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Case Report

Inflamed Mesenteric Pseudocyst Associated with Meckel's Diverticulitis: Cause or Consequence

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Abstract

Introduction: Mesenteric pseudocyst describes an abdominal mass that appears on small bowel mesentery or mesocolon, or at any part of the abdomen and retroperitoneum. This paper aims to emphasize the non-specific clinical appearance and highlight Meckel's diverticulitis as a potential cause of the development of pseudocyst.

Case Report: A 26-year-old male with a palpable mass in the right upper abdominal quadrant and an increased body temperature of 38.3˚C was admitted for further medical investigation. Computed tomography (CT) presented a cystic mass with a diameter of 5.5 cm, and emergency laparotomy was performed. Wedge resection of pathologic findings of small bowel, its mesenterium, and the cyst mass associated with nearby Meckel's diverticulum was performed.

Discussion: Meckel's diverticulum can be considered as a risk for developing mesenteric pseudocyst, because of its frequent exacerbation of chronic inflammation. This report adds to the limited literature on the association between Meckel's diverticulum and mesenteric pseudocysts, providing valuable insights that can guide future clinical evaluations and surgical interventions. Early and accurate diagnosis, aided by imaging techniques such as CT and magnetic resonance imaging (MRI), is essential for effective management. This case highlights the potential link between chronic inflammation in Meckel's diverticulum and the formation of mesenteric pseudocysts.

Conclusion: This case highlights the need to consider Meckel's diverticulitis in patients with mesenteric pseudocysts, suggesting a possible pathophysiological link between them. Surgical resection is recommended for effective management.

OPEN ACCESS

Keywords: mesenteric pseudocyst, mesenteric cyst, small bowel, Meckel's diverticulitis

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1. Introduction

Mesenteric pseudocyst is a term used to describe an abdominal cystic mass with an unknown abdominal origin [1]. The appearance of pseudocysts on the mesentery is very rare and anatomically more frequently found on small bowel mesentery or mesocolon; however, it can be present at any part of the abdomen including retroperitoneum [2]. Mesenteric or retroperitoneal cystic masses do not cause specific symptoms [1]. The clinical presentation is characterized as a palpable mass or on imaging techniques visual tumor, which may be painful and can be moved on pressure up and down, left and right laterally. Complications like intestinal obstruction, volvulus, infection, hemorrhage, and rupture can mimic an acute abdomen, with spontaneous infection being particularly uncommon [2, 3].

The anatomical connection between the inflamed mesenteric pseudocyst and Meckel's diverticulum is significant due to their proximity within the gastrointestinal tract. Meckel's diverticulum, a remnant of embryonic development, is located in the ileal segment of the small intestine and can be associated with chronic inflammation [4]. This chronic irritation may lead to the development of a mesenteric pseudocyst, which forms as a result of localized inflammation and fluid accumulation in the surrounding mesenteric tissue. The close anatomical relationship allows for potential communication between the diverticulum and the pseudocyst, where inflammatory processes from the diverticulum can contribute to the cyst's formation, creating a pathophysiological link that complicates the clinical presentation [5].

Meckel diverticulum is the most common congenital anomaly of the gastrointestinal tract, and it is caused by the incomplete obliteration of the omphalomesenteric duct in the developing embryo [5, 6].

Figure **1** presents a hand-drawn illustration comparing Meckel's pseudocyst and vitelline duct cyst, crucial for differential diagnosis. Meckel's pseudocyst forms from inflamed Meckel's diverticulum in the distal ileum, while the vitelline duct cyst arises from a persistent vitelline duct and is located midline. Understanding these distinctions is essential for accurate diagnosis and treatment.

This paper aims to emphasize the nonspecific clinical presentation and to note Meckel's diverticulitis as a possible cause for the occurrence of pseudocysts.

2. Case Report

2.1. Patient Information

A 26-year-old male was admitted with mild epigastric and periumbilical pain lasting for 3 days, which became more pronounced on the day of admission.

