Complicated Meckel's and its mimics: CT image revised

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Learning Objectives

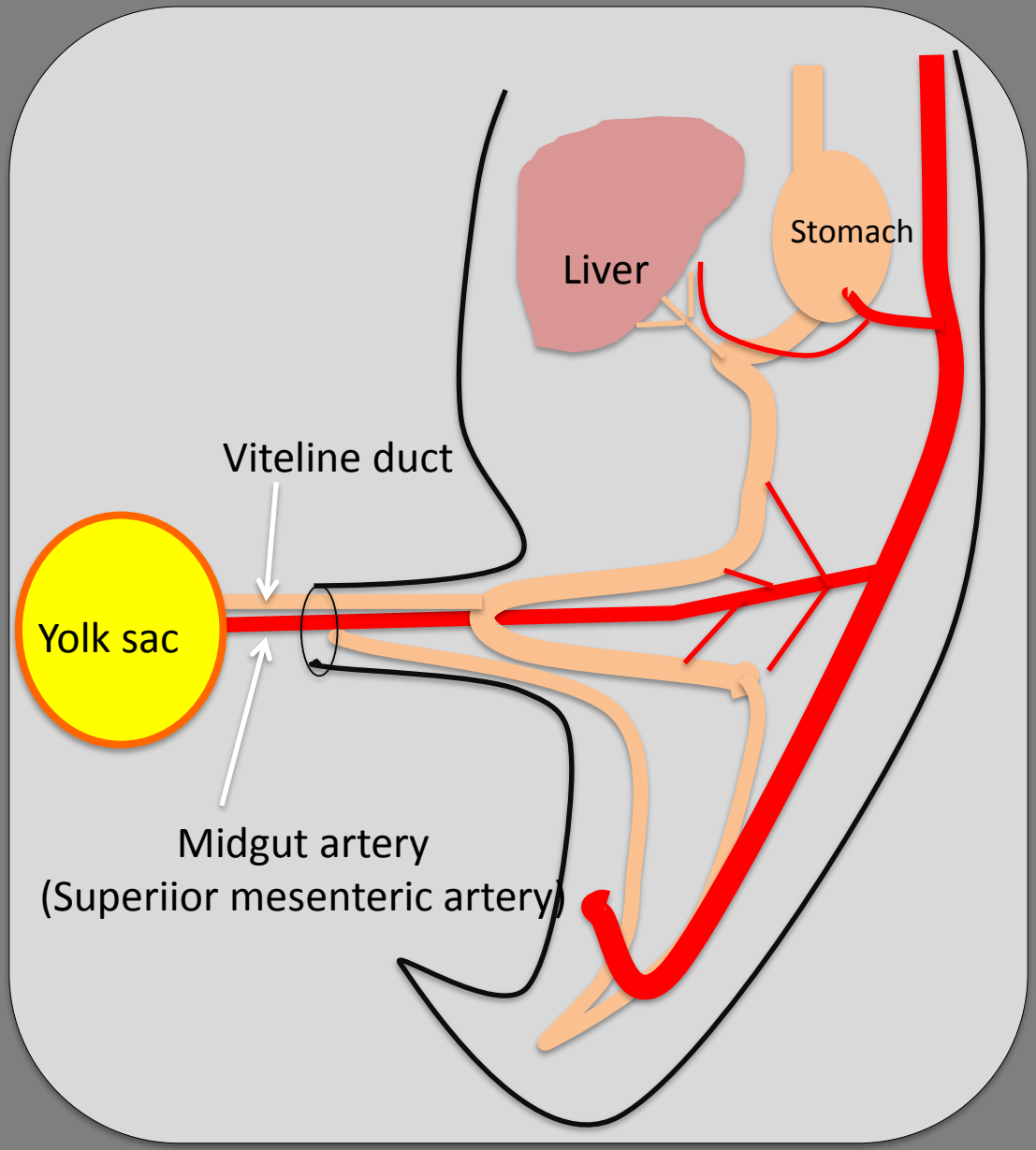
- Revise Meckel's diverticulum including anatomy and embryology
- Know the complications of Meckel's diverticulum.
- Know the features of CT images of complicated Meckel's diverticulum and how to differentiate them from its mimics.
  - Inverted Meckel's diverticulum
    - Intussusception
    - Intestinal lipoma
  - Meckel's diverticulitis
    - Ectopic pancreatitis
    - Appendicitis

Back ground

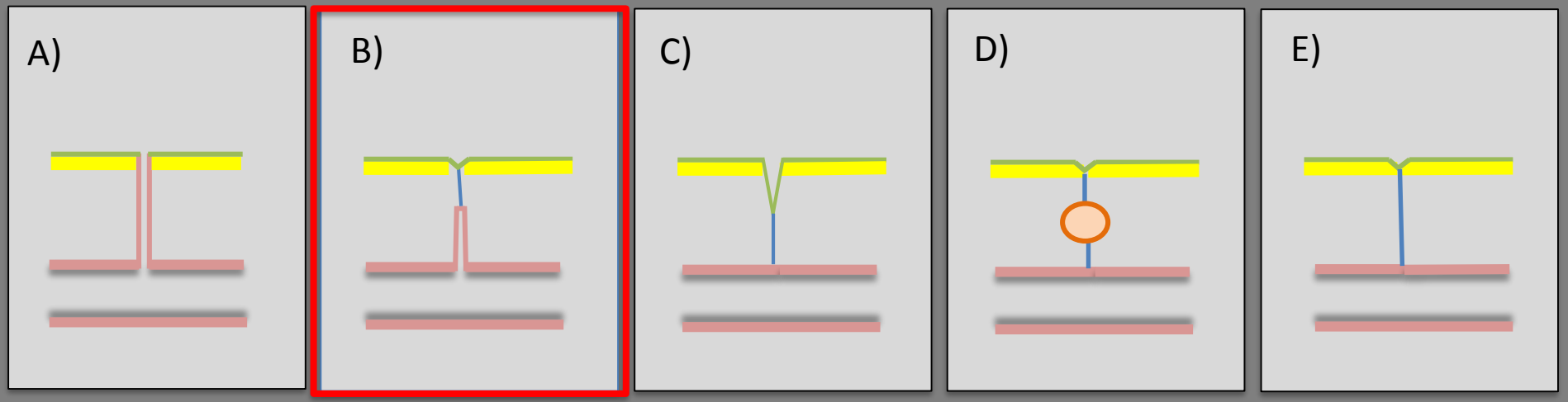
- Meckel's diverticulum is a well known congenital anomaly with complications. Although Meckel’s diverticulum is a recognized disorder, it is oftentimes challenging to diagnose preoperatively.
- We have examined retrospectively the CT cases of which Meckel’s diverticulum was listed as a differential diagnosis and reviewed the radiological features.

