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Case Report

Closed-Loop Small Bowel Obstruction Caused by Meckel's Diverticulum: A Rare Case with Radiologic–Surgical Correlation

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Abstract

Background: Meckel's diverticulum (MD) is the one of most common congenital abnormality of the gastrointestinal tract, affecting approximately 2% of the population. Although it is usually asymptomatic, MD can occasionally lead to severe complications, including inflammation, bleeding, and very rarely obstruction, Closed-loop small bowel obstruction (SBO) due to internal herniation around MD is extremely rare and potentially life threatening.

Case Presentation: A 31-year-old Kazakhstani female presented to Al-Ahli Hospital with a two-day history of severe lower abdominal pain, repeated vomiting, and constipation. Laboratory tests showed elevated C-reactive protein, hypokalemia, and hypocalcemia. CT abdomen with contrast revealed a closed-loop small bowel obstruction with a C-shaped configuration, "double-beak" sign, and a tubular structure tethered to the distal ileum, suggestive of Meckel's diverticulum. Urgent diagnostic laparoscopy demonstrated a fibrous band extending from the tip of a Meckel's diverticulum, and adherent to the adjacent mesentery, forming a ring-like structure that entrapped an ileal loop. The bowel was congested but viable. The band was divided, releasing the bowel, and approximately 20 cm of the terminal ileum including the necrotic diverticulum was resected with a stapled ileoileal anastomosis. Histopathology confirmed an inflamed Meckel's diverticulum with vascular congestion and fibrous proliferation; resection margins were clear. The patient recovered well, and was discharged in stable condition on postoperative day three.

Conclusion: MDCT findings of the double-beak sign, closed-loop configuration, and vessel convergence, along with a band-like structure around the area of transition, should raise suspicion for an internal hernia, particularly in patients with no history of prior abdominal surgery. Early radiologic diagnosis enables prompt surgical intervention and may prevent the need for bowel resection.

Keywords: meckel's diverticulum; small bowel obstruction; closed-loop obstruction; internal hernia; multidetector computed tomography; ischemia

Abbreviations:

MD: Meckel's diverticulum

SBO: Small bowel obstruction

MDCT: Multidetector Computed Tomography

1.Introduction

Meckel's diverticulum results from incomplete obliteration of the vitelline duct during embryogenesis and is present in 2–3% of the population [1]. Most cases remain asymptomatic; however, complications occur in 4-6% of patients, most commonly bleeding, diverticulitis, and rarely obstruction [2]. Obstruction may arise from fibrous mesodiverticular band [3], intussusception with MD acting as the lead point [3], or internal herniation through adhesions fiber formed at the diverticular tip [4].

2.Case Presentation

A 31-year-old Kazakhstani female presented to the Emergency Department at Al-Ahli Hospital with a two-day history of severe lower abdominal pain, repeated episodes of vomiting, and constipation. She reported no passage of stool for the preceding two days. The patient was married with two children and had a history of two previous cesarean sections.

On physical examination, the abdomen was markedly distended with generalized tenderness and guarding. Laboratory investigations revealed an elevated C-reactive protein (CRP) level of 85 mg/L, hypokalemia (serum potassium 3.2 mmol/L), and hypocalcemia (serum calcium 1.98 mmol/L), while other hematological and biochemical parameters were within normal limits.Simple X-Ray of the Abdomen showed features of small bowel obstruction. **[Figure 1]**

