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CASE REPORT

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Recognizing perforated Meckel's diverticulum: A crucial differential in acute appendicitis imitation

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Key Clinical Message

Meckel's diverticulitis (MD) mimics acute appendicitis with right lower abdominal pain. Clinicians must consider MD in acute abdomen cases to avoid diagnostic delays. Perforated MD can lead to serious complications. Timely use of advanced imaging and surgical assessment is essential for accurate diagnosis and management.

Abstract

Meckel's diverticulum (MD) is a gastrointestinal congenital anomaly that signifies a persistent remnant of the omphalomesenteric duct. While frequently asymptomatic, its complications vary widely, ranging from mild and painless to potentially life-threatening conditions. This is a case of a 4-year-old female patient with sudden abdominal pain and tenderness, with an elusive cause before surgery. The definitive diagnosis of a perforated MD was established during diagnostic laparoscopy due to worsening symptoms. Detecting MD and its potential complications requires a high degree of suspicion. Once recognized, prompt management is essential to prevent further complications. Although perforation is uncommon in MD, its symptoms can mimic acute appendicitis, confusing emergency settings. This article underscores the significance of diagnosing MD, despite its rarity, and emphasizes the necessity for swift treatment upon identification.

KEYWORDS

acute appendicitis, congenital, Meckel's diverticulum, pediatrics, perforation, peritonitis

1 | INTRODUCTION

Meckel's diverticulum (MD), initially documented in 1598 by Fabricius Hildanus, gained its name from the German anatomist Johann Friedrich Meckel, who comprehensively described its embryological and pathological features in 1809. As a true diverticulum, MD encompasses all three layers of the bowel wall, often with ectopic tissue,[1] resulting from incomplete obliteration of the proximal omphalomesenteric duct during the 7th week of gestation, making it the most prevalent congenital malformation of the gastrointestinal tract.[2] Adhering to the "rule of two," it is estimated to be present in approximately 2% of the population, with a male-to-female ratio of 2:1, typically situated 2 feet (60 cm) from

the ileocecal valve, measuring around 2 cm in diameter and 2 inches (5 cm) in length, and it frequently harbors two types of ectopic tissue, commonly gastric and pancreatic, and is often identified before the age of 2.[1]

Given its diverse clinical manifestations, MD can be challenging to diagnose, especially in pediatric cases. Symptomatic MD commonly presents with bleeding, followed by intestinal obstruction, diverticulitis, intussusception, and, rarely, neoplasm or perforation.[3] In this context, we present a case of spontaneous MD perforation in a female child, diagnosed during laparotomy and confirmed postoperatively.

2 | CASE HISTORY

A 4-year-old female patient of Asian origin presented to the emergency department with a two-day history of fever, vomiting, abdominal pain, and abdominal distension, which worsened in the 2 h of preceding admission. The patient did not report blood in the stool or constipation, had no prior episodes of similar complaints, and was up-to-date with immunizations. Her medical history and family medical history did not reveal any noteworthy findings. Upon initial examination, the patient exhibited a body temperature of 39.8°C, with other vital signs within normal limits. Laboratory tests showed mild anemia (hemoglobin level 10.2 g/dL), elevated platelet count (4.7 lakhs/mm^3), and normal absolute value count of WBC (6900 μL) with neutrophilia (71%). The abdominal region appeared mildly distended with tenderness concentrated in the lower abdomen and associated muscle guarding, while no masses were palpated.

3 | METHODS (DIFFERENTIAL DIAGNOSIS, INVESTIGATIONS AND TREATMENT)

Since the orthostatic chest and abdominal X-ray images (Figure 1) were technically inconclusive, plain abdominal and pelvic computed tomography (CT) was performed. The CT results (Figure 2A,B) indicated dilated small loops (2.7 cm), multiple sub-centimeter mesenteric lymph nodes (the largest measuring 7 mm), diffuse mesenteric and peritoneal thickening, and free fluid in the right iliac fossa, pelvic, and paracolic gutter—consistent with appendicular perforation. However, visualization of the appendix was not achieved.