Meckel's Diverticulum

- The vitelline duct (omphalomesenteric duct) is a tubler structure, which connects the yolk sac and the midgut lumen of the developing embrio.
- Obliterates during 7th week of embryonic development



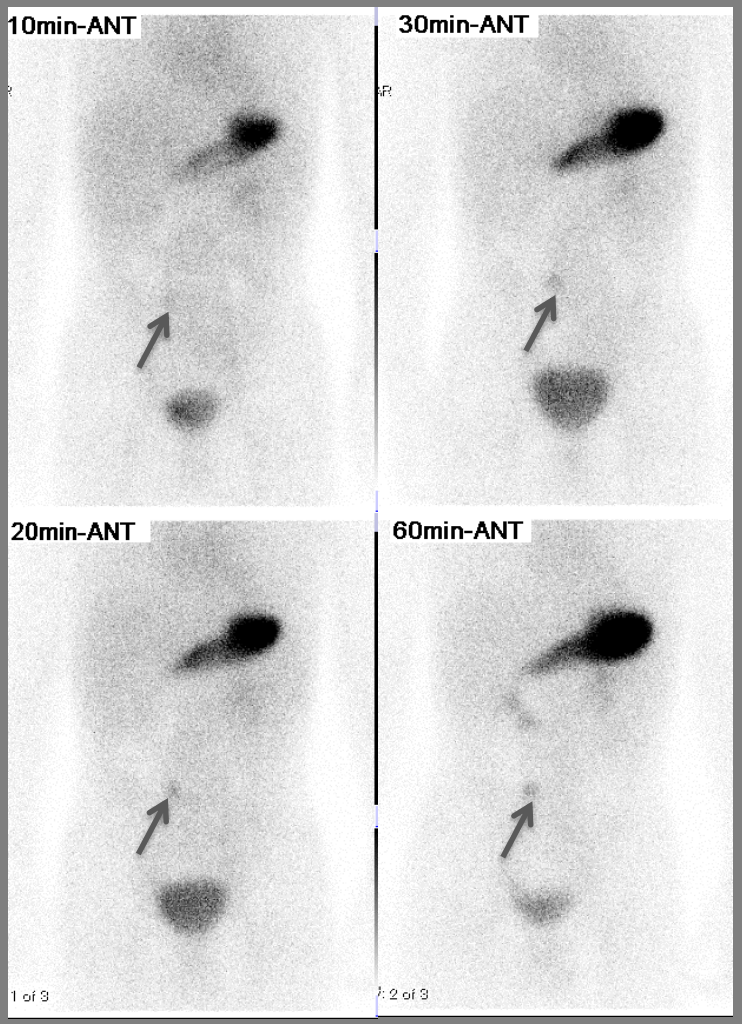
- Vitelline duct imcomplete closure are:
  - A) Vitelline fistula
  - B) Meckel's diverticulum
  - C) Vitelline sinus
  - D) Vitelline cyst
  - E) Viteline band



- In Meckel's diverticulum the peripheral portion of the vitelline duct obliterates but the central portion remains.
- Meckel's diverticulum accounts for 98% of the cases of omphalomesenteric duct anomalies.
- It is the most congenital anomaly.
- Present in 2%–3% of the population

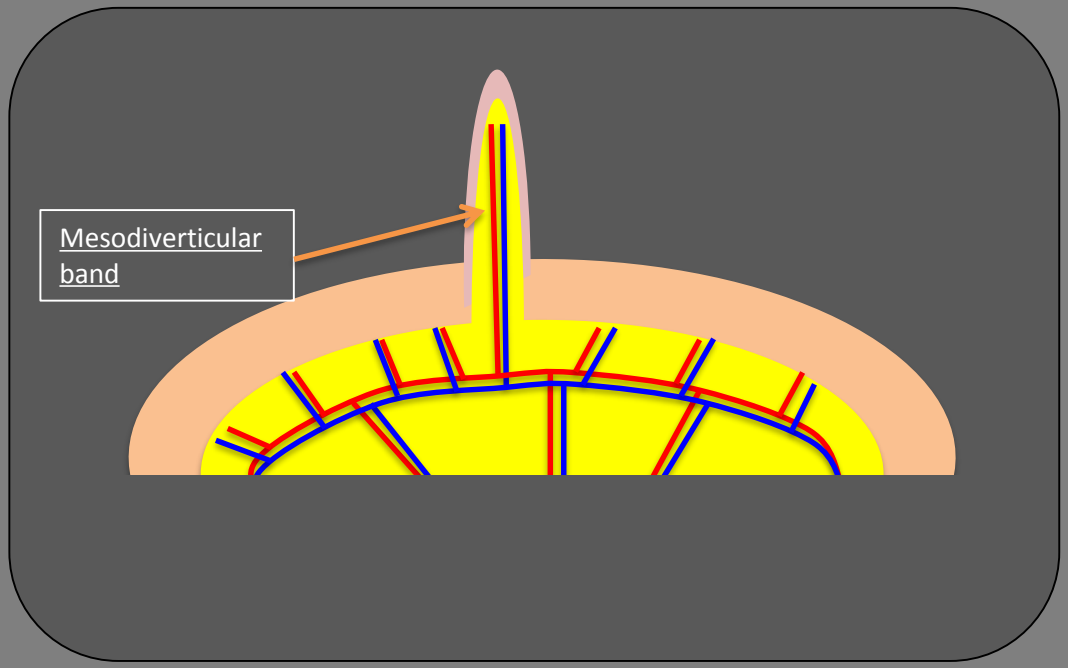
- About 60 % of Meckel's contain ectopic gastric mucosa.
- About 6 % contain ectopic pancreatic tissue.

- 99 ^{m}Technetium pertechnetate scan
  - It accumulates in THE mucus secreting gland OF the stomach.
  - It also accumulates in the ectopic gastric mucosa.
  - Sensitivity 85% ,Specificity 95%, Accuracy 90% in pediatric population
  - Sensitivity 63% ,Specificity 2%, Accuracy 46% in pediatric population
    - Prevalence of heterotopic gastric mucosa declines with age.
    - There are other abdominal disorders that cause gastrointestinal bleeding are more frequently encountered
  - False negatives are thought to be necrosis, rapid peristalisis.



Meckel's Diverticulum;anatomy

- Antimesenteric structure
- 2 inch long , within 2 feet from the iliocecal valve
- Blood supply from the mesentery of the ilium
- Vessels that lie within a separate fold of the small intestinal mesentery supporting the diverticulum or along the surface of the diverticulum.
- Mesenteric fat may be present with the vessels (mesodiverticular band may contains fat).



Angela D. Levy, et al.From the Archives of the AFIP Meckel Diverticulum: Radiologic Features with Pathologic Correlation1 .Radiolgraphics 2004;24:565-587

