

Perforated Meckel Diverticulum

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Case Summary

A teenager presented with a one-day history of non-bloody, non-bilious emesis, incomplete defecation, and periumbilical abdominal pain with an episode of extreme groin and anal pain. The patient had a medical history significant for a right inguinal hernia repair. While vital signs were normal, laboratory evaluation revealed a markedly elevated white blood cell count of 21,850/mm³ with a left shift.

Imaging Findings

A right lower quadrant ultrasound (Figure 1) was performed to evaluate for appendicitis. The scan did not show the appendix. However, a tubular structure was visible that did not connect to the cecum. The tubular structure had a thickened wall, associated echogenic fat, and mild wall hyperemia. A small collection with internal debris was visible adjacent to the tubular structure.

The study was interpreted as indeterminate for appendicitis. A

computed tomography (CT) scan (Figure 2) showed a dilated, blind-ending tubular structure measuring up to 2.1 cm in diameter in the mid-lower abdomen. This appeared to arise off the antimesenteric side of the distal ileum, with hyperenhancement of the mucosa. There was some irregularity and discontinuity along the posterior aspect of the structure with scattered areas of free air within the peritoneal cavity. An additional, non-enhancing fluid collection was seen in the retro-vesicular pouch. The appendix was identified and appeared normal.

Surgical pathology revealed a perforated ileum at the junction with a Meckel diverticulum containing ectopic gastric mucosa.

Diagnosis

Ruptured Meckel diverticulum

Discussion

A Meckel diverticulum is a congenital anomaly of the gastrointestinal tract, occurring in 0.3-2.9% of the population.¹ It results from incomplete regression of the vitelline duct during the 10th through 12th weeks of gestation. The result is a blind pouch at the antimesenteric border of the terminal ileum, with variable location up to 200 cm proximal to the ileocecal valve.¹ There are other anomalies of the vitelline

duct, including an umbilical sinus or ileo-intestinal fistula; however, these account for only 2% of vitelline duct abnormalities. Pathologically, a Meckel diverticulum is expected to contain normal intestinal mucosa. However, ectopic tissue is common; it most frequently arises from the stomach or pancreas.²

A Meckel diverticulum can become symptomatic for one of two reasons: obstruction causing diverticulitis, or the effects of ectopic tissue. Patients with symptomatic Meckel diverticulitis classically present with abdominal pain and are often misdiagnosed with appendicitis. Patients with ectopic gastric mucosa may first present with painless gastrointestinal bleeding.

Although it occurs with similar frequency in males and females, Meckel diverticulum is more commonly symptomatic in males.³ The causes for symptomatic Meckel diverticulum are not limited to the inflammation seen in Meckel diverticulitis. A systematic review of the etiology of symptomatic Meckel diverticula showed that approximately 47% of cases in children present with obstruction (a large portion resulting from intussusception), 25% of cases with painless gastrointestinal bleeding, and 20% with inflammation.^{1,2}

Other complications of a Meckel diverticulum include perforation, neoplasm, and enterolith formation.⁴

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Figure 1. (A) Transverse ultrasound image of the right lower quadrant shows an inflamed bowel segment (arrow) with a thickened wall, mild hyperemia, a small amount of surrounding free fluid, and surrounding echogenic fat. (B) Transverse ultrasound image of the right lower quadrant shows an irregularly shaped fluid collection adjacent to the inflamed bowel segment. Debris is layering within the posterior aspect of the collection, and adjacent mesenteric fat is echogenic.

