38.4° C (101° F), blood pressure is 141/90 mm Hg, pulse is 92/min, and respirations are 18/min. Physical examination shows a moderately distended abdomen. There is a tender bulge below the inguinal ligament, just lateral to the pubic tubercle. The overlying skin is erythematous. Which of the following structures is most likely immediately lateral to the bulge?

A. Inferior epigastric vessels
B. Cooper's ligament
C. Femoral vein
D. Transversalis fascia
E. Rectus muscle sheath
F. Round ligament

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Item 14 of 40
Question Id: 417

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- A. Inferior epigastric vessels [20%]
- B. Cooper's ligament [3%]
- ✔ C. Femoral vein [66%]
- D. Transversalis fascia [3%]
- E. Rectus muscle sheath [2%]
- F. Round ligament [4%]

Omitted
Correct answer
C

66%
Answered correctly

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Explanation

There are 3 types of **groin hernias**: direct inguinal, indirect inguinal, and femoral. Direct and indirect inguinal hernias occur above the inguinal

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Explanation

There are 3 types of **groin hernias**: direct inguinal, indirect inguinal, and femoral. Direct and indirect inguinal hernias occur above the inguinal ligament; femoral hernias are located below it.

Femoral hernias protrude through the femoral ring, which can widen and become lax with age. They are lateral to the pubic tubercle and lacunar ligament and medial to the femoral artery and vein. Femoral hernias are more common in women and tend to occur on the right side. Femoral hernias may present with upper thigh, groin, or pelvic discomfort.

Because the femoral canal is small, femoral hernias are prone to **incarceration**. Incarcerated hernias cannot be reduced; if a segment of bowel is present in the hernia sac, incarceration can cause bowel obstruction (nausea/vomiting/abdominal pain and distention). Impaired blood flow to contents trapped in the hernia sac occurs a few hours after incarceration, causing **strangulation**. Ischemia and necrosis of the contents of the hernia sac occur, which may lead to systemic symptoms such as fever.

(Choice A) Direct inguinal hernias lie medial to the inferior epigastric vessels, and indirect inguinal hernias are lateral to the vessels.

(Choice B) The pectineal (Cooper's) ligament is a thickened part of the pectineal fascia. It overlies the pectineal ridge of the pubic bone and is located posteriorly to the femoral canal.

(Choice D) The transversalis fascia is found between the transversalis muscle and the extraperitoneal fat. It forms the posterior wall of the inguinal canal. The deep inguinal ring is an opening in the transversalis fascia and is the site of protrusion of indirect inguinal hernias.

(Choice E) The rectus muscle sheath forms the medial border of Hesselbach's triangle. Direct inguinal hernias are located just lateral to the rectus abdominis muscle sheath.

(Choice F) The round ligament in women is homologous to the spermatic cord in men. It leaves the pelvis through the deep inguinal ring and passes through the inguinal canal.

Educational objective:

ligament, femoral hernias are located below it.

Femoral hernias protrude through the femoral ring, which can widen and become lax with age. They are lateral to the pubic tubercle and lacunar ligament and medial to the femoral artery and vein. Femoral hernias are more common in women and tend to occur on the right side. Femoral hernias may present with upper thigh, groin, or pelvic discomfort.

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(Choice A) Direct inguinal hernias lie medial to the inferior epigastric vessels, and indirect inguinal hernias are lateral to the vessels.

(Choice B) The pectineal (Cooper's) ligament is a thickened part of the pectineal fascia. It overlies the pectineal ridge of the pubic bone and is located posteriorly to the femoral canal.

(Choice D) The transversalis fascia is found between the transversalis muscle and the extraperitoneal fat. It forms the posterior wall of the inguinal canal. The deep inguinal ring is an opening in the transversalis fascia and is the site of protrusion of indirect inguinal hernias.

(Choice E) The rectus muscle sheath forms the medial border of Hesselbach's triangle. Direct inguinal hernias are located just lateral to the rectus abdominis muscle sheath.

(Choice F) The round ligament in women is homologous to the spermatic cord in men. It leaves the pelvis through the deep inguinal ring and passes through the inguinal canal.

Educational objective:
Femoral hernias are inferior to the inguinal ligament, lateral to pubic tubercle, and medial to the femoral vein. They can present with groin discomfort or manifest with a bulge on the upper thigh. Incarceration and strangulation are common complications of femoral hernias.

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E. Rectus muscle sheath [2%]

Exhibit Display

Groin hernias			
Type	**Classic presentation**	**Pathophysiology**	**Anatomy**
Indirect inguinal	Male infants	Patent processus vaginalis	• Content protrudes through deep inguinal ring • Travels lateral to inferior epigastric vessels
Direct inguinal	Older men	Weakness of transversalis fascia	• Content protrudes through Hesselbach triangle • Travels medial to inferior epigastric vessels
Femoral	Women	Weakness of proximal femoral canal	• Content protrudes through femoral ring • Travels inferior to inguinal ligament

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located posteriorly to the femoral canal.

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Item 15 of 40
Question Id: 11840

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A 42-year-old man comes to the office with rectal bleeding. He used to have occasional streaks of blood on the tissue after wiping, but for the past several days he has seen blood dripping into the toilet at the end of defecation. The patient reports chronic constipation and has to strain while having a bowel movement but has no rectal or abdominal pain. He works as a truck driver, and his diet consists mainly of hamburgers and French fries. Abdominal examination is unremarkable. There is no mass or tenderness on digital rectal examination, but anoscopy shows bulging purplish-blue mucosal lesions above the dentate line. Rubber band ligation of the lesions is most likely to involve which of the following?

A. Deep external pudendal artery branches
B. External iliac vein tributaries
C. Inferior mesenteric vein tributaries
D. Internal pudendal vein tributaries
E. Left colic artery branches
F. Superior vesical artery branches

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Item 15 of 40
Question Id: 11840

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A. Deep external pudendal artery branches [3%]
B. External iliac vein tributaries [4%]
✔ C. Inferior mesenteric vein tributaries [62%]
D. Internal pudendal vein tributaries [24%]
E. Left colic artery branches [2%]
F. Superior vesical artery branches [2%]

Omitted
Correct answer
C

62%
Answered correctly

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Explanation

Hemorrhoids are classified based on their relation to the dentate line in the anal canal, with **internal hemorrhoids** originating **above the line** and

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Explanation

Hemorrhoids are classified based on their relation to the dentate line in the anal canal, with **internal hemorrhoids** originating **above the line** and external hemorrhoids below. They result from abnormal distension of the anal **arteriovenous plexus**, which normally forms the anal cushions (composed of venous sinusoids and connective tissue) that are important for maintaining fecal continence. Chronically increased venous pressure due to prolonged straining or breakdown of supporting tissue due to advancing age can cause the cushions to bulge into the anal canal, where they can become inflamed, thrombose, or prolapse.

Hemorrhoids can be treated with rubber band ligation, which cuts off the blood supply to the lesions and causes them to degenerate. The venous components of internal hemorrhoids drain into the **superior rectal vein**, which communicates with the **inferior mesenteric vein**. External hemorrhoids drain via the inferior rectal vein into the internal pudendal vein, which communicates with the internal iliac veins **(Choice D)**. Internal hemorrhoids have no somatic sensory innervation and cannot cause pain; however, external hemorrhoids are innervated by the same nerves that cover the perianal area and can be very sensitive to pain.

(Choice A) Branches of the deep external pudendal artery supply the scrotum (labia majora in females) and the perineum.

(Choice B) The external iliac vein receives drainage from the inferior epigastric and deep circumflex iliac veins, which serve the anterior abdominal wall and iliac crest, respectively.

(Choice E) The left colic artery branches off the inferior mesenteric artery to supply the transverse and descending colon.

(Choice F) The superior vesical artery and its branches supply portions of the urinary bladder and ductus deferens.

Educational objective:
Hemorrhoids result from abnormal distension of a portion of the anal arteriovenous plexus. The vascular components of internal hemorrhoids drain into the superior rectal vein, which subsequently drains into the inferior mesenteric vein. Band ligation of hemorrhoids cuts off their blood supply, causing them to degenerate.

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E. Left colic artery branches [2%]

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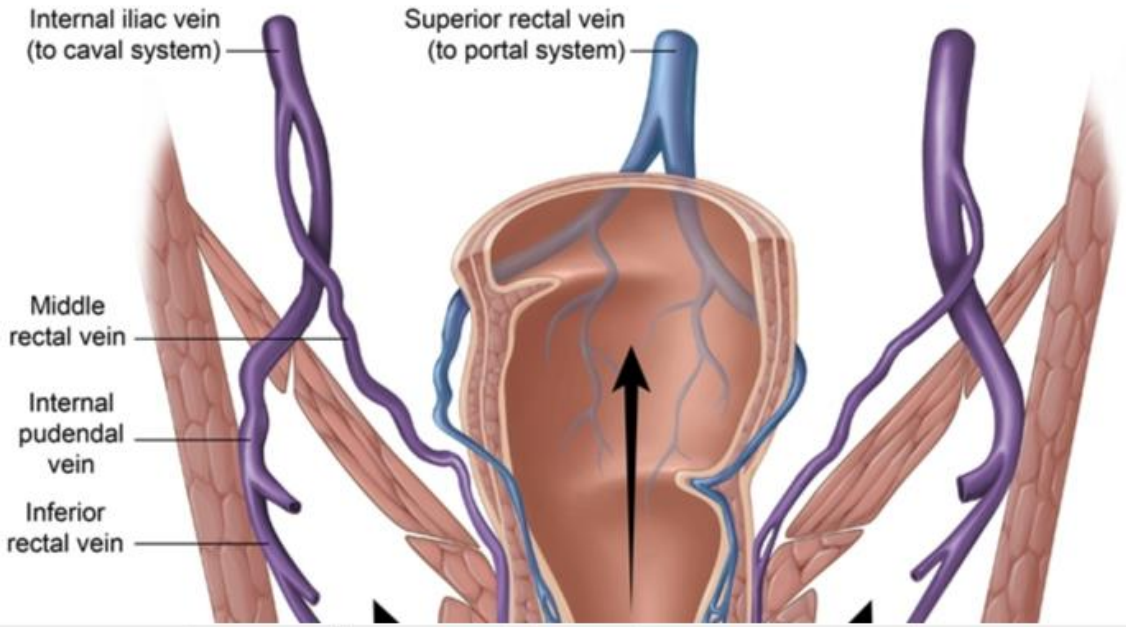
Anorectal venous drainage



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abdominal wall and iliac crest, respectively

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E. Left colic artery branches [2%]

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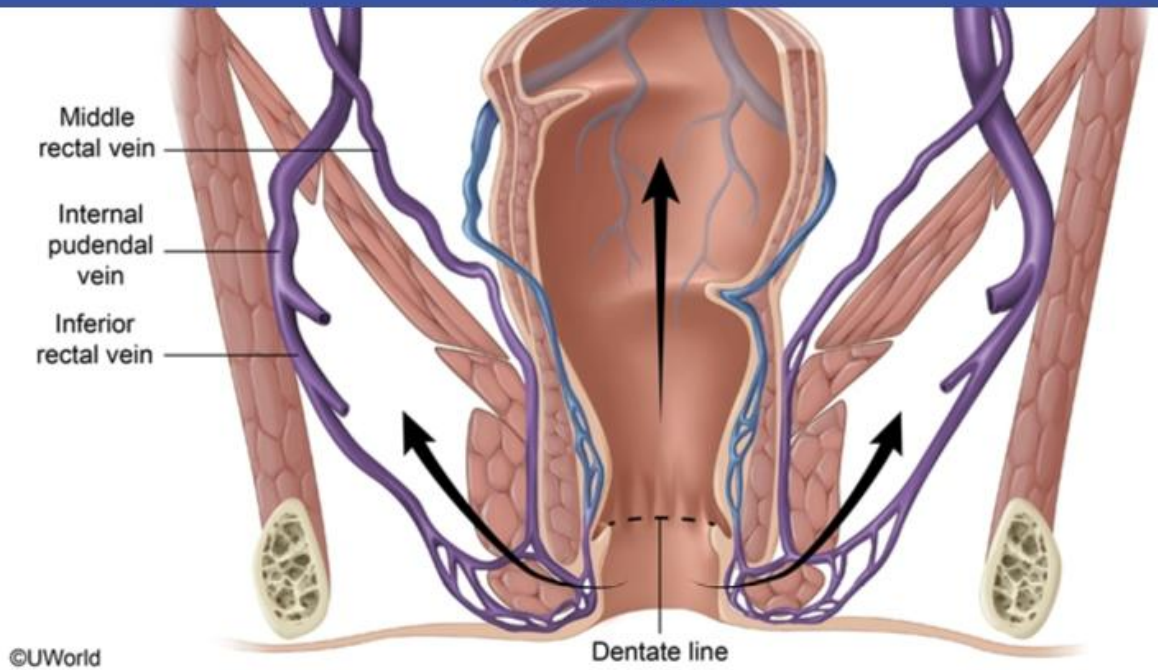

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abdominal wall and iliac crest, respectively

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Item 16 of 40
Question Id: 418

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A 55-year-old man comes to the physician because of swelling in his groin that he first noticed 2 weeks ago. Physical examination shows a bulge above the inguinal ligament that increases in size when the patient is asked to cough. He is referred to a surgeon and scheduled to undergo elective laparoscopic hernia repair. Which of the following landmarks will best aid the surgeon in distinguishing an indirect from a direct inguinal hernia?

A. Inferior epigastric vessels
B. Cooper's ligament
C. Femoral vein
D. Transversalis fascia
E. Rectus muscle sheath
F. Spermatic cord

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Item 16 of 40
Question Id: 418

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A 55-year-old man comes to the physician because of swelling in his groin that he first noticed 2 weeks ago. Physical examination shows a bulge above the inguinal ligament that increases in size when the patient is asked to cough. He is referred to a surgeon and scheduled to undergo elective laparoscopic hernia repair. Which of the following landmarks will best aid the surgeon in distinguishing an indirect from a direct inguinal hernia?

- A. Inferior epigastric vessels [82%] ✔
- B. Cooper's ligament [2%]
- C. Femoral vein [3%]
- D. Transversalis fascia [4%]
- E. Rectus muscle sheath [1%]
- F. Spermatic cord [5%]

Omitted
Correct answer
A

82%
Answered correctly

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Time Spent

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Explanation

Inguinal hernias are common in men, and 25% will be found to have an inguinal hernia during their lifetime (versus 2% of women). In contrast to femoral hernias, inguinal hernias are located above the inguinal ligament. The inferior epigastric vessels serve as an anatomic landmark that can

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Inguinal hernias are common in men, and 25% will be found to have an inguinal hernia during their lifetime (versus 2% of women). In contrast to femoral hernias, inguinal hernias are located above the inguinal ligament. The inferior epigastric vessels serve as an anatomic landmark that can be used to distinguish between direct and indirect inguinal hernias. These vessels are clearly visible on the anterior abdominal wall during laparoscopic hernia repair.

Indirect inguinal hernias are more common than direct and tend to appear on the right side. They occur due to failure of the processus vaginalis to obliterate, allowing abdominal contents to protrude through the deep inguinal ring. Abdominal contents follow the path of the inguinal canal and may exit through the external inguinal ring into the scrotum. On examination, these hernias can be detected by deep palpation of the external ring with the tip of the finger.

Direct inguinal hernias protrude through Hesselbach's triangle, a weak spot of the anterior abdominal wall. Hesselbach's triangle is bounded by the rectus abdominis muscle medially, inferior epigastric vessels laterally, and inguinal ligament inferiorly. Compared to indirect inguinal hernias, direct hernias are less prone to incarceration due to their wide neck. It is also uncommon for them to descend into the scrotum as there is no direct path. Direct inguinal hernias are best felt with the pulp of the examiner's finger on deep palpation.

(Choice B) Cooper's (pectineal) ligament will be posterior to a femoral hernia.

(Choice C) The femoral vein will be lateral to a femoral hernia.

(Choice D) The transversalis fascia lies posteriorly to indirect inguinal hernias.

(Choice E) The rectus abdominis muscle sheath is medial to direct inguinal hernias.

(Choice F) Indirect inguinal hernial sacs are located along the anteromedial aspect of the spermatic cord.

Educational objective:
Indirect inguinal hernias are located lateral to the inferior epigastric vessels. They can continue into the scrotum and are felt by deep palpation of the external inguinal ring with the tip of the finger. In contrast, direct inguinal hernias are located medially to the inferior epigastric vessels. They

femoral hernias, inguinal hernias are located above the inguinal ligament. The inferior epigastric vessels serve as an anatomic landmark that can be used to distinguish between direct and indirect inguinal hernias. These vessels are clearly visible on the anterior abdominal wall during laparoscopic hernia repair.

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(Choice E) The rectus abdominis muscle sheath is medial to direct inguinal hernias.

(Choice F) Indirect inguinal hernial sacs are located along the anteromedial aspect of the spermatic cord.

Educational objective:
Indirect inguinal hernias are located lateral to the inferior epigastric vessels. They can continue into the scrotum and are felt by deep palpation of the external inguinal ring with the tip of the finger. In contrast, direct inguinal hernias are located medially to the inferior epigastric vessels. They do not protrude into the scrotum and are best felt with the pulp of the finger.

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Question Id: 11760

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A 58-year-old man comes to the office with upper abdominal pain, fatigue, and anorexia. He says his symptoms began about a month ago and seem to be getting worse. The patient has a history of cirrhosis due to chronic hepatitis C. Physical examination shows cachexia and worsening ascites. Imaging studies reveal a large mass in the right hepatic lobe consistent with unresectable hepatocellular cancer. The patient is scheduled to undergo percutaneous embolization of the artery supplying the tumor. Contrast material administration into which of the following structures is most likely to visually enhance the artery prior to embolization?

A. Celiac trunk
B. Gastroduodenal artery
C. Inferior mesenteric artery
D. Inferior vena cava
E. Splenic artery
F. Superior mesenteric artery

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Question Id: 11760

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 58-year-old man comes to the office with upper abdominal pain, fatigue, and anorexia. He says his symptoms began about a month ago and seem to be getting worse. The patient has a history of cirrhosis due to chronic hepatitis C. Physical examination shows cachexia and worsening ascites. Imaging studies reveal a large mass in the right hepatic lobe consistent with unresectable hepatocellular cancer. The patient is scheduled to undergo percutaneous embolization of the artery supplying the tumor. Contrast material administration into which of the following structures is most likely to visually enhance the artery prior to embolization?