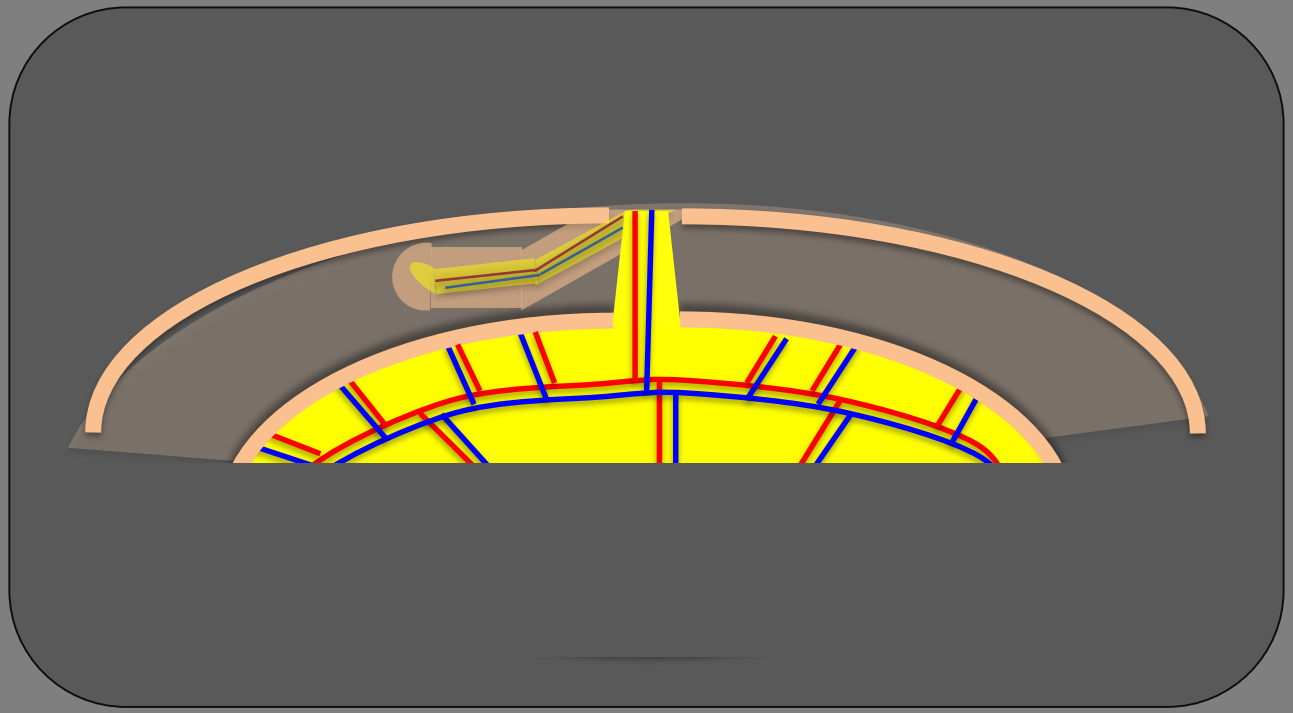
Meckel's Diverticulum;complicaions

- Hemorrhage
- Diverticulitis
- Inversion
  - Obstruction
  - Intussusception
- Volvulus
- Torsion
- Hernia
- Neoplasia within the diverticulum
  - Benign tumors
    - Leiomyoma
    - Lipoma
    - Harmatoma
  - Malignant tumors
    - Carcinoids-most common 44%
    - Mesenchymal tumor
    - Adenocarinoma 16%
    - Desmoplastic small round cell tumor

Complications from a Meckel's diverticulum is 4% up to the age of 20 years, 2% up to the age of 40 years, and zero in the elderly population.

Inverted Meckel's diverticulum

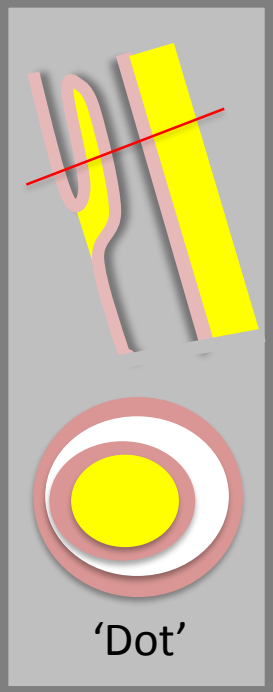
- Inversion of the diverticulum;you 'flipping a sox' inside out.
- Serosal side prerienteric fat is brought into the bowl lumen.
- The exact mechanisum of the inversion is not well understood.
  - Perilsatlisis?
  - Ulceration?
- It can be speculated that if the fibrouelastic band between the diverticulum and the abdominal wall is present, the inversion might not occur.

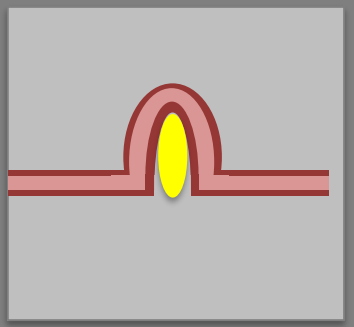


Case 1: Inverted diverticulum

- PC: 51 year old male with haematochezia
- CT report:
  - Intussception or Meckel's diverticulum
- 99m TcO_4 scintigraphy: Negative

✓ The fat density is seen as a linear in longitudianl dimenstion.
✓ In the axial dimantion, the fat density is seen as a dot.



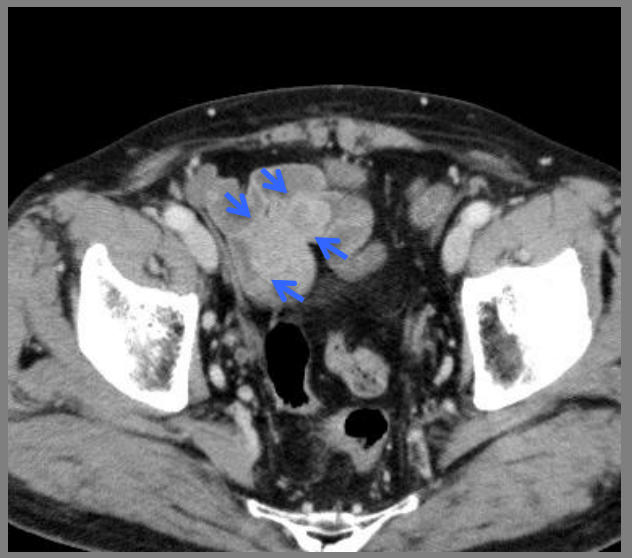


- In inverted Meckel's diverticulum the fat density is covered with all layers of gut wall.

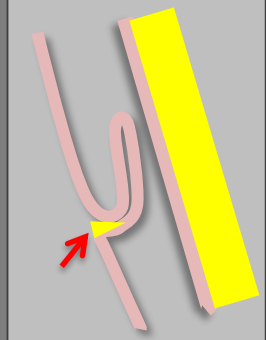
Case 2: Inverted diverticulum

- PC: 73 year-old male presented with hematochezia
- CT report:
  - Possible submucosal tumor in the ilium.
- 99m TcO_4 – scintigraphy: Negative

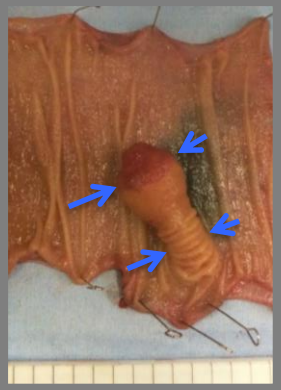
✓ Only a small amount of fat density is seen at the base of the inverted diverticulum.



↑ Small dot of fat density is seen



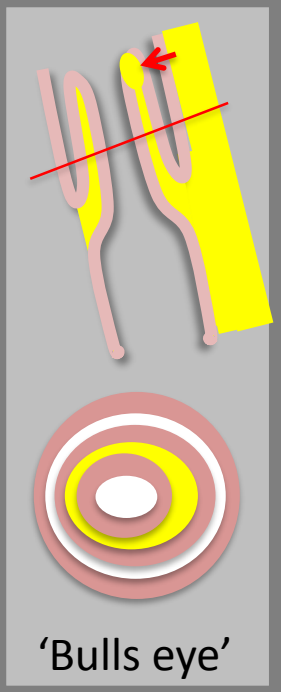
There is only A small amount of fat at the root of the inverted diveticulum.

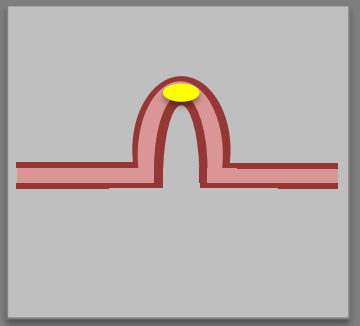


Resected ilium

Case 3: Intususseption (lipoma at the leading point)

- PC: 67 year old with abdominal pain
- CT report:
  - Intussusception with a lipoma in the leading point, Meckel's diverticulum could be a possibility.
- ✓ Bulls eye pattern in the axial plain.
- ✓ Theoretically, the fat density in the leading point is surrounded by only the mucosa.





- Lipoma in the leading point is covered with partial thickness of gut wall.

