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Perforated Meckel's Diverticulum: A Case Report

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Abstract

Meckel's diverticulum is a true diverticulum that consists of all layers of bowel normally found in a normal small bowel wall. The three most common presentations in children are intestinal bleeding (30–56%), intestinal obstruction (14–42%), and diverticular inflammation (6–14%). Complications result in more severe symptoms, such as acute abdomen and signs of peritonitis. These presentations are not specific to Meckel's diverticulum and can be found in many other conditions, making the diagnosis difficult. A five-year-old child came to the emergency department with complaint of acute abdominal pain, especially in the right lower quadrant. The pain was accompanied by vomiting. On physical examination, patient was febrile and signs of peritonitis were found. Abdominal plain film revealed the probability of focal inflammation in the right lower region of the abdomen, with partial intestinal obstruction. Ultrasonography showed a presence of a mass in right iliac region with the size of 24x20x23 mm, with normal appendix. During exploratory laparotomy, a necrotic and perforated Meckel's diverticulum was found, with associated purulent matter. Diverticulectomy with segmental resection of ileum followed by end-to-end anastomosis were done. Diagnosis of Meckel's diverticulum requires a high index of suspicion, especially in the pediatric population. It is important for clinicians to be aware of unusual presentations of Meckel's diverticulum.

Keywords: Meckel's Diverticulum, Acute Abdomen, Perforation

INTRODUCTION

Abdominal pain accompanied by fever and gastrointestinal symptoms are common complaints in children admitted to the emergency department. The differential diagnoses for this range from mild conditions frequently encountered in clinical practice such as acute gastroenteritis, urinary tract infections, typhoid fever, acute appendicitis, intussusception, to rare conditions such as Meckel's diverticulum (Fraser et al., 2018).

Meckel's diverticulum is a true diverticulum that consists of all layers of bowel normally found in a normal small bowel wall. It is the most common congenital anomaly of the gastrointestinal tract (An & Zabbo., 2024). This anomaly is rarely encountered and more commonly discovered incidentally during surgical procedures performed for other reasons (Jabri & Sherbini, 2012).

The three most common presentations in children are intestinal bleeding (30–56%), intestinal obstruction (14–42%), and diverticular inflammation (6–14%) (Leader et al., 2022). Spontaneous perforation is very rare and can mimic acute appendicitis (Sellars & Boorman, 2017). However, these presentations are not specific to Meckel's diverticulum and can be found in many other conditions (Kotha et al., 2014). Imaging modalities commonly available in healthcare facilities are of little use in diagnosing Meckel's diverticulum, despite current

development of imaging techniques. Therefore, Meckel's represents a diagnostic challenge (Hansen & Søreide, 2018).

We report a case of a 5-year-old child with incidental finding of perforated Meckel's diverticulum with unusual complication, with symptoms mimicking intussusception and acute appendicitis. The initial evaluation failed to yield the etiology. Final diagnosis of perforated Meckel's diverticulum was revealed by laparotomy performed for initial diagnosis of intussusception with differential diagnosis of acute appendicitis. This case report highlights the importance of considering Meckel's diverticulum as one of the differential diagnoses in patients presenting with acute abdominal pain (Abizeid & Aref, 2017).

Despite Meckel's diverticulum being the most common congenital anomaly of the gastrointestinal tract, its diagnosis remains challenging due to the non-specific nature of its symptoms, which often mimic other common conditions like appendicitis or intussusception. Many previous studies have focused on the general presentations of Meckel's diverticulum, such as gastrointestinal bleeding and obstruction, but limited research has been conducted on rare complications like spontaneous perforation, especially in pediatric patients. Additionally, while imaging advancements have improved the diagnostic process for many gastrointestinal conditions, there is still a lack of effective imaging techniques specifically for diagnosing Meckel's diverticulum. This gap in diagnostic capabilities highlights the need for further investigation into more accurate and efficient diagnostic approaches for this condition.

The urgency of this research stems from the fact that Meckel's diverticulum, though rare, can lead to life-threatening complications if not diagnosed and treated promptly. Cases of perforation, as presented in this case report, can easily be misdiagnosed as other conditions, resulting in delayed or inappropriate treatment. Given that early intervention can significantly improve patient outcomes, it is crucial to raise awareness among clinicians about the possibility of Meckel's diverticulum in pediatric patients with acute abdominal pain, particularly in cases where the initial diagnosis is unclear or ambiguous.