- ✔ A. Celiac trunk [82%]
- B. Gastroduodenal artery [5%]
- C. Inferior mesenteric artery [1%]
- D. Inferior vena cava [3%]
- E. Splenic artery [1%]
- F. Superior mesenteric artery [5%]

Omitted
Correct answer
A

82%
Answered correctly

3 Seconds
Time Spent

11/01/2018
Last Updated

Explanation

The vascular supply to the upper abdomen mainly comes from the **celiac trunk** (celiac artery), which is the first anterior branch of the abdominal

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Explanation

The vascular supply to the upper abdomen mainly comes from the **celiac trunk** (celiac artery), which is the first anterior branch of the abdominal aorta. The celiac trunk branches into the left gastric, common hepatic, and splenic arteries. The left gastric artery further divides into the esophageal and stomach branches, which supply blood to the abdominal esophagus and upper stomach. The splenic artery and its branches (dorsal pancreatic, short gastric, left gastro-omental, and greater pancreatic arteries) provide blood to the spleen, pancreas, and gastric fundus **(Choice E).**

The **common hepatic artery** further divides into the gastroduodenal, right gastric, and proper hepatic arteries. The gastroduodenal artery supplies blood to the pylorus, proximal duodenum, and pancreatic head **(Choice B).** The right gastric artery supplies blood to the gastric fundus along the lesser curvature before combining with the left gastric artery. The **proper hepatic artery** runs with the portal vein and common bile duct to form the portal triad in the liver. This artery forms the arterial blood supply to the liver and would therefore perfuse this patient's right hepatic lobe mass.

(Choice C) The inferior mesenteric artery branches off the abdominal aorta at the L3 level (inferior to both the celiac trunk and superior mesenteric artery). This artery provides blood supply to the colon from the splenic flexure to the upper rectum (eg, descending and sigmoid colon).

(Choice D) The inferior vena cava (IVC) is formed by the union of both common iliac veins and drains blood from the lower part of the body to the right atrium. Other veins that empty into the IVC include the hepatic, renal, lumbar, and gonadal veins.

(Choice F) The superior mesenteric artery branches off the abdominal aorta inferior to the origin of the celiac trunk. The superior mesenteric artery supplies blood to the pancreas and the intestine from the lower part of the duodenum to the first two-thirds of the transverse colon.

Educational objective:
The celiac trunk is the first main branch of the abdominal aorta; it provides oxygenated blood to the spleen, stomach, liver, abdominal esophagus,

The vascular supply to the upper abdomen mainly comes from the **celiac trunk** (celiac artery), which is the first anterior branch of the abdominal aorta. The celiac trunk branches into the left gastric, common hepatic, and splenic arteries. The left gastric artery further divides into the esophageal and stomach branches, which supply blood to the abdominal esophagus and upper stomach. The splenic artery and its branches (dorsal pancreatic, short gastric, left gastro-omental, and greater pancreatic arteries) provide blood to the spleen, pancreas, and gastric fundus **(Choice E).**

The **common hepatic artery** further divides into the gastroduodenal, right gastric, and proper hepatic arteries. The gastroduodenal artery supplies blood to the pylorus, proximal duodenum, and pancreatic head **(Choice B).** The right gastric artery supplies blood to the gastric fundus along the lesser curvature before combining with the left gastric artery. The **proper hepatic artery** runs with the portal vein and common bile duct to form the portal triad in the liver. This artery forms the arterial blood supply to the liver and would therefore perfuse this patient's right hepatic lobe mass.

(Choice C) The inferior mesenteric artery branches off the abdominal aorta at the L3 level (inferior to both the celiac trunk and superior mesenteric artery). This artery provides blood supply to the colon from the splenic flexure to the upper rectum (eg, descending and sigmoid colon).

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(Choice F) The superior mesenteric artery branches off the abdominal aorta inferior to the origin of the celiac trunk. The superior mesenteric artery supplies blood to the pancreas and the intestine from the lower part of the duodenum to the first two-thirds of the transverse colon.

Educational objective:
The celiac trunk is the first main branch of the abdominal aorta; it provides oxygenated blood to the spleen, stomach, liver, abdominal esophagus, and parts of the duodenum and pancreas. The proper hepatic artery is a distal branch of the celiac trunk that supplies arterial blood to the liver.

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Item 18 of 40
Question Id: 321

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Laparotomy performed in a 4-year-old Caucasian girl with abdominal pain reveals a blind pouch connected to the ileum. The pouch is removed; under microscopy, it demonstrates pancreatic acini in the mucosa. The latter finding would be best described as which of the following?

A. Hypoplasia
B. Hyperplasia
C. Metaplasia
D. Dysplasia
E. Ectopy

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Item 18 of 40
Question Id: 321

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Laparotomy performed in a 4-year-old Caucasian girl with abdominal pain reveals a blind pouch connected to the ileum. The pouch is removed; under microscopy, it demonstrates pancreatic acini in the mucosa. The latter finding would be best described as which of the following?

- A. Hypoplasia [1%]
- B. Hyperplasia [1%]
- C. Metaplasia [13%]
- D. Dysplasia [3%]
- ✔ E. Ectopy [79%]

Omitted
Correct answer
E

79%
Answered correctly

2 Seconds
Time Spent

02/06/2019
Last Updated

Explanation

Meckel diverticulum is the most common congenital anomaly of the small intestine, being present in 2% of the population. It forms due to incomplete obliteration of the omphalomesenteric duct that connects the midgut lumen and yolk sac cavity early in fetal life. Meckel diverticulum is connected to the ileum, and is located approximately 2 feet proximal to the ileocecal valve.

A variety of tissues have been found in Meckel diverticulum, including gastric, pancreatic, colonic, jejunal, duodenal and endometrial. The most

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Meckel diverticulum is the most common congenital anomaly of the small intestine, being present in 2% of the population. It forms due to incomplete obliteration of the omphalomesenteric duct that connects the midgut lumen and yolk sac cavity early in fetal life. Meckel diverticulum is connected to the ileum, and is located approximately 2 feet proximal to the ileocecal valve.

A variety of tissues have been found in Meckel diverticulum, including gastric, pancreatic, colonic, jejunal, duodenal and endometrial. The most common of these is gastric tissue, which is significant because gastric epithelium produces acid that can cause ulceration of adjacent tissues and lower GI bleeding. Meckel diverticulum most often presents with painless melena. The diverticulum may also become inflamed and simulate the clinical presentation of acute appendicitis.

Gastric, pancreatic, and other types of mucosa found in Meckel diverticulum are examples of ectopy (also called heterotopy). "Ectopy" is a term that identifies microscopically and functionally normal cells/tissues found in an abnormal location due to embryonic maldevelopment.

(Choice A) Hypoplasia is an embryologically-associated decrease in the number of cells resulting in decreased volume or size of the organ or tissue. Renal hypoplasia is an example of this abnormality.

(Choice B) Hyperplasia is a compensatory increase in the number of cells with a subsequent increase in the size of an organ. Endometrial hyperplasia due to estrogen hypersecretion is an example of this process.

(Choice C) Replacement of one type of epithelium with another type not typical for location is called metaplasia. Unlike ectopia, which is the result of congenital malformation, metaplasia occurs during adult life and is initially a compensatory process. Metaplasia increases cancer risk in varying degrees.

(Choice D) Dysplasia includes a number of changes, such as pleomorphism, increased size of the nucleus, loss of cellular orientation, and loss of characteristics of the original tissue. Dysplasia is a sign of malignant transformation.

Educational Objective:
A number of ectopic tissues are found in Meckel diverticulum−most commonly, gastric epithelium. Gastric mucosa is present in 80% of cases of symptomatic Meckel diverticulum. Gastric acid production leads to ulceration and subsequent bleeding.

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Item 19 of 40
Question Id: 11753

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A 26-year-old previously healthy man is brought to the emergency department after a motor vehicle collision. The patient was driving while wearing a seatbelt when his car was hit on the left side by another vehicle. He has since had persistent left shoulder pain. He also has nausea and hiccups. The patient's blood pressure is 90/60 mm Hg and pulse is 115/min. On examination, he has a bruise on the left lower chest wall with tenderness to palpation along the area. Chest auscultation reveals normal heart sounds and bilaterally equal breath sounds. He has a rigid and tender abdomen. Which of the following is the most likely diagnosis?

A. Aortic rupture
B. Hemopericardium
C. Humerus fracture
D. Lung contusion
E. Myocardial contusion
F. Pneumothorax
G. Splenic laceration

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Item 19 of 40
Question Id: 11753

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

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A. Aortic rupture [3%]
B. Hemopericardium [4%]
C. Humerus fracture [0%]
D. Lung contusion [3%]
E. Myocardial contusion [1%]
F. Pneumothorax [1%]
✔ G. Splenic laceration [85%]

Omitted
Correct answer
G

85%
Answered correctly

3 Seconds
Time Spent

10/30/2018
Last Updated

Explanation

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Explanation

This patient's rigid abdomen with associated left shoulder pain, hypotension, and tachycardia suggests a possible **splenic laceration** and hemoperitoneum. The shoulder pain likely represents referred pain due to peritoneal irritation (**Kehr sign**).

The phrenic nerves originate from C3-C5 and pass between the lung and heart to provide motor function to the diaphragm. The phrenic nerves also provide sensory fibers to the pericardium, mediastinal pleura, and diaphragmatic peritoneum. The supraclavicular nerves originate from C3-C4 and their branches innervate the sternoclavicular joint, local muscles (eg, sternocleidomastoid), and the skin of the upper and posterior shoulder. Any abdominal process (eg, ruptured spleen, peritonitis, hemoperitoneum) irritating the sensory fibers around the diaphragm can cause **referred pain** via the phrenic nerve to the C3-C5 shoulder region. Phrenic nerve irritation can also cause **hiccups** due to spasmodic diaphragmatic contraction pulling air against a closed larynx.

(Choice A) Traumatic aortic rupture presents with chest wall contusions and hypotension, but it is not typically associated with persistent left shoulder pain or hiccups.

(Choices B and D) Hemopericardium (blood accumulation in the pericardial sac) typically presents with shortness of breath, tachycardia, jugular venous distention, and possible hypotension. Lung contusion usually presents gradually with shortness of breath, chest pain, and consolidation on lung imaging. However, persistent shoulder pain is not commonly associated with either condition.

(Choice C) Humerus fracture typically presents with acute shoulder pain that is increased with movement. Examination can show a deformed shoulder joint. This patient's rigid abdomen and absence of obvious shoulder abnormalities make this less likely.

(Choice E) Myocardial contusion after chest wall trauma typically presents with mid-anterior chest wall pain, shortness of breath, persistent tachycardia, and new conduction defects on ECG (eg, bundle branch block). It is not typically associated with persistent abdominal or shoulder pain.

(Choice F) Pneumothorax after chest trauma usually presents with tachypnea, shortness of breath, decreased or absent breath sounds, unilateral hyperresonance to percussion, and pleuritic chest pain. This patient's bilaterally equal breath sounds make this unlikely.

diaphragmatic contraction pulling air against a closed larynx.

(Choice A) Traumatic aortic rupture presents with chest wall contusions and hypotension, but it is not typically associated with persistent left shoulder pain or hiccups.

(Choices B and D) Hemopericardium (blood accumulation in the pericardial sac) typically presents with shortness of breath, tachycardia, jugular venous distention, and possible hypotension. Lung contusion usually presents gradually with shortness of breath, chest pain, and consolidation on lung imaging. However, persistent shoulder pain is not commonly associated with either condition.

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(Choice F) Pneumothorax after chest trauma usually presents with tachypnea, shortness of breath, decreased or absent breath sounds, unilateral hyperresonance to percussion, and pleuritic chest pain. This patient's bilaterally equal breath sounds make this unlikely.

Educational objective:
Any abdominal process (eg, ruptured spleen, peritonitis, hemoperitoneum) irritating the phrenic nerve sensory fibers around the diaphragm can cause referred pain to the C3-C5 shoulder region (Kehr sign).

References

- Traditional Kehr's sign: Left shoulder pain related to splenic abscess.

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Item 20 of 40
Question Id: 11775

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A 21-year-old man comes to the emergency department due to abdominal pain, nausea, and vomiting. The patient started having dull periumbilical pain several hours ago, but the pain is now more severe and localized to the right lower abdominal quadrant. His temperature is 38.3 C (101 F), blood pressure is 132/84 mm Hg, pulse is 102/min, and respirations are 12/min. The patient keeps his hips flexed and there is maximal tenderness one-third of the distance from the anterior superior iliac spine to the umbilicus in the right lower abdomen. Bowel sounds are decreased. Laboratory studies show a leukocyte count of 16,000/mm^3. Which of the following is the most likely cause of the change in the quality of pain in this patient?

- A. Inflammation of the parietal peritoneum
- B. Involvement of the obturator internus muscle
- C. Involvement of the psoas major muscle
- D. Irritation of the cecal nerve endings
- E. Retrocecal orientation of the appendix

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Item 20 of 40
Question Id: 11775

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 21-year-old man comes to the emergency department due to abdominal pain, nausea, and vomiting. The patient started having dull periumbilical pain several hours ago, but the pain is now more severe and localized to the right lower abdominal quadrant. His temperature is 38.3 C (101 F), blood pressure is 132/84 mm Hg, pulse is 102/min, and respirations are 12/min. The patient keeps his hips flexed and there is maximal tenderness one-third of the distance from the anterior superior iliac spine to the umbilicus in the right lower abdomen. Bowel sounds are decreased. Laboratory studies show a leukocyte count of 16,000/mm^3. Which of the following is the most likely cause of the change in the quality of pain in this patient?

- A. Inflammation of the parietal peritoneum [60%]
- B. Involvement of the obturator internus muscle [1%]
- C. Involvement of the psoas major muscle [17%]
- D. Irritation of the cecal nerve endings [8%]
- E. Retrocecal orientation of the appendix [11%]

Omitted
Correct answer
A

60%
Answered correctly

3 Seconds
Time Spent

11/21/2018
Last Updated

Explanation

This patient's presentation is concerning for **appendicitis**, which can cause both visceral (dull, non-localized) and somatic (severe, well-localized)

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This patient's presentation is concerning for **appendicitis**, which can cause both visceral (dull, non-localized) and somatic (severe, well-localized) abdominal pain. **Visceral abdominal pain** is most often due to luminal distension and stretching of smooth muscle and is carried by general visceral afferent fibers of the autonomic nervous system. The pain typically occurs in the **midline** region and is **poorly localized** and of a dull, constant, or cramping quality. Patients can also develop nausea, vomiting, or sweating due to the autonomic stimulation. In contrast, somatic pain is usually due to irritation of the parietal peritoneum and is well localized, more severe, and worsened with deep inspiration or pushing on the abdominal wall.

The afferent pain fibers for the appendix, proximal colon, and overlying visceral peritoneum cross through the superior mesenteric plexus and enter the spinal cord at the T10 level to produce vague, referred pain at the umbilicus. As the appendix becomes more inflamed, it irritates the **parietal peritoneum** and abdominal wall and causes a **more severe somatic pain** that **shifts** from the umbilical region to **McBurney point** (two-thirds of the distance from the umbilicus to the anterior superior iliac spine). The abdominal wall becomes very sensitive to gentle pressure or sudden release of deep pressure (rebound tenderness).

(Choices B and C) The appendix is usually 2 cm beneath the ileocecal valve in the right lower quadrant. Depending on its orientation, there can be additional clinical findings. An inflamed appendix lying against the right obturator internus muscle can cause right lower quadrant pain with internal rotation of the right hip. If the inflamed appendix lies against the right psoas muscle, there can be pain with hip extension.

(Choice D) The cecum is innervated by the superior mesenteric plexus and has only visceral sensation.

(Choice E) Patients with a retrocecal appendix may not have significant right lower quadrant tenderness, as the inflamed appendix does not contact the anterior parietal peritoneum and the cecum (distended with gas) acts as a cushion that blocks the examiner's hand.

Educational objective:
Appendicitis causes dull visceral pain at the umbilicus due to afferent pain fibers entering at the T10 level in the spinal cord. Progressive inflammation in the appendix irritates the parietal peritoneum and abdominal wall to cause more severe somatic pain shifting from the umbilicus to McBurney point (two-thirds of the distance from the umbilicus to the anterior superior iliac spine).

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Item 21 of 40
Question Id: 11771

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A 46-year-old man comes to the emergency department due to severe anal pain. He has a history of chronic constipation and on several occasions has noticed streaks of blood on the tissue paper after wiping. He has no abdominal pain, nausea, vomiting, or weight loss and has no family history of malignancy. His temperature is 36.7 C (98 F). On examination, there are several large, purplish-blue sacs bulging into the anal canal, one of which originates below the dentate line and is extremely tender. Excision of the tender lesion under local anesthesia is planned. The anesthetic agent most likely blocks sensory impulses carried by which of the following structures?

A. Ilioinguinal nerve
B. Inferior gluteal nerve
C. Inferior hypogastric plexus
D. Pelvic splanchnic nerves
E. Pudendal nerve

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Item 21 of 40
Question Id: 11771

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A 46-year-old man comes to the emergency department due to severe anal pain. He has a history of chronic constipation and on several occasions has noticed streaks of blood on the tissue paper after wiping. He has no abdominal pain, nausea, vomiting, or weight loss and has no family history of malignancy. His temperature is 36.7 C (98 F). On examination, there are several large, purplish-blue sacs bulging into the anal canal, one of which originates below the dentate line and is extremely tender. Excision of the tender lesion under local anesthesia is planned. The anesthetic agent most likely blocks sensory impulses carried by which of the following structures?