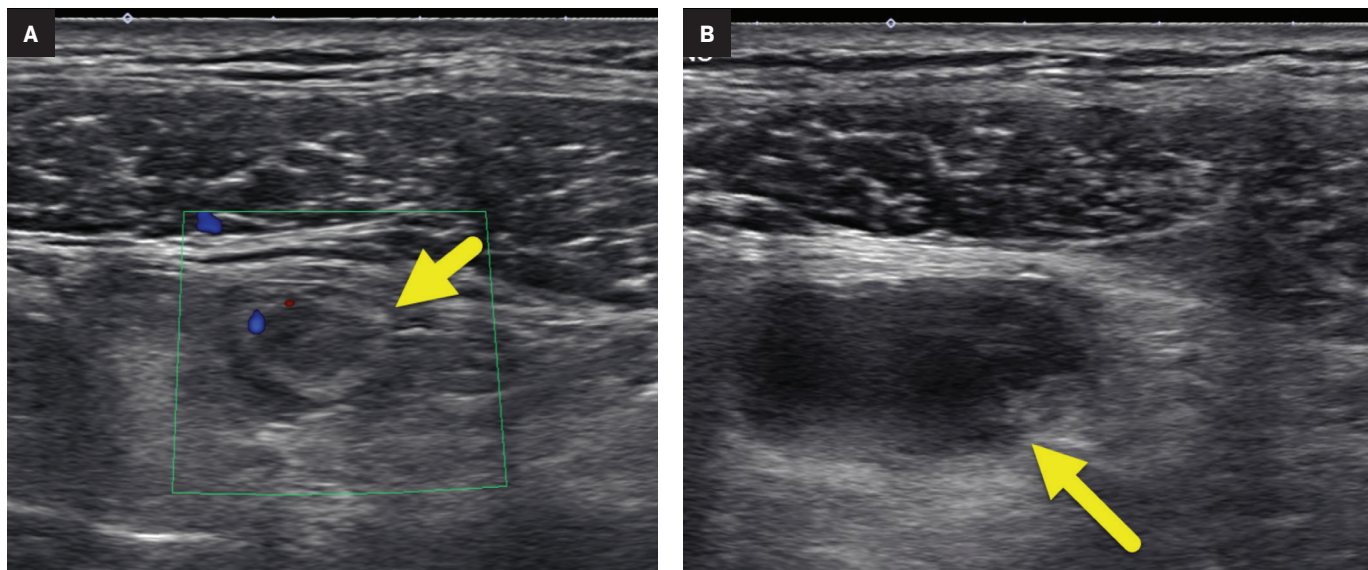
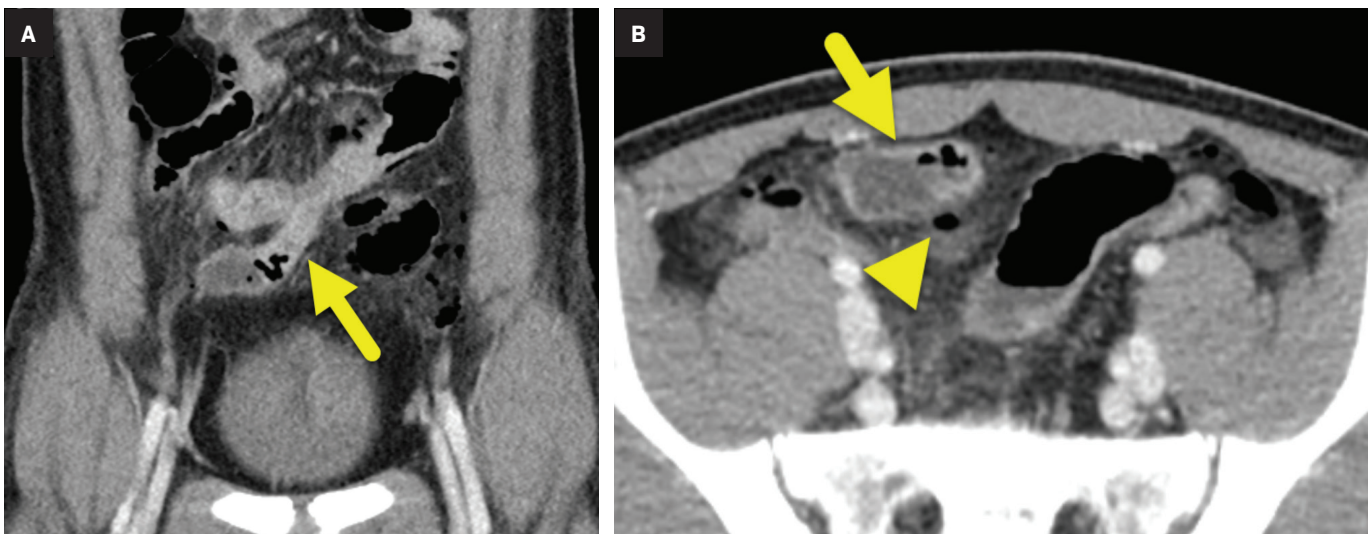


Figure 2. (A) Coronal CT image of the abdomen shows a Meckel diverticulum (arrow) arising from the anti-mesenteric side of the ileum. The segment is inflamed with a thickened wall and mild adjacent fat stranding. The distal portion of the diverticulum is more dilated and has a thin, irregular wall. (B) Axial CT image obtained at the distal portion of the diverticulum (arrow) shows a defect along the posterior wall with a small adjacent collection. A locule of free air (arrowhead) is visible within the collection.



In most patients, a Meckel diverticulum-associated complication is not the initial diagnosis, and these cases are often misdiagnosed as appendicitis, colonic diverticulitis, other bowel obstruction, or endometriosis.⁵

Imaging plays a key role in early diagnosis of Meckel diverticulum and its associated complications. Ultrasoundography is often first-line imaging

in patients presenting with abdominal pain. On right lower-quadrant ultrasound, a diverticulum will have the appearance of normal gut. The tubular, blind-ending pouch will appear continuous with the ileum and often be mistaken for the appendix. Identifying the normal appendix can help the radiologist make a more confident diagnosis of Meckel diverticulitis.

The diverticulum may be difficult to visualize on CT, but it appears as a blind-ending structure of small bowel proximal to the ileocecal valve.⁶ When it is inflamed, CT shows increased mural thickness along with signs of mesenteric inflammation. Bowel obstruction caused by a diverticulum can be visible with the presence of a transition point,

volvulus, or intussusception. A small-bowel perforation should be suspected when free intraperitoneal air is present.⁷

Gastrointestinal bleeding is often caused by ectopic gastric mucosa. In these instances, scintigraphy with ^{99m}Tc-pertechnetate has an 85-90% sensitivity in the pediatric population.⁸ The radiologist should look for fixed accumulation of the radiopharmaceutical that becomes visible at the same time gastric mucosa is visible.

Conclusion

Meckel diverticulum is a congenital abnormality that occurs in up to 3% of the population. Accurately diagnosing its complications remains a challenge. Diagnostic imaging plays a key role in the work-up of patients

with abdominal pain or painless gastrointestinal bleeding.

References

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