Initial management involved intravenous fluids, analgesics, and prophylactic antibiotics. Subsequently, a laparotomy was performed, during which accumulated peritoneal fluid was suctioned out. The surgeon identified a perforated MD (Figure 3A,C) at a 2-inch distance from the ileocecal valve and an acute appendix (Figure 3B). A diverticulectomy of the segment with Meckel's and appendectomy was performed with enterotomy followed by end-to-end anastomosis. Histopathological analysis using E and D staining under 40x magnification(Figure 4) of the excised specimen (Figure 3D) revealed an MD measuring 4 × 3 cm, long broad base type with signs of congestion, denudation, and mucosal necrosis of the ileal type with villi. The specimen's walls exhibited dense and widespread infiltration of polyps extending to the serosa, confirming the diagnosis of a perforated MD with acute appendicitis.

4 | CONCLUSION AND RESULT

Identifying MD poses a challenge as its clinical presentation often mirrors the nonspecific right lower abdominal quadrant pain characteristic of acute appendicitis. This case report highlights the significance of including MD as a potential differential diagnosis when confronted with a patient exhibiting symptoms of an acute abdomen. A perforated MD can give rise to severe, life-threatening complications. The utilization of advanced diagnostic methods, including imaging studies and surgical exploration, when necessary, becomes crucial for achieving a precise and timely diagnosis.

5 | DISCUSSION

The prevalence of MD in the general population is documented to be between 0.3% and 1.2%.[4] Most studies

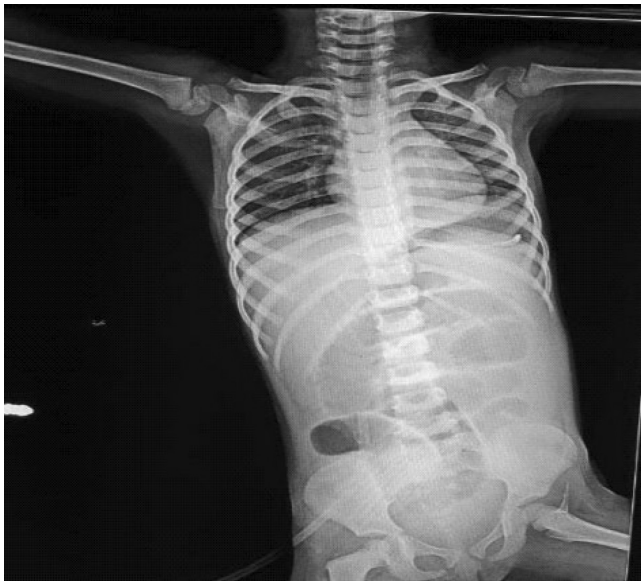

FIGURE 1 AP view chest and abdominal X-ray.

reviewed indicate an average age of 5.1 years for MD presentation, with a significant proportion occurring in individuals younger than 2 years old, accounting for almost 50% of cases.[5,6] The male-to-female ratio varies from 2:1 to 4:1, with a higher occurrence of complications observed in males.[7,8] Symptomatic MD is reported in 4.2% to 16.9% of individuals with MD.[9]

In the majority of reported cases, patients manifest abdominal pain, predominantly localized around the umbilicus, in the right iliac fossa, or the lower abdominal region. Additional symptoms include bloody stool, as well as nausea and vomiting.[9] The pediatric population with symptomatic MD tends to exhibit obstructive symptoms more frequently.[9] J F Meckel previously suggested a 25% incidence of complications related to MD, but the recent literature indicates a range of 4%–16%.[5] Perforation is a rare occurrence and was described in a review as the contributing complication in 0.5% of cases of symptomatic MD.[10] The manifestation of MD perforation involves signs of diffuse peritonitis, typically concentrated in the lower abdominal area.[5]

Individuals with a diverticular length exceeding 2 cm were found to be more susceptible to developing symptoms, as reported by the Mayo Clinic survey.[10] Some studies have indicated that an MD with a long or thin base is more likely to exhibit symptoms than a short or broad-based one.[6]

In cases of children experiencing obstructive symptoms, despite its low specificity, the clinical preference for radiological or sonographic modalities over a Meckel's scan is emphasized, as MD accounts for only a small fraction of intestinal obstruction. While experienced radiologists may identify certain imaging clues for MD, routine