- A. Ilioinguinal nerve [3%]
- B. Inferior gluteal nerve [5%]
- C. Inferior hypogastric plexus [3%]
- D. Pelvic splanchnic nerves [5%]
- ✔ E. Pudendal nerve [83%]

Omitted
Correct answer
E

83%
Answered correctly

3 Seconds
Time Spent

11/08/2018
Last Updated

Explanation

This patient has both internal and **external hemorrhoids**, which each have a distinct epithelial lining and innervation. Internal hemorrhoids originate above the dentate line and are covered by columnar epithelium. They have autonomic innervation from the inferior hypogastric plexus,

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Explanation

This patient has both internal and **external hemorrhoids**, which each have a distinct epithelial lining and innervation. Internal hemorrhoids originate above the dentate line and are covered by columnar epithelium. They have autonomic innervation from the inferior hypogastric plexus, which is only sensitive to stretch and not pain, temperature, or touch.

External hemorrhoids, which originate below the dentate line, are covered by modified squamous epithelium and have cutaneous (somatic) nervous innervation from the inferior rectal nerve, a branch of the pudendal nerve. **Branches** of the **pudendal nerve** supply the perineum and external genitalia in males and females and are very sensitive to touch, temperature, and **pain**. External hemorrhoids are generally asymptomatic but can become exquisitely painful if they thrombose, as in this case.

(Choice A) The ilioinguinal nerve is mostly sensory, derived from L1, and carries sensation from skin of the upper and medial part of the thigh, the root of the penis and upper part of the scrotum in males, and the mons pubis and labia majora in females.

(Choice B) The inferior gluteal nerve, composed of branches of L5, S1, and S2, is the main nerve supplying motor functions to the gluteus maximus muscle.

(Choice C) The inferior hypogastric plexus, which has both sympathetic and parasympathetic components, innervates the internal pelvic viscera but not the external perirectal area.

(Choice D) The pelvic splanchnic nerves are derived from S2, S3, and S4 and provide parasympathetic innervation to the pelvic and genital organs.

Educational objective:
External hemorrhoids, which originate below the dentate line, are covered by modified squamous epithelium and have cutaneous (somatic) nervous innervation from the inferior rectal nerve, a branch of the pudendal nerve.

References

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Item 22 of 40
Question Id: 1706

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A 47-year-old male comes to your office complaining of dysphagia. He says that it feels like food is "sticking in his throat", and that the "sticking" feeling has persisted over the last month. He has changed his diet to accommodate his symptoms and now only consumes liquid foods. The patient has a long history of postprandial heartburn that sometimes awakens him from sleep. He has treated his heartburn with over the counter antacids in the past, but says he experiences only partial relief. Which of the following structures in the computed tomography (CT) image below is responsible for this patient's symptoms?

- A. A
- B. B
- C. C
- D. D
- E. E

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Question Id: 1706

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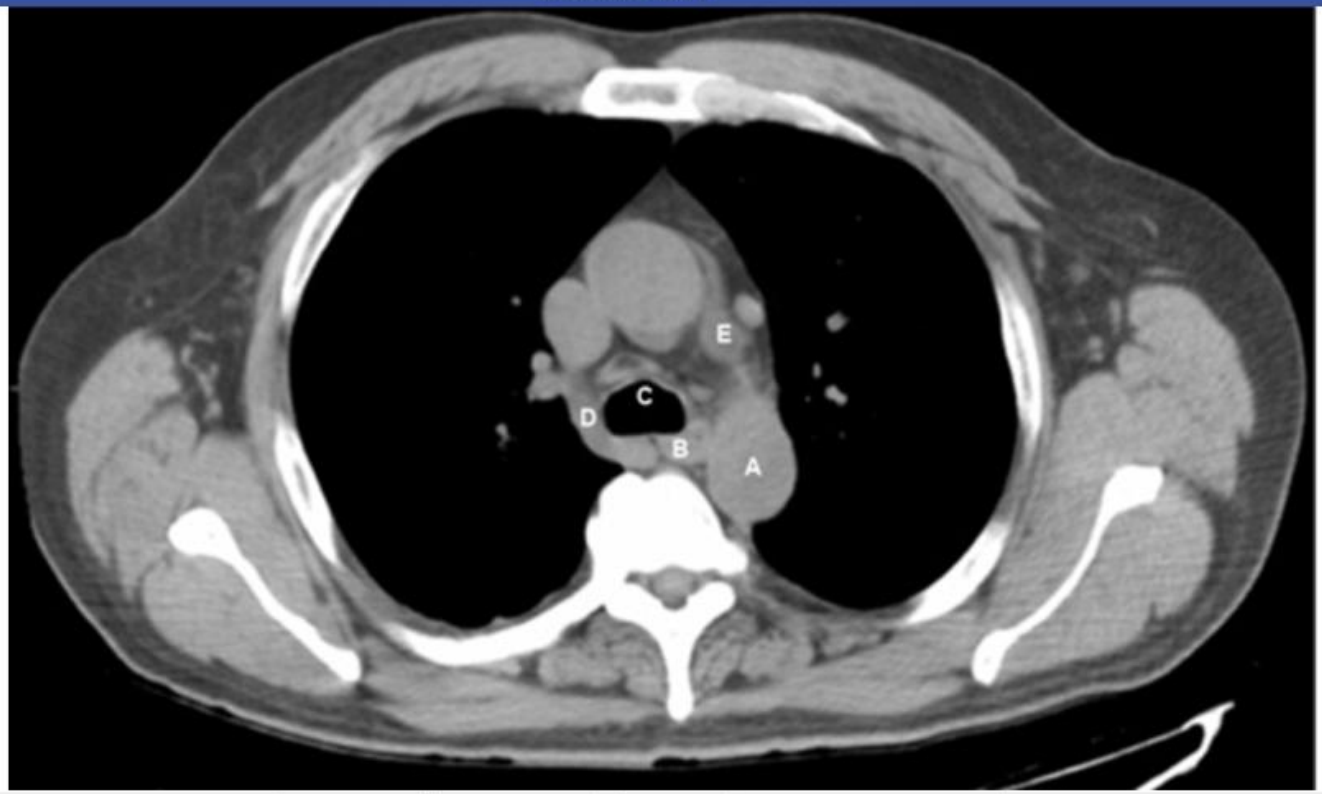

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Item 22 of 40
Question Id: 1706

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 47-year-old male comes to your office complaining of dysphagia. He says that it feels like food is "sticking in his throat", and that the "sticking" feeling has persisted over the last month. He has changed his diet to accommodate his symptoms and now only consumes liquid foods. The patient has a long history of postprandial heartburn that sometimes awakens him from sleep. He has treated his heartburn with over the counter antacids in the past, but says he experiences only partial relief. Which of the following structures in the computed tomography (CT) image below is responsible for this patient's symptoms?

- A. A
- B. B
- C. C
- D. D
- E. E

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Item 22 of 40
Question Id: 1706

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A 47-year-old male comes to your office complaining of dysphagia. He says that it feels like food is "sticking in his throat", and that the "sticking" feeling has persisted over the last month. He has changed his diet to accommodate his symptoms and now only consumes liquid foods. The patient has a long history of postprandial heartburn that sometimes awakens him from sleep. He has treated his heartburn with over the counter antacids in the past, but says he experiences only partial relief. Which of the following structures in the computed tomography (CT) image below is responsible for this patient's symptoms?

- A. A [5%]
- ✔ B. B [58%]
- C. C [24%]
- D. D [6%]
- E. E [4%]

Omitted
Correct answer
B

58%
Answered correctly

3 Seconds
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01/31/2019
Last Updated

Explanation

AA- Ascending aorta

DA- Descending aorta

SVC- Superior vena cava

This patient suffers from gastroesophageal reflux disease (GERD), a condition that affects the esophagus. Dysphagia is common in patients with

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Omitted
Correct answer
B

58%
Answered correctly

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01/31/2019
Last Updated

Explanation

AA- Ascending aorta DA- Descending aorta SVC- Superior vena cava

This patient suffers from gastroesophageal reflux disease (GERD), a condition that affects the esophagus. Dysphagia is common in patients with longstanding GERD, and can be caused by impaired peristalsis or esophageal inflammation, stricture, or malignancy. In the thorax, the esophagus courses between the trachea and the vertebral bodies and is typically collapsed with no visible lumen. The trachea **(Choice C)** serves as a good landmark here because the radiolucency of the air in this structure allows one to differentiate it from the esophagus posteriorly and the great vessels anteriorly.

(Choice A) This is the descending aorta.

(Choice D) This is the arch of the azygos vein.

(Choice E) This is a section of the left pulmonary artery.

Educational Objective:
The esophagus is located between the trachea and the vertebral bodies in the superior thorax. It is typically collapsed with no visible lumen on CT images of the chest.

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Item 23 of 40
Question Id: 129

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A 54-year-old man is evaluated for episodic abdominal discomfort, bloating sensation, flatulence, and occasional diarrhea. He has no blood in the stool or weight loss. The patient has tried avoiding dairy products, but the symptoms did not improve. On examination, there is mild epigastric tenderness on deep palpation. Stool occult blood testing is positive. Histopathological evaluation of hyperemic mucosa seen during gastrointestinal endoscopy reveals hyperplasia of branched, tubular submucosal glands containing alkaline secretions. Which of the following areas is the most likely site of biopsy in this patient?

A. Antrum of the stomach
B. First part of the duodenum
C. Fundus of the stomach
D. Mid-part of the jejunum
E. Terminal ileum
F. Transverse colon

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Item 23 of 40
Question Id: 129

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 54-year-old man is evaluated for episodic abdominal discomfort, bloating sensation, flatulence, and occasional diarrhea. He has no blood in the stool or weight loss. The patient has tried avoiding dairy products, but the symptoms did not improve. On examination, there is mild epigastric tenderness on deep palpation. Stool occult blood testing is positive. Histopathological evaluation of hyperemic mucosa seen during gastrointestinal endoscopy reveals hyperplasia of branched, tubular submucosal glands containing alkaline secretions. Which of the following areas is the most likely site of biopsy in this patient?

- A. Antrum of the stomach [6%]
- ✔ B. First part of the duodenum [77%]
- C. Fundus of the stomach [3%]
- D. Mid-part of the jejunum [5%]
- E. Terminal ileum [4%]
- F. Transverse colon [3%]

Omitted
Correct answer
B

77%
Answered correctly

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Last Updated

Explanation

The integrity of the small intestinal mucosa depends on the complete and rapid neutralization of hydrochloric acid in gastric contents. This is

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2/7/2019

The integrity of the small intestinal mucosa depends on the complete and rapid neutralization of hydrochloric acid in gastric contents. This is accomplished by alkaline secretions from 2 primary sources:

- **Submucosal (Brunner) glands** secrete copious amounts of alkaline mucus into the duodenum. These glands are most numerous at the pylorus but may be found intermittently up to the ampulla of Vater. The ducts of these glands pass through the muscularis mucosa and terminate in the mucosal crypts (crypts of Lieberkühn).
- The epithelial cells of the pancreatic ductules and ducts produce watery secretions containing high concentrations of bicarbonate ions. The strongly alkaline pancreatic secretions are then emptied into the duodenum at the ampulla.

Tactile stimulation of the duodenal mucosa and increased parasympathetic activity following meals induce bicarbonate secretion from the submucosal glands. In addition, the presence of acid in the duodenum and jejunum causes release of **secretin** from the mucosa, stimulating secretion of bicarbonate from the submucosal glands and pancreas. Excess gastric acid secretion, such as seen in *Helicobacter pylori* infection, can cause increased production of secretin that, over time, can lead to hyperplasia of the submucosal glands.

(Choices A and C) The antrum of the stomach contains numerous pyloric glands that secrete copious mucus for protection of the mucosa. Gastric acid is primarily secreted by parietal cells of the oxyntic glands at the body and fundus of the stomach.

(Choice D) The mucosal crypts in the jejunum contain goblet cells (secrete mucus) and enterocytes (secrete water and electrolytes). These secretions have only minimal bicarbonate content.

(Choices E and F) Bicarbonate is secreted by epithelial cells in the ileum and colon to neutralize acid produced by colonic bacteria. However, this bicarbonate is secreted at the villi in the ileum and crypts in the colon, and submucosal glands are not present in these locations.

Educational objective:
Gastric acid is neutralized by bicarbonate from the submucosal glands of the duodenum (Brunner glands) and from pancreatic duct secretions. Chronic overproduction of gastric acid can lead to hyperplasia of the submucosal glands.

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Item 24 of 40
Question Id: 1744

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A 71-year-old man comes to the emergency department due to several episodes of bright red blood per rectum. His recent colonoscopy revealed numerous colonic diverticula. Laboratory studies on admission are notable for a hemoglobin of 8.2 g/dL with an unremarkable coagulation profile. An abdominal angiogram shows active bleeding from the sigmoid colon. Catheter embolization is planned via the femoral artery. During the procedure, the arterial catheter is most likely to proceed in which of the following orders?

A. External iliac, common iliac, abdominal aorta, celiac
B. External iliac, common iliac, abdominal aorta, inferior mesenteric
C. External iliac, common iliac, abdominal aorta, superior mesenteric
D. External iliac, internal iliac, internal pudendal
E. External iliac, internal iliac, middle rectal

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Item 24 of 40
Question Id: 1744

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A 71-year-old man comes to the emergency department due to several episodes of bright red blood per rectum. His recent colonoscopy revealed numerous colonic diverticula. Laboratory studies on admission are notable for a hemoglobin of 8.2 g/dL with an unremarkable coagulation profile. An abdominal angiogram shows active bleeding from the sigmoid colon. Catheter embolization is planned via the femoral artery. During the procedure, the arterial catheter is most likely to proceed in which of the following orders?

- A. External iliac, common iliac, abdominal aorta, celiac [1%]
- ✔ B. External iliac, common iliac, abdominal aorta, inferior mesenteric [86%]
- C. External iliac, common iliac, abdominal aorta, superior mesenteric [5%]
- D. External iliac, internal iliac, internal pudendal [3%]
- E. External iliac, internal iliac, middle rectal [3%]

Omitted
Correct answer
B

86%
Answered correctly

3 Seconds
Time Spent

10/19/2018
Last Updated

Explanation

In this patient with recurrent gastrointestinal bleeding, arterial embolization (mechanical occlusion of the artery using coils or absorbable substances) is planned to stop the active bleeding originating from his sigmoid colon. The distal one-third of the transverse colon, descending colon, **sigmoid** colon, and rectum are all **hindgut** derivatives. Hindgut structures receive blood from the **inferior mesenteric artery** (IMA), a

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Correct answer
B

86%
Answered correctly

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Last Updated

Explanation

In this patient with recurrent gastrointestinal bleeding, arterial embolization (mechanical occlusion of the artery using coils or absorbable substances) is planned to stop the active bleeding originating from his sigmoid colon. The distal one-third of the transverse colon, descending colon, **sigmoid** colon, and rectum are all **hindgut** derivatives. Hindgut structures receive blood from the **inferior mesenteric artery** (IMA), a branch of the aorta. These structures are drained by the inferior mesenteric vein (IMV), which does not course with the IMA. The IMV drains blood from the hindgut into the splenic vein, which drains into the portal vein.

(Choice A) The celiac trunk supplies blood to most foregut structures from the lower esophagus to the second part of the duodenum. Foregut derivatives include the liver, pancreas, and gallbladder. The celiac trunk also supplies the spleen.

(Choice C) The superior mesenteric artery supplies blood to the midgut, which spans from the third part of the duodenum to the proximal two-thirds of the transverse colon.

(Choices D and E) The internal iliac artery supplies portions of the gut through branches such as the inferior rectal artery (a branch of the internal pudendal artery, which arises from the internal iliac artery) and the middle rectal artery (arises from the internal iliac). The internal pudendal artery supplies blood to the external genitalia. The superior rectal artery is a continuation of the IMA.

Educational objective:
The hindgut encompasses the distal one-third of the transverse colon, the descending colon, the sigmoid colon, and the rectum. These structures receive their main arterial blood supply from the inferior mesenteric artery.

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Item 25 of 40
Question Id: 318

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A 3-day-old boy is brought to the emergency department due to poor feeding, emesis, and lethargy over the last 24 hours. The patient was born via uncomplicated spontaneous vaginal delivery to a 30-year-old woman who had a normal pregnancy. The boy was discharged from the newborn nursery yesterday and was breastfeeding exclusively until the onset of symptoms. Stool and urine output were normal while he was in the newborn nursery. The patient is afebrile and normotensive but tachycardic and tachypneic. He appears dehydrated, and the abdomen is distended. The patient vomits during the examination, and the vomitus is shown in the **exhibit**. On laparotomy, fibrous bands are seen extending from the cecum and right colon to the retroperitoneum, causing extrinsic compression of the duodenum. Which of the following embryologic processes most likely failed in this patient?

