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Case Report

A case report of inverted Meckel's diverticulum ☆☆☆★

Elizabeth Rhodes, BS^a, Trevor Stone, MD^b, Laura Spruill, MD^c, Andrew D Hardie, MD^{b,*}

^a College of Medicine, Medical University of South Carolina University Medical Center, Charleston, South Carolina

^b Department of Radiology, Medical University of South Carolina University Medical Center, 25 Courtenay St., Charleston, SC, 29412 USA

^c Department of Pathology and Laboratory Medicine, Medical University of South Carolina University Medical Center, Charleston, South Carolina

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ABSTRACT

Inverted Meckel's diverticulum is an entity often discovered incidentally or through a clinical evaluation for gastrointestinal bleeding. While rare, inverted Meckel's diverticulum should be considered in the evaluation of a patient presenting with gastrointestinal bleeding, intestinal obstruction, or intussusception. In this case, a 67-year-old female with a remote history of surgically treated breast cancer presents to an urgent care facility with weakness and fatigue. She was found to be anemic with hemoglobin of 4. Imaging revealed a blind-ending pouch in the mid to distal ileum consistent with an inverted Meckel's diverticulum. Inverted Meckel's diverticulum is identified on computerized tomography as an intraluminal, blind-ending structure in the mid to distal ileum. The possibility of a lead point should be investigated and surgical resection is indicated to prevent intestinal obstruction.

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Introduction

Meckel's diverticulum occurs in 1%-3% of the population, making it the most common congenital anomaly of the gastrointestinal tract [1]. It is a true diverticulum which contains all three layers of the gut wall and often has ectopic tissue, such as gastric, duodenal, colonic, pancreatic, Brunner's

glands, hepatobiliary, and endometrial tissue. Gastric heterotopia is more common in patients with symptomatic Meckel's diverticulum [2]. Meckel's diverticulum receives a separate blood supply from the vitelline artery, which may be detected on imaging [3]. Patients may present with a wide variety of complications and clinical findings secondary to a Meckel's diverticulum at any age. Complications, including inflammation, ulceration, hemorrhage, small-bowel obstruction, stone

Abbreviations: CT, Computed tomography; MRI, Magnetic resonance imaging.

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* Corresponding author.

E-mail address: andrewdhardie@gmail.com (A.D. Hardie).

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formation, perforation, fistulae, neoplasm, and intussusception, occur in 4–40% of patients with a Meckel's diverticulum [3,4]. Bleeding is the most common clinical presentation, especially in younger patients [3]. Inverted Meckel's diverticulum is a rare pathology, and an even more rare cause of small bowel obstruction [5]. Most literature on the subject of inverted Meckel's diverticulum is in the form of case reports.

Meckel's diverticulum occurs due to persistence of the congenital omphalomesenteric duct. In fetal life, the omphalomesenteric duct connects the yolk sac to the intestinal tract via the umbilical cord and normally obliterates in the 5th–7th week of life [3]. There is no clear familial predisposition related to Meckel's diverticulum, however the risk of having Meckel's diverticulum is increased with malformation of the gastrointestinal tract, nervous system, or cardiovascular system. Many patients may remain asymptomatic throughout their lifetimes, with Meckel's diverticulum discovered incidentally on imaging or autopsy [6]. Consequently, exact prevalence is difficult to determine, but estimated to be 2% in the general population.

Patients commonly become symptomatic in the first decade of life, with an average age of presentation of 2.5 years. Risk factors that increase the likelihood of developing symptoms include age less than 50 years, male gender, diverticulum greater than 2 centimeters in length, presence of ectopic tissue, broad based diverticulum, and the attachment of fibrous bands to the diverticulum [6]. Men are more likely than women to present with symptomatic Meckel's diverticulum. Symptoms occur more commonly in younger patients, though patients may present at any age. Obstruction, hemorrhage, and inflammation are the most common presentations of a symptomatic Meckel's diverticulum [1,7]. The ectopic gastric mucosa secretes acid that is not buffered, which damages the adjacent small bowel wall, leading to ulceration and bleeding distal to Meckel's diverticulum [3,5]. Gastrointestinal bleeding is a major cause of presentations to the emergency department and hospital admissions [3]. Bowel obstructions are a common cause of hospitalizations resulting in urgent abdominal surgery. Bowel obstructions are most commonly caused by adhesions secondary to a prior operation, but can also be caused by neoplasms, hernias, volvulus, inflammatory bowel disease, or intussusception [5,8]. Meckel's diverticulum can act as a lead point for intussusception or serve as a site for benign or malignant neoplasms, resulting in small bowel obstruction secondary to this underlying congenital anomaly.