Previous studies have documented the most common presentations of Meckel's diverticulum, including intestinal bleeding, obstruction, and inflammation (Chen et al., 2014). However, spontaneous perforation remains a rare and understudied complication. In a study by Keese et al., (2019), it was noted that many cases of Meckel's diverticulum are discovered incidentally during surgery for other suspected conditions, as was the case in this report. Furthermore, the diagnostic limitations of current imaging techniques in detecting Meckel's diverticulum have been highlighted by various researchers, indicating a need for improved diagnostic approaches (Sun et al., 2023). This case report builds on these findings by exploring the diagnostic difficulties and the unusual presentation of perforated Meckel's diverticulum in children.

This case report adds novelty to the existing literature by presenting a rare complication of Meckel's diverticulum—spontaneous perforation—along with symptoms that closely mimic intussusception and appendicitis. The rarity of spontaneous perforation, particularly in pediatric patients, makes this case unique and underscores the diagnostic challenges associated with Meckel's diverticulum. Furthermore, this report emphasizes the importance of including Meckel's diverticulum in differential diagnoses for abdominal pain, especially when imaging fails to provide clear answers. The insight provided by this case offers a valuable contribution to understanding the varied clinical presentations of Meckel's diverticulum and its potential complications.

This research has significant global implications, as Meckel's diverticulum is a congenital condition that can affect individuals worldwide. By highlighting the challenges in diagnosing this condition, particularly in cases of rare complications like perforation, this case report can raise awareness among healthcare providers globally. Early and accurate diagnosis can lead to timely surgical intervention, reducing the risk of serious complications and

improving patient outcomes. Additionally, this report may inspire further research into better diagnostic tools and methods for identifying Meckel's diverticulum, which could benefit healthcare systems worldwide by reducing misdiagnosis and ensuring appropriate treatment.

RESEARCH METHODS

The research design for this study uses the case report method, which is ideal for providing an in-depth exploration and description of a specific case. This method allows the researcher to study unique, complex, or rare phenomena within a real-life context, helping to gain detailed insights and understanding. The case report method typically involves a qualitative approach but can also include quantitative data where applicable.

Data collection for the case report is conducted through a combination of methods, ensuring multiple perspectives on the case:

1. Interviews: In-depth interviews with key stakeholders (e.g., company executives, employees, customers, or regulators) to gather qualitative insights.
2. Document Analysis: Analysis of secondary data, such as reports, publications, financial statements, or media coverage, to provide context and support findings.
3. Observation: Where feasible, direct observation of the phenomena (e.g., operations or meetings) to gather firsthand information on the processes involved.

RESULT AND DISCUSSION

A 5-year-old boy was referred to Kalabahi Regional Hospital with right lower quadrant abdominal pain accompanied by nausea and vomiting in the last three days that worsened over 1 day. The patient had decreased appetite with no change of bowel habit. There was no history of painless rectal bleeding. The patient had abdominal massage one day before admission, which is a common false practice in the region.

On physical examination, the temperature was elevated and other than that the vital signs were normal with stable hemodynamic. The abdomen was distended with decreased bowel sound and muscular rigidity in the right iliac region. Other physical examinations showed no abnormalities. Laboratory findings showed a leukocytosis with shift to the left.

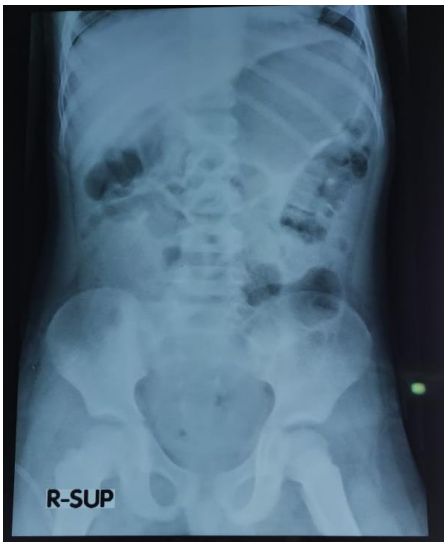

Figure 1. Abdominal plain film showed focal inflammation in the right lower quadrant and partial bowel obstruction.