Case 3: Intususseption (lipoma at the leading point)

- PC: 67 year-old with abdominal pain
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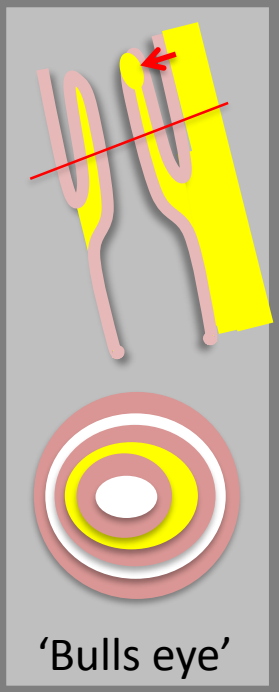
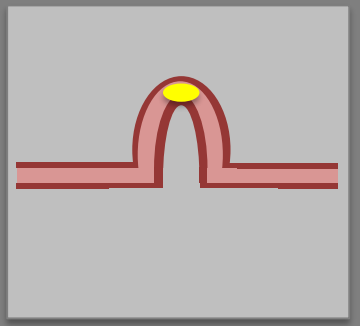




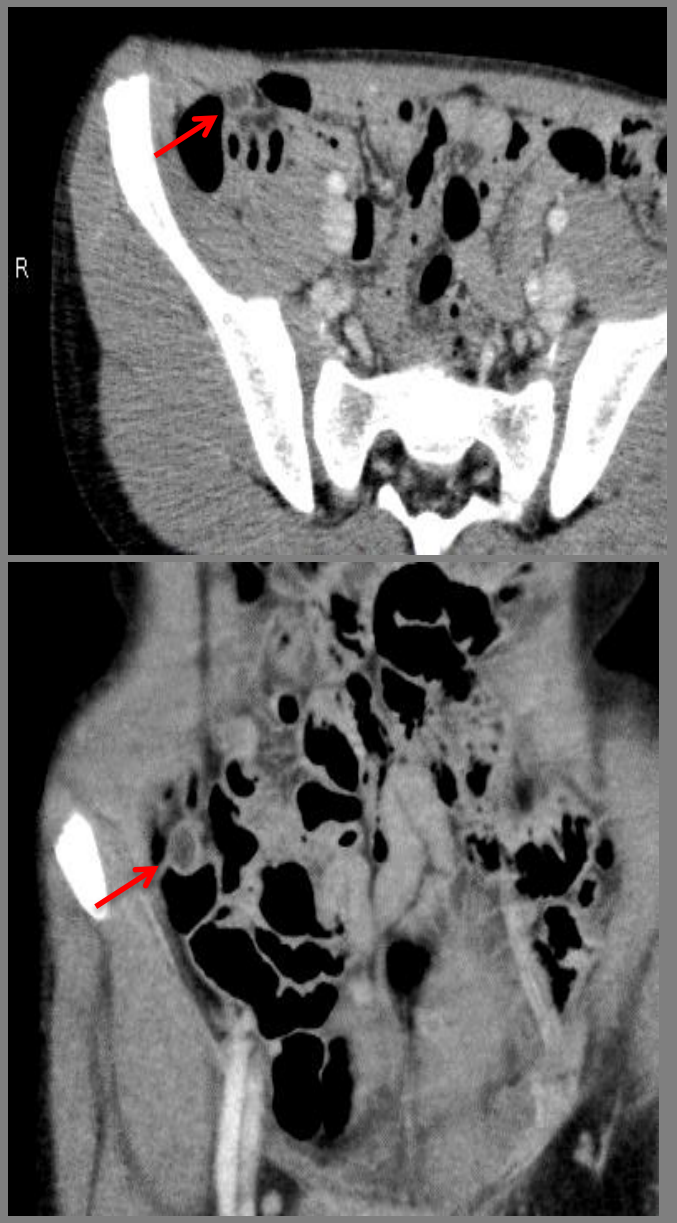
- Lipoma in the leading point is covered with the partial thickness of gut wall.

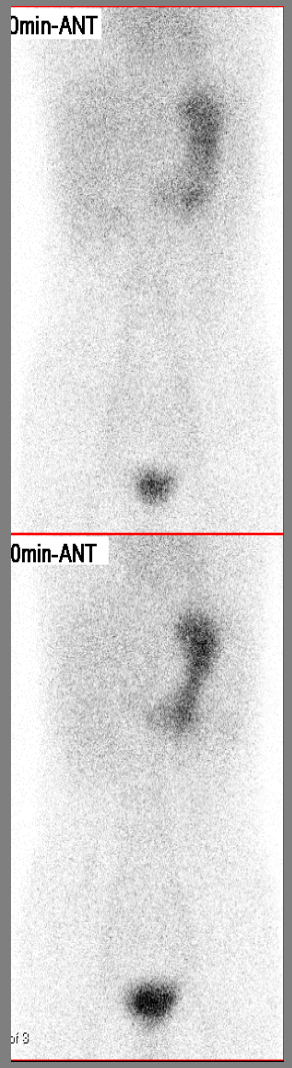
Case 4: Meckel's diverticulitis

- PC: 7 year-old boy abdominal pain, hematochezia

- CT report:
  - No appendicitis
  - Possible meckel's diverticulitis

- 99m TcO_4 – scintigraphy: negative
- ✓ It may be in antimesenteric location. However in this case, it seems difficult to accurately diagnose Meckel's .



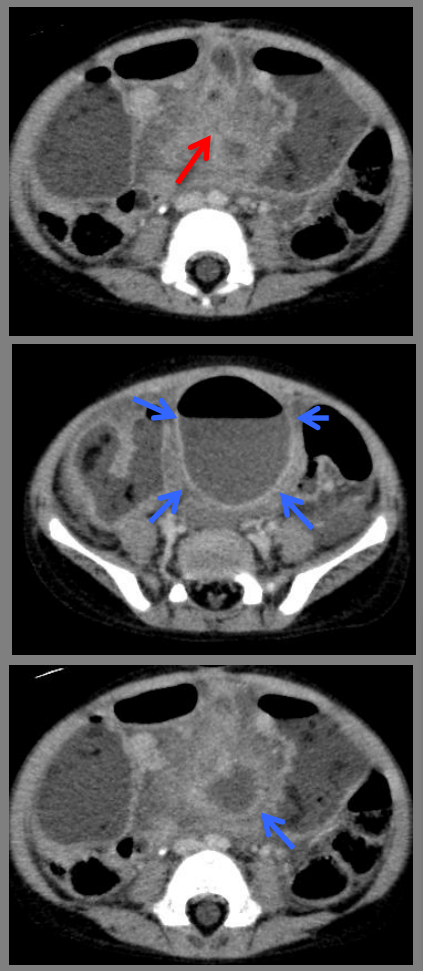


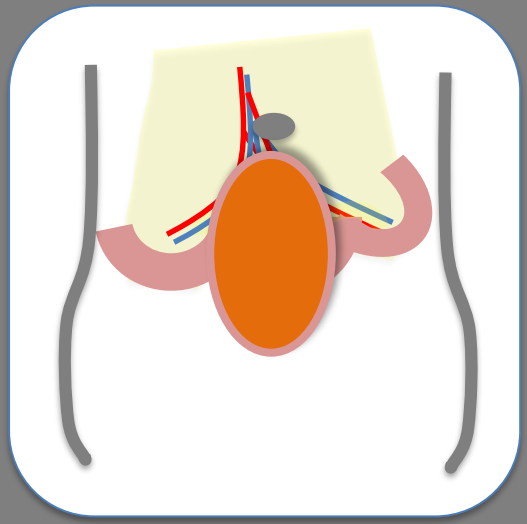
Case 5: Meckel's diverticulitis

- PC: 4 year-old boy with abdominal pain and fever
- CT report:
  - Abscess. Possible Meckel's diverticulitis.

✓ The cystic lesion with air density appears to be opposed to the mesentery. There are no small bowles caudial to the lesion. The lesion appears to be connected to the ilium(↑).

✓ The cyst lies in the midline.