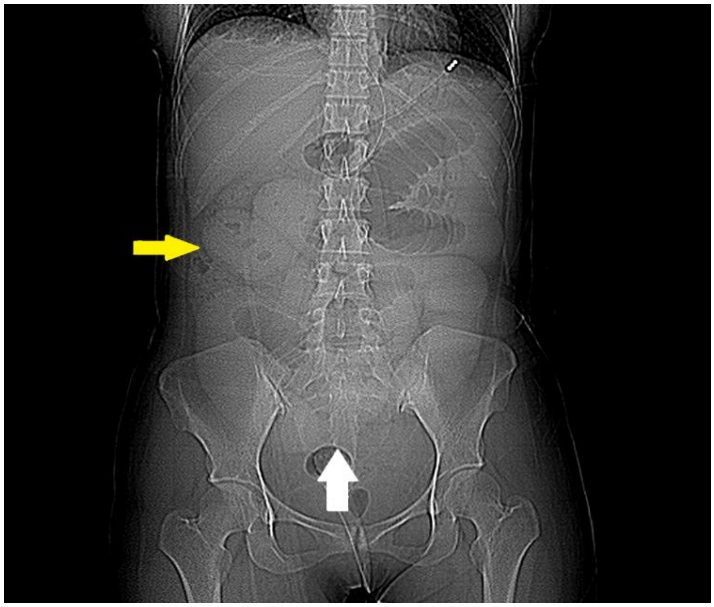

Figure 1: Supine abdominal radiograph demonstrating dilated loops of proximal small bowel in the central part of abdomen, (yellow arrow), containing non-ionic oral contrast, consistent with small bowel obstruction. A transition point is noted in the mid pelvis position (white arrow), suggestive of a mechanical etiology.

Multidetector computed tomography (MDCT) of the abdomen with oral non-ionic contrast demonstrated a tubular structure arising from the distal ileum, showing two adjacent transition points (the "double-beak" sign), a C-shaped closed-loop configuration, and convergence of mesenteric vessels toward the diverticular base. These findings were consistent with a closed-loop small bowel obstruction (SBO) secondary to Meckel's diverticulum. [Figure 2] [Figure 3] [Figure 4]

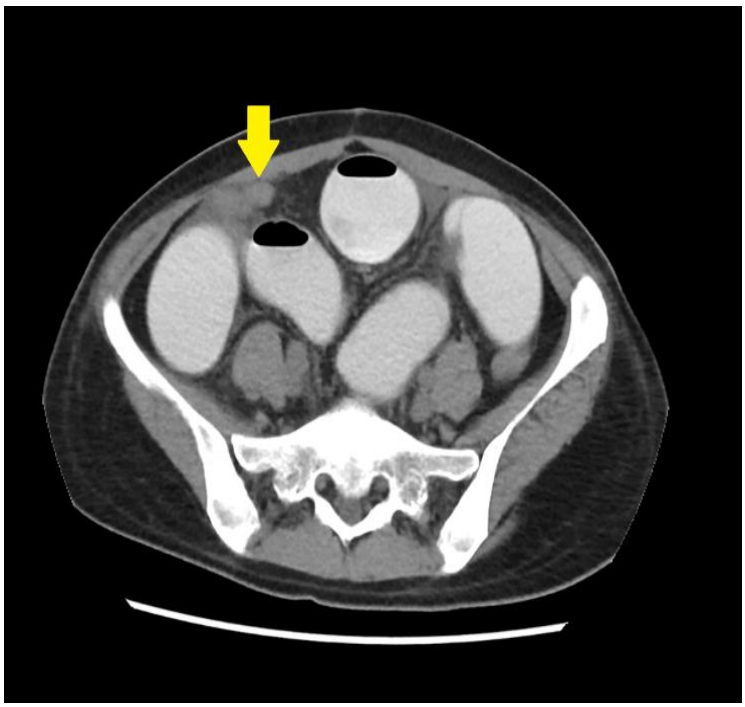

Figure 2: Axial contrast-enhanced CT image of the lower abdomen shows dilated loops of contrast-filled small bowel, consistent with small bowel obstruction. A blind-ending tubular structure tethered toward the terminal ileum (yellow arrow) is visualized, representing a Meckel's diverticulum, which appears to be the lead point causing obstruction.

Figure 3: sagittal CT image of the abdomen shows A fibrous band arising from a Meckel's diverticulum (yellow arrow) is seen encircling the distal ileal loops, forming the transition point. Dilated fluid-filled loop of obstructed small bowel below this point, consistent with a closed-loop obstruction., contrast-filled proximal small bowel loops are observed above the site of obstruction.

Figure 4: ***Left image:*** Coronal contrast-enhanced CT image of the abdomen demonstrating a Meckel's diverticulum forming a ring-like fibrous band around a segment of distal small bowel (blue arrow), consistent with internal herniation. Proximal to the transition, there are contrast-filled, dilated small bowel loops, while a collapsed, C-shaped, fluid-filled obstructed loop is seen distal to the point of constriction—findings suggestive of closed-loop small bowel obstruction. ***Right image:*** Coronal CT image of the abdomen shows a C-shaped, fluid-filled loop of obstructed small bowel (yellow arrowheads), consistent with a closed-loop obstruction. A fibrous band arising from a Meckel's diverticulum (blue arrow) is seen encircling the distal ileal loops, forming the transition point. Dilated, contrast-filled proximal small bowel loops are observed above the site of obstruction.