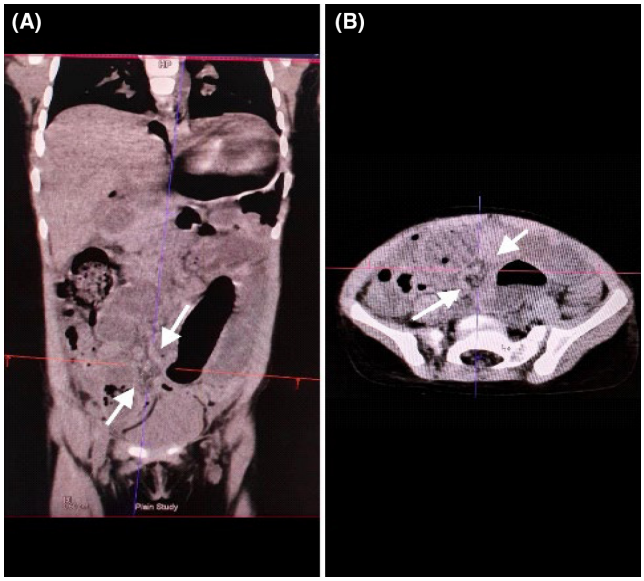

FIGURE 2 CT scan of the abdomen and pelvis in sagittal (A) and axial (B) planes showcasing inflammatory and peritoneal changes, with the appendix not visualized.

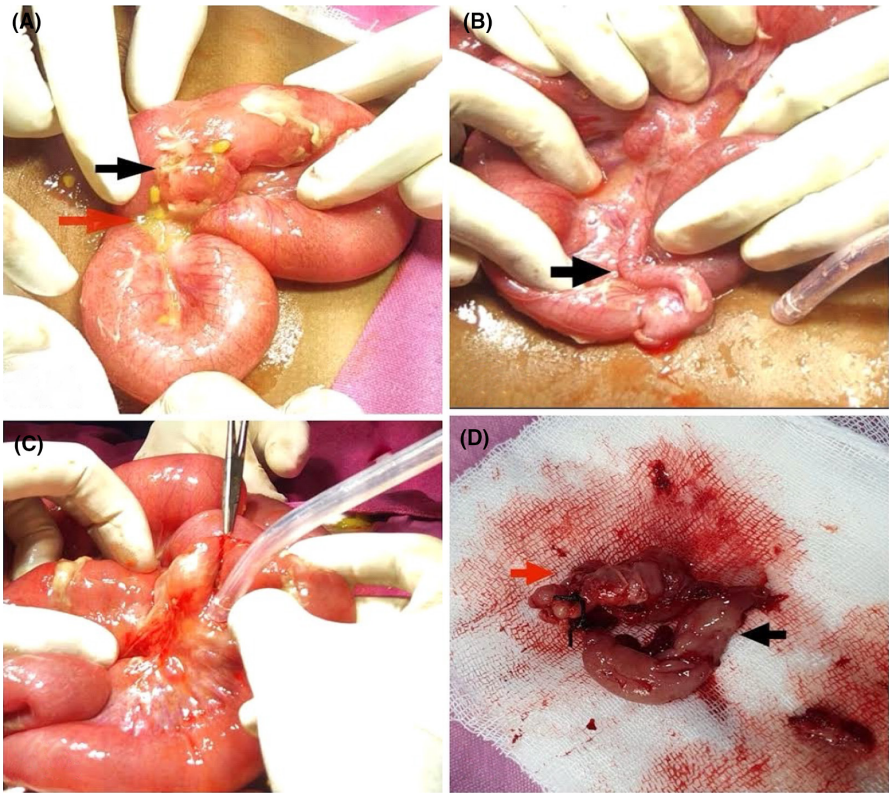

FIGURE 3 Intraoperative findings: (A) perforated MD (black arrow) with leaked feces (red arrow); (B) Mildly inflamed appendix; (C) Suctioning of the perforated MD; (D) Resected specimen of the small bowel sent for histopathology revealing part of the ileum (red arrow) and part of the MD (black arrow).