Case report

Clinical history

A 67-year-old female with a remote history of surgically treated breast cancer presents to an urgent care facility with weakness and fatigue. She was found to be anemic with hemoglobin of 4. An esophagogastroduodenoscopy was performed and was normal. A subsequent capsule study revealed a small submucosal mass in the ileum.

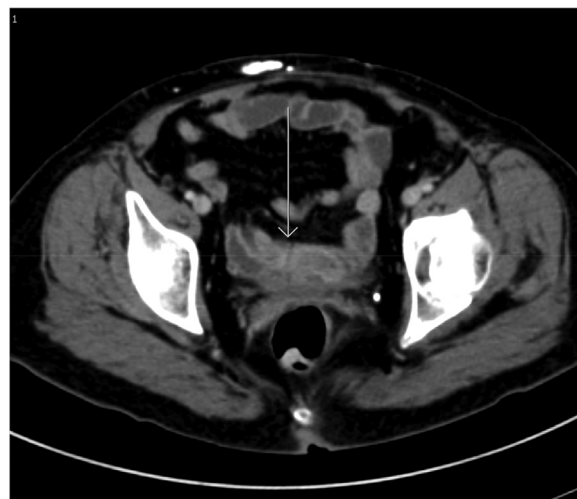


Fig. 1 – A 67-year-old female with an inverted Meckel's diverticulum.

Findings: Intraluminal, blind-ending structure (arrow) in the mid to distal ileum and in the expected location of a Meckel's diverticulum. No evidence of bowel obstruction. Consistent with inverted Meckel's diverticulum.

Technique: CT imaging of the abdomen and pelvis was performed following the administration of IV contrast. Coronal and sagittal images were reconstructed from the axial data set.

Imaging findings

A contrast-enhanced CT of the abdomen and pelvis without oral contrast demonstrated an intraluminal structure in the mid to distal ileum. The structure is a blind-ending pouch in the expected location of a Meckel's diverticulum (Figs. 1 and 2). There is no evidence of bowel obstruction.

Management

The patient was diagnosed with inverted Meckel's diverticulum via CT. She underwent a laparoscopic small bowel resection with anastomosis. Surgical pathology demonstrated small bowel with intraluminal small bowel, consistent with inverted Meckel's diverticulum (Figs. 3 and 4).

Discussion

Meckel's diverticulum may be asymptomatic throughout an individual's life, only to be discovered incidentally during autopsy. Inverted Meckel's diverticulum can present with lower gastrointestinal bleeding, chronic abdominal pain, or symptoms of small bowel obstruction such as nausea, vomiting, abdominal pain, and failure to pass flatus or bowel movements [5]. The wide variety of clinical presentations and age at presentation provides an important role for radiologic imaging in the diagnostic workup.



Fig. 2 – A 67-year-old female with an inverted Meckel's diverticulum.

Findings: Intraluminal, blind-ending structure (arrow) in the mid to distal ileum and in the expected location of a Meckel's diverticulum. No evidence of bowel obstruction. Consistent with inverted Meckel's diverticulum.

Technique: CT imaging of the abdomen and pelvis was performed following the administration of IV contrast. Coronal and sagittal images were reconstructed from the axial data set.

Radiographs are often obtained in the initial workup of a patient presenting with abdominal pain or concern for small bowel obstruction, however they are of limited value in the diagnosis of Meckel's diverticulum. Radiographs may show enteroliths, findings consistent with bowel obstruction, or gas or air-fluid levels within the diverticulum [1].

Barium studies can demonstrate Meckel's diverticulum as a blind-ending pouch, similar in appearance to the appendix. Meckel's diverticulum is located in the distal portion of the ileum. Masses or ectopic mucosa may cause a filling defect within the diverticulum [1,9].

Sonography is often used in pediatric patients and has some utility in the diagnosis of Meckel's diverticulum. Sonography demonstrates a fluid-filled, blind-ending pouch located in the right lower quadrant. The structure has an echotexture consistent with the gut and a demonstrable connection to the normal small bowel. The echo-free contents cannot be compressed or expressed into the connecting bowel loop. Enteroliths are seen as echogenic foci producing shadows [10].