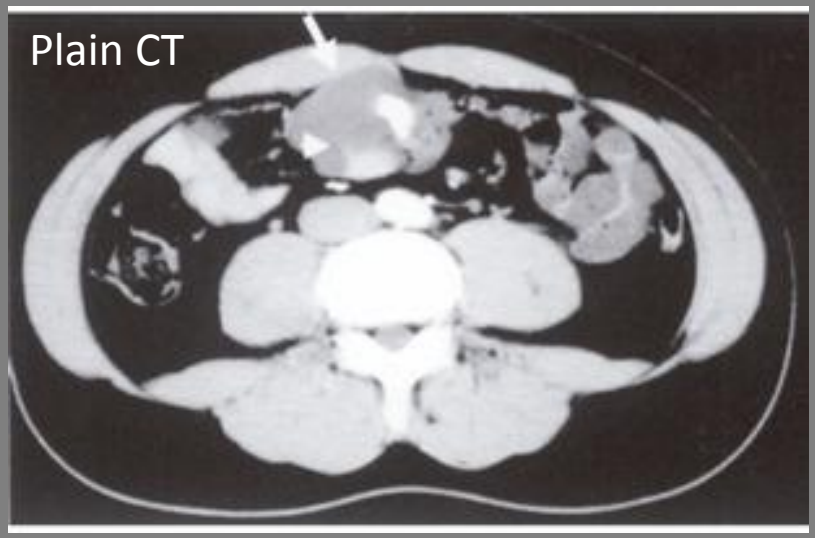




Of note…

A case report of a vitelline cyst

- 11 × 7 × 5cm mass with calcification
- It is in the peritonium
- It lies under the umbellicus
- It lies on the midline of the body.



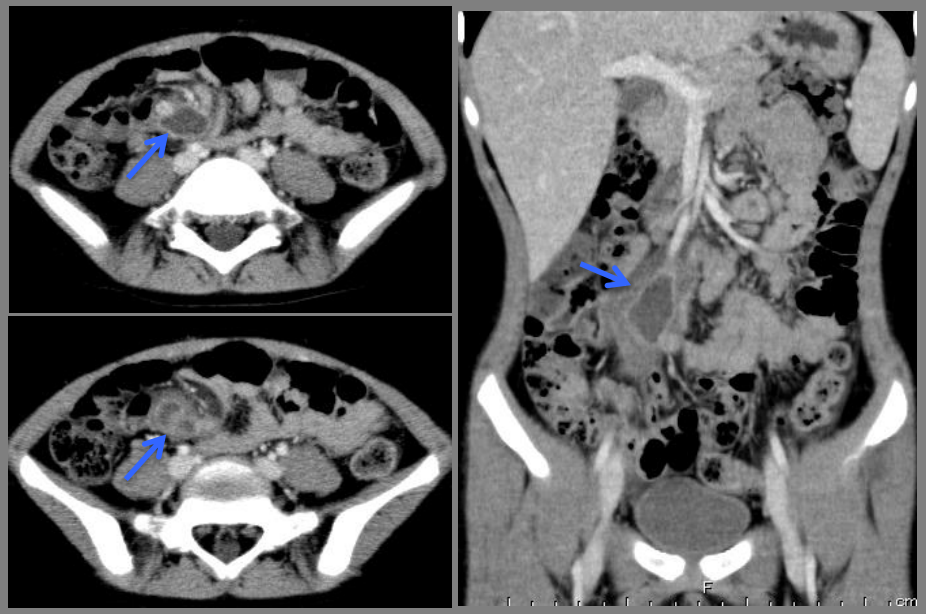
World J Gastroenterol. 2006 Feb 7; 12(5): 825–827.
PMCID: PMC4066143 Published online 2006 Feb 7. doi:
10.3748/wjg.v12.i5.825

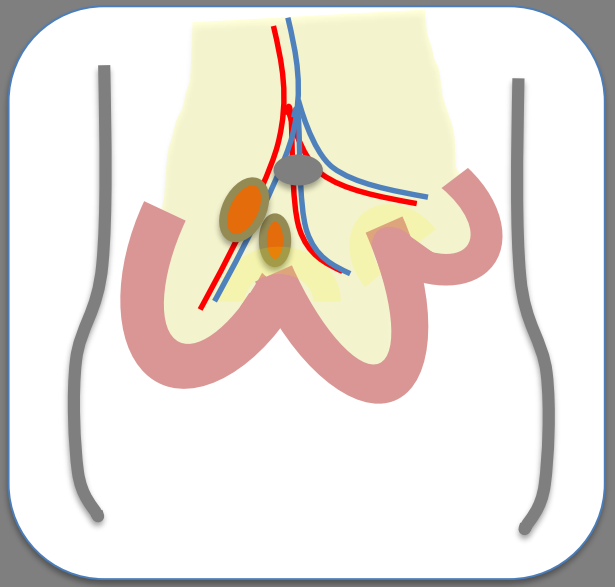
Case 6: Intestinal duplication cyst with ectopic pancreatitis

- PC: 6 year-old girl with fever and abdominal pain
- CT report:
  - Abscess in the mesentery. Meckel's diverticulum is unlikely since it is in the mesentery.

✓ The cystic lesions are located along with the mesenteric vessels. located in the mesentery.

- Pathologically, the resected cystic mass resembled Meckel's diverticulum.





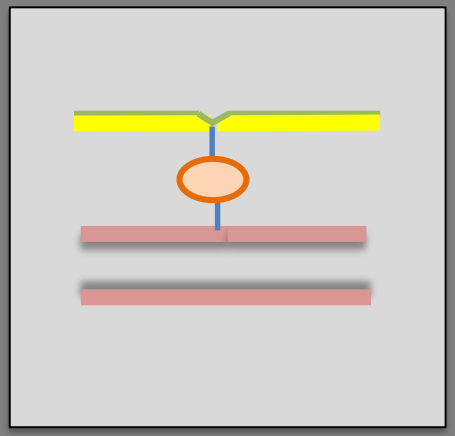
Of note…

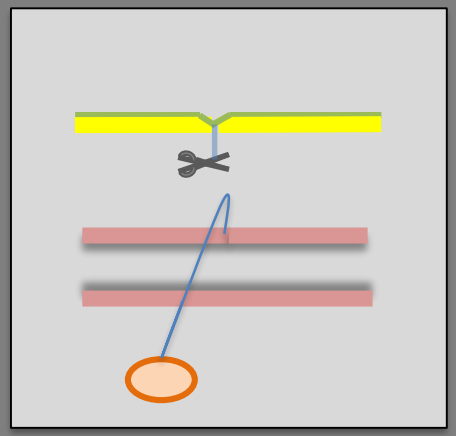
- Intestinal dupulication cysts can contain two-mucosal layers sharing a common muscle layer.[14,15]
- Meckel's diverticulum contains all the five layers of the small intestine.
- Ectopic gastric mucosa:
  - Meckel's diverticulum (60%)
  - Intestinal deupulication cyst (16–39%)
- Ectopic pancreatic tissue:
  - Meckel's diverticulum (6%)
  - Intestinal deupulication cyst (3%)

✓ Caridinal feature of Meckel's Diverticulum is its antimesenteric location.

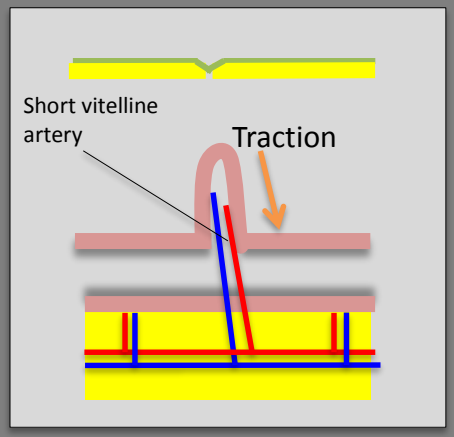
✓ There are mesenteric Meckel's diverticulum reports.

