

Synchronous Complicated Meckel's Diverticulum and Acute Appendicitis Across the Paediatric Spectrum: A Case Series and Evidence-Based Operative Appraisal

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Abstract

Background

Meckel's diverticulum (MD) is the most common congenital anomaly of the gastrointestinal tract, with a prevalence of approximately 2–4% in the general population. Although most individuals remain asymptomatic, a minority develop clinically significant complications. Acute appendicitis remains the most frequent indication for emergency abdominal surgery worldwide. The synchronous occurrence of complicated MD and acute appendicitis is rare and presents diagnostic and therapeutic challenges.

Case presentation

We report three cases across the paediatric–adolescent spectrum: a 17-year-old male with perforated MD and concurrent appendicitis presenting as generalised peritonitis; a 9-year-old boy with inflammatory MD identified during laparoscopic appendicectomy; and a 5-year-old child with torsion and gangrenous perforation of MD with concomitant acute suppurative appendicitis. We correlate clinical presentation, imaging findings, intraoperative decision-making, and operative strategy with contemporary surgical evidence. In all cases, segmental ileal resection with primary anastomosis and appendicectomy achieved definitive source control and favourable outcomes.

Conclusion

These cases underscore the importance of maintaining diagnostic vigilance for dual pathology, routine distal ileal inspection when indicated, and adherence to morphology-based resection principles in complicated MD.

Keywords: Synchronous, Diverticulum, Acute Appendicitis, Paediatric Spectrum.

Introduction

Meckel's diverticulum (MD) arises from incomplete obliteration of the omphalomesenteric duct and represents a true diverticulum containing all layers of the intestinal wall. It originates from the antimesenteric border of the ileum, typically located 40–100 cm proximal to the ileocaecal valve [1].

The natural history of MD was classically described by Soltero and Bill, who demonstrated that although prevalence approaches 2–4%, only approximately 4–6% of individuals develop complications [2]. Subsequent epidemiological analyses have confirmed these findings [3]. Complications include bleeding, diverticulitis, obstruction, intussusception, torsion, and perforation [1,3].

Acute appendicitis carries a lifetime risk of approximately 7–8% and remains the leading cause of emergency

abdominal surgery worldwide [4]. Although both entities are common independently, synchronous presentation is distinctly uncommon and sparsely reported [5,6].

Large institutional series, including the Mayo Clinic experience, have emphasised variability in anatomical features and risk factors associated with symptomatic progression [3]. More recent systematic reviews and paediatric cohort analyses have reaffirmed male sex, age younger than 45 years, diverticular length greater than 2 cm, and abnormal morphology as predictors of complications [7,8].

Radiologically, differentiation between appendicitis and MD remains challenging. CT and ultrasound reliably identify appendicitis but demonstrate reduced sensitivity for MD unless complicated [9,10]. Contemporary radiological reviews highlight persistent diagnostic limitations in inflammatory MD [11].

This case series illustrates three operative phenotypes of synchronous MD and appendicitis across the paediatric–adolescent spectrum and contextualises management within contemporary evidence.

Case 1

A 17-year-old male presented with a 48-hour history of progressively worsening abdominal pain, distension, bilious vomiting, and high-grade fever. The pain initially localised to the peri-umbilical region and later became diffuse. He had a history of recurrent lower gastrointestinal bleeding during childhood; previous oesophagogastroduodenoscopy and colonoscopy were unremarkable. A Technetium-99m pertechnetate scan had shown focal tracer uptake in the right lower abdomen consistent with Meckel's diverticulum containing ectopic gastric mucosa, and bleeding episodes were managed conservatively. One week before admission he had a brief self-limiting episode of haematochezia. On examination he appeared toxic, febrile, and tachycardic with abdominal distension, generalised tenderness, guarding, rigidity, and absent bowel sounds consistent with diffuse peritonitis. Laboratory investigations showed leukocytosis with neutrophilia. Contrast-enhanced CT demonstrated perforated Meckel's diverticulum with moderate free fluid and an enlarged inflamed appendix. Emergency exploratory laparotomy revealed approximately 80 mL of turbid fluid and a perforated Meckel's diverticulum 70 cm proximal to the ileocaecal valve with base inflammation, along with a grossly inflamed appendix. Segmental ileal resection with primary end-to-end anastomosis and appendicectomy were performed due to haemodynamic stability, healthy bowel edges, and absence of gross faecal contamination (Figure 1). Histopathology confirmed perforated Meckel's diverticulum with ectopic gastric mucosa and acute suppurative appendicitis. Recovery was uneventful.

