Concerning secretin, what is true?

- A) is NOT correct – secretin must be slowly administered over one minute to avoid abdominal pain and vomiting
- B) is NOT correct – the only relative contraindication to secretin use is acute pancreatitis
- C) is NOT correct – secretin causes a transient increase in tone at the sphincter of Oddi which partly accounts for duct dilation
- D) is NOT correct – secretin has no effect on gallbladder contraction
- E) is correct – secretin stimulates bicarbonate secretion which, combined with increased tone at the sphincter of Oddi, causes pancreatic duct dilation

References

SAM 1: Concerning secretin, what is true?
A. Administered as a bolus
B. Contraindicated in cholelithiasis
C. Relaxes the sphincter of Oddi
D. Causes gallbladder contraction
E. Stimulates bicarbonate secretion

SAM 2: What feature of chronic pancreatitis is seen in this secretin MRCP?
A. Parenchymal calcification
B. Peripancreatic fluid collection
C. Pancreatic parenchymal edema
D. Side branch dilation
E. Pancreatic duct stone
What feature of chronic pancreatitis is seen in this secretin MRCP?

- A) is NOT correct – calcifications are not visible.
- B) is NOT correct – peripancreatic fluid collections are a finding of acute pancreatitis and are not seen in this case.
- C) is NOT correct – parenchymal edema is a finding of acute pancreatitis and is not seen in this case.
- D) is correct – dilated side branches are visible in the head and body of the pancreas.
- E) is NOT correct – there is no filling defect in the pancreatic duct to suggest the presence of a pancreatic duct stone.

References:

5 year old with pancreatitis. What is the most likely diagnosis and etiology of the pancreatitis based on the image?

Answer: Choice C is correct: The 3D reconstruction from MRCP shows dilated intra and extrahepatic ducts which qualify as a Type 4A choledochal cyst according to the Todani classification. There is mass effect on the pancreatic duct which is not uncommon and results in backwash of pancreatic fluid resulting in pancreatitis.

Choice A is not correct as the pancreatic duct and CBD do not separately insert, the definition of pancreas divisum.

Choice B is not correct. A child with chronic pancreatitis will have multiple episodes of pancreatitis in the past with a very abnormal appearing duct with undulations, irregularities, strictures and opacification of side branches (see Figure B).

Choice D is not correct as well. There would be filling defects representing stones but there are no stones or debris in the ducts. No gallstones either. Keep in mind though bile stasis predisposes patients to develop sludge and stones in the biliary system.

References:
- Rizzo RJ, Szuca RA et al. Congenital Abnormalities of the Pancreas and Biliary Tree in Adults.
SAM 4: Boy with Crohn’s disease and new buttock pain. What is the diagnosis?

A. Skin Tag
B. Intersphincteric Abscess
C. Transphincteric Fistula
D. Extrasphincteric Fistula
E. Supralevator Abscess

Boy with Crohn’s disease and new buttock pain. What is the diagnosis?

- Answer is B. Intersphincteric Abscess
- Rationales: The images show a peripherally-enhancing fluid collection located in the intersphincteric space, consistent with an intersphincteric abscess. Such abscesses that cross the midline are sometimes referred to as “horseshoe” abscesses.
- A supralevator abscess would be located above the levator ani musculature. Transphincteric fistulas are linear tracts that traverse both the internal and external anal sphincter muscles, while extrasphincteric fistulas extend from the high perirectal region through the levator ani musculature into the ischioanal fossa. Skin tags appear as enhancing lobular polypoidal growths arising from the perianal skin surface.

References

SAM 5: 9 year old with failure to thrive and coffee ground emesis. Touch the abnormality.

SAM 5: 9 year old with failure to thrive and coffee ground emesis. Touch the abnormality.
SAM 6: What is the abnormality in this 9 year old with failure to thrive and coffee ground emesis?

A. Pancreas divisum  
B. Pancreatitis  
C. Choledochal Cyst  
D. Annular Pancreas

9 year old with failure to thrive and coffee ground emesis. What is the abnormality?