CT usually cannot distinguish Meckel's diverticulum from normal bowel in asymptomatic patients. However, when visualized, Meckel's diverticulum appears as a blind-ending structure filled with gas or fluid, in communication with the small bowel, and covered with a thick coating of enhancing soft tissue [1,11]. Complications of Meckel's diverticulum including enteroliths, intussusception, diverticulitis, and small bowel obstruction can be evaluated with CT. CT angiography may show the persistent omphalomesenteric artery in some individuals with Meckel's diverticulum who present with continued bleeding [1].

Scintigraphy with technetium-99m pertechnetate can be used to evaluate patients for rare sources of bleeding, such as a suspected Meckel's diverticulum [3]. This study approaches a diagnostic accuracy of 90% in pediatric patients but has a diagnostic accuracy of <50% when used in adults [12]. Gastric mucosa and ectopic gastric tissue take up the pertechnetate, which allows for the diagnosis of Meckel's diverticulum containing ectopic gastric mucosa [1].

While imaging findings may be highly consistent with Meckel's diverticulum, the gold standard diagnosis remains surgical exploration [12].

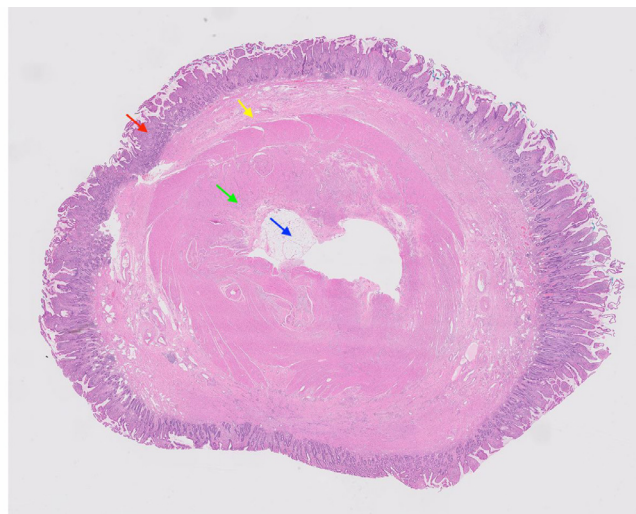


Fig. 3 – Inverted Meckel's diverticulum histology at 1.5x. This low power histologic image demonstrates circumferential small bowel mucosa (red arrow), surrounding the submucosa (yellow arrow), muscularis propria (green arrow) and serosal adipose tissue (blue arrow). This orientation is the reverse of normal bowel, confirming inversion has occurred. There is no evidence of dysplasia or malignancy in the mucosa or submucosal spaces.

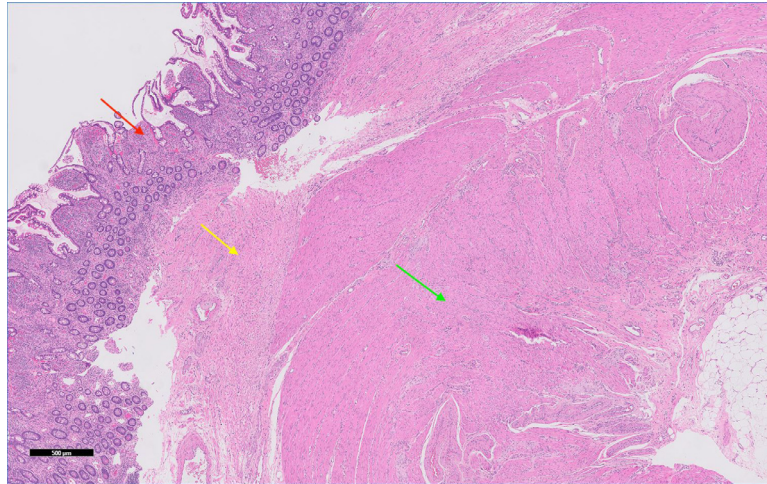


Fig. 4 – Inverted Meckel's diverticulum histology at 10 x. This higher power image demonstrates small bowel mucosa (red arrow), submucosal fibroconnective tissue (yellow arrow) and smooth muscle (green arrow), in the reverse configuration of normal bowel consistent with inversion.

The differential diagnosis for small bowel mass includes an inverted appendix, inverted colonic diverticulum, intussusception, hernia, lipoma, polyp, and benign or malignant neoplasm.