A. Failure of gut recanalization
B. Fusion of the ventral and dorsal pancreatic buds
C. Midgut rotation around the superior mesenteric artery
D. Neural crest cell migration into the bowel wall
E. Obliteration of the omphalomesenteric duct

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Item 25 of 40
Question Id: 318

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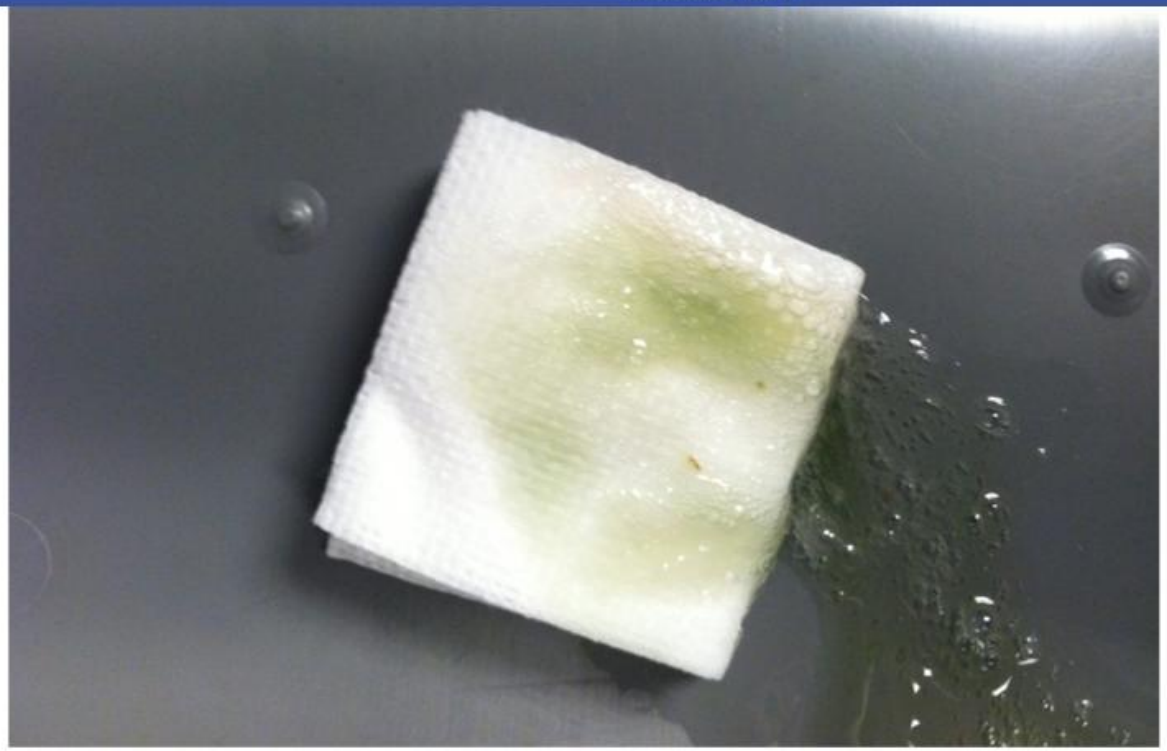

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Item 25 of 40
Question Id: 318

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A 3-day-old boy is brought to the emergency department due to poor feeding, emesis, and lethargy over the last 24 hours. The patient was born via uncomplicated spontaneous vaginal delivery to a 30-year-old woman who had a normal pregnancy. The boy was discharged from the newborn nursery yesterday and was breastfeeding exclusively until the onset of symptoms. Stool and urine output were normal while he was in the newborn nursery. The patient is afebrile and normotensive but tachycardic and tachypneic. He appears dehydrated, and the abdomen is distended. The patient vomits during the examination, and the vomitus is shown in the **exhibit**. On laparotomy, fibrous bands are seen extending from the cecum and right colon to the retroperitoneum, causing extrinsic compression of the duodenum. Which of the following embryologic processes most likely failed in this patient?

A. Failure of gut recanalization [14%]
B. Fusion of the ventral and dorsal pancreatic buds [9%]
✔ C. Midgut rotation around the superior mesenteric artery [53%]
D. Neural crest cell migration into the bowel wall [4%]
E. Obliteration of the omphalomesenteric duct [17%]

Omitted
Correct answer
C

53%
Answered correctly

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Time Spent

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Last Updated

Explanation

Around 6 weeks gestation, the midgut (supplied by the superior mesenteric artery) herniates through the umbilical ring in order to grow rapidly.

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Explanation

Around 6 weeks gestation, the midgut (supplied by the superior mesenteric artery) herniates through the umbilical ring in order to grow rapidly. During this process, the midgut rotates 90 degrees counterclockwise. Following additional growth, the midgut returns to the abdominal cavity at 8-10 weeks gestation and turns an additional 180 degrees counterclockwise (270 degrees total). Subsequently, the gut is fixed to the posterior abdomen on a wide-based mesentery.

Incomplete counterclockwise rotation (eg, 180 degrees) will result in **midgut malrotation**. The cecum will rest in the right upper quadrant instead of the right lower quadrant (RLQ). Additionally, **Ladd's (fibrous) bands** connect the retroperitoneum in the RLQ to the right colon/cecum by passing over the second part of the duodenum, causing **intestinal obstruction** in the process. Obstruction manifests as bilious emesis during the first days of life. In addition, because the mesenteric base is abnormally narrowed, the mesentery is vulnerable to twisting around the **superior mesenteric artery**. The twisting, referred to as midgut **volvulus**, compromises intestinal perfusion and may lead to life-threatening bowel necrosis.

(Choice A) Failure of gut recanalization is a possible mechanism for development of **duodenal atresia** (distension of stomach and duodenum on X-ray). Ladd's bands are not found in this condition.

(Choice B) Failure of ventral and dorsal pancreatic buds to fuse at 8 weeks gestation results in pancreas divisum. However, this condition is usually asymptomatic and an incidental finding on imaging study or autopsy.

(Choice D) Failure of neural crest cell migration in the gut causes aganglionic sigmoid colon/rectum. The affected bowel segments cannot relax and are therefore narrow and obstructive. **Hirschsprung disease** presents in the neonatal period with delayed passage of meconium, abdominal distension, and bilious emesis.

(Choice E) The omphalomesenteric duct connects the midgut lumen with the yolk sac. Failed obliteration of the duct causes vitelline fistula (complete failure) or a **Meckel diverticulum** (partial failure). If symptomatic, Meckel diverticulum most commonly presents with painless lower gastrointestinal bleeding without emesis.

Educational objective:

passing over the second part of the duodenum, causing **intestinal obstruction** in the process. Obstruction manifests as bilious emesis during the first days of life. In addition, because the mesenteric base is abnormally narrowed, the mesentery is vulnerable to twisting around the **superior mesenteric artery**. The twisting, referred to as midgut **volvulus**, compromises intestinal perfusion and may lead to life-threatening bowel necrosis.

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Educational objective:
Intestinal malrotation results when the midgut undergoes incomplete embryological counterclockwise rotation. It can present as intestinal obstruction (due to compression by the adhesive bands) and midgut volvulus (intestinal ischemia due to twisting around the blood vessels).

References

- Intestinal malrotation and catastrophic volvulus in infancy

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E. Obliteration of the omphalomesenteric duct [17%]

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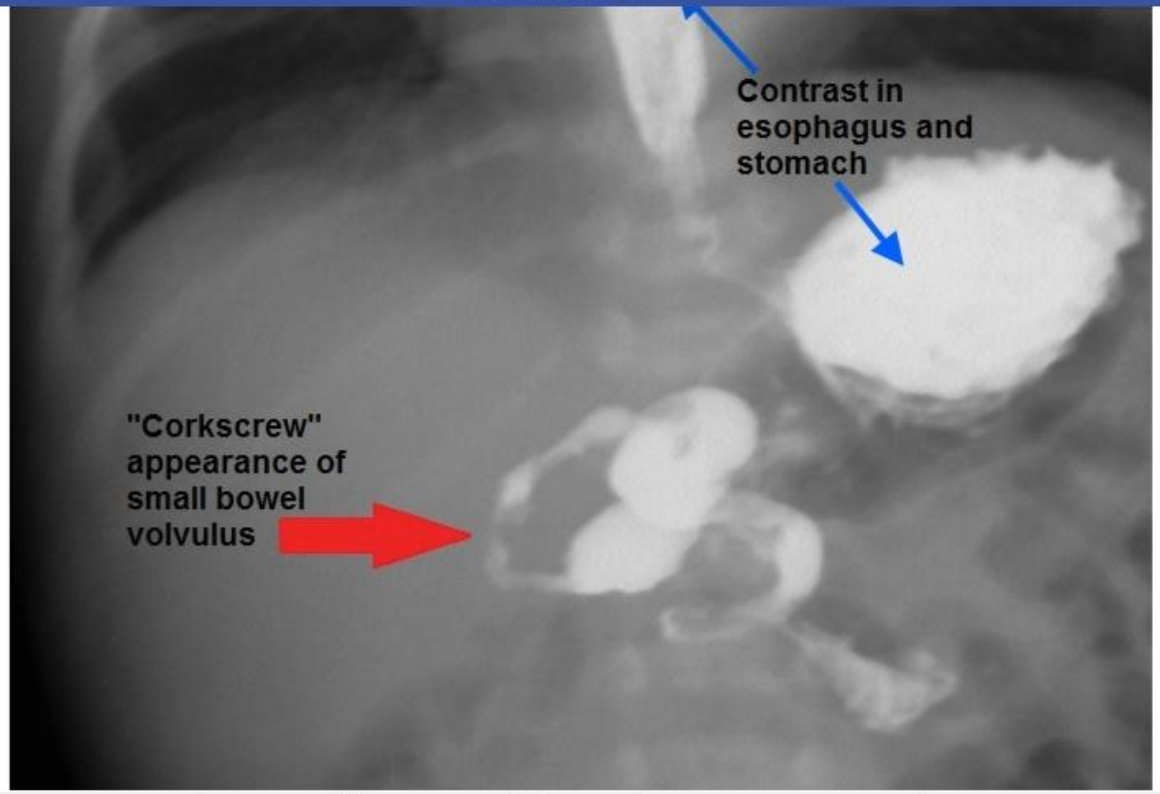

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usually asymptomatic and an incidental finding on imaging study or autopsy.

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E. Obliteration of the omphalomesenteric duct [17%]

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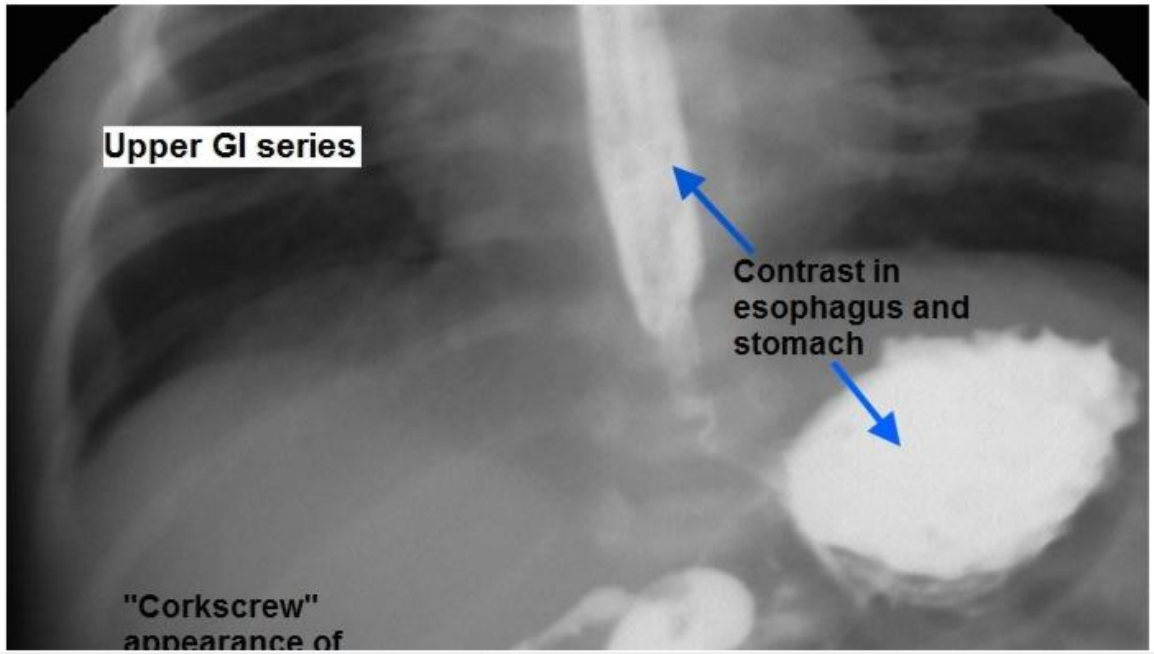

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usually asymptomatic and an incidental finding on imaging study or autopsy.

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Item 26 of 40
Question Id: 10583

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A 23-year-old-man is brought to the emergency department after he was stabbed in the right upper quadrant of the abdomen. His blood pressure is 70/42 mm Hg, pulse is 135/min, and respirations are 26/min; pulse oximetry shows oxygen saturation of 95% on room air. Physical examination shows a stab wound 2 cm inferior to the right costal margin. The patient's abdomen is firm and distended. Focused assessment with sonography for trauma (FAST) is positive for blood in the right upper quadrant. He is taken for immediate laparotomy, and approximately 1 liter of blood is evacuated from the peritoneal cavity. Brisk, nonpulsatile bleeding is seen emanating from behind the liver. The surgeon occludes the hepatoduodenal ligament, but the patient continues to hemorrhage. Which of the following structures is the most likely source of this patient's bleeding?

A. Common bile duct
B. Cystic artery
C. Hepatic artery
D. Inferior vena cava
E. Portal vein

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Item 26 of 40
Question Id: 10583

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 23-year-old-man is brought to the emergency department after he was stabbed in the right upper quadrant of the abdomen. His blood pressure is 70/42 mm Hg, pulse is 135/min, and respirations are 26/min; pulse oximetry shows oxygen saturation of 95% on room air. Physical examination shows a stab wound 2 cm inferior to the right costal margin. The patient's abdomen is firm and distended. Focused assessment with sonography for trauma (FAST) is positive for blood in the right upper quadrant. He is taken for immediate laparotomy, and approximately 1 liter of blood is evacuated from the peritoneal cavity. Brisk, nonpulsatile bleeding is seen emanating from behind the liver. The surgeon occludes the hepatoduodenal ligament, but the patient continues to hemorrhage. Which of the following structures is the most likely source of this patient's bleeding?

A. Common bile duct [0%]
B. Cystic artery [10%]
C. Hepatic artery [8%]
✔ D. Inferior vena cava [58%]
E. Portal vein [21%]

Omitted
Correct answer
D

58%
Answered correctly

3 Seconds
Time Spent

01/15/2019
Last Updated

Explanation

Block Time Remaining: 00:02:23
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Explanation

The **portal triad** runs through the **hepatoduodenal ligament** and is composed of the hepatic artery, portal vein, and common bile duct. In the setting of traumatic liver injury with persistent bleeding, occlusion of the hepatoduodenal ligament can be performed to identify the vascular source (ie, the Pringle maneuver). If liver bleeding does not cease when the portal triad is occluded, it is likely that there has been injury to the inferior vena cava or hepatic veins.

(Choice A) The common bile duct makes up one-third of the portal triad. Damage to the biliary ducts can cause biliary leakage and bile peritonitis.

(Choice B) The cystic artery most commonly arises from the right hepatic artery and would be devascularized following portal triad occlusion. In addition, arterial bleed is usually pulsatile whereas venous bleed is nonpulsatile.

(Choices C and E) The hepatic artery and portal vein are part of the portal triad; occlusion of the hepatoduodenal ligament would cause the bleeding to stop if either of these vessels is the source.

Educational objective:
Occlusion of the portal triad (Pringle maneuver) is a surgical technique used to distinguish the source of right upper quadrant bleeding. If hepatic bleeding persists after occlusion of the portal triad, the inferior vena cava or hepatic veins are likely to be injured.

References

- Vascular control during hepatectomy: review of methods and results.
- Emergency strategies and trends in the management of liver trauma.

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Item 27 of 40
Question Id: 11839

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A 65-year-old man with a history of hypertension, type 2 diabetes mellitus, and tobacco smoking comes to the office reporting mild back pain. Abdominal examination reveals a bruit, but no pulsatile mass is palpated. Femoral and pedal pulses are symmetric. The patient is sent for ultrasound and is found to have a large infrarenal abdominal aortic aneurysm. Open aneurysm repair is performed. During the procedure, the inferior mesenteric artery is ligated, the diseased portion of the aorta is dissected, and a graft is placed from below the renal arteries to the bifurcation of the aorta. Collateral circulation from which of the following vessels is most likely responsible for preventing ischemia of the descending colon?

A. Celiac trunk
B. External iliac artery
C. Inferior vena cava
D. Internal iliac artery
E. Portal vein
F. Renal artery
G. Superior mesenteric artery

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Item 27 of 40
Question Id: 11839

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A 65-year-old man with a history of hypertension, type 2 diabetes mellitus, and tobacco smoking comes to the office reporting mild back pain. Abdominal examination reveals a bruit, but no pulsatile mass is palpated. Femoral and pedal pulses are symmetric. The patient is sent for ultrasound and is found to have a large infrarenal abdominal aortic aneurysm. Open aneurysm repair is performed. During the procedure, the inferior mesenteric artery is ligated, the diseased portion of the aorta is dissected, and a graft is placed from below the renal arteries to the bifurcation of the aorta. Collateral circulation from which of the following vessels is most likely responsible for preventing ischemia of the descending colon?

- A. Celiac trunk [2%]
- B. External iliac artery [6%]
- C. Inferior vena cava [0%]
- D. Internal iliac artery [20%]
- E. Portal vein [1%]
- F. Renal artery [2%]
- ✔ G. Superior mesenteric artery [65%]

Omitted
Correct answer
G

65%
Answered correctly

3 Seconds
Time Spent

08/12/2018
Last Updated

Explanation

Block Time Remaining: 00:02:26
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The gastrointestinal tract receives its blood supply from 3 main arteries:

- Celiac trunk
- **Superior mesenteric artery** (SMA)
- **Inferior mesenteric artery** (IMA)

The celiac trunk supplies the stomach, part of the duodenum, gallbladder, liver, spleen, and pancreas **(Choice A)**. The SMA and IMA are the 2 main vessels supplying the small and large intestines and are connected by a pair of anastomoses: the **marginal artery** of Drummond, which is the principal **anastomosis**, and the inconsistently present arc of Riolan (mesenteric meandering artery). These anastomoses protect the intestines from ischemia and, due to the marginal artery, the IMA is not always reconnected during aortic aneurysm repair.

(Choice B) The **external iliac artery** supplies the inferior epigastric artery and the deep circumflex iliac artery before becoming the femoral artery. Although the inferior epigastric artery anastomoses with the superior epigastric artery, these provide blood supply to the abdominal wall, not the intestines.

(Choices C and E) The inferior vena cava (IVC) has little role in the direct drainage of the intestines except from the rectum, which partially drains via the middle and inferior rectal veins into the internal iliac veins. The remainder of the **venous drainage** occurs via the superior and inferior mesenteric veins, which drain into the portal vein. After perfusing the liver, the portal vein drains into the IVC via the hepatic veins.

(Choice D) The internal iliac artery supplies part of the rectum via the middle rectal artery. An anastomosis exists between the superior and middle rectal arteries, which can help prevent rectal ischemia after IMA occlusion. However, the SMA is more likely to prevent ischemia in the descending colon due to its proximity and the extensive collateral arcades between the SMA and IMA.

(Choice F) Although the renal arteries arise from the abdominal aorta just inferior to the SMA, they do not provide collateral circulation to the intestines.

Educational objective:
The superior mesenteric artery and inferior mesenteric artery are the 2 main vessels supplying the small and large intestines. They are connected

intestines from ischemia and, due to the marginal artery, the IMA is not always reconnected during aortic aneurysm repair.