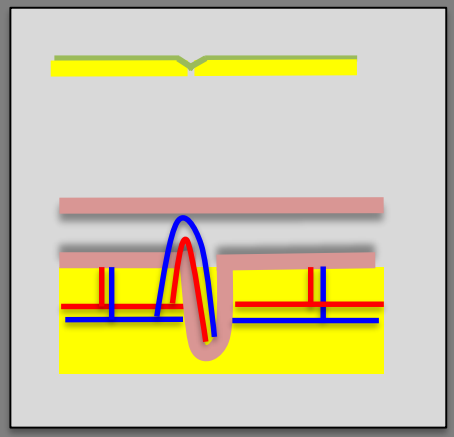
- The above mentioned case might have been Meckel's diverticulum:
  - The cystic wall was made of all the five layers
  - Location
  - Ectopic pancreatic tissue

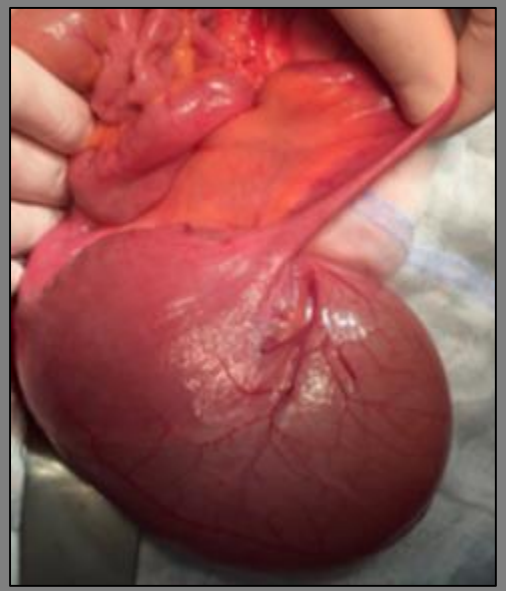




- It can be speculated that the fibrous band attaching to the abdominal wall is likely to be obliterated to flip to the mesenteric side.







- The proposed possible cause of mesenteric Meckel's diverticulum:
  - Short vitelline artery in the embriological period pulls the mesodiverticular band towards the mesenteric side.

Astrit R. Hamzaa,b, Besnik X. et al. Mesenteric Meckel's diverticulum or intestinal duplication cyst: A case report with review of literature. International Journal of Surgery Case Reports 26 (2016) 50–52

Case 6: appendicitis

- PC: 10 year-old girl with fever and abdominal pain
- CT report:
  - Appendicitis with abscess formation at the base of the appendix. Meckel's diverticulum could be a possibility.

✓ Tubler structure is seen from the cystic mass.

- It seems difficult to accurately diagnose Meckel's divertisculum if the existing anatomy is not clearly identifiable.

Conclusion

- Although it is not always straightforward to diagnose Meckel's diverticulum, a careful observation of the CT images based on anatomical and structural knowledge could lead to the diagnosis.
- There are mesenteric Meckel's diverticulum case reports.

Reference

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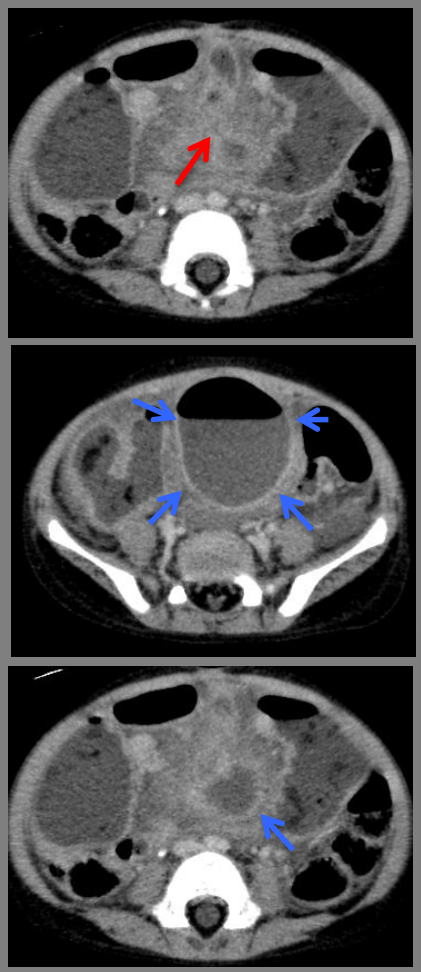
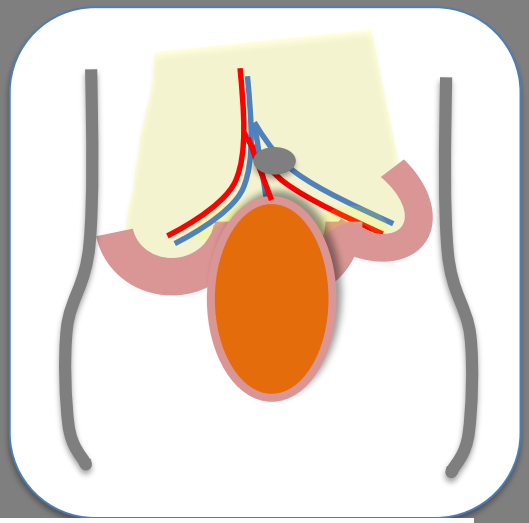
- Meckel's diverticulum results from the in utero failure of closure of THE omphalomesenteric duct and is seen to occur in 1-3% of the population. The diverticulum tends to occur on the antimesenteric side of the terminal ileum within two feet from the ileo-cecal valve. Most of the lesions remain asymptomatic throughout life, however, IN ADULTS it may present in the form of haemorrhage, volvulus, intussusception and perforation. In children, bleeding per rectum is the MOST common presentation. Approximately 50% of all Meckel's diverticula contain gastric mucosa. It is the diverticula containing ectopic gastric mucosa that commonly ulcerateS and bleedS. 99m technetium pertechnetate is primarily concentrated by (IN??) the mucus secreting cells of the stomach. The ectopic gastric mucosa present in the Meckel's diverticulum accumulates the 99m Tc pertechnetate by the same mechanism as normal gastric mucosa [2].
- The specificity and sensitivity of nuclear imaging in Meckel's diverticulum is 85% and 95% respectively in children while in adults the sensitivity and specificity are low, being around 60% and 9% respectively [3]. Connolly et al have used single photon emission computed tomography (SPECT) to enhance THE pick up rate of small Meckel's diverticula [4]. Various pharmacological agents have also been used to enhance the sensitivity of Meckel's scintigraphy. Oral cimetidine [5] has been found to increase the target to background ratio by inhibiting intraluminal secretion of pertechnetate, subcutaneous pentagastrin [6] to increase the mucosal uptake of pertechnetate and intravenously administered glucagon [2] has been found to decrease intestinal peristalsis and thus enhance the accumulation of pertechnetate. In our case, no pharmacological pretreatment was undertaken.
- False negative studies have been attributed to the diverticulum containing mucosa other than gastric, necrosis of the mucosa and rapid peristalsis. False positive studies have been seen to result from abnormal uterine blush [7], Crohn's disease, ulcerative colitis, appendicitis and less commonly, due to renal activity [8]. However, despite these pitfalls, nuclear imaging with 99m technetium pertechnetate is seen to serve as a simple, safe and non invasive tool in the diagnosis of Meckel's diverticulum, especially in paediatric age group patients.