An urgent diagnostic laparoscopy was performed, revealing a large amount of serous ascetic fluid within the peritoneal cavity, which was subsequently drained. The small bowel appeared markedly dilated. A fibrous band was identified originating from the tip of a large ileal diverticulum, located approximately 50 cm proximal to the ileocecal junction (consistent with a Meckel's diverticulum). This band extended downward toward the left side of the pelvis, where it was adherent to the adjacent mesentery, forming a ring-like structure that entrapped a loop of ileum—creating an internal herniation of the small bowel.

The herniated bowel loop appeared severely congested but remained viable. The fibrous band was divided, allowing complete reduction of the herniated segment, which gradually regained normal color and adequate perfusion. The Meckel's diverticulum was found to be necrotic at its base with evidence of a small perforation and tiny leak. Consequently, resection of approximately 20 cm of the terminal ileum, including the diverticulum, was performed. A side-to-side ileoileal anastomosis was fashioned using a linear stapler, and the mesenteric defect was closed. A leak test of the anastomosis was conducted and revealed no leakage. A drain was placed, and the abdominal wall was closed in layers. [Figure 5]

Figure 5: ***Left image:*** intra-operative image shows A fibrous band of Meckel's diverticulum, (yellow arrow) is seen encircling the distal ileal loops, forming the transition point. Dilated fluid-filled loop of obstructed small bowel below this point, appear congested, consistent with a closed-loop obstruction, proximal dilated small bowel loops are observed above the site of obstruction. ***Right image:*** Intra-operative imaging following lysis of the fibrous band revealed a Meckel's diverticulum exhibiting necrosis at its base (red arrows).

The patient's condition improved gradually, and she resumed normal bowel movements. The abdominal drain was removed on the third postoperative day, and the patient was discharged home in stable condition.

Gross examination of the resected specimen revealed a piece of small bowel measuring 7.5 x 3 cm, contains Mackle's diverticulum in the middle measuring 2.5 cm with congested serosal surface. Microscopical examination revealed Meckel's diverticulum lined by small bowel villous mucosa with marked vascular congestion and inflammation in keeping with the clinical diagnosis of Inflamed Meckel's Diverticulum. [Figure 6]

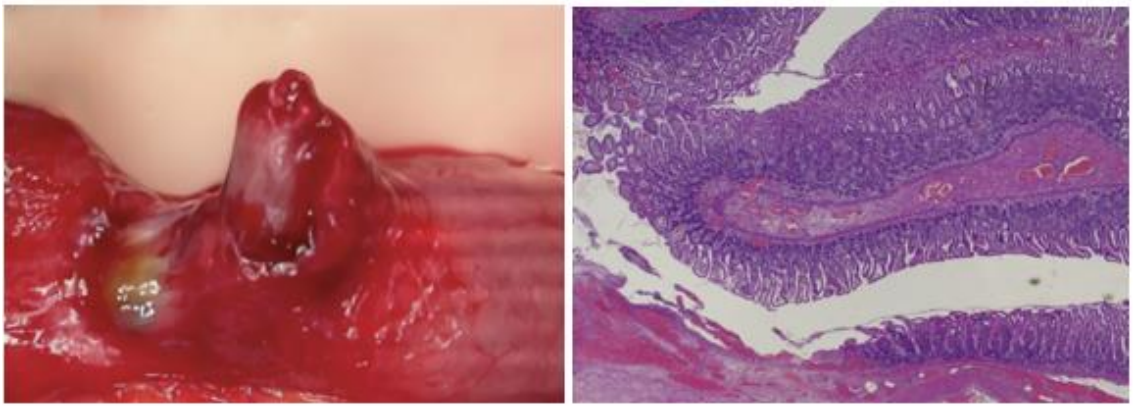

Figure 6: Left image: Gross photo of small bowel segment with Meckel's diverticulum. Right image: Diverticulum lined by small bowel mucosa with inflamed wall (Hematoxylin & Eosin, 4X).