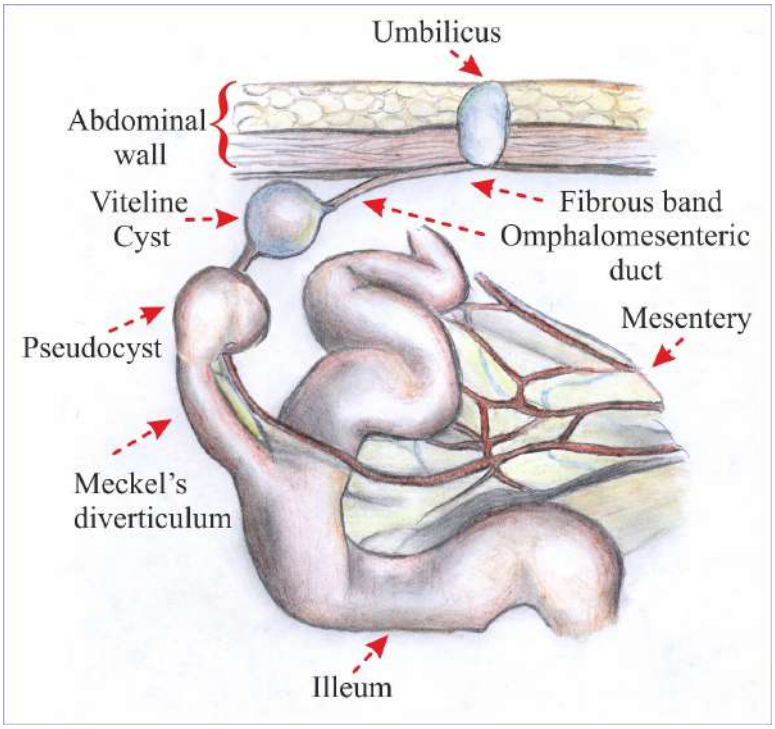

Figure 1: Hand-drawn virtual Illustration comparing Meckel's pseudocyst and vitelline duct cyst: Pathological variations of embryological origins.

2.2. Presenting Symptoms

His blood pressure was 115/74 mm Hg, pulse rate was 94 beats per minute (BPM), respiration rate was 26 breaths per minute (breaths/min), and body temperature was 38.7°C. He had nausea after drinking liquids and immediately vomited the ingested contents, had an increased body temperature of 38.0–38.3°C, for 3 days. The patient has experienced constipation and has not passed any stool or flatus for the past 4 days. However, the on-call doctors did not consider a flatus tube necessary based on the clinical assessment at that time.

2.3. Clinical Examination

On deep palpation of the right upper-abdominal quadrant, a palpable mass measuring approximately 5 x 4 cm was intermittently noted. The mass had an oval, egg-like shape with clearly defined margins, indicating a well-demarcated border. It was slightly movable under gentle pressure, suggesting some adherence to surrounding structures. The texture of the mass was smooth, consistent with a cystic formation, and palpation revealed no tenderness.

Despite 4 days without stool or flatus, the patient showed no significant tenderness or abdominal rigidity, which can occur in less acute obstructions, such as those involving a mesenteric pseudocyst or Meckel's

diverticulitis. Auscultation revealed quiet, slow peristalsis, and radiographs showed no hydroaeric levels, further suggesting a nonacute presentation.

2.4. Diagnostic Findings

Peripheral blood test results at admission were: leukocytes (20.4 x 10^9/L), granulocytes (18.4 x 10^9/L), C-reactive protein (181.5 mg/L), procalcitonin (0.94 ng/mL), D-dimers (4710 ngFEU/mL), erythrocytes (4.4 x 10^{12}/L), hemoglobin (124 g/L), alanine aminotransferase (39 U/L), aspartate aminotransferase (25 U/L), total protein (64 g/L), albumin (36 g/L), urea (3.3 mmol/L), creatinine (66 µmol/L), sodium (134 mmol/L), potassium (3.5 mmol/L), and chloride (100 mmol/L).

Initial abdominal X-ray revealed no signs of acute abdomen or free air under the diaphragm. While non-specific hydroaeric levels and mild intestinal spasms were observed, there was no conclusive evidence of intestinal obstruction or perforated viscus (Figure **2**).