Meckel's diverticulitis

✓ 4 year old boy with fever and abdominal pain

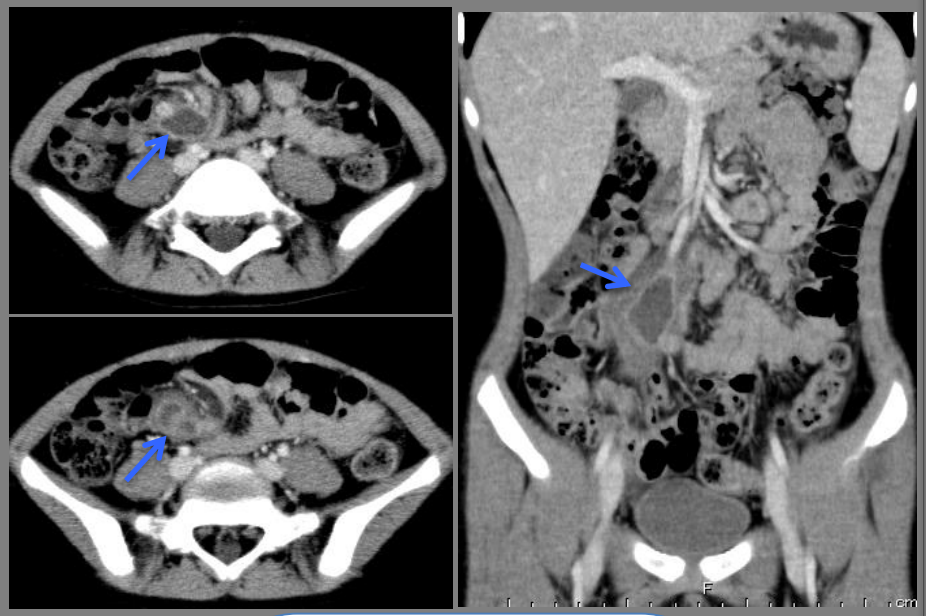


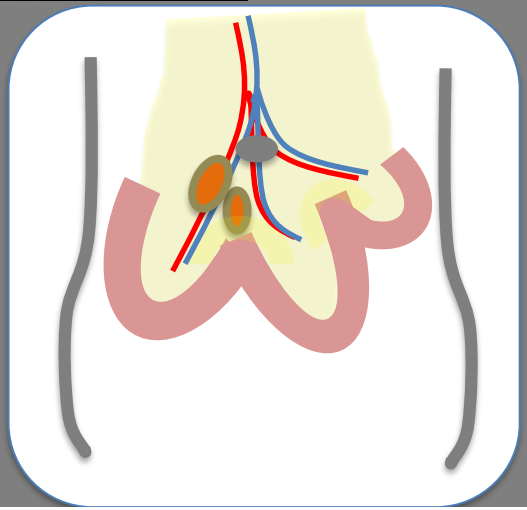


- The cystic lesion with air density appears to be opposed to the mesentery. There are no small bowles caudial to the lesion. The lesion appears to be connected to the ilium( )

Ectopic pancreatitis in mesentery

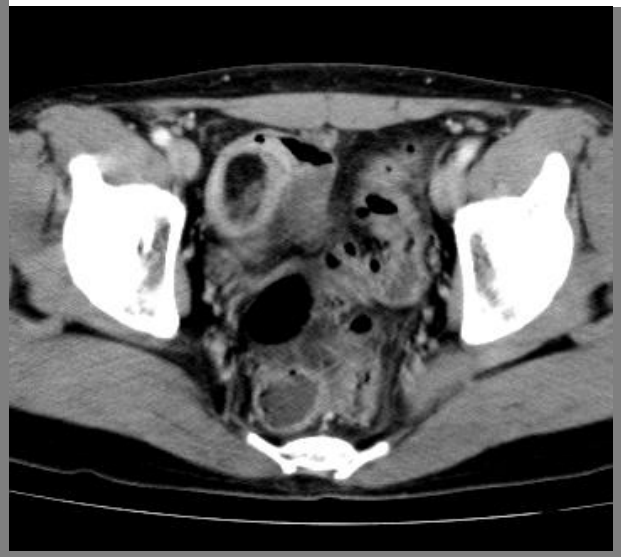
- ✓ 6 year old girl with fever and abdominal pain

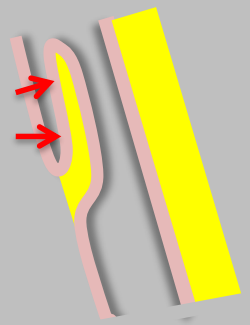




The cystic lesions are located along the mesenteric vessels.
located in the mesentery.

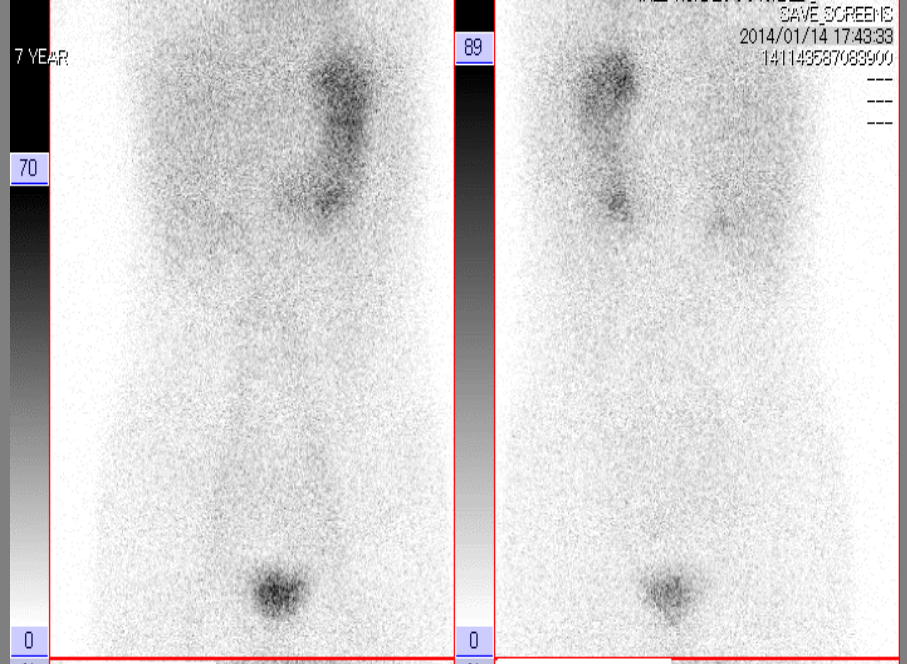
✓ 40 year old male presented hematochezia





The fat density is present all along the inverted diveticulum.