• Answer-Correct Choice D Annular Pancreas: This spot image from the upper GI demonstrates an incomplete obstruction in the second portion of the duodenum. The basis of annular pancreas is duodenal stenosis/obstruction. In the largest series to date, all children presented with duodenal obstruction (Zyromski et al), not pancreatitis as was once thought. There is also a higher association with other congenital anomalies. Embryologically there is an error in rotation and fusion of the pancreas during the 4-9th weeks of gestation. The ventral pancreatic bud fuses to the duodenum—this then results in abnormal rotation of the ventral bud during the fusion with the dorsal analge. Eventually there is a partial or complete ring of pancreatic tissue around the second portion of the duodenum with or without inclusion of the pancreatic duct.

9 year old with failure to thrive and coffee ground emesis. What is the abnormality?

• Choice A is not correct as there is no bowel obstruction associated with pancreas divisum. In fact the diagnosis can be made on MRCP not on upper GI examination.  
• Choice B is not correct and this diagnosis cannot be made based on this modality, but is best identified on US, MRI or CT. Pancreatitis alone will result in edema, enlargement of the pancreas with mild dilatation of the pancreatic duct with or without pancreatic fluid collections. There is no associated duodenal obstruction with pancreatitis  
• Choice C is not correct. Choledochal cysts are a form of ductal ectasia and can result in mass effect on the head of the pancreas or result in upstream intrahepatic ductal dilatation, but they do not result in duodenal narrowing or obstruction.

References
• Mortele KF, Rocha T et al Multimodality Imaging of Pancreatic and Biliary Congenital Anomalies, Radiographics 2006  
• Rizzo RJ, Szucs RA et al. Congenital Abnormalities of the Pancreas and Biliary Tree in Adults

SAM 7: 6-year-old male. Which is the most likely mechanism of injury?

A. Penetrating laceration  
B. Blunt injury from bicycle handlebar  
C. Diving into a shallow pool  
D. Flank injury from karate kick
6-year-old male. Which is the most likely mechanism of injury?

- The answer is “B”. Blunt injury from bicycle handlebar.
- Rationales: Bicycle accidents account for 5-14% of blunt abdominal trauma in children, and handlebar injuries account for 27% of blunt pancreatic trauma in children. All other listed mechanisms of pancreatic injury would be substantially less likely to cause a pancreatic laceration.

References:

SAM: 12 year-old-male with upper abdominal trauma. Which of the following is most suggestive of a pancreatic ductal injury?

- The answer is “C”. Peripancreatic fluid collection
- Rationales: Peripancreatic fluid collections in the setting of suspected pancreatic trauma are suggestive of pancreatic ductal injury. Approximately one half of focal fluid collections that develop after pancreatic injury evolve into pseudocysts, and approximately one half of pseudocysts resolve spontaneously. Others require percutaneous drainage or surgical drainage. When pancreatic ductal injury occurs, the duct distal to the injury often dilates (as seen in the provided image). Free fluid in the pelvis may be present in patients with abdominal trauma, but this finding would be unlikely to be related to pancreatic ductal injury. Free intraperitoneal air implies a hollow visceral injury.

References:
- Sivit CJ et al. Imaging Children with Abdominal TraumaAJR May 2009, Volume 192, Number 5

SAM 8: 12 year-old-male with upper abdominal trauma. What is most suggestive of a pancreatic ductal injury?

A. Non-visualization of the pancreatic duct
B. Free fluid in the pelvis
C. Peripancreatic fluid collection
D. Free intraperitoneal air visualized by ultrasound

SAM 9: What would suggest a predominantly fibrotic stricture?

A. Luminal narrowing
B. Proximal bowel dilation
C. Hyperintense T2W signal in the bowel wall
D. Lack of significant early post-contrast enhancement
E. Persistent on multiple different sequences
Terminal ileum stricture (arrows) and small bowel dilation (*). What suggests the diagnosis of a predominantly fibrotic stricture in Crohn’s disease?

- A – incorrect – luminal narrowing could be seen with any type of stricture (inflammatory, fibrotic or mixed)
- B – incorrect – proximal bowel dilation can also be seen with any type of stricture
- C – incorrect – hyperintense T2W signal in the bowel wall indicates edema and is seen with active inflammation
- D – correct – lack of significant enhancement indicates the absence of active inflammation, which would support a fibrotic stricture
- E – incorrect – stricture from any etiology should persist on all sequences

References:

Recurrent pancreatitis. What is the abnormality?

- A. Bayonete pancreas
- B. Annular pancreas
- C. Pancreas divisum
- D. Ectopic pancreas

Recurrent pancreatitis. Touch the abnormality.
Recurrent pancreatitis. What is the abnormality?