Supine abdomen plain x-ray showed a probability of focal inflammation in the lower right region of the abdomen, with partial bowel obstruction. Abdominal ultrasonography showed a presence of mass in the right iliac region with the size of 24 x 20 x 23 millimeter,

with normal appendix. The patient was finally diagnosed with intussusception and immediately scheduled for emergency exploratory laparotomy with general anesthesia.

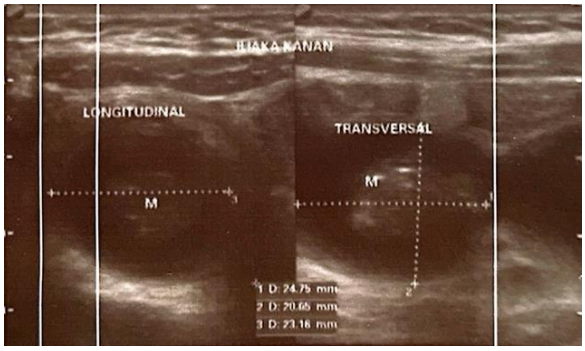

Figure 2. Ultrasonografi showed a mass in the right iliac region.

During surgery, upon entering the peritoneal cavity, there was gross distension of the small bowel and incidental finding of necrotic and perforated Meckel's diverticulum located 60 centimeters from the ileocecal valve, with associated purulent fluid of approximately 50 milliliters. (Figure 3,4). Diverticulectomy followed by ileum resection and end-to-end ileum anastomosis were performed. The patient made an uneventful recovery postoperatively.

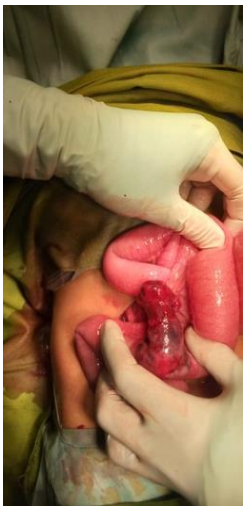

Figure 3. Necrotic and perforated Mecke's diverticulum

Figure 4. Segmental ileum resection and end-to-end ileum anastomosis

Discussion

Meckel diverticulum is a congenital anomaly of the small bowel caused by incomplete obliteration of the vitelline duct (Javid & Pauli, 2020). The male-to-female ratio is nearly equal in asymptomatic patients; among symptomatic patients it is twice as frequent in males (2.3 :1) (Leader et al., 2022). The rule of 2 of Meckel's diverticulum: 2 types of heterotopic mucosa, 2 feet from the ileocecal valve, 2 feet long, 2 inch in diameter, usually discovered before 2 years of age, 2 times as common in males, and it is found in 2% of the population (Coran et al., 2012). Owing to the predominant location of Meckel's diverticulum, diverticulitis is often misdiagnosed with acute appendicitis (Tekriwal et al., 2024).

Most of the patients are asymptomatic. If present, symptoms usually appear in the first decade of life, with the average age of 2,5 years old. The most common symptom in children is painless lower gastrointestinal bleeding, which can present as currant jelly stool (Patel & Kay, 2021).

Complications of Meckel's diverticulum are bleeding, intestinal obstruction, and diverticulitis. Bleeding most commonly affects children and can be massive, causing anemia and hemorrhagic shock. Intestinal obstruction and diverticulitis more commonly found in older adults (Choi et al., 2017). Spontaneous perforation of diverticulitis is rarely encountered. Diverticulitis can present as abdominal pain in the periumbilical area that radiates to the right lower quadrant. Abdominal tenderness presents as diffuse or focal. Abdominal rigidity, rebound tenderness, abdominal distension, and hypoactive bowel sounds are late findings (Boyle, 2004).

Imaging modality that can be reliably used for diagnosing Meckel's diverticulum is technetium-99 pertechnetate scan (Meckel's scan), double-balloon enteroscopy, and capsule endoscopy. However, these modalities are not readily available in all healthcare facilities, especially in rural areas (Coran et al., 2012).