(Choice B) The **external iliac artery** supplies the inferior epigastric artery and the deep circumflex iliac artery before becoming the femoral artery. Although the inferior epigastric artery anastomoses with the superior epigastric artery, these provide blood supply to the abdominal wall, not the intestines.

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(Choice F) Although the renal arteries arise from the abdominal aorta just inferior to the SMA, they do not provide collateral circulation to the intestines.

Educational objective:
The superior mesenteric artery and inferior mesenteric artery are the 2 main vessels supplying the small and large intestines. They are connected by a pair of anastomoses: the marginal artery of Drummond, which is the principal anastomosis, and the inconsistently present arc of Riolan (mesenteric meandering artery).

References

- Clinical interest of digestive arterial trunk anastomoses.
- Rare case of "wandering artery of drummond" as a result of chronic triple mesenteric vessel occlusion treated by isolated angioplasty and stenting of the inferior mesenteric artery.

Settings

Item 28 of 40
Question Id: 292

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A 75-year-old man is brought to the emergency department due to acute-onset profuse vomiting of large amounts of bright red blood. He has had intermittent, dull epigastric pain for the last 3 months. Medical history is significant for chronic obstructive pulmonary disease with multiple exacerbations and lumbar spinal stenosis. The patient has smoked 1 pack of cigarettes daily for 40 years. Blood pressure is 70/40 mm Hg and pulse is 120/min. Examination shows epigastric tenderness. The patient dies an hour after admission despite resuscitation efforts. Autopsy shows a deep peptic ulcer localized proximally on the lesser curvature of the stomach. The ulcer most likely penetrated which of the following arteries?

- A. Common hepatic
- B. Gastroduodenal
- C. Inferior pancreaticoduodenal
- D. Left gastric
- E. Right gastroepiploic
- F. Splenic
- G. Superior mesenteric

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2/7/2019

Settings

Item 28 of 40
Question Id: 292

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 75-year-old man is brought to the emergency department due to acute-onset profuse vomiting of large amounts of bright red blood. He has had intermittent, dull epigastric pain for the last 3 months. Medical history is significant for chronic obstructive pulmonary disease with multiple exacerbations and lumbar spinal stenosis. The patient has smoked 1 pack of cigarettes daily for 40 years. Blood pressure is 70/40 mm Hg and pulse is 120/min. Examination shows epigastric tenderness. The patient dies an hour after admission despite resuscitation efforts. Autopsy shows a deep peptic ulcer localized proximally on the lesser curvature of the stomach. The ulcer most likely penetrated which of the following arteries?

- A. Common hepatic [1%]
- B. Gastroduodenal [9%]
- C. Inferior pancreaticoduodenal [0%]
- ✔ D. Left gastric [75%]
- E. Right gastroepiploic [6%]
- F. Splenic [5%]
- G. Superior mesenteric [0%]

Omitted
Correct answer
D

75%
Answered correctly

3 Seconds
Time Spent

09/02/2018
Last Updated

Explanation

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Massive hemorrhage with hypovolemic shock is a potential life-threatening complication of peptic ulcer disease (PUD). Most cases of PUD are due to *Helicobacter pylori* infection or nonsteroidal anti-inflammatory drug use. Other risk factors include smoking, glucocorticoid use, and older age.

Most **gastric ulcers** arise along the **lesser curvature** of the stomach, usually at the transitional zone between the gastric corpus (body) and antrum. Glands in the corpus contain parietal cells that produce hydrochloric acid and intrinsic factor; mucosal glands in the antrum contain G cells that secrete gastrin. This **transitional zone** provides the optimal microenvironment (eg, pH, host immune factors) for *H pylori* proliferation. The resultant inflammation leads to mucosal atrophy and ulcer formation.

The left and right **gastric arteries** run along and perfuse the lesser curvature of the stomach, and are a common source of hemorrhage from penetrating gastric ulcers. Other potential complications of PUD include penetration into other adjacent structures (eg, biliary tract, colon), gastric outlet obstruction, and free wall perforation with peritonitis.

(Choices A and B) The common hepatic artery perfuses the liver, gallbladder, pylorus, duodenum, and pancreas. It arises from the celiac trunk and ends when it bifurcates into the proper hepatic and gastroduodenal arteries. The gastroduodenal artery supplies blood to the pylorus and proximal duodenum. Ulcers in the posterior duodenal bulb can erode into the gastroduodenal artery, but a gastric ulcer at the lesser curvature would not involve these arteries.

(Choices C and G) The superior mesenteric and inferior pancreaticoduodenal arteries do not perfuse the stomach.

(Choice E) The right gastroepiploic artery arises from the gastroduodenal artery and perfuses the distal greater curvature of the stomach. Gastric ulcers do not commonly occur in the greater curvature.

(Choice F) The splenic artery arises from the celiac trunk and supplies blood to the spleen. It is separated from the posterior wall of the stomach by the pancreas and is only rarely penetrated by gastric ulcers.

Educational objective:
Most gastric ulcers arise along the lesser curvature of the stomach, usually at the transitional zone between the gastric corpus (body) and antrum.

age.

Most **gastric ulcers** arise along the **lesser curvature** of the stomach, usually at the transitional zone between the gastric corpus (body) and antrum. Glands in the corpus contain parietal cells that produce hydrochloric acid and intrinsic factor; mucosal glands in the antrum contain G cells that secrete gastrin. This **transitional zone** provides the optimal microenvironment (eg, pH, host immune factors) for *H pylori* proliferation. The resultant inflammation leads to mucosal atrophy and ulcer formation.

The left and right **gastric arteries** run along and perfuse the lesser curvature of the stomach, and are a common source of hemorrhage from penetrating gastric ulcers. Other potential complications of PUD include penetration into other adjacent structures (eg, biliary tract, colon), gastric outlet obstruction, and free wall perforation with peritonitis.

(Choices A and B) The common hepatic artery perfuses the liver, gallbladder, pylorus, duodenum, and pancreas. It arises from the celiac trunk and ends when it bifurcates into the proper hepatic and gastroduodenal arteries. The gastroduodenal artery supplies blood to the pylorus and proximal duodenum. Ulcers in the posterior duodenal bulb can erode into the gastroduodenal artery, but a gastric ulcer at the lesser curvature would not involve these arteries.

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(Choice E) The right gastroepiploic artery arises from the gastroduodenal artery and perfuses the distal greater curvature of the stomach. Gastric ulcers do not commonly occur in the greater curvature.

(Choice F) The splenic artery arises from the celiac trunk and supplies blood to the spleen. It is separated from the posterior wall of the stomach by the pancreas and is only rarely penetrated by gastric ulcers.

Educational objective:
Most gastric ulcers arise along the lesser curvature of the stomach, usually at the transitional zone between the gastric corpus (body) and antrum. The left and right gastric arteries run along the lesser curvature and are likely to be penetrated by ulcers, causing gastric bleeding.

Settings

Item 29 of 40
Question Id: 303

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A 32-year-old female presents to your office with severe nausea and recurrent bilious vomiting. Her symptoms initially began as postprandial epigastric pain and early satiety, but have progressed over the last two weeks. She works as an actress, and tells you that her symptoms only started when she "landed a role in a soap opera" and was inspired to lose 25 lbs. on a "crash diet". On physical exam, her abdomen is tender and slightly distended with high-pitched bowel sounds. Concerned about a small bowel obstruction, you admit the patient to the hospital. A laparotomy is performed, and it is observed that the angle between her superior mesenteric artery and her aorta is significantly decreased. Which of the following structures is most likely to be obstructed by the artery?

- A. Ascending portion of the duodenum
- B. Descending portion of the duodenum
- C. Duodenal bulb
- D. Duodenojejunal flexure
- E. Gastric antrum
- F. Transverse portion of the duodenum

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Settings

Item 29 of 40
Question Id: 303

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 32-year-old female presents to your office with severe nausea and recurrent bilious vomiting. Her symptoms initially began as postprandial epigastric pain and early satiety, but have progressed over the last two weeks. She works as an actress, and tells you that her symptoms only started when she "landed a role in a soap opera" and was inspired to lose 25 lbs. on a "crash diet". On physical exam, her abdomen is tender and slightly distended with high-pitched bowel sounds. Concerned about a small bowel obstruction, you admit the patient to the hospital. A laparotomy is performed, and it is observed that the angle between her superior mesenteric artery and her aorta is significantly decreased. Which of the following structures is most likely to be obstructed by the artery?

- A. Ascending portion of the duodenum [4%]
- B. Descending portion of the duodenum [9%]
- C. Duodenal bulb [5%]
- D. Duodenojejunal flexure [15%]
- E. Gastric antrum [2%]
- ✔ F. Transverse portion of the duodenum [62%]

Omitted
Correct answer
F

62%
Answered correctly

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Time Spent

12/28/2018
Last Updated

Explanation

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✔ F. Transverse portion of the duodenum [62%]

Omitted
Correct answer
F

62%
Answered correctly

3 Seconds
Time Spent

12/28/2018
Last Updated

Explanation

The superior mesenteric artery (SMA) leaves the aorta at the level of L1 and supplies the intestine from the duodenum and pancreas to the left colic flexure. The transverse portion of the duodenum lies horizontally at the level of L3, between the aorta and superior mesenteric artery. Normally, the SMA and aorta form an approximately 45 degree angle. If this angle diminishes to less than 20 degrees, the transverse portion of the duodenum can get entrapped between the SMA and aorta, leading to symptoms of partial small bowel obstruction. This condition is called superior mesenteric artery syndrome.

Narrowing of the aortomesenteric angle can occur with any condition that causes **diminished mesenteric fat**, including low body weight, recent weight loss, severe burns or other inducers of catabolism, and prolonged bed rest. It can also occur with pronounced lordosis or after surgical correction of scoliosis, as this procedure lengthens the spine resulting in decreased mobility of the SMA.

Educational Objective:
Superior mesenteric artery syndrome occurs when the transverse portion of the duodenum is entrapped between the SMA and aorta, causing symptoms of partial intestinal obstruction. This syndrome occurs when the aortomesenteric angle critically decreases, secondary to diminished mesenteric fat, pronounced lordosis, or surgical correction of scoliosis.

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E Transverse portion of the duodenum [62%]

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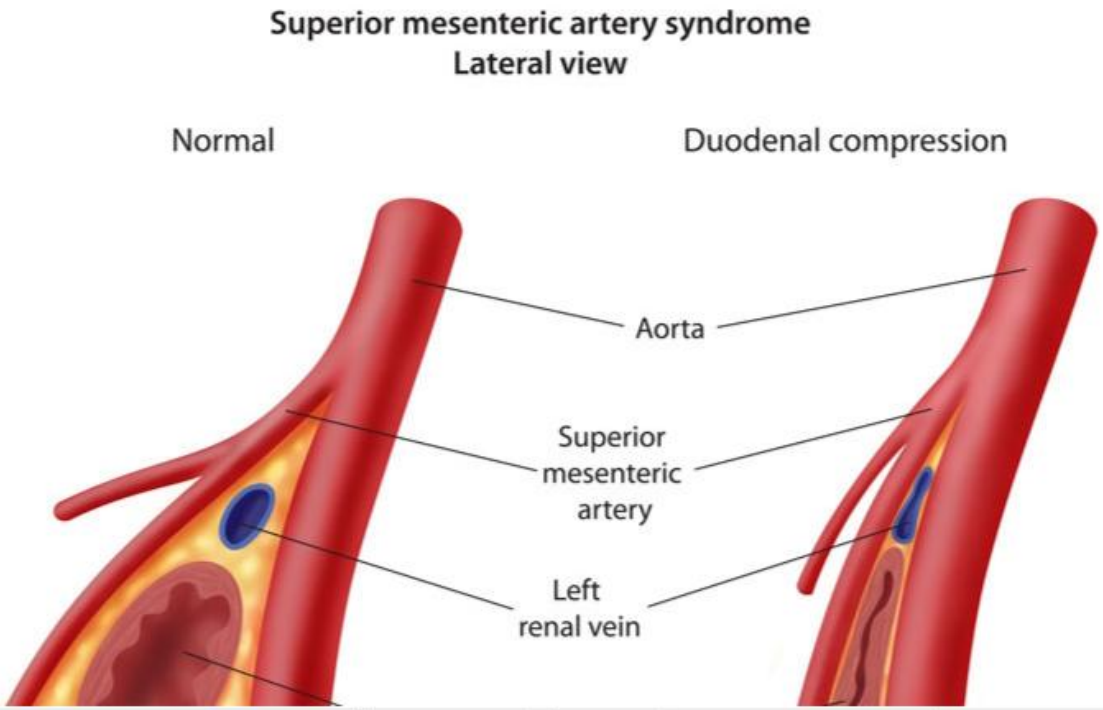

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Question Id: 303

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E. Transverse portion of the duodenum [62%]

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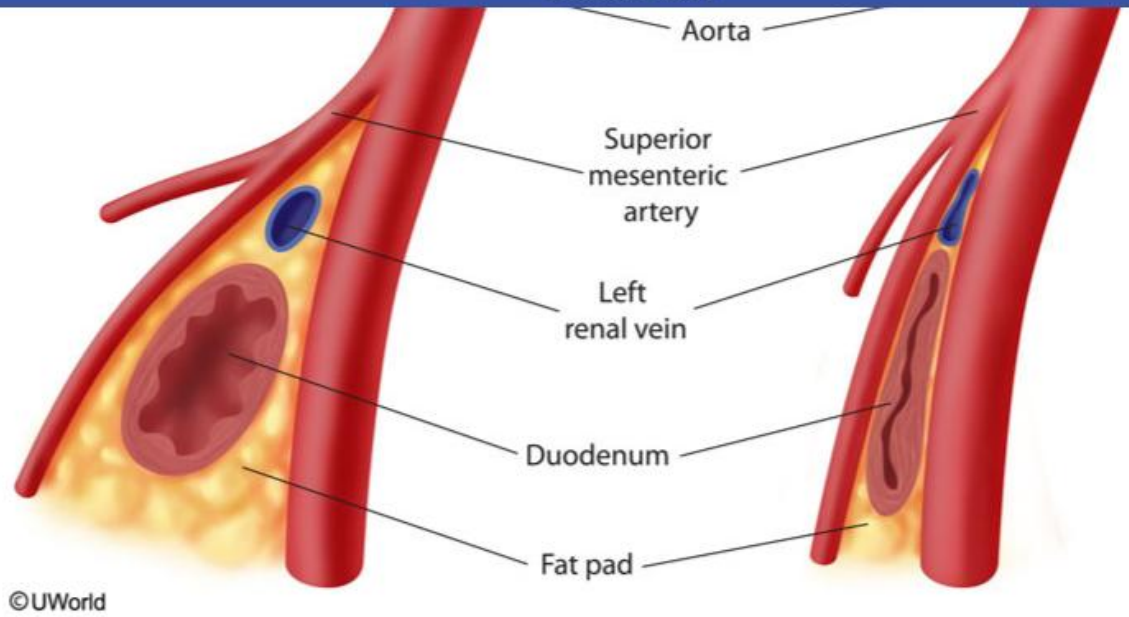

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Item 30 of 40
Question Id: 330

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It is suggested that some unknown factors may specifically interrupt the normal migration of neural crest cells to the intestine. This migration process is typically complete by the 12th week. If progress is interrupted during the final week of migration, which of the following organs are most likely to be affected?

- A. Duodenum
- B. Jejunum
- C. Ileum
- D. Cecum
- E. Sigmoid colon
- F. Rectum

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Item 30 of 40
Question Id: 330

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

It is suggested that some unknown factors may specifically interrupt the normal migration of neural crest cells to the intestine. This migration process is typically complete by the 12th week. If progress is interrupted during the final week of migration, which of the following organs are most likely to be affected?

- A. Duodenum [6%]
- B. Jejunum [2%]
- C. Ileum [8%]
- D. Cecum [5%]
- E. Sigmoid colon [31%]
- ✔ F. Rectum [43%]

Omitted
Correct answer
F

43%
Answered correctly

5 Seconds
Time Spent

02/06/2019
Last Updated

Explanation

Neural crest cells start migrating to the intestinal wall very early during embryonic development. They give rise to ganglion cells of the submucosal (Meissner) and myenteric (Auerbach) plexi of the bowel wall. These parasympathetic ganglia are responsible for intestinal peristalsis. Neural

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Explanation

Neural crest cells start migrating to the intestinal wall very early during embryonic development. They give rise to ganglion cells of the submucosal (Meissner) and myenteric (Auerbach) plexi of the bowel wall. These parasympathetic ganglia are responsible for intestinal peristalsis. Neural crest cells move caudally along the vagal nerve fibers. They are present in the wall of proximal colon at 8th week of gestation and in the rectum by 12th week.

The arrest of migration of neural crest cells causes Hirschsprung disease, in which a segment of colon is deprived of ganglion cells. Since neural crest cells migrate caudally, the rectum is always involved in Hirschsprung disease. The absence of ganglion cells in the colonic wall causes the affected segment to be narrowed because it cannot relax. The passage of intestinal contents through this area is difficult, and compensatory dilatation of proximal areas of the colon occurs.

Newborns with Hirschsprung disease fail to pass meconium within 48 hours of birth. They also demonstrate other symptoms of intestinal obstruction, such as bilious vomiting and abdominal distention. The bowel is filled with stool, but the rectum is empty; the tone of the anal sphincter is usually increased. Rectal biopsy reveals an aganglionic segment of bowel.

(Choices A, B and C) Involvement of the duodenum, jejunum, and ileum is extremely rare, although cases of total intestinal agangliosis have been described.

(Choice D) The cecum is rarely involved in Hirschsprung disease.

(Choice E) The sigmoid colon is involved in Hirschsprung disease in 75% of the cases. The rectum and anus, however, are always involved.

Educational Objective:
Hirschsprung disease is a result of abnormal migration of neural crest cells during embryogenesis. These cells are the precursors of ganglion cells of intestinal wall plexi. Since neural crest cells migrate caudally, the rectum is always affected in Hirschsprung disease.