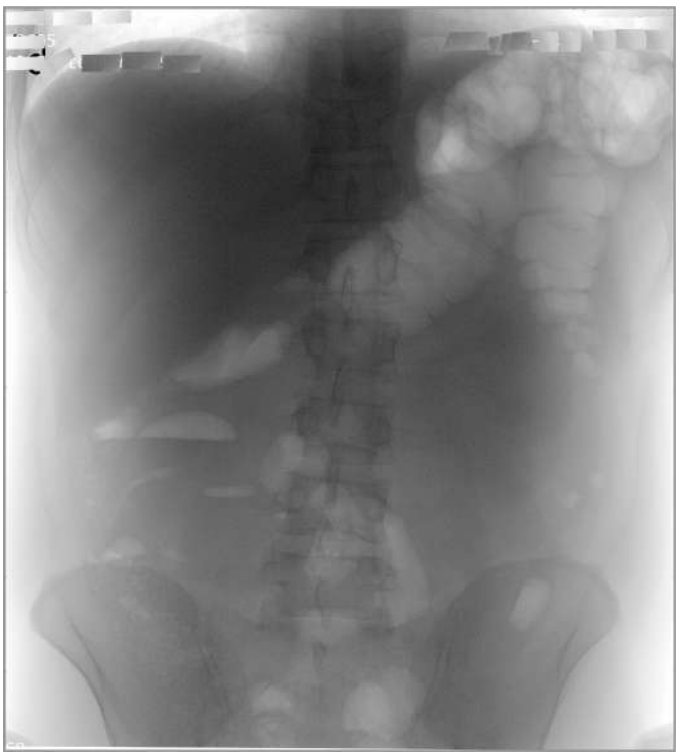

Figure 2: Native abdominal X-ray in standing position (70 kVp, 40 mAs) demonstrating **nonspecific hydroaeric levels** in the lower abdomen and mild **intestinal spasm**. There is **no free air** under the diaphragm and no radiographic signs of **acute abdomen** or **definitive bowel obstruction.**

Clinical correlation and further observation were followed by an abdominal computed tomography (CT) scan to rule out subtle mechanical obstruction or evolving pathology. The CT revealed a cystic mass measuring 5.5 cm in diameter, consistent with the findings from abdominal palpation. Preoperative CT images are presented in Figures **3**(a)-(c).

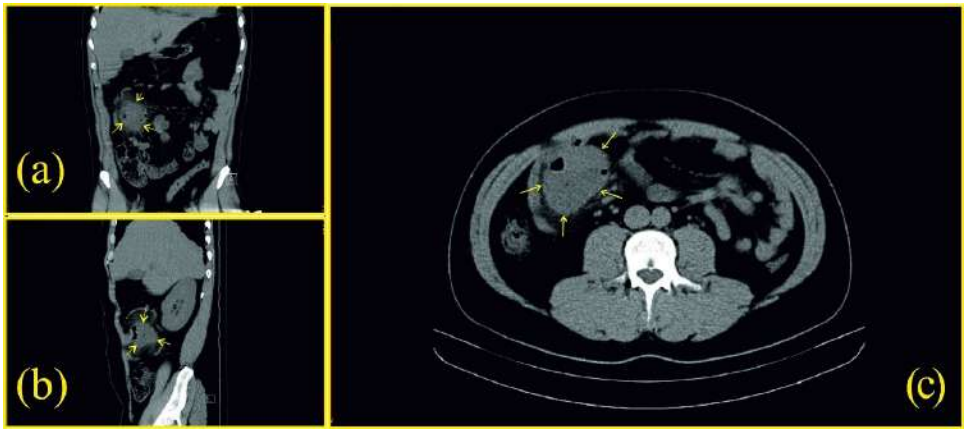

Figure 3: Preoperative computed tomography (CT) Scan: (a) native axial series, (b) native coronal, and (c) sagittal series.

2.5. Pre-operative Management and Anesthesia

The patient received 2 mg of intravenous Midazolam (Dormicum) for sedation and anxiety reduction, along with 1 mg of Atropine sulfate to prevent bradycardia and reduce secretions. For the induction of general anesthesia, 180 mg of Propofol was administered intravenously, followed by 100 mg of Leptosuccin for neuromuscular blockade and endotracheal intubation. Anesthesia was maintained with a continuous Propofol infusion and Fentanyl delivered via a syringe pump for pain management. Mechanical ventilation was initiated, and vital signs were monitored throughout to ensure hemodynamic stability.

2.6. Surgical Interventions

Emergency lower midline mini-laparotomy was performed, with the incision made in the umbilical (5th quadrant) and hypogastric (8th quadrant) regions of the abdomen, according to the 9-quadrant classification system (Figure **4**) [7]. After identifying the diverticulum, we excised it using a segmental resection due to its morphology and associated complications. We then carefully dissected the mesenteric pseudocyst from surrounding tissues to ensure complete removal while preserving adjacent structures. This provided optimal access for the wedge resection of a pathological finding in the small bowel, including its mesenterium and a cyst mass associated with a nearby inflamed, swollen, and thickened Meckel's diverticulum, which was neither perforated nor gangrenous. Following the excision of the diverticulum and the pseudocyst, we performed an end-to-end anastomosis to restore intestinal continuity. Finally, we closed the surgical site in layers, ensuring meticulous attention to minimize complications.