Diagnosing Meckel's diverticulum preoperatively is quite a challenge to clinicians because the presenting symptoms are often nonspecific, and the differential diagnosis is broad. Moreover, the imaging features are often overlapping with other cause of acute surgical conditions of the abdomen (Giambelluca et al., 2019).

In our case, the patient was a boy, which was the population in which Meckel's diverticulum is often found. Prior to the abdominal pain, the patient did not experience any symptoms, such as painless rectal bleeding, which is the most common presentation in children. This is typical for Meckel's diverticulum, where symptoms don't usually appear until complications rise (Farah et al., 2015). In our patient, symptoms appeared as a sudden onset of abdominal pain in the right lower quadrant. This symptom is caused by inflammation, necroses, and perforation of the diverticulum. This complication is more often found in adults, and rarely in children. The most common complications in children are bleeding and intestinal obstruction (Leader et al., 2022).

On physical examination, the patient was febrile and there was abdominal muscular rigidity, with decreased bowel sound. These findings suggest the presence of peritonitis, which is an inflammation of the peritoneum. In this case, peritonitis is caused by perforated diverticulitis. The presence of peritonitis was supported by the finding of leukocytosis in the blood test result.

The radiology examination that could be done was plain abdominal radiography and ultrasonography. Abdominal radiography only showed probability of focal inflammation in right lower quadrant of the abdomen, with partial bowel obstruction. Meanwhile, ultrasonography only showed a mass in the right lower quadrant with normal appendix. Further

examination with more reliable modalities were not possible in our case because of the limited facility in rural areas. However, if available, it is recommended for patients who are hemodynamically stable to undergo other examinations such as Meckel's scan, double balloon enteroscopy, or capsule endoscopy (Kuru, 2018).

Considering the clinical findings of the patient, diagnosis of intussusception was made. As with majority of cases, preoperative diagnose of Meckel's diverticulum is often overlooked because of the nonspecific symptoms and the lack of imaging modalities to help confirm the diagnose. Higaki et al examined 776 patients and concluded that diagnosing Meckel's diverticulum in cases with manifestations other than bleeding is more difficult compared to those with bleeding manifestation. In addition, the symptoms of complicated diverticulum can mimic a variety of intraabdominal pathologies, such as inflammatory bowel disease, acute appendicitis, intussusception in children, and peptic ulcer disease (Kuru, 2018).

The results of the diagnostic testing in this patient are not cot conclusive and the final diagnosis could not be determined preoperatively, hence the need for exploratory laparotomy. During laparotomy, a necrotic and perforated Meckel's diverticulum was found located 60 centimeters (2 feet) from ileocecal valve. This is the rule of 2 of Meckel's diverticulum (Leader et al., 2022).

Management of symptomatic diverticulum is diverticulectomy and ileal resection if necessary. This procedure can be done laparoscopically or openly. On the patient, diverticulectomy with segmental ileal resection followed by end-to-end anastomosis were performed for the indication of necrotic and perforated diverticulum (Schwartz & Brunicardi, 2010).

CONCLUSION

Based on the results and discussion that have been explained, it can be concluded that the diagnosis of Meckel's diverticulum, particularly in the pediatric population, requires a high index of suspicion due to its varied and often non-specific clinical presentations. As highlighted in this case, Meckel's diverticulum can mimic common conditions like intussusception or acute appendicitis, making it difficult to identify, especially in emergency settings. Clinicians must be aware of these atypical presentations and maintain a broad differential diagnosis when encountering pediatric patients with acute abdominal pain. The importance of thorough history taking and physical examination cannot be overstated, as these are crucial in building a diagnostic framework. Although Meckel's diverticulum is a rare cause of acute abdominal pain or gastrointestinal bleeding in children, it should always be considered, particularly when more common diagnoses fail to provide conclusive results.

This case emphasizes the diagnostic challenges associated with Meckel's diverticulum, reaffirming the need for heightened clinical awareness and consideration of this anomaly in pediatric patients presenting with abdominal symptoms. Future research is essential to improve diagnostic methods and enhance early detection, which can lead to timely surgical intervention and better outcomes for pediatric patients. The case also highlights the global implications of better diagnostic approaches for rare congenital anomalies like Meckel's diverticulum, which, if diagnosed and treated early, can significantly reduce morbidity and mortality worldwide.

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