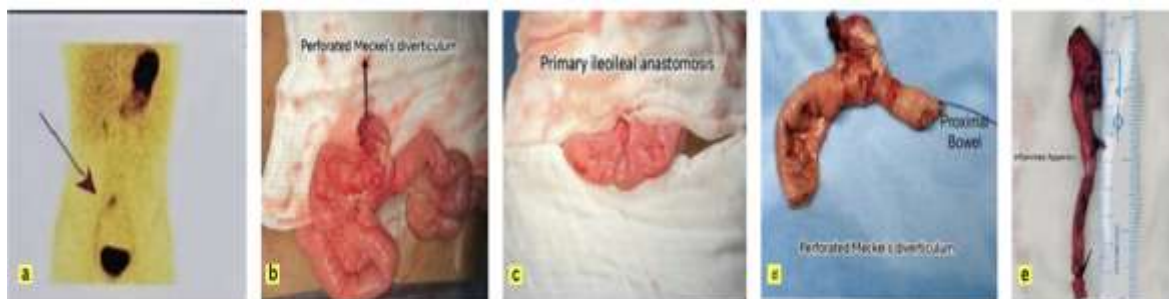


Figure 1. Perforated Meckel's diverticulum with appendicitis. (a) Technetium-99m pertechnetate scan showing focal uptake consistent with Meckel's diverticulum. (b) Intraoperative perforated diverticulum. (c) Primary ileo-ileal anastomosis. (d) Resected diverticulum. (e) Resected appendix.

Case 2

A 9-year-old boy presented with three days of peri-umbilical pain migrating to the right iliac fossa, associated with low-grade fever and non-bilious vomiting. He had a history of intermittent abdominal pain for approximately 18 months, which had not been previously investigated. On examination, he had right iliac fossa tenderness with localised guarding and rebound tenderness. Laboratory investigations demonstrated leukocytosis with neutrophilic

predominance and elevated C-reactive protein. Abdominal ultrasonography revealed a non-compressible, enlarged appendix consistent with acute appendicitis. No additional pathology was clearly visualised. Laparoscopic appendicectomy was undertaken. Intraoperatively, the appendix appeared inflamed but intact. Given the chronicity of symptoms disproportionate to appendiceal findings, systematic inspection of the distal ileum was performed. An inflamed MD was identified approximately 60 cm proximal to the ileocaecal valve, with inflammatory involvement extending to the diverticular base. A limited segmental ileal resection with primary anastomosis was therefore performed with mini-laparotomy assistance for anastomosis. Appendicectomy was completed during the same procedure (Figure 2). Histopathological examination confirmed acute-on-chronic appendicitis and transmural inflammation of MD. Postoperative period was uneventful.



Figure 2. Intraoperative findings and management. (a) Inflamed appendix and Meckel's diverticulum. (b) Resected appendix and diverticulum. (c) Primary ileo-ileal anastomosis following segmental resection.

Case 3:

A previously healthy 5-year-old boy presented with 48 hours of peri-umbilical abdominal pain, later localized to right iliac fossa regions. He had low-grade fever and one episode of non-bilious vomiting without rectal bleeding. Examination revealed fever, tachycardia, and lower abdominal guarding. Laboratory evaluation demonstrated leukocytosis with neutrophilia. Ultrasonography showed moderate pelvic free fluid with a non-visualised appendix. In view of evolving peritonitis, emergency exploratory laparotomy was performed. Approximately 80 ml of seropurulent fluid was encountered. A 5-cm Meckel's diverticulum, located 60 cm proximal to the ileocaecal valve, was twisted 360° at its base, resulting in vascular compromise, gangrene, and a pinpoint perforation. The adjacent ileum was viable. The appendix was oedematous and hyperaemic, consistent with acute suppurative appendicitis. Given torsion at the base and risk of microscopic ileal compromise, segmental ileal resection with primary end-to-end anastomosis was performed. The patient was haemodynamically stable with limited contamination, supporting primary reconstruction. Concomitant appendicectomy was undertaken (Figure 3). Recovery was uneventful. Histopathology confirmed transmural necrosis and perforated Meckel's diverticulum with acute suppurative appendicitis.



Figure 3. Intraoperative findings demonstrating axial torsion and perforation of Meckel's diverticulum. (a) (b) (c)

Axially twisted, gangrenous Meckel's diverticulum with 360° torsion at its base. (b) Transmural congestion and ischemia consistent with torsion-induced vascular compromise and perforation. (c) Post-segmental ileal resection with primary ileo-ileal anastomosis following complete excision.