2.7. Postoperative Management

The patient was kept nil per mouth (NPM) for 48 hr postoperatively to allow bowel function to return and reduce complications. After this, he began a clear liquid diet once stable vital signs and bowel

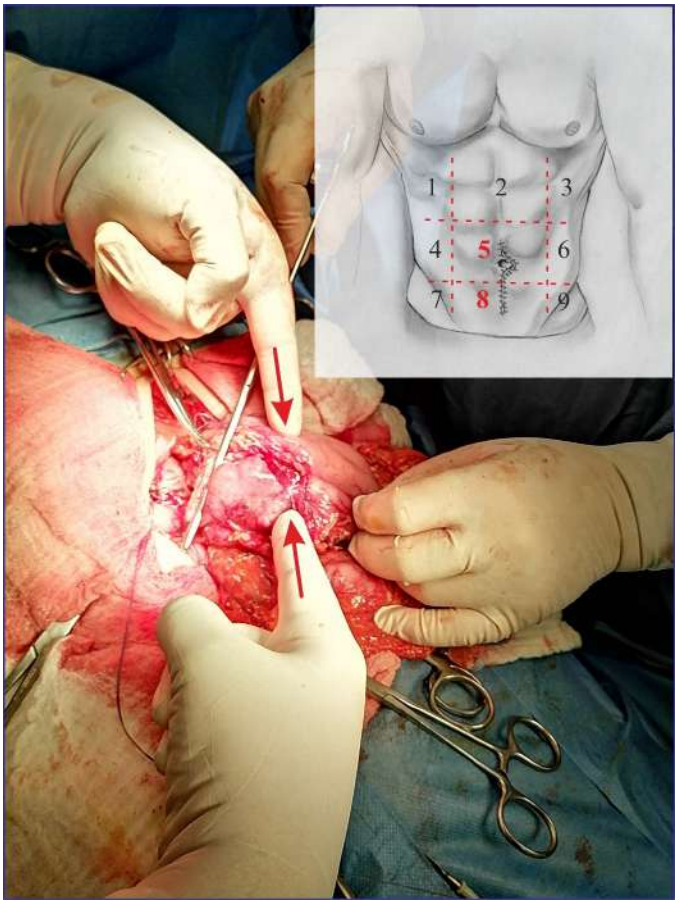

Figure 4: Intraoperative view during laparotomy showing the pseudocyst (between index fingers) accessed through an infraumbilical midline incision, with a hand-drawn schematic of the human torso in the upper right corner depicting the incision site within regions 5 (umbilical) and 8 (epigastric) according to the 9-quadrant abdominal classification.

sounds returned. Clear liquids included broth, gelatin, and juices. Following good tolerance, a soft diet was introduced 3 days later, consisting of mashed potatoes, yogurt, and pureed vegetables.

The patient was closely monitored, with regular checks of vital signs to ensure hemodynamic stability and assessments of fluid balance, including input and output measurements. Pain management was addressed with analgesics as needed, and the surgical site was regularly inspected for signs of infection or complications. Early mobilization was encouraged to promote recovery and education on home care and a sign of potential complications was provided prior to discharge.

2.8. Histopathological Findings

Pathohistology revealed a 6.5 cm cystic mass surrounded by a small intestine from the mesenteric edge. The cross-section showed a cyst filled with yellowish-brown material, adhering to a thinned intestinal wall with flattened mucosa. The remaining intestine appeared reactive and normal over 5 cm. One surgical margin showed diverticulosis, with lesions measuring 2 x 1 and 5 x 1 cm. Enlarged lymph glands, up to 2 cm, were also present around the cyst in the fatty tissue.

Microscopically a mesenteric abscess with a thin fibrous capsule was observed, featuring young granulation tissue with numerous small blood vessels and abundant polymorphonuclear inflammatory cells (Figures **5**(a)–(b)).