Inverted appendix is a rare finding. Location of the lesion plays an important role in distinguishing an inverted appendix from an inverted Meckel's diverticulum. Both an inverted appendix and an inverted Meckel's diverticulum demonstrate soft tissue enhancement on imaging. Barium enema may show a filling defect in the cecum. CT may demonstrate inversion of the appendix within the cecum [13]. Conversely, Meckel's diverticulum would be expected in the distal portion of the ileum. Similarly, inverted colonic diverticulum is so rare that there are limited studies to describe imaging findings, although may mimic colonic polyps. On barium enema, inverted colonic diverticulum has been described as a smooth, polypoid mass [14]. When intussusception occurs as a result of an inverted colonic diverticulum acting as a lead point, a target sign or coiled spring appearance may be seen on CT [15].

Intussusception can occur in the presence or absence of an identifiable lead point. In adults, a lead point is almost always identified. Ultrasound can be used to evaluate possible intussusception in children but has limited diagnostic value in adults. Barium enema will demonstrate a classic coiled spring appearance produced by barium within the intussusceptum and intraluminal space. CT may demonstrate a target sign with the layers of bowel forming concentric rings. When an intussusception occurs, mesenteric fat can be drawn into the lumen of the bowel. The fat results in soft tissue enhancement on imaging, causing an intussusception to appear similar to a lipoma or an inverted Meckel's diverticulum. Lipomas can appear quite similar to inverted Meckel's diverticulum on CT. The inverted Meckel's diverticulum pulls mesenteric fat into the lumen of the bowel, as demonstrated in Figures 1 and 2. The presence of fat, and consequently soft tissue enhancement on imaging, is common to both lipomas and inverted

Meckel's diverticula. Lipomas will demonstrate a thin covering over a low-density fatty mass. Inverted Meckel's diverticulum will appear as an intraluminal polypoid lesion in the small intestine covered by a thick collar of enhancing soft tissue [11].

If there are multiple polyps, inverted Meckel's diverticulum and inverted appendix can be ruled out as they are by definition singular lesions. Polyps produce radiolucent filling defects on barium enema. Ultrasound can demonstrate a spherical or ovoid hypoechoic lesion. CT may demonstrate pedunculated or sessile lesions. Polyps lack a fatty tissue component, in contrast to inverted Meckel's diverticulum and lipomas. Neoplasms arising in Meckel's diverticula occur in 3% of complicated cases and are quite rare. Carcinoid tumors are the most common, but other tumors including leiomyoma, leiomyosarcoma, angioma, neuroma, lipoma, carcinosarcoma, and adenocarcinoma have also been reported. Tumors can have nonspecific, variable imaging findings but may demonstrate a sessile or lobulated filling defect. Malignant neoplasms have the potential to invade mesenteric fat [1].

Asymptomatic Meckel's diverticulum does not require prophylactic surgical resection if detected [5,16]. Resection of an incidentally noted Meckel's diverticulum had a higher rate of early complications with an increased risk of later development of intestinal obstruction compared to leaving it in situ. The rationale for prophylactic resection focuses on the removal of a potential cause of symptoms throughout an individual's lifetime [2]. However, if inverted Meckel's diverticulum is identified on imaging, surgical management is recommended due to the high risk of small bowel obstruction and bowel ischemia secondary to intussusception with the Meckel's diverticulum as a lead point [5]. In adults, surgical treatment is required in all cases of suspected intussusception due to the high risk of an associated malignancy acting as a lead point or risk of recurrent intussusception and subsequent obstruction with benign lesions [4].

Conclusion

Inverted Meckel's diverticulum can be a cause of gastrointestinal bleeding; however, neoplasm should be considered as a possible lead point, the possibility of an inverted colonic diverticulum or inverted appendix should be considered, and diagnosis confirmed by surgical resection and pathologic review of the specimen.

Teaching point

Inverted Meckel's diverticulum is a rare entity, which appears on CT as an intraluminal, blind-ending structure in the mid to distal ileum. Presentations may be variable; however, the possibility of a lead point should be investigated, and surgical resection performed to prevent intestinal obstruction.

Consent

Did the author obtain written informed consent from the patient for submission of this manuscript for publication? (Answer with yes or no.)

Yes.

Human and animal rights

Not applicable.

Authors' contributions

Elizabeth Rhodes compiled, drafted, and finalized the case report.

Trevor Stone assisted with image acquisition and with editing and revising each draft.

Laura Spruill provided pathology images and assisted with detailed descriptions of the histology slides.

Andrew Hardie proposed the case for the submission and assisted with editing and revising each draft.

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