Liner fat density is seen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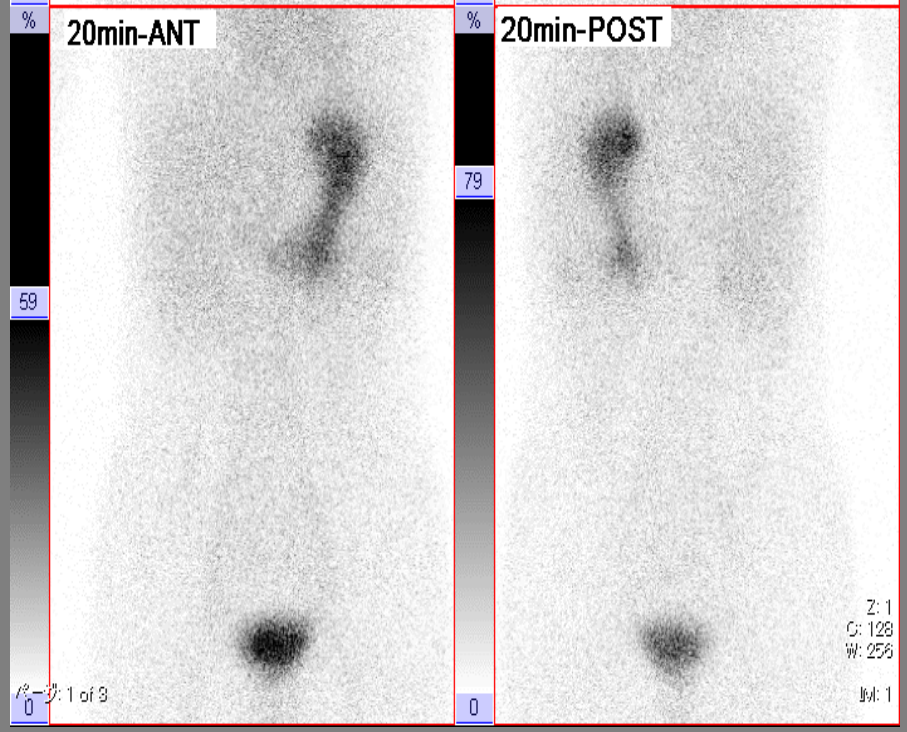
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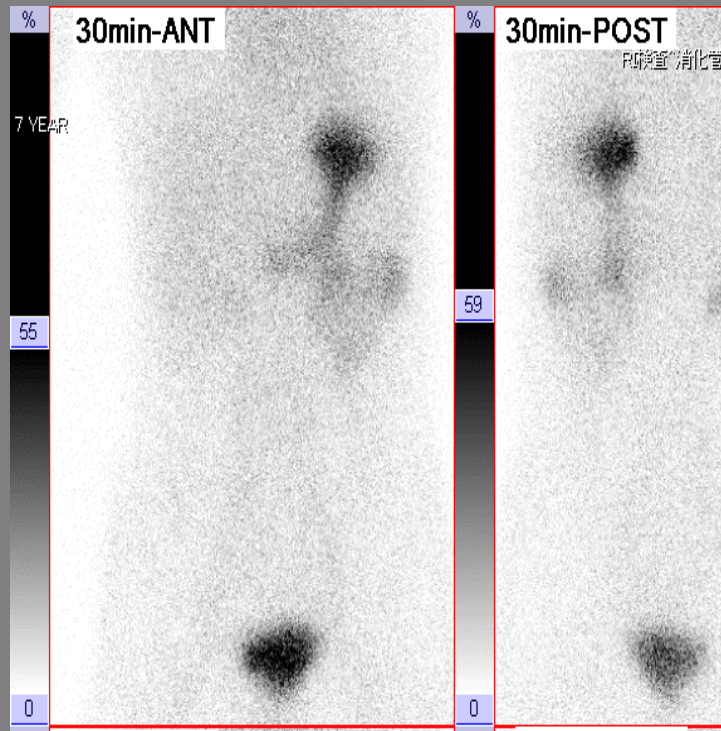
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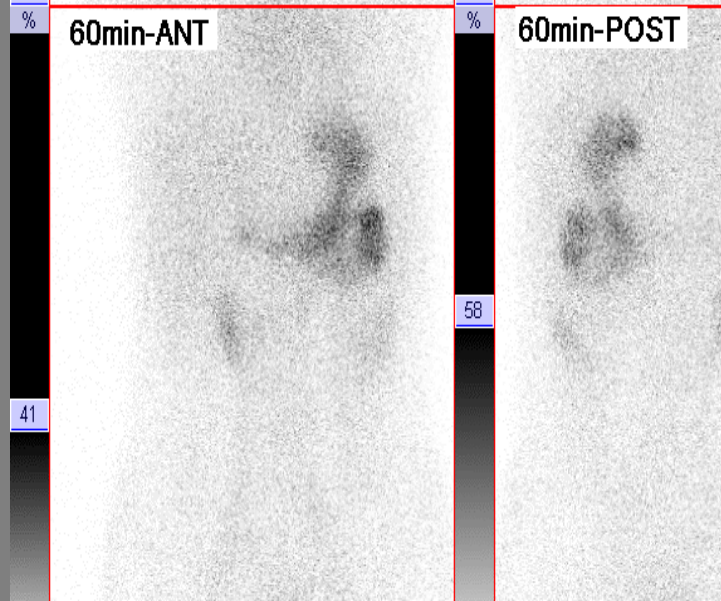
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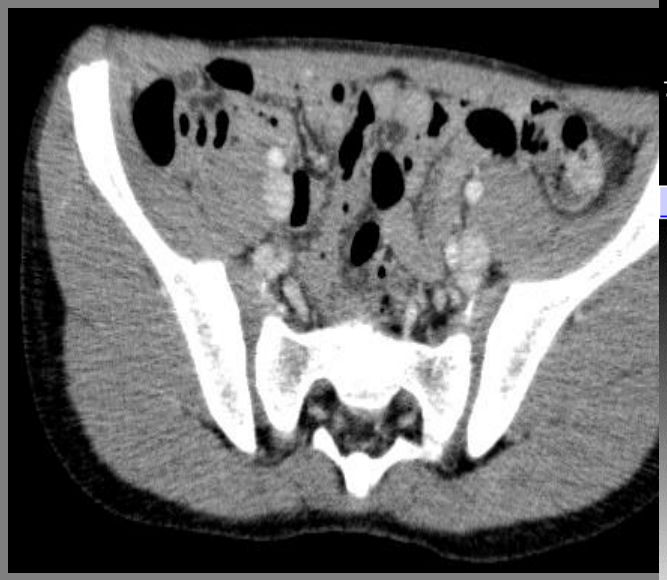

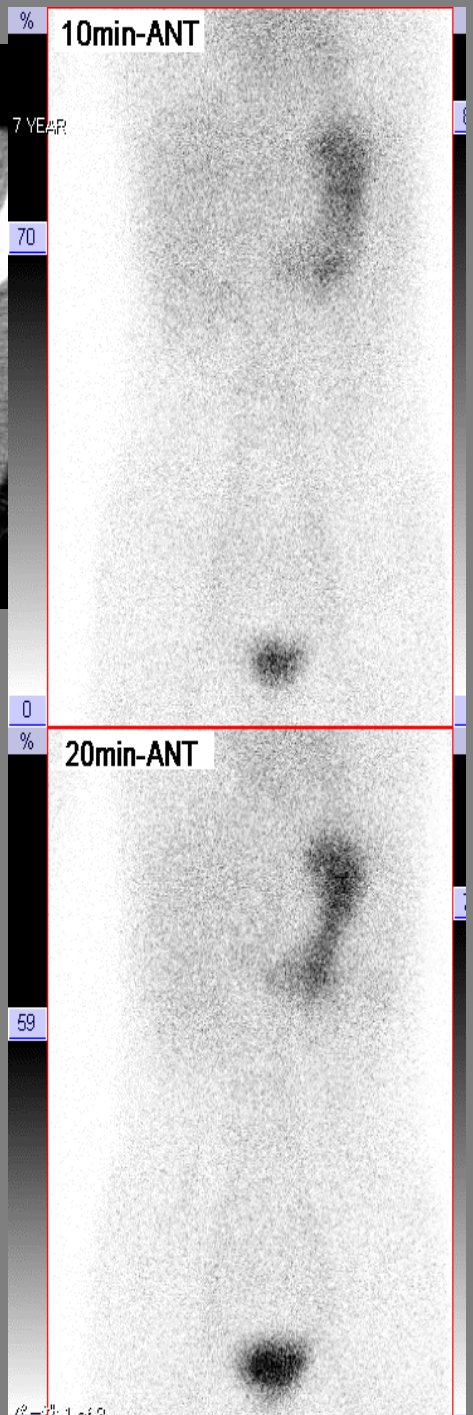
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