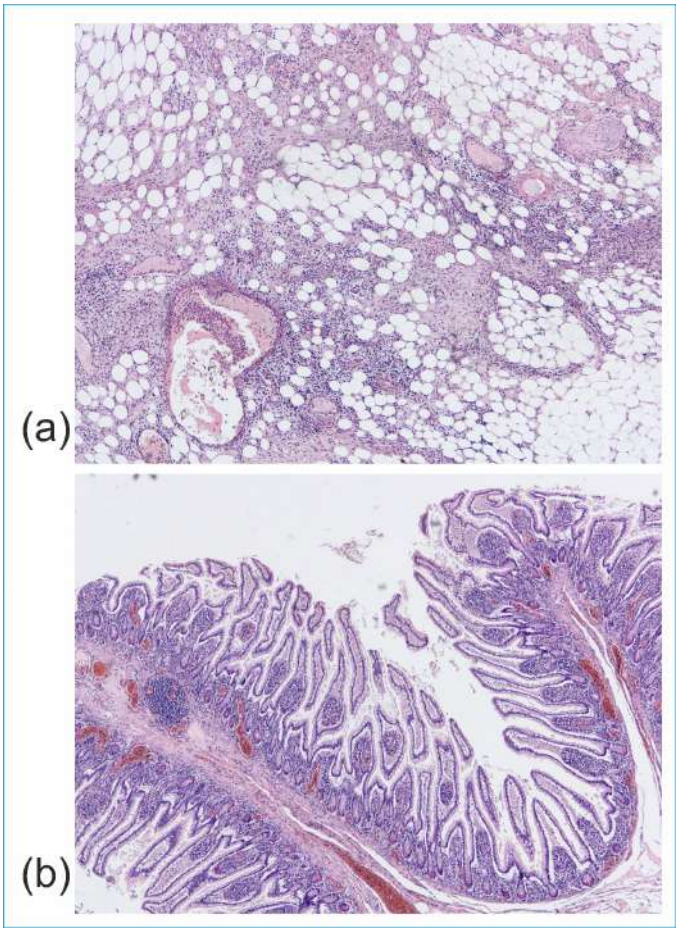

Figure 5: Histology findings: (a) of inflamed mesenteric pseudocyst associated with Meckel's diverticulitis, (b) of Meckel's diverticulum with ectopic gastric mucosa.

The surrounding intestinal mucosa showed chronic enteritis with acute exacerbation. The diverticulosis fragment revealed a strong inflammatory reaction with leukocyte infiltration. Lymph nodes exhibited acute inflammation. The final pathohistological diagnosis included mesenteric abscess, acute exacerbation of chronic enteritis and diverticulitis, and acute mesenteric lymphadenitis.

2.9. Follow-up and Outcome

Inflammatory biomarkers responded positively to the intravenous antibiotic clindamycin (600 mg twice a day), with leukocytes at 11.7 x 10^9/L, granulocytes at 7.3 x 10^9/L), C-reactive protein at 45.7 mg/L, and procalcitonin at 0.06 ng/mL). No further episodes of fever were observed, and the patient was discharged on day 7 postoperation.

3. Discussion

Meckel's diverticulum is a congenital outpouching of the bowel that includes all three layers of the intestinal wall and has its own blood supply. Like the appendix, it can be prone to obstruction and inflammation [7, 8].

Mesenteric cysts are relatively uncommon, occurring more often in females aged between 40 and 70. Histopathologically, they may originate from mesothelial tissues, urogenital sources, enteric structures, dermoid cysts, or lymphatic tissue, or present as pseudocysts with traumatic or infectious origins [2]. The exact cause remains unclear, but factors like lymph node obstruction, lymph duct injury, failure of mesenteric leaves to fuse, pelvic surgery, and pelvic inflammatory diseases have been reported [4]. Mesenteric cysts can develop anywhere in the gastrointestinal mesentery, most commonly in the ileal mesentery, but also along the digestive tract or into the retroperitoneum [4, 6].

Mesenteric cysts can occur throughout the mesentery of the gastrointestinal tract, from the duodenum to the rectum. A review of 162 patients found that 60% of mesenteric cysts were located in the small-bowel mesentery, 24% in the large-bowel mesentery, and 14.5% in the retroperitoneum, while the location was unspecified in 1.5% of cases. Specifically, these cysts are more commonly found in the ileal mesentery of the small intestine (67%) and the mesocolon (33%) [9].

The inflamed mesenteric pseudocyst was closely associated with Meckel's diverticulum, which showed signs of chronic inflammation. Although no overt perforation of the diverticulum was observed in our patient, it is hypothesized that repeated episodes of diverticulitis contributed to the development of the pseudocyst [8, 9]. Chronic inflammation likely led to the exudation of inflammatory fluids, which became encapsulated, forming a fibrous-walled pseudocyst. This connection was evident in the proximity of the pseudocyst to the diverticulum and the shared inflammatory process.