- **Diagnosis: Pancreas Divisum**
- **Rationale:** Pancreas divisum is the most common of the congenital anomalies resulting from failure of fusion of the ventral and dorsal anlage of the pancreas. In those with recurrent pancreatitis, 12-26% of patients have PDV. The main imaging feature of Pancreas divisum on MR is that the main dorsal duct is in continuity with the duct of Santorini and drains into the major papilla and the ventral duct (not communicating with dorsal duct) joins the CBD and drains into the minor papilla.

SAM: What best describes the finding in known Crohn’s disease?

- **A** – incorrect – while the enhancement is evidence of inflammation, many strictures have components of both inflammation and fibrosis and enhancement does not exclude a fibrotic component
- **B** – incorrect – all types of strictures (inflammatory, fibrotic and mixed) will cause proximal dilation
- **C** – correct – many strictures that have findings of active inflammation also have histologic evidence of fibrosis
- **D** – incorrect – the proximal bowel dilation and clinical presentation of bowel obstruction both indicate a stricture
- **E** – incorrect – adhesions would not cause the bowel wall thickening and hyper-enhancement indicative of active inflammation

What best describes the finding in known Crohn’s disease?

References

SAM: What best describes the finding in known Crohn’s disease?

A. Given the enhancement, this is a purely inflammatory stricture.
B. Given the proximal bowel dilation, this is a purely fibrotic stricture.
C. There is a stricture with evidence of inflammation, but underlying fibrosis could also be present.
D. There is active inflammation without a stricture.
E. The findings are likely due to adhesions from prior surgery.

SAM: 15 year-old boy with Crohn’s proctitis and pelvic pain. What is the most likely diagnosis?

A. Cutaneous Crohn’s Disease
B. Ischioanal Abscess
C. Transphincteric Fistula
D. Intersphincteric Fistula
E. Suprarelevator Fistulous Disease
In this 15 year-old boy with proctitis due to Crohn’s disease and pelvic pain, what is the most likely diagnosis?

- **Answer is E. Supralevator Fistulous Disease**
- The images show supralevator T2-weighted signal hyperintensity and enhancement that is most likely due to supralevator fistulous disease.
- Visualized skin appears normal without thickening or hyperenhancement. No peripherally-enhancing fluid collection is present in the ischioanal fossa. Transphincteric fistulas are linear tracts that traverse both the internal and external anal sphincter muscles, while intersphincteric fistulas course through the intersphincteric plane.

References:

Pelvic axial T2 in an 8-year-old male with treated anal stricture. What is the presacral mass (arrow)?

- The answer is D.
- The MRI shows a heterogeneous presacral mass. Anorectal malformations (ARM) are associated with presacral masses such as sacrococcygeal teratomas and anterior meningoceles.
- Option A is NOT correct. A posterior urethral diverticulum is one of the most common urologic complications in postoperative ARM patients. Patients with anal strictures are often treated non-operatively. The diverticulum is the result of the incomplete resection of the distal rectum. When present, they occur between the bladder and the rectum, not posterior to the rectum.
- Option B is NOT correct. Anterior meningoceles are the most common presacral mass in patients with ARM. They are cystic lesions that are uniformly bright on T2-W images. In addition, the meningocele should be connected to the spinal canal.
- Option C is NOT correct. A duplicated colon can occur; however, they have an appearance more similar to bowel.
- Option D is correct. Sacrococcygeal teratoma is the most common tumor in patients with ARM. It is often mixed cystic and solid with a heterogeneous appearance on MRI.
- Option E is NOT correct. Stool should be within the colon.

References:

SAM: Pelvic axial T2 in an 8-year-old male with treated anal stricture. What is the presacral mass (arrow)?

A. Posterior urethral diverticulum  
B. Anterior meningocele  
C. Duplicated rectum  
D. Sacrococcygeal teratoma  
E. Stool

SAM: 5-year-old male with repaired imperforate anus. What is the cystic mass posterior to the bladder?

A. Posterior urethral diverticulum  
B. Anterior meningocele  
C. Post-operative seroma  
D. Sacrococcygeal teratoma  
E. Ectopic ureter
5-year-old male with repaired imperforate anus. What is the cystic mass posterior to the bladder?