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Item 31 of 40
Question Id: 2022

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A 35-year-old man comes to the emergency department due to persistent abdominal pain. Yesterday, during a soccer game, he suffered a full-speed collision with another player. He had diffuse abdominal pain at the time but did not seek care until this morning, when the pain seemed to worsen. As part of the patient's evaluation, a CT scan of the abdomen is obtained and shown in the image below. It is determined that his injury involves an organ that is supplied mainly by an artery of the foregut even though the organ itself is not a foregut derivative. Which of the following organs is most likely to be injured in this patient?

- A. A
- B. B
- C. C
- D. D
- E. E

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Item 31 of 40
Question Id: 2022

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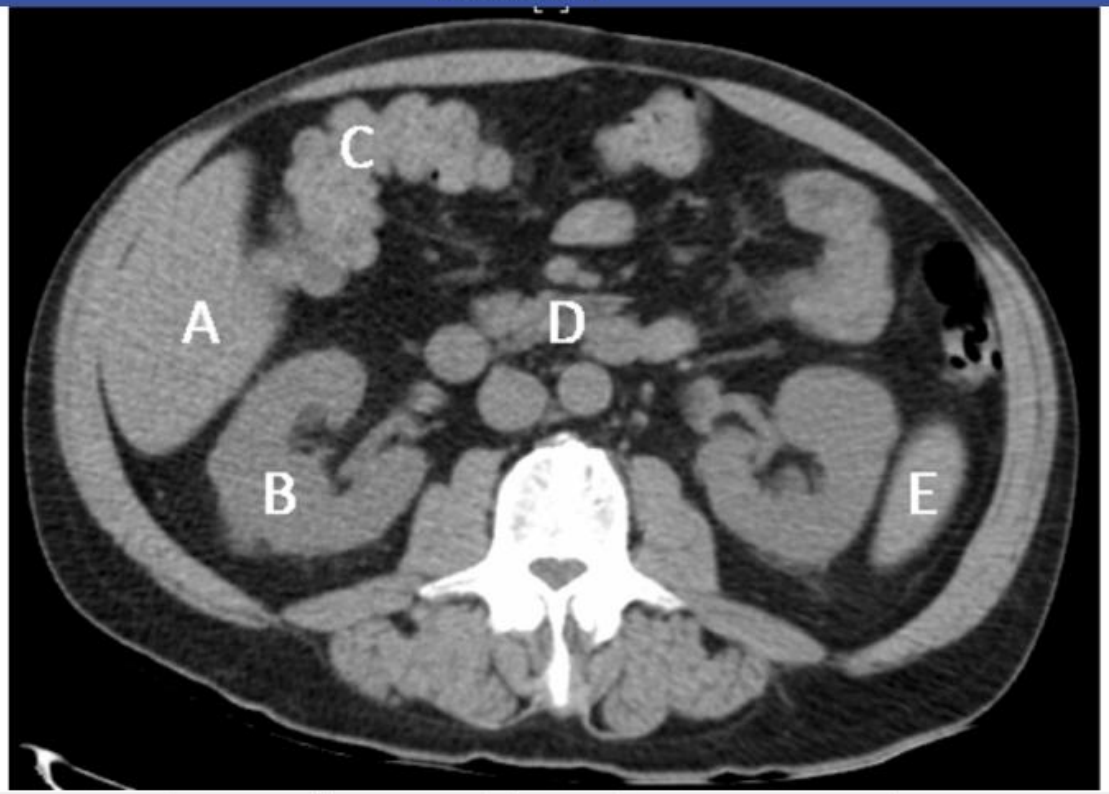

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A. A [9%]

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2/13/2019

Settings

Item 31 of 40
Question Id: 2022

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 35-year-old man comes to the emergency department due to persistent abdominal pain. Yesterday, during a soccer game, he suffered a full-speed collision with another player. He had diffuse abdominal pain at the time but did not seek care until this morning, when the pain seemed to worsen. As part of the patient's evaluation, a CT scan of the abdomen is obtained and shown in the image below. It is determined that his injury involves an organ that is supplied mainly by an artery of the foregut even though the organ itself is not a foregut derivative. Which of the following organs is most likely to be injured in this patient?

- A. A
- B. B
- C. C
- D. D
- E. E

Submit

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Settings

Item 31 of 40
Question Id: 2022

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 35-year-old man comes to the emergency department due to persistent abdominal pain. Yesterday, during a soccer game, he suffered a full-speed collision with another player. He had diffuse abdominal pain at the time but did not seek care until this morning, when the pain seemed to worsen. As part of the patient's evaluation, a CT scan of the abdomen is obtained and shown in the image below. It is determined that his injury involves an organ that is supplied mainly by an artery of the foregut even though the organ itself is not a foregut derivative. Which of the following organs is most likely to be injured in this patient?

- A. A [9%]
- B. B [3%]
- C. C [5%]
- D. D [11%]
- ✔ E. E [69%]

Omitted
Correct answer
E

69%
Answered correctly

3 Seconds
Time Spent

01/16/2019
Last Updated

Explanation

The most common intra-abdominal organ injured during **blunt trauma** is the **spleen**. CT scans and MRI are conventionally presented so that the patient's left is on the reader's right (imagine that the patient is supine with the feet directed toward the viewer). This is a relatively caudal (lower) abdominal image that includes the kidneys; therefore, only the tail of the spleen is visible.

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13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

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2/7/2019

Explanation

The most common intra-abdominal organ injured during **blunt trauma** is the **spleen**. CT scans and MRI are conventionally presented so that the patient's left is on the reader's right (imagine that the patient is supine with the feet directed toward the viewer). This is a relatively caudal (lower) abdominal image that includes the kidneys; therefore, only the tail of the spleen is visible.

The spleen is an intraperitoneal organ derived from the **mesoderm** of the dorsal mesentery. However, the spleen is unique in that its blood supply derives from a **foregut derivative** (the splenic artery off of the **celiac trunk**). Venous return from the spleen courses through the **splenic vein** to return to the portal circulation rather than the systemic circulation.

(Choice A) The liver is an endoderm-derived structure of the foregut and receives its arterial blood from the proper hepatic artery (via the celiac trunk). The liver also receives venous blood from the gut via the portal vein.

(Choice B) Like the spleen, the kidneys are derived from the mesoderm. However, the kidneys are retroperitoneal and supplied by the renal arteries (from the abdominal aorta) and drained by the renal veins (to the inferior vena cava).

(Choice C) The first two-thirds of the transverse colon is derived from the midgut and supplied by the superior mesenteric artery. The last one-third of the transverse colon arises from the hindgut and is supplied by branches of the inferior mesenteric artery. These 2 vessels anastomose via the marginal artery.

(Choice D) The pancreas is an endoderm-derived structure of the foregut that receives blood primarily from the superior and inferior pancreaticoduodenal arteries.

Educational objective:
The spleen is of mesodermal origin (the dorsal mesentery). Although it is supplied by the splenic artery (a branch of the major foregut vessel, the celiac trunk), it is not a foregut derivative.

References

Settings

Item 32 of 40
Question Id: 1525

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 68-year-old woman comes to the emergency department due to a 2-day history of crampy abdominal pain and vomiting. The patient has had no hematemesis, melena, or hematochezia. She has a history of hypertension, type 2 diabetes mellitus, and coronary artery disease. Several months ago, the patient had an episode of acute calculous cholecystitis that was managed non-operatively. Physical examination shows a distended, tympanic abdomen with high-pitched bowel sounds. Abdominal x-ray reveals air in the gallbladder and biliary tree. This patient's gallstone has most likely lodged in which of the following sites?

- A. Common bile duct
- B. Cystic duct
- C. Duodenum
- D. Ileum
- E. Jejunum

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Settings

Item 32 of 40
Question Id: 1525

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 68-year-old woman comes to the emergency department due to a 2-day history of crampy abdominal pain and vomiting. The patient has had no hematemesis, melena, or hematochezia. She has a history of hypertension, type 2 diabetes mellitus, and coronary artery disease. Several months ago, the patient had an episode of acute calculous cholecystitis that was managed non-operatively. Physical examination shows a distended, tympanic abdomen with high-pitched bowel sounds. Abdominal x-ray reveals air in the gallbladder and biliary tree. This patient's gallstone has most likely lodged in which of the following sites?

- A. Common bile duct [24%]
- B. Cystic duct [11%]
- C. Duodenum [17%]
- ✔ D. Ileum [44%]
- E. Jejunum [1%]

Omitted
Correct answer
D

44%
Answered correctly

3 Seconds
Time Spent

11/07/2018
Last Updated

Explanation

This patient likely has **gallstone ileus**, an uncommon complication of longstanding cholelithiasis that usually occurs in elderly women. A large (typically ≥2.5 cm) gallstone causes formation of a **cholecystoenteric fistula** between the gallbladder and adjoining gut (most often the

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This patient likely has **gallstone ileus**, an uncommon complication of longstanding cholelithiasis that usually occurs in elderly women. A large (typically ≥2.5 cm) gallstone causes formation of a **cholecystoenteric fistula** between the gallbladder and adjoining gut (most often the duodenum) due to pressure necrosis and erosion of these tissues.

Fistula formation allows passage of the gallstone into the small bowel, where it travels freely until it becomes trapped in the **ileum**, the narrowest portion of the intestine. Patients consequently develop symptoms/signs of **small bowel obstruction**, including abdominal pain/distension, nausea/vomiting, high-pitched (tinkling) bowel sounds, and tenderness to palpation. Abdominal x-ray may reveal dilated loops of bowel with air-fluid levels due to intestinal obstruction. Communication between the intestine and gallbladder may also allow gas to enter the biliary tree (**pneumobilia**).

(Choice A) Obstruction of the common bile duct by a gallstone (choledocholithiasis) can lead to pancreatitis and/or cholangitis. Cholangitis typically presents with fever, right upper quadrant abdominal pain, and jaundice (Charcot triad). Pneumobilia and features of small bowel obstruction are not characteristic.

(Choice B) Obstruction of the cystic duct by a gallstone may result in biliary colic or acute cholecystitis. Acute cholecystitis usually presents with fever, abdominal pain, leukocytosis, and an inspiratory pause during right upper quadrant palpation (Murphy sign). Pneumobilia and features of small bowel obstruction are not characteristic.

(Choices C and E) The caliber of the duodenum and jejunum is typically sufficient to allow passage of larger gallstones that cause gallstone ileus.

Educational objective:
Gallstone ileus results from passage of a large gallstone through a cholecystenteric fistula into the small bowel, where it ultimately causes obstruction at the ileum. Patients typically present with symptoms/signs of small bowel obstruction, and an abdominal x-ray may reveal gas within the gallbladder and biliary tree.

Settings

Item 33 of 40
Question Id: 8574

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 56-year-old man comes to the physician complaining of early satiety, nausea, and vague epigastric pain for the past 4 months. He has a 36-pack-year smoking history and admits to drinking alcohol daily for the past 15 years. On physical examination, the patient appears thin and cachectic. Palpation of his abdomen reveals splenomegaly. Abdominal CT scan shows a large irregular mass extending posteriorly from the greater curvature of the stomach, impinging on the splenic artery and vein as they pass below. Tissues supplied by which of the following arteries would most likely be affected by compression of the splenic artery?

- A. Gastroduodenal
- B. Left gastroepiploic
- C. Right gastric
- D. Right gastroepiploic
- E. Short gastric

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2/7/2019

Settings

Item 33 of 40
Question Id: 8574

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 56-year-old man comes to the physician complaining of early satiety, nausea, and vague epigastric pain for the past 4 months. He has a 36-pack-year smoking history and admits to drinking alcohol daily for the past 15 years. On physical examination, the patient appears thin and cachectic. Palpation of his abdomen reveals splenomegaly. Abdominal CT scan shows a large irregular mass extending posteriorly from the greater curvature of the stomach, impinging on the splenic artery and vein as they pass below. Tissues supplied by which of the following arteries would most likely be affected by compression of the splenic artery?

- A. Gastroduodenal [4%]
- B. Left gastroepiploic [31%]
- C. Right gastric [4%]
- D. Right gastroepiploic [5%]
- ✔ E. Short gastric [54%]

Omitted
Correct answer
E

54%
Answered correctly

3 Seconds
Time Spent

12/19/2018
Last Updated

Explanation

The splenic artery originates from the celiac artery and courses superior to the pancreas. Along its route, it gives off several branches to the stomach and pancreas before reaching the spleen. The short gastric arteries and the left gastroepiploic artery arise from the splenic artery

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2/7/2019

Omitted
Correct answer
E

54%
Answered correctly

3 Seconds
Time Spent

12/19/2018
Last Updated

Explanation

The splenic artery originates from the celiac artery and courses superior to the pancreas. Along its route, it gives off several branches to the stomach and pancreas before reaching the spleen. The short gastric arteries and the left gastroepiploic artery arise from the splenic artery immediately after it passes the greater curvature of the stomach. The short gastric arteries have very poor anastomoses, and the tissue supplied by them is vulnerable to ischemic injury following splenic artery blockage. In contrast, tissues supplied by the left gastroepiploic artery can be alternatively supplemented by its strong anastomotic connection with the right gastroepiploic artery **(Choice B)**.

(Choice A) The gastroduodenal artery supplies blood to the pylorus and the proximal part of the duodenum. It arises from the common hepatic artery.

(Choice C) The right gastric artery supplies blood to the distal lesser curvature of the stomach. It arises from the proper hepatic artery.

(Choice D) The right gastroepiploic artery arises from the gastroduodenal artery and perfuses the distal greater curvature of the stomach. It forms an anastomosis with the left gastroepiploic artery.

Educational objective:
The splenic artery originates from the **celiac artery** and gives off several branches to the stomach and pancreas (pancreatic, short gastric, and left gastroepiploic arteries) before finally reaching the spleen. Due to poor anastomoses, the gastric tissue supplied by the short gastric arteries is vulnerable to ischemic injury following splenic artery blockage.

Exhibit Display

Splenic artery branches	Distribution
Pancreatic branches	Run posterior to the upper border of the pancreas, supplying its body and tail
Left gastroepiploic artery	Supply the middle part of the greater curvature of the stomach
Short gastric branches	Supplies the upper part of the greater curvature of the stomach

Zoom In | Zoom Out | Reset | Add To Flash Card

Settings

Item 34 of 40
Question Id: 1537

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 53-year-old man who has not seen a physician in years presents to your office complaining of abdominal distention. He states "Last month my stomach started to swell up and it hasn't gotten any better". He has no other medical problems. The patient admits to drinking 10-12 beers a day for the last 20 years. His temperature is 36.7 C (98 F), blood pressure is 116/72 mm Hg, pulse is 78/min and respirations are 20/min. On examination his abdomen is distended with engorged paraumbilical veins. There is also palmar erythema and multiple spider angiomas are present. You decided to place him on a low-salt diet and start therapy with furosemide and spironolactone, with subsequent improvement of his abdominal distention. Before beginning this patient's treatment, which of the following structures labeled on the image below is expected to have an increased pressure?

- A. A
- B. B
- C. C
- D. D

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Item 34 of 40
Question Id: 1537

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

Exhibit Display

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Settings

Item 34 of 40
Question Id: 1537

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 53-year-old man who has not seen a physician in years presents to your office complaining of abdominal distention. He states "Last month my stomach started to swell up and it hasn't gotten any better". He has no other medical problems. The patient admits to drinking 10-12 beers a day for the last 20 years. His temperature is 36.7 C (98 F), blood pressure is 116/72 mm Hg, pulse is 78/min and respirations are 20/min. On examination his abdomen is distended with engorged paraumbilical veins. There is also palmar erythema and multiple spider angiomas are present. You decided to place him on a low-salt diet and start therapy with furosemide and spironolactone, with subsequent improvement of his abdominal distention. Before beginning this patient's treatment, which of the following structures labeled on the image below is expected to have an increased pressure?

- A. A
- B. B
- C. C
- D. D

Submit

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Settings

Item 34 of 40
Question Id: 1537

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 53-year-old man who has not seen a physician in years presents to your office complaining of abdominal distention. He states "Last month my stomach started to swell up and it hasn't gotten any better". He has no other medical problems. The patient admits to drinking 10-12 beers a day for the last 20 years. His temperature is 36.7 C (98 F), blood pressure is 116/72 mm Hg, pulse is 78/min and respirations are 20/min. On examination his abdomen is distended with engorged paraumbilical veins. There is also palmar erythema and multiple spider angiomas are present. You decided to place him on a low-salt diet and start therapy with furosemide and spironolactone, with subsequent improvement of his abdominal distention. Before beginning this patient's treatment, which of the following structures labeled on the image below is expected to have an increased pressure?

- A. A [3%]
- B. B [18%]
- ✔ C. C [71%]
- D. D [5%]

Omitted
Correct answer
C

71%
Answered correctly

3 Seconds
Time Spent

01/24/2019
Last Updated

Explanation

The patient described in the question stem is likely suffering from alcoholic cirrhosis. Alcoholic cirrhosis is a form of micronodular cirrhosis associated with hepatocyte death followed by fine fibrosis of the liver. As cirrhosis worsens and the number of functioning hepatocytes decreases,

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The patient described in the question stem is likely suffering from alcoholic cirrhosis. Alcoholic cirrhosis is a form of micronodular cirrhosis associated with hepatocyte death followed by fine fibrosis of the liver. As cirrhosis worsens and the number of functioning hepatocytes decreases, the functional ability of the liver diminishes. In advanced disease, portal blood has an increasingly difficult time passing through the liver because the vasculature becomes compromised by the progressive fibrosis, causing portal hypertension. Of the structures identified on the image above, only the portal and splenic veins are part of the portal venous system. In this patient, high pressure would be expected throughout the portal system, including the superior mesenteric, portal, and splenic veins. The effects of prolonged portal hypertension include varices at the four sites of portocaval anastomoses (esophagus, rectum, umbilicus, and retroperitoneal), as well as ascites.

The pathogenesis of ascites in patients with cirrhosis is complex. In addition to mechanical compromise of portal vein flow by fibrotic tissue, vasoactive agents also play a role by causing dilatation of the splanchnic arterial vasculature and further intrahepatic vasoconstriction. These processes result in increased portal vein hydrostatic pressure leading to ascitic fluid formation, as well as decreased systemic perfusion pressure. The kidney senses the decreased perfusion pressure (accentuated by renal vasoconstriction in hepatorenal syndrome) and responds with avid retention of sodium and water, thus promoting further increase in ascitic fluid formation. Treatment of ascites secondary to cirrhosis involves restriction of sodium intake combined with diuretics. The most commonly prescribed initial therapy is a combination of furosemide and spironolactone.