3.Discussion

Incomplete obliteration of the omphalomesenteric duct during embryonic development results in what we call a Meckel diverticulum. It represents the most common congenital anomaly of the gastrointestinal tract. [1] While Fabricius Hildanus first described it in 1598, the condition is named after Johann Friedrich Meckel, who identified its embryonic origin in 1809. [5,6]

It is classified as a true diverticulum because it contains all layers of the small intestinal wall. In some cases, the diverticulum may also contain ectopic tissue within its walls. The embryonic origin of the ectopic tissue is unknown. Approximately 15% of patients have ectopic tissue within the diverticulum. [1] The ectopic mucosa may also originate from pancreatic or jejunal tissue, or it may consist of a combination of different mucosal types. [7] Acid secretion from ectopic gastric mucosa within the diverticulum may lead to gastrointestinal bleeding and abdominal pain. It is helpful to recall the "rule of twos": Meckel diverticulum occurs in approximately 2% of the population; about 2% of those affected become symptomatic; symptoms typically present before the age of 2 years; it occurs twice as frequently in males as in females; it is usually located about 2 feet proximal to the ileocecal valve; measures 2 inches or less in length; and may contain 2 types of mucosal lining. [8,9] In Meckel diverticulum, acid secretion from ectopic gastric mucosa is not adequately neutralized, leading to ulceration of the adjacent intestinal mucosa.

Children typically present with the characteristic "currant jelly"–colored stool, whereas adults more commonly present with melena. [10] Risk factors associated with an increased likelihood of developing symptoms include age younger than 50 years, male sex, a diverticulum measuring greater than 2 cm in length, the presence of ectopic tissue, a broad-based

diverticulum, and the presence of fibrous bands attached to the diverticulum. [11]

Closed-loop SBO secondary to Meckel's diverticulum is extremely rare (<1% of all small bowel mechanical obstructions). [11] CT features such as a blind-ending ileal pouch, double-beak transition points, and radial mesenteric vessel convergence are diagnostic. [4,12] A CT scan of the abdomen and pelvis may reveal signs of inflammation or obstruction associated with the diverticulum. The most sensitive diagnostic test is the Meckel radionuclide scan (commonly referred to as a Meckel scan). [13] Previous studies emphasize the importance of MDCT for early diagnosis of internal hernias and preserve the viability of bowel. [4,11,14]

Prompt diagnosis can prevent ischemic complications and improve outcomes. The treatment for symptomatic Meckel diverticulum is surgical excision, which can be performed using either a laparoscopic or an open surgical approach. [15]

The present case exemplifies these findings, demonstrating a rare instance of closed-loop small bowel obstruction caused by a fibrous band extending from the tip of a Meckel's diverticulum. The MDCT findings in our patient showing the classic "double-beak" sign, C-shaped closed-loop configuration, and radial mesenteric vessel convergence—were instrumental in establishing a prompt and accurate preoperative diagnosis. Intraoperative exploration confirmed the imaging findings, revealing an internal herniation of viable bowel through a fibrous band, consistent with the described mechanism of obstruction in the literature. This case highlights the crucial role of high-resolution CT in recognizing the characteristic radiologic features of Meckel's diverticulum–related complications and underscores the importance of early surgical intervention to prevent ischemia and improve patient outcomes.

4.Conclusion

Closed-loop small bowel obstruction secondary to a fibrous band arising from the tip of a Meckel's diverticulum is an exceedingly rare but clinically significant cause of intestinal obstruction. Early and accurate recognition of this entity on CT—particularly identifying features such as a blind-ending ileal pouch, double-beak transition points, and radial mesenteric vessel convergence—is crucial for timely surgical intervention. Prompt diagnosis not only facilitates appropriate management but also helps prevent ischemic complications and improves patient outcomes. Surgical excision remains the definitive treatment and ensures both resolution of obstruction and prevention of recurrence.

Author Contributions

Mustafa Sadeq Alghazzawi: Study concept and design, data collection and analysis, writing the paper.

Thair Salman Abdullah: Critical revision of the manuscript, final approval of the paper.

Bakhos Alhaddad: Study concept and design, revision of the manuscript.

Rafif Mahmood Al Saady: Writing the histopathological section, revision of manuscript.

Patient Consent Statement

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

Conflict of Interest / Funding Statement

The authors declare no conflicts of interest and no funding was received for this study.

Ethical Approval Statement

Ethical approval was obtained from the Institutional Review Board of Al-Ahli Hospital for publication of this case report. A copy of the approval letter is available for review upon request.

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