Table 1. Clinical, Radiological and Operative Characteristics of Patients with Synchronous Meckel's Diverticulum and Acute Appendicitis

Variable	Case 1	Case 2	Case 3
Age / Sex	17 / Male	9 / Male	5 / Male
Duration of Symptoms	48 hours	3 days	48 hours
Initial Pain Location	Diffuse abdominal pain	Right lower quadrant	Peri-umbilical → right lower quadrant
Associated Symptoms	Fever	Fever	Low-grade fever, vomiting
Rectal Bleeding	Yes	No	No
Imaging Findings	Suggestive of perforated meckel's diverticulum with inflamed appendix	Inflamed appendix on ultrasound	Pelvic free fluid; inflamed bowel loop; appendix not clearly visualised
Operative Approach	Emergency laparotomy	Laparoscopic appendicectomy with ileal inspection	Emergency exploratory laparotomy
Intraoperative Findings – Meckel's Diverticulum	Perforated MD with base involvement	Inflamed, thickened MD with base involvement	5-cm MD, 60 cm from ileocaecal valve; 360° torsion; gangrenous; pinpoint perforation
Intraoperative Findings – Appendix	Inflamed appendix	Inflamed, non-perforated appendix	Oedematous, hyperaemic appendix (suppurative, non-perforated)
Extent of Ileal Involvement	Base involvement	Base inflammation	Adjacent ileum viable
Peritoneal Contamination	Generalised peritonitis	Minimal contamination	Generalised peritonitis
Surgical Procedure	Segmental ileal resection	Segmental ileal resection	Segmental ileal resection

	+ primary anastomosis + appendicectomy	+ primary anastomosis + appendicectomy	+ primary anastomosis + appendicectomy
Histopathology – MD	Perforated diverticulitis	Acute diverticulitis	Transmural necrosis with perforation
Histopathology – Appendix	Acute appendicitis	Acute appendicitis	Acute suppurative appendicitis
Postoperative Course	Uneventful	Uneventful	Uneventful
Outcome at Follow-Up	Full recovery	Full recovery	Full recovery

Discussion

The synchronous occurrence of complicated MD and acute appendicitis remains rare, with literature largely limited to case reports and small series [5,6,12]. Despite the relatively high independent incidence of both conditions [2-4], their simultaneous presentation is distinctly uncommon.

Pathophysiology

Complications of MD arise from ectopic mucosa, luminal obstruction, inflammation, torsion, or perforation [3,7]. Axial torsion, as seen in the 5-year-old child, is an uncommon but recognised mechanism leading to vascular compromise and gangrene [7].

Contemporary systematic reviews confirm that inflammatory MD frequently mimics appendicitis clinically and radiologically [8,14]. Shared bacterial flora and regional inflammatory spread may explain concurrent appendiceal hyperaemia in severe diverticulitis.

Diagnostic Considerations

Ultrasonography remains first-line imaging in paediatric appendicitis but has limited sensitivity for MD [9]. CT improves diagnostic accuracy for appendicitis but may misinterpret MD as inflamed small bowel unless specifically considered [10,11].

Technetium-99m pertechnetate scintigraphy remains most useful in bleeding MD [15] but has limited utility in acute inflammatory presentations.

Selective distal ileal inspection during appendicectomy has been advocated when findings are atypical or disproportionate [16,17]. Contemporary paediatric surgical guidance supports targeted ileal evaluation in equivocal cases [14,18]. The 9-year-old case exemplifies the value of this principle.

Operative Strategy

Morphology-guided resection remains central to MD management. Cullen et al. demonstrated that simple diverticulectomy is adequate when inflammation is confined to the tip, whereas segmental ileal resection is recommended for base involvement or perforation [13]. More recent reviews reaffirm that segmental resection reduces the risk of residual ectopic mucosa and luminal stenosis in complicated MD. A population-based study reported an annual malignancy incidence of 1.44 per 10 million in Meckel's diverticulum, with an estimated 70-fold higher cancer risk compared with other ileal sites, supporting consideration of prophylactic resection. Current evidence favours a risk-based approach, particularly in males younger than 50 years with diverticula >2 cm or abnormal features. Decisions regarding incidental resection should be individualised, balancing operative risk against lifetime risk of malignancy and complications [7,19]. All three cases fulfilled criteria mandating segmental resection. Primary anastomosis in haemodynamically stable patients with viable bowel is supported by contemporary paediatric outcome data [13,18].

Incidental Resection Debate

The question of incidental MD resection remains debated. Early population studies suggested low lifetime risk [2], whereas modern risk-stratified analyses favour resection in young males with diverticula >2 cm or abnormal morphology [3,8,20].

In the presence of macroscopic inflammation, however, definitive resection is clearly indicated to prevent recurrent pathology.

Clinical Implications

These cases reinforce three operative principles:

- Maintain vigilance for dual pathology in paediatric acute abdomen
- Perform selective distal ileal inspection when appendiceal findings appear insufficient
- Base resection strategy on morphology and extent of inflammation
- Early recognition and evidence-based operative management resulted in favourable outcomes across all cases.

Conclusion

Synchronous complicated Meckel's diverticulum and acute appendicitis is rare but clinically significant. Historical bleeding episodes, atypical symptom duration, or disproportionate intraoperative findings should prompt careful distal ileal evaluation. Imaging may not conclusively identify dual pathology.

When base involvement or perforation is present, segmental ileal resection with primary anastomosis is supported by current surgical evidence. Early recognition and evidence-based operative management result in favourable outcomes.

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