- The answer is A.
- The MRI shows a cystic mass arising from the posterior aspect of the bladder. The mass has a fluid/fluid level.
- Option A is correct. A posterior urethral diverticulum is one of the most common urologic complications in postoperative ARM patients. The diverticulum is the result of the incomplete resection of the distal rectum. Patients with posterior urethral diverticulum are at increased risk to develop urinary calculi, recurrent urinary tract infections, and even malignancy.
- Option B is NOT correct. Anterior meningoceles are the most common presacral mass in patients with ARM. They are cystic lesions that are uniformly bright on T2-W images. In addition, the meningocele should be connected to the spinal canal, not the bladder.
- Option C is NOT correct. Post-operative seromas can occur but should not have a direct connection to the bladder.
- Option D is NOT correct. Sacrococcygeal teratoma are the most common tumor in patients with ARM. They are typically mixed cystic and solid with a heterogeneous appearance on MRI. They do not connect to the bladder.
- Option E is NOT correct. Ectopic ureters connect to the bladder but course superiorly towards the kidney. This collection courses inferiorly towards the base of the pelvis.

References:

Upper abdomen US in a 9 year old girl with sickle cell disease, gallstones, and now upper abdominal pain. Which is most correct regarding the superior mesenteric artery and vein?

- Answer is D.
- The sonographic image illustrates inversion of the superior mesenteric artery and vein relationship – the vein is anterior and to the left of the artery. It is present in most cases of malrotation including patients with so-called “nonrotation.”
- Option A is not correct. A normal relationship does not exclude malrotation.
- Option B is not correct. A normal relationship is not usually present in “non-rotation”.
- Option C is not correct. Inversion of the relationship may be present with normal rotation.
- Option E is not correct. Inversion does not indicate the presence of a midgut volvulus.

References:

SAM: Upper abdomen US in 9 year old girl with sickle cell disease, gallstones, and now upper abdominal pain. Which is most correct regarding the superior mesenteric artery and vein?

A. A normal relationship excludes malrotation.
B. A normal relationship is present in “non-rotation”
C. Inversion of the relationship is never a normal finding.
D. Inversion of the relationship is present in “non-rotation”
E. Inversion of the relationship indicates the presence of volvulus

SAM: Upper abdomen transverse US in a 9 year old girl with sickle cell disease, gallstones, and now upper abdominal pain. Which is most correct regarding the superior mesenteric artery and vein?

A. Intussusception
B. Inflammatory bowel disease
C. Midgut malrotation and volvulus
D. Inflamed Meckel’s diverticulum
E. Solid neoplasm of pancreas

SAM: 1 year old boy with vomiting. Diagnosis?

A. Intussusception
B. Inflammatory bowel disease
C. Midgut malrotation and volvulus
D. Inflamed Meckel’s diverticulum
E. Solid neoplasm of pancreas

References:
1 year old boy with vomiting. Diagnosis?

• **Answer is C.** The sonogram demonstrates a “mass” with a concentric ring appearance which is most in keeping with a volvulus of the midgut associated with malrotation.

• **Option C is correct.** The sonographic appearance is due to the small intestine and vessels coiled around the superior mesenteric artery in the centre.

• Option A is not correct. The mass of an intussusception does not have a vessel in the centre. There is more echogenic mesenteric fat between the layers of an intussusception.

• Option B is not correct. Inflammation of the bowel wall causes thickening of the wall and increased echogenicity but does not have this concentric ring appearance.

• Option D is not correct. Although Meckel’s diverticulum can present as a mass it is seldom in the upper abdomen and if inflamed may often surrounding echogenic fat.

• Option E is not correct. Pancreatic neoplasms are rare in infants and do not have a concentric ring appearance.

References


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SAM: Cumulative effective dose (CED) above 50 mSv has been associated with an increased cancer risk. About what fraction of inflammatory bowel disease patients undergoing imaging will exceed 50 mSv?

• A. 3%

• B. 6%

• C. 9%

• D. 12%

• E. 24%

**Answer is B. 6%**

In retrospective studies it was found that the CED was >50 mSv in approximately 6% of patients with inflammatory bowel disease undergoing imaging studies.