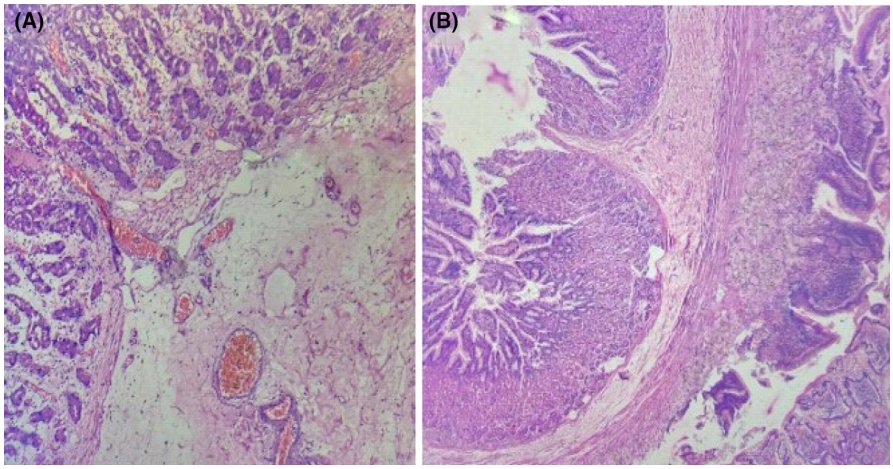

FIGURE 4 Histopathology examination: (A)—Demonstrates serosal congestion, partial denudation, and necrosis of mucosa; (B)—Demonstrates mucosa of ileum with villi.

computed tomography is not recommended for cases presenting with intestinal obstruction.[6]

In a study, 20 children presented with acute abdomen (acute-onset abdominal pain, fever, and leukocytosis) preoperatively with the diagnosis of acute appendicitis, and none of them received Tc-99 m scanning. However, ultrasonography (US) was performed in all patients before surgery to diagnose appendicitis but was of limited value in diagnosing MD.

The use of technetium-99 m (Tc-99 m) pertechnetate scintigraphy to detect ectopic gastric mucosa has been a well-established tool to diagnose MD in patients with repeated lower gastrointestinal bleeding or repeated attacks of intussusception, especially in older children or chronic intussusception, with relatively high sensitivity and specificity.[11] A study encompassing ultrasound examinations in all patients failed to identify MD in any case, and only 6% of those who underwent an abdominal CT scan exhibited MD as the cause of symptoms, highlighting the challenges in establishing a diagnosis.[11] Moreover, CT scans and ultrasound are not viable diagnostic tests as they cannot distinguish between a diverticulum and a loop of bowel.[3] In a study, 20 children presented with acute abdomen (acute-onset abdominal pain, fever, and leukocytosis) preoperatively with the diagnosis of acute appendicitis, and none of them received Tc-99 m scanning. However, ultrasonography (US) was performed in all patients before surgery to diagnose appendicitis but was of limited value in diagnosing MD.[16] Consequently, most instances of MD prove challenging to diagnose and are often incidentally discovered during surgical procedures conducted for other reasons. It is noted that less than 10% of symptomatic cases receive a preoperative diagnosis.[12]

Surgical resection is considered the preferred treatment for symptomatic MD, encompassing diverticulectomy, segmental bowel resection, anastomosis, and wedge resection.[13] The overall lifetime complication rate stands at approximately 4%.[14] The most prevalent presentations include bleeding, followed by intestinal obstruction, diverticulitis, intussusception, neoplasm, and perforation.[11] Perforated MD is attributed to acute inflammation of the MD[15] and may present as an acute abdomen, resembling acute appendicitis.

A recent literature review by Keese et al. in 2019 identified 641 pediatric patients (aged 1 day to 17 years) with MD, of whom 528 were symptomatic. Half of the symptomatic patients were under 4 years old, with a male-to-female ratio of 3:1. Intestinal obstruction was reported in 41% of cases, with 17% secondary to intussusception. Gastrointestinal bleeding, diverticulitis, and perforation were reported in 34%, 13%, and 10% of cases, respectively.[9] In cases presenting clinical symptoms akin to acute appendicitis, maintaining a high index of suspicion for MD is imperative. Clinicians should consider MD as a differential diagnosis, particularly in pediatric and young adult patients, emphasizing the importance of early intervention to prevent serious complications. This underscores the significance of vigilant clinical assessment and an informed diagnostic approach.

AUTHOR CONTRIBUTIONS

Faiza Azeema Shaikh: Conceptualization; data curation; investigation; methodology; project administration; validation; writing – original draft. **Dilip Vasant KA:** Conceptualization; data curation; formal analysis; investigation; resources; supervision; validation; visualization; writing – original draft. **Humaira Shaikh:** Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; software; supervision; validation; visualization; writing – original draft. **Malik Olatunde Oduoye:** Conceptualization; data curation; funding acquisition; software; validation; visualization; writing – original draft.

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CONFLICT OF INTEREST STATEMENT

The author(s) has no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

All relevant data about this case are made available within the manuscript.

ETHICS STATEMENT

Our institution does not require ethics approval for reporting individual cases or case series.

CONSENT

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

GUARANTOR

MOO is the guarantor.

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