(Choice A) The descending abdominal aorta will have elevated pressures in patients with systemic hypertension.

(Choice B) The inferior vena cava experiences increased pressure in cases of heart failure. This patient does not present with the typical symptoms associated with heart failure, such as lower extremity edema and shortness of breath.

(Choice D) The celiac trunk emerges from the aorta at this level (T12 / L1).

Educational Objective:
The portal vein can be identified on cross-sectional scans lying medial to (or just within) the right lobe of the liver and anterior to the inferior vena cava. The pressure in the portal system is elevated in liver cirrhosis.

Settings

Item 35 of 40
Question Id: 11795

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 64-year-old man comes to the emergency department after an episode of hematemesis. He also reports dark stools and abdominal pain for the past several days. The patient has a history of chronic pancreatitis. Abdominal examination shows epigastric tenderness to palpation. Rectal examination is notable for black, guaiac-positive feces. Upper gastrointestinal endoscopy reveals a bleeding spot within a cluster of enlarged tortuous veins in the gastric fundus. The rest of the stomach and esophagus appears normal. Increased pressure in which of the following vascular structures is the most likely cause of this patient's condition?

- A. Azygos vein
- B. Left gastric vein
- C. Pancreaticoduodenal vein
- D. Splenic vein
- E. Superior mesenteric vein

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A 64-year-old man comes to the emergency department after an episode of hematemesis. He also reports dark stools and abdominal pain for the past several days. The patient has a history of chronic pancreatitis. Abdominal examination shows epigastric tenderness to palpation. Rectal examination is notable for black, guaiac-positive feces. Upper gastrointestinal endoscopy reveals a bleeding spot within a cluster of enlarged tortuous veins in the gastric fundus. The rest of the stomach and esophagus appears normal. Increased pressure in which of the following vascular structures is the most likely cause of this patient's condition?

- A. Azygos vein [6%]
- B. Left gastric vein [51%]
- C. Pancreaticoduodenal vein [7%]
- ✔ D. Splenic vein [30%]
- E. Superior mesenteric vein [3%]

Omitted
Correct answer
D

30%
Answered correctly

3 Seconds
Time Spent

11/30/2018
Last Updated

Explanation

Gastric varices are dilated submucosal veins that can cause life-threatening bleeding in the upper gastrointestinal tract. The varices are commonly due to portal hypertension, which can be a complication of cirrhosis. Gastric varices can also be seen with **splenic vein thrombosis**

Gastric varices are dilated submucosal veins that can cause life-threatening bleeding in the upper gastrointestinal tract. The varices are commonly due to portal hypertension, which can be a complication of cirrhosis. Gastric varices can also be seen with **splenic vein thrombosis** due to chronic pancreatitis, pancreatic cancer, and abdominal tumors. The splenic vein runs along the posterior surface of the pancreas and can develop a blood clot from pancreatic inflammation. The **short gastric veins** drain the fundus of the stomach into the splenic vein. Splenic vein thrombosis can increase pressure in the short gastric veins and cause **gastric varices** only in the **fundus**. The rest of the stomach and esophagus are usually not affected.

(Choice A) The azygos vein drains blood from the esophageal veins into the superior vena cava. The formation of esophageal varices in the setting of portal hypertension provides collateral drainage from the portal venous system to the azygos system. The azygos vein also provides collateral circulation between the superior and inferior vena cava and can become enlarged with caval obstruction.

(Choice B) The left gastric vein drains blood from the upper stomach and lower esophagus into the portal vein. Portal hypertension can increase pressure in the left gastric veins and usually causes both gastric and esophageal varices.

(Choices C and E) The pancreaticoduodenal vein drains the pancreas and duodenum into the superior mesenteric vein (SMV). The SMV also drains blood from the lower stomach (via the right gastroepiploic vein) and small intestine. Blockage of the SMV could lead to variceal formation in the lower stomach, but not the upper regions.

Educational objective:
The short gastric veins drain blood from the gastric fundus into the splenic vein. Pancreatic inflammation (eg, pancreatitis, pancreatic cancer) can cause a blood clot within the splenic vein, which can increase pressure in the short gastric veins and lead to gastric varices only in the fundus.

References

- Repeated pancreatitis-induced splenic vein thrombosis leads to intractable gastric variceal bleeding: A case report and review.

Settings

Item 36 of 40
Question Id: 838

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 39-year-old woman is brought to the emergency department after an end-to-end motor vehicle collision. She was a restrained passenger and denies hitting her head or losing consciousness but has had abdominal pain and nausea since the accident. The patient's blood pressure is 115/55 mm Hg and pulse is 96/min and regular. On examination, she has ecchymosis over the area of the seat belt and abdominal tenderness. CT scan of the abdomen reveals a retroperitoneal hematoma. This patient most likely experienced which of the following injuries?

- A. Contusion of the body of the pancreas
- B. Laceration of the inferior border of the spleen
- C. Laceration of the right hepatic lobe
- D. Rupture of the suprarenal aorta
- E. Tear at the lesser curvature of the stomach
- F. Tear at the proximal transverse colon

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2/7/2019

Settings

Item 36 of 40
Question Id: 838

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 39-year-old woman is brought to the emergency department after an end-to-end motor vehicle collision. She was a restrained passenger and denies hitting her head or losing consciousness but has had abdominal pain and nausea since the accident. The patient's blood pressure is 115/55 mm Hg and pulse is 96/min and regular. On examination, she has ecchymosis over the area of the seat belt and abdominal tenderness. CT scan of the abdomen reveals a retroperitoneal hematoma. This patient most likely experienced which of the following injuries?

- A. Contusion of the body of the pancreas [43%]
- B. Laceration of the inferior border of the spleen [38%]
- C. Laceration of the right hepatic lobe [2%]
- D. Rupture of the suprarenal aorta [12%]
- E. Tear at the lesser curvature of the stomach [0%]
- F. Tear at the proximal transverse colon [2%]

Omitted
Correct answer
A

43%
Answered correctly

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Time Spent

10/04/2018
Last Updated

Explanation

Retroperitoneal hematomas are commonly associated with abdominal and pelvic trauma. Pancreatic injury is a frequent cause of retroperitoneal hematomas. It can occur following severe blunt or penetrating abdominal trauma, such as from malpositioned seat belts or steering wheels during

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A

Explanation

Retroperitoneal hematomas are commonly associated with abdominal and pelvic trauma. Pancreatic injury is a frequent cause of retroperitoneal hematomas. It can occur following severe blunt or penetrating abdominal trauma, such as from malpositioned seat belts or steering wheels during motor vehicle collisions. Pancreatic injury with retroperitoneal hematoma may initially cause only mild symptoms or be asymptomatic, but it can lead to life-threatening blood loss. Therefore, an abdominal CT scan is frequently performed in patients with blunt abdominal trauma to rule out retroperitoneal hematoma.

(Choices B, C, E, and F) The spleen, liver, stomach, and transverse colon are intraperitoneal organs. Lacerations or rupture of these organs can occur in blunt abdominal trauma, but these injuries would lead to hemoperitoneum (free blood in the peritoneal space), not retroperitoneal hematoma.

(Choice D) Although the abdominal aorta is a retroperitoneal structure, rupture would most likely result in massive and rapid blood loss leading to hemorrhagic shock.

Educational objective:
Retroperitoneal hematoma is a common complication of abdominal and pelvic trauma. The pancreas is a retroperitoneal organ, and pancreatic injury is frequently a source of retroperitoneal bleeding.

References

- The diagnosis and treatment of traumatic retroperitoneal hematoma.

Settings

Item 37 of 40
Question Id: 322

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 3-year-old boy is brought to the emergency department by his parents after he develops acute abdominal pain and vomiting. Imaging studies reveal a foreign body lodged within his intestine causing a small bowel obstruction. Laparotomy is performed to remove the foreign body; during the procedure, an incidental abdominal cyst is discovered and removed. The cyst is connected by a fibrous band to the ileum and the umbilicus. Which of the following conditions is also caused by the same embryologic defect responsible for this patient's abdominal cyst?

- A. Duodenal atresia
- B. Hirschsprung disease
- C. Meckel diverticulum
- D. Umbilical hernia
- E. Imperforate anus
- F. Omphalocele
- G. Malrotation

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Settings

Item 37 of 40
Question Id: 322

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 3-year-old boy is brought to the emergency department by his parents after he develops acute abdominal pain and vomiting. Imaging studies reveal a foreign body lodged within his intestine causing a small bowel obstruction. Laparotomy is performed to remove the foreign body; during the procedure, an incidental abdominal cyst is discovered and removed. The cyst is connected by a fibrous band to the ileum and the umbilicus. Which of the following conditions is also caused by the same embryologic defect responsible for this patient's abdominal cyst?

- A. Duodenal atresia [1%]
- B. Hirschsprung disease [0%]
- ✔ C. Meckel diverticulum [79%]
- D. Umbilical hernia [5%]
- E. Imperforate anus [1%]
- F. Omphalocele [8%]
- G. Malrotation [2%]

Omitted
Correct answer
C

79%
Answered correctly

3 Seconds
Time Spent

11/17/2018
Last Updated

Explanation

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The omphalomesenteric (vitelline) duct connects the midgut lumen with the yolk sac cavity early in embryonic life. It normally obliterates during the 7th week of embryonic development. If its obliteration is incomplete or abnormal, a number of abnormalities can result:

1. A **persistent vitelline duct**, or vitelline fistula, occurs due to complete failure of the vitelline duct to close. A small connection between the intestinal lumen and the outside of the body exists at the umbilicus. Meconium discharge from the umbilicus is seen soon after birth if such a fistula is present.
2. **Meckel diverticulum** is the most common vitelline duct anomaly. It results from a partial closure of the vitelline duct, with the patent portion attached to the ileum. A fibrous band may connect the tip of the Meckel diverticulum with the umbilicus.
3. **Vitelline sinus** results from a partial closure of the vitelline duct, with the patent portion open at the umbilicus.
4. **Vitelline duct cyst** (enterocyst) forms if peripheral portions of the vitelline duct (connected to the ileum and umbilicus) obliterate, but the central part remains. This cyst is connected with the ileum and abdominal wall by fibrous bands.

Most vitelline duct abnormalities are asymptomatic and often discovered incidentally. However, Meckel diverticulum may present with rectal bleeding or intestinal obstruction. Remember the rule of 2's with Meckel diverticulum: 2% of the population, 2 feet from the ileocecal valve, 2 inches in length, 2% are symptomatic, and males are 2 times more likely to be affected.

(Choice A) Duodenal atresia results from failure of the duodenum to recanalize in early embryonic life. Although often associated with trisomy 21, it is not associated with any vitelline duct anomalies.

(Choice B) Hirschsprung disease results from the failure of migration of neural crest cells into the intestinal wall.

(Choice D) Umbilical hernias occur due to weakness of the abdominal wall at the umbilicus. These hernias are common in children and usually close spontaneously by 2 years of age. Unlike omphaloceles, umbilical hernias are midline protrusions that are covered by skin.

(Choice E) Imperforate anus occurs due to abnormal development of anorectal structures. This condition manifests during the first days of life, when the newborn fails to pass meconium.

(Choice F) Omphalocele is a midline defect in the abdominal wall due to incomplete closure during fetal life. Abdominal organs protrude through

4. **Vitelline duct cyst** (enterocyst) forms if peripheral portions of the vitelline duct (connected to the ileum and umbilicus) obliterate, but the central part remains. This cyst is connected with the ileum and abdominal wall by fibrous bands.

Most vitelline duct abnormalities are asymptomatic and often discovered incidentally. However, Meckel diverticulum may present with rectal bleeding or intestinal obstruction. Remember the rule of 2's with Meckel diverticulum: 2% of the population, 2 feet from the ileocecal valve, 2 inches in length, 2% are symptomatic, and males are 2 times more likely to be affected.

(Choice A) Duodenal atresia results from failure of the duodenum to recanalize in early embryonic life. Although often associated with trisomy 21, it is not associated with any vitelline duct anomalies.

(Choice B) Hirschsprung disease results from the failure of migration of neural crest cells into the intestinal wall.

(Choice D) Umbilical hernias occur due to weakness of the abdominal wall at the umbilicus. These hernias are common in children and usually close spontaneously by 2 years of age. Unlike omphaloceles, umbilical hernias are midline protrusions that are covered by skin.

(Choice E) Imperforate anus occurs due to abnormal development of anorectal structures. This condition manifests during the first days of life, when the newborn fails to pass meconium.

(Choice F) Omphalocele is a midline defect in the abdominal wall due to incomplete closure during fetal life. Abdominal organs protrude through the defect, covered with a peritoneal sac.

(Choice G) Malrotation results from the failure of the midgut to rotate counterclockwise as it returns to the abdominal cavity during early embryonic development. Malrotation leads to abnormal positioning of the intestine in the abdominal cavity and sometimes twisting of an intestinal loop (volvulus).

Educational objective:
The omphalomesenteric (vitelline) duct normally obliterates during the 7th week of embryonic development. Both enterocysts and Meckel diverticula result from a failure of obliteration involving the omphalomesenteric duct.

References

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Item 38 of 40
Question Id: 8669

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A 62-year-old man comes to the physician because of intermittent groin pain. He is a construction worker and says that the pain is worse when lifting heavy loads and after a long day of working. Physical examination shows a bulge above the inguinal ligament. The bulge increases in size when he bears down. A groin ultrasound reveals that the mass originates medial to the inferior epigastric vessels. This patient's condition is most likely caused by which of the following?

A. Breakdown of the transversalis fascia
B. Failure of the internal inguinal ring to close
C. Patent processus vaginalis
D. Weakness of the rectus abdominis muscle
E. Widening of the femoral ring

Submit

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Settings

Item 38 of 40
Question Id: 8669

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 62-year-old man comes to the physician because of intermittent groin pain. He is a construction worker and says that the pain is worse when lifting heavy loads and after a long day of working. Physical examination shows a bulge above the inguinal ligament. The bulge increases in size when he bears down. A groin ultrasound reveals that the mass originates medial to the inferior epigastric vessels. This patient's condition is most likely caused by which of the following?

- A. Breakdown of the transversalis fascia [45%]
- B. Failure of the internal inguinal ring to close [6%]
- C. Patent processus vaginalis [7%]
- D. Weakness of the rectus abdominis muscle [37%]
- E. Widening of the femoral ring [3%]

Omitted
Correct answer
A

45%
Answered correctly

7 Seconds
Time Spent

01/31/2019
Last Updated

Explanation

Groin hernias			
	Classic		

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Groin hernias			
Type	**Classic presentation**	**Pathophysiology**	**Anatomy**
Indirect inguinal	Male infants	Patent processus vaginalis	• Content protrudes through deep inguinal ring • Travels lateral to inferior epigastric vessels
Direct inguinal	Older men	Weakness of transversalis fascia	• Content protrudes through Hesselbach triangle • Travels medial to inferior epigastric vessels
Femoral	Women	Weakness of proximal femoral canal	• Content protrudes through femoral ring • Travels inferior to inguinal ligament

Direct and indirect inguinal hernias are both located above the inguinal ligament. Direct inguinal hernias protrude through **Hesselbach's triangle**, which is formed by the inguinal ligament inferiorly, the inferior epigastric vessels laterally, and the rectus abdominus muscle medially. The transversalis fascia forms the floor of the triangle, and defects or weakness involving the transversalis fascia can lead to protrusion of abdominal

Femoral	Women	proximal femoral canal	• Travels inferior to inguinal ligament

Direct and indirect inguinal hernias are both located above the inguinal ligament. Direct inguinal hernias protrude through **Hesselbach's triangle**, which is formed by the inguinal ligament inferiorly, the inferior epigastric vessels laterally, and the rectus abdominus muscle medially. The transversalis fascia forms the floor of the triangle, and defects or weakness involving the transversalis fascia can lead to protrusion of abdominal contents through Hesselbach's triangle into the inguinal canal. Failure of this fascial layer is most often due to acquired connective tissue abnormalities or chronic abdominal wall injury. Thus, direct inguinal hernias are more common in the elderly.

Direct inguinal hernias do not pass through the deep inguinal ring but pass only through the superficial inguinal ring. As a result, they are covered only by the external spermatic fascia, in contrast to indirect inguinal hernias, which are covered by all 3 **spermatic fascial layers.**

(Choices B and C) Indirect inguinal hernias are the most common type of groin hernia in both sexes. They frequently occur in infants, children, and young adults due to failure of the processus vaginalis to obliterate and the internal inguinal ring to close. Indirect inguinal hernias protrude through the internal inguinal ring, lateral to the inferior epigastric vessels.

(Choice D) The rectus abdominis muscle forms the medial border of Hesselbach's triangle. Direct inguinal hernias are located lateral to the rectus abdominis muscle.

(Choice E) Femoral hernias occur below the inguinal ligament and protrude through the femoral ring, which is medial to the femoral sheath and lateral to the lacunar ligament. The femoral sheath contains the femoral artery and femoral vein.

Educational objective:
Direct hernias occur most commonly in older men and are caused by weakness of the transversalis fascia in Hesselbach's triangle. They are medial to the inferior epigastric vessels, protrude only through the external inguinal ring, and are covered by the external spermatic fascia.