References

• Fuchs Y, Markowitz J, Weinstein T, Kohn N, Choi-Rosen J, Levine J. Pediatric inflammatory bowel disease and imaging-related radiation: are we increasing the likelihood of malignancy? JPGN (2011) 52: 280-285


SAM: Children have higher risk of cancer development from ionizing radiation than adults. Patients with inflammatory bowel disease are at even higher cancer risk because:

A. Inherently higher risk of cancer development from the disease itself

B. Repetitive diagnostic studies due to recurrence of the disease

C. Medications used to treat the inflammatory bowel disease

D. A and B

E. A, B and C
Children have higher risk of cancer development from ionizing radiation than adults. Patients with inflammatory bowel disease are at even higher cancer risk because:

- **Answer is E. A, B, and C.**
- All the above factors are additional factors that increase the risk of cancer in patients with inflammatory bowel disease undergoing imaging studies.

References
- Fuchs Y, Markowitz J, Weinstein T, Kohn N, Choi-Rosen J, Levine J. Pediatric inflammatory bowel disease and imaging-related radiation: are we increasing the likelihood of malignancy? JPGN (2011) 52: 280-285

15-year-old with pancreatic laceration from bicycle handlebar injury. What are the salient imaging findings?

A. Normal proximal pancreatic segment and fatty infiltration of the distal segment
B. Fatty infiltration of the proximal pancreatic segment and normal distal segment
C. Normal proximal pancreatic segment and pancreatitis of the distal segment
D. Pancreatitis of the proximal pancreatic segment and normal distal segment

15-year-old female with pancreatic laceration from bicycle handlebar injury. What are the salient imaging findings?

- C. Normal proximal pancreatic segment and pancreatitis of the distal segment
- Explanation: Axial T2 images show normal signal of the gland proximal to the laceration. The distal pancreatic segment is enlarged and demonstrates heterogeneous intrasubstance increased signal, as well as surrounding free fluid and abnormal fluid signal in the anterior pararenal space, consistent with pancreatitis. Pancreatic duct is dilated in the distal pancreatic segment

Crohn’s disease and intermittent partial bowel obstruction. Touch the stricture.
Crohn’s disease and intermittent partial bowel obstruction.

Touch the stricture.

Based on the illustration, indicate which numbered tract is a transphincteric fistula?

- A. 1
- B. 2
- C. 3
- D. 4

Answer is B. 2

Rationale: The illustration shows four types of fistula tracts. "2" represents a transphincteric fistula, crossing both the internal and external sphincter muscles. "1" represents an intersphincteric fistula coursing through the intersphincteric plane, while "3" represents a suprasphincteric fistula which extends superiorly through the intersphincteric space before passing through the levator ani musculature and extending into the ischioanal fossa. "4" represents an extrasphincteric fistula which extends from the high perirectal region through the levator ani musculature into the ischioanal fossa.

References:

8-year-old female with repaired anorectal malformation and fecal incontinence. What is in the red oval?

- A. Levator muscle
- B. Ischiorectal fossa
- C. Mesenteric fat
- D. Space of Retzius
8-year-old female with repaired anorectal malformation and fecal incontinence. Red oval shows mesenteric fat.

- **Answer C.**
- **Discussion:** A pull-through with attached mesenteric fat indicates that the rectum was resected and the sigmoid colon was pulled through. This causes a loss of the normal rectal reservoir and can lead to fecal incontinence.

Reference:

Transverse ultrasound image of upper abdomen in a neonate with vomiting. Touch the abnormality.

- **Finding:** The color Doppler image depicts the whirlpool sign of a midgut volvulus.
- **Explanation:** The color Doppler image shows flow in the mesenteric veins which are coiled around the superior mesenteric artery which is present in the centre of the whirlpool. The volvulus has caused obstruction to the duodenum which is dilated with fluid to the right of the whirlpool and the stomach is distended with fluid anterior to the whirlpool.

14 year old with chronic pancreatitis; identify on the MRI the pancreatic duct stricture that prompted subsequent ERCP.
14 year old with chronic pancreatitis; identify on the MRI the pancreatic duct stricture that prompted subsequent ERCP.

Finding to be made:
Focal stricture of the main pancreatic duct at the level of the pancreatic head.

Explanation:
There are several findings of chronic pancreatitis in this case including dilation and irregularity of the main pancreatic duct and dilation of side branch ducts. The focal change in caliber at the level of the pancreatic head reflects a stricture that was subsequently dilated endoscopically.