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Question Id: 8669

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Femoral | Women | proximal femoral | Travels inferior to inguinal

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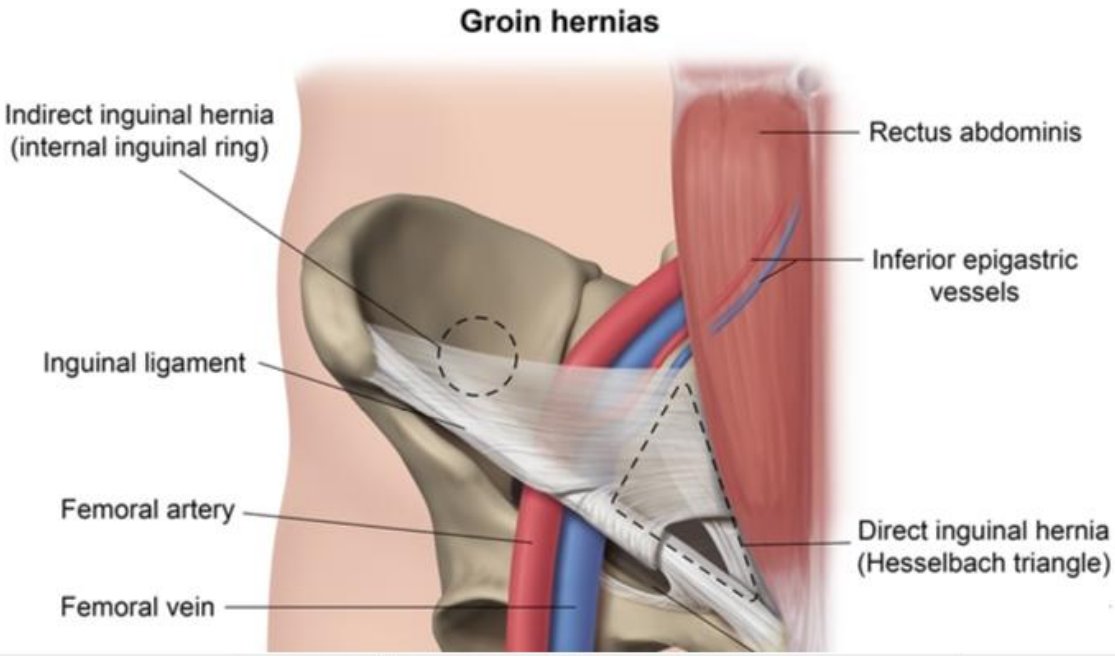

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Femoral | Women | proximal femoral | • Travels inferior to inguinal

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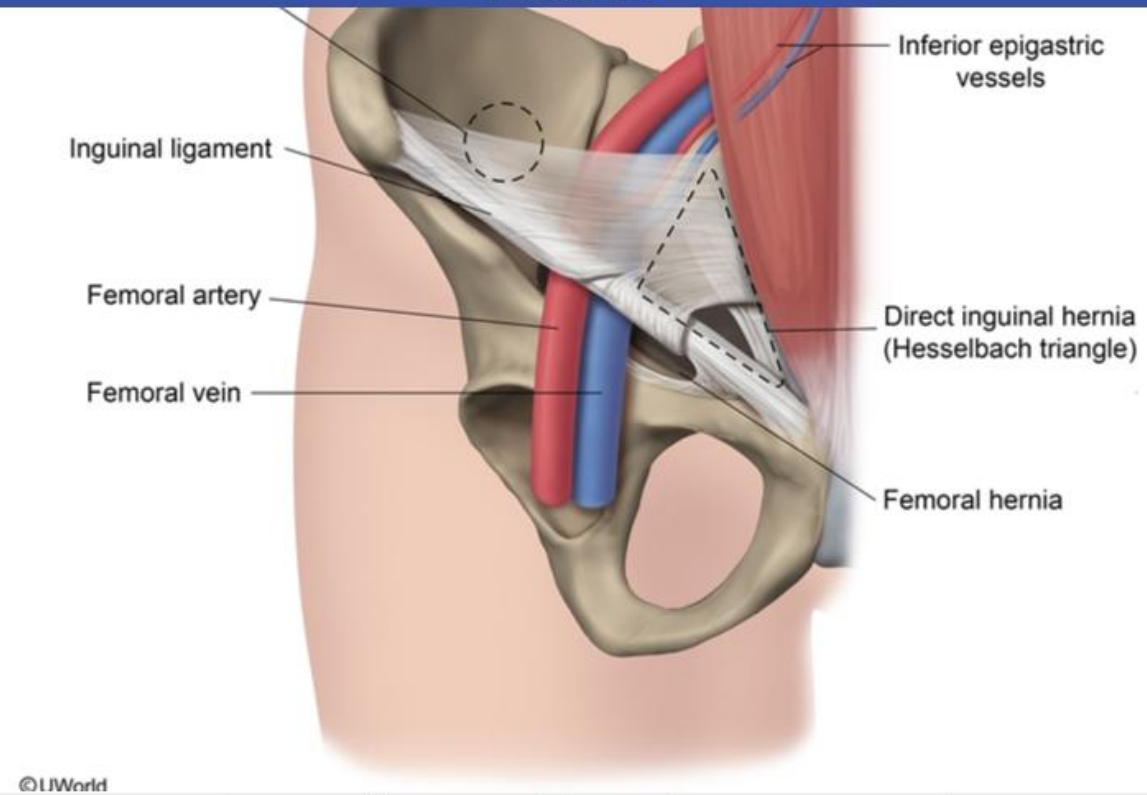

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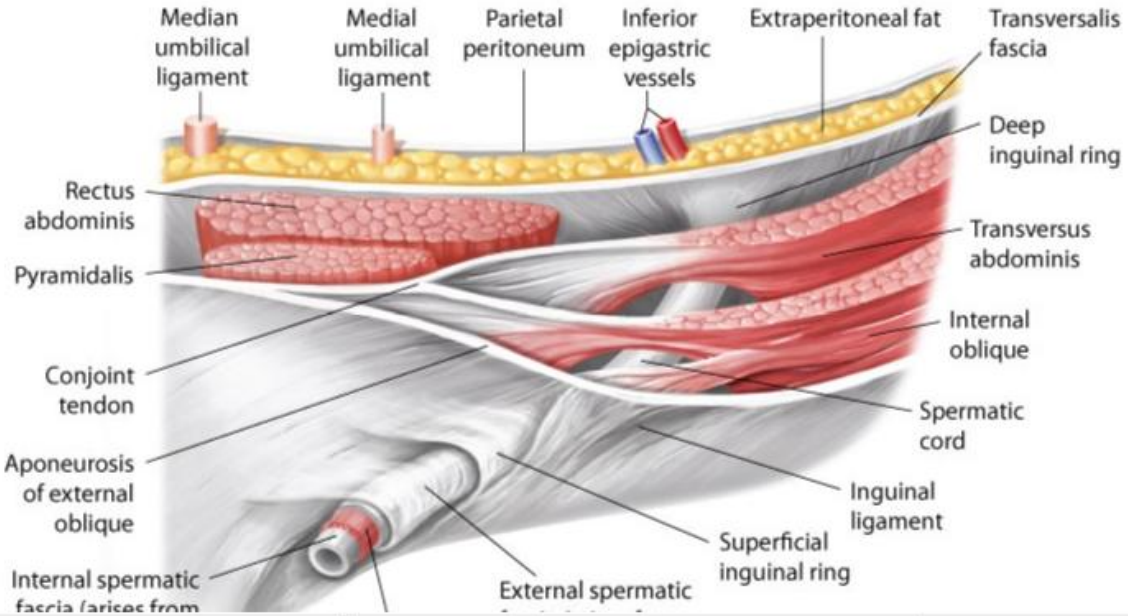
Femoral | Women | proximal femoral

- Travels inferior to inguinal

Exhibit Display

Spermatic cord layers



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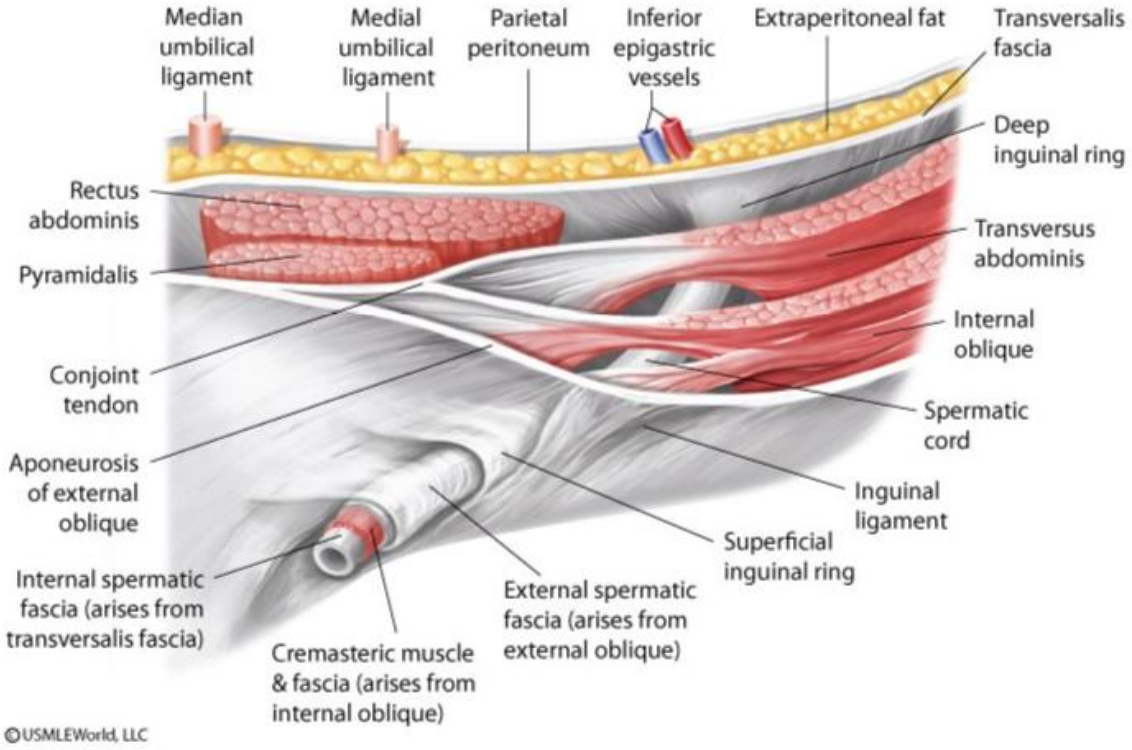
Femoral | Women | proximal femoral | • Travels inferior to inguinal

Exhibit Display



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Item 39 of 40
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A 27-year-old woman, gravida 1 para 0, with gestational diabetes mellitus comes to the hospital at 38 weeks gestation for evaluation of abdominal pain. The patient is scheduled for an elective cesarean section at 39 weeks as a recent ultrasound revealed that the estimated fetal weight is 5200 g (11 lb 4 oz). Examination reveals that the patient is in active labor and the fetus is in breech presentation; an urgent cesarean section is performed. During the surgery, the rectus abdominus muscle is split vertically, but space appears to be limited. In anticipation of a large-for-gestational-age baby, a decision is made to transect the rectus abdominis muscle. If the rectus abdominis muscle is incised laterally, which of the following structures is at greatest risk of injury?

- A. Deep circumflex iliac artery
- B. Deep inguinal ring
- C. Femoral sheath
- D. Inferior epigastric artery
- E. Lateral femoral cutaneous nerve
- F. Superior epigastric artery

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Settings

Item 39 of 40
Question Id: 11850

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

A 27-year-old woman, gravida 1 para 0, with gestational diabetes mellitus comes to the hospital at 38 weeks gestation for evaluation of abdominal pain. The patient is scheduled for an elective cesarean section at 39 weeks as a recent ultrasound revealed that the estimated fetal weight is 5200 g (11 lb 4 oz). Examination reveals that the patient is in active labor and the fetus is in breech presentation; an urgent cesarean section is performed. During the surgery, the rectus abdominus muscle is split vertically, but space appears to be limited. In anticipation of a large-for-gestational-age baby, a decision is made to transect the rectus abdominis muscle. If the rectus abdominis muscle is incised laterally, which of the following structures is at greatest risk of injury?

- A. Deep circumflex iliac artery [1%]
- B. Deep inguinal ring [4%]
- C. Femoral sheath [4%]
- ✔ D. Inferior epigastric artery [73%]
- E. Lateral femoral cutaneous nerve [4%]
- F. Superior epigastric artery [11%]

Omitted
Correct answer
D

73%
Answered correctly

3 Seconds
Time Spent

02/07/2019
Last Updated

Explanation

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Explanation

The rectus abdominis is a pair of vertically aligned muscles that connect the xiphoid process to the pubic symphysis. The **arcuate line** is a horizontal line located below the umbilicus that demarcates the lower limit of the posterior rectus sheath. Above the arcuate line, the rectus abdominis is surrounded by anterior and posterior sheaths; below, the muscle is covered only by the anterior sheath.

The superior **(Choice F)** and inferior epigastric arteries supply the superior and inferior portions of the rectus abdominis muscle, respectively. The epigastric artery ascends the posterior surface of the rectus abdominis muscle and enters the lateral aspect of this muscle at the arcuate line. Because there is **no supporting posterior sheath**, trauma to the **inferior epigastric artery** below the arcuate line can result in significant hemorrhage.

Regardless of the direction of skin incision, a **cesarean delivery** typically involves midline vertical separation of the rectus abdominis muscle. **Horizontal transection** of the **rectus abdominis** muscle may be considered when additional space is necessary (eg, due to fetal weight or position). If the **rectus abdominis** is **transected horizontally**, the **inferior epigastric arteries** must be identified and ligated bilaterally to prevent bleeding complications (eg, hematoma).

(Choice A) The deep circumflex iliac artery supplies blood to the anterior iliac crest and arises from the lateral aspect of the external iliac artery. It is located significantly laterally and inferiorly to the rectus abdominis muscle.

(Choice B) The inguinal canal contains structures (eg, ilioinguinal nerve, round ligament [women], spermatic cord [men]) between the abdomen and external genitalia. Men are more susceptible to **inguinal hernias** compared to women due to their relatively larger deep inguinal ring.

(Choice C) The femoral sheath is located in the inguinofemoral region and contains the **femoral artery**, femoral vein, and femoral canal.

(Choice E) The **lateral femoral cutaneous nerve** travels under the inguinal ligament. It provides sensory innervation to the anterolateral thigh. Entrapment (meralgia paresthetica) most commonly occurs in obese or pregnant persons or in those who wear garments that are tight around the hip.

Educational objective:

Horizontal transection of the **rectus abdominis** muscle may be considered when additional space is necessary (eg, due to fetal weight or position). If the **rectus abdominis** is **transected horizontally**, the **inferior epigastric arteries** must be identified and ligated bilaterally to prevent bleeding complications (eg, hematoma).

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Educational objective:
Horizontal transection of the rectus abdominis muscle must be performed with great caution as the inferior epigastric arteries enter this muscle at the level of the arcuate line. The inferior epigastric arteries below the arcuate line are susceptible to injury (eg, hematoma) due to lack of a supporting posterior rectus sheath.

References

- Reviewing the vascular supply of the anterior abdominal wall: redefining anatomy for increasingly refined surgery.
- Rectus sheath hematoma: a review of the literature.

Settings

Item 40 of 40
Question Id: 11817

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A 58-year-old man is being evaluated for constipation and weight loss over the last several months. During the past 2 weeks, he has had several episodes of rectal bleeding. The patient has never had a screening colonoscopy. Examination shows a soft and nontender abdomen without masses or organomegaly. Digital rectal examination reveals a firm palpable mass in the rectal vault. Flexible rectosigmoidoscopy shows a large ulcerative mass in the middle third of the rectum extending to the rectosigmoid junction. He undergoes surgical resection of the rectosigmoid colon. Frozen section analysis reveals clear margins of the colon specimen with metastases in the pararectal lymph nodes. Which of the following lymph node groups should be sampled in this patient for further assessment of metastatic disease?

- A. Celiac
- B. Internal iliac
- C. Left colic
- D. Right colic
- E. Superficial inguinal
- F. Superior mesenteric
- G. Supraclavicular

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Settings

Item 40 of 40
Question Id: 11817

Mark | Previous | Next | Tutorial | Lab Values | Notes | Calculator | Reverse Color | Text Zoom

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- A. Celiac [1%]
- ✔ B. Internal iliac [53%]
- C. Left colic [18%]
- D. Right colic [1%]
- E. Superficial inguinal [13%]
- F. Superior mesenteric [7%]
- G. Supraclavicular [4%]

Omitted
Correct answer
B

53%
Answered correctly

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Last Updated

Explanation

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Explanation

Lymphatic drainage of the colon generally follows the arterial supply. Lymph nodes are located on the bowel wall (epicolic nodes), inner bowel margins along the arterial arcades (paracolic nodes), around the corresponding mesenteric vessels (intermediate nodes), and at the origin of the superior and inferior mesenteric arteries (principal nodes). The sentinel lymph nodes (first 1-4 lymph nodes draining a specific colonic segment) are usually the first site for colon cancer metastasis.

Lymphatic channels **proximal** to the anal **dentate line** drain into the **inferior mesenteric** and **internal iliac lymph nodes**. The upper rectum and superior part of the middle rectum follow the superior rectal nodes along the superior rectal artery into the inferior mesenteric lymph nodes. The middle to lower third of the rectum can drain upward into the inferior mesenteric nodes or follow the middle rectal nodes along the middle rectal artery to the internal iliac lymph nodes. Areas **distal** to the anal dentate line drain primarily into the **inguinal nodes**, although some lymph can also reach the inferior mesenteric and internal iliac nodes.

(Choice A) The celiac lymph nodes are located around the celiac trunk and drain lymph from the gastric, hepatic, and splenic nodes. These in turn drain their respective organ systems (not the colon).

(Choice C) The left colic lymph nodes and their branches are located along the left colic artery and drain the left colonic flexure and upper descending colon.

(Choice D) The right colic lymph nodes are found along the right colic artery and primarily drain the upper ascending colon.

(Choice E) The superficial inguinal lymph nodes lie below the inguinal ligament and are bordered by the sartorius and adductor longus muscles. They drain parts of the genitalia (eg, penis, scrotum, perineum, and vulva), buttocks, anus below the dentate line, and abdominal wall below the umbilicus.

(Choice F) The superior mesenteric lymph nodes (mesenteric, ileocolic, and mesocolic) mainly drain the ileum, jejunum, vermiform process, and parts of the ascending and transverse colon.

(Choice G) Lymph node metastasis typically occurs sequentially through the epicolic/paracolic, intermediate, and paraaortic lymph nodes. Later

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(Choice G) Lymph node metastasis typically occurs sequentially through the epicolic/paracolic, intermediate, and paraaortic lymph nodes. Later in the disease course, the cancer can spread via the thoracic duct to the supraclavicular lymph node (Virchow node).

Educational objective:
Lymphatic drainage of the rectum proximal to the anal dentate line occurs via the inferior mesenteric and internal iliac lymph nodes. Areas distal to the dentate line drain primarily into the inguinal nodes.