The final pathohistological diagnosis in our patient reveals a mesenteric abscess, pseudocyst, acute exacerbation of chronic enteritis, diverticulitis, and acute mesenteric lymphadenitis, reflecting the complexity of the patient's condition. The presence of diverticulitis suggests inflammation of Meckel's diverticulum, which can cause significant complications [6, 7]. This case underscores the need to consider Meckel's diverticulum in the differential diagnosis of acute abdominal conditions and the potential necessity for advanced imaging for accurate management [8].

Diagnosing Meckel's diverticulum preoperatively is challenging, often leading to incorrect or missed diagnoses. Laparoscopy is the preferred diagnostic method in unclear cases. Autopsy series show that heterotopic mucosa or surgically resected Meckel diverticula occur in 15% to 45% of cases, including both incidental and symptomatic patients. The ectopic gastric mucosa is the most common (57%), with less frequent occurrences of duodenal, colonic, pancreatic, and hepatobiliary tissues [4, 6].

Meckel's diverticulum can present as painless rectal bleeding, especially if gastric mucosa causes peptic ulceration, and can be identified by technetium-99m scanning, CT, MRI, or native plain radiography. In

cases of complications like pseudocyst formation, these imaging modalities, along with ultrasound, may assist in diagnosis [10].

In this case, no perforation of the Meckel's diverticulum was observed. The formation of the mesenteric pseudocyst is attributed to chronic inflammation associated with Meckel's diverticulitis, rather than perforation. Chronic inflammatory processes can lead to the accumulation of inflammatory fluids and tissue exudates, which may encapsulate over time, forming a fibrous-walled pseudocyst [10]. This process can occur due to ongoing irritation or inflammation of surrounding tissues, even in the absence of a clear perforation. The inflammatory response can induce changes in the local tissue architecture, facilitating the formation of a cystic structure. Thus, while perforation can contribute to pseudocyst formation, it is not a prerequisite. In this case, the chronic inflammation associated with Meckel's diverticulitis was likely sufficient to create the conditions necessary for the development of the mesenteric pseudocyst [11].

Patients with abdominal masses resembling pseudocysts undergo ultrasonography, CT, or MRI. Ultrasound reveals cystic formations with internal echoes, while CT and MRI assess size, shape, tissue quality, organ relations, vascularization, and topography [2, 6]. Meckel's diverticulum is notoriously challenging to visualize using contrast radiology [10].

Open surgery is standard for cyst removal, but laparoscopic techniques are increasingly preferred [12, 13]. The surgical approach to Meckel's diverticulum can vary based on its morphology and anatomical characteristics [14, 15]. Traditionally, management has involved laparotomy with options such as simple diverticulectomy or segmental ileal resection, which remain common procedures for MD. Recent advancements in laparoscopic techniques have improved diagnosis and treatment, offering excellent cosmetic outcomes, shorter hospital stays, and less postoperative pain. Two laparoscopic procedures are frequently used: the trans-umbilical laparoscopic-assisted diverticulectomy, which allows the diverticulum to be exteriorized through the navel for an outside abdominal procedure, and a three-port laparoscopic approach utilizing an endoscopic linear stapler-cutting device [15]. In our case, we opted for an open laparotomy approach, which is consistent with traditional surgical management for Meckel's diverticulum, allowing for direct access and evaluation of the condition [15, 16].

Excision or enucleation is common, though local organ resection may be required. Meckel's diverticulitis is rarely found with mesenteric pseudocysts and is often overlooked in reports. Persistent Meckel's diverticulum can lead to pseudocyst formation due to frequent inflammation. This inflammation may exacerbate diverticulitis and increase the risk of developing mesenteric pseudocysts [16, 17].

This case underscores the importance of considering Meckel's diverticulitis as a potential underlying cause in the differential diagnosis of mesenteric pseudocysts. Given the non-specific clinical presentation and the potential for chronic inflammation to exacerbate this condition, early recognition and accurate diagnosis are crucial for optimal patient outcomes. This report adds to the limited literature on the association between Meckel's diverticulum and mesenteric pseudocysts, providing valuable insights that can guide future clinical evaluations and surgical interventions [17, 18].

4. Conclusion

In conclusion, this case underscores the importance of considering Meckel's diverticulitis in patients with mesenteric pseudocysts, contributing valuable insights to the understanding and management of this rare association. The co-occurrence of Meckel's diverticulitis may suggest a pathophysiological link where pseudocysts could trigger subsequent episodes of acute diverticulitis. Surgical resection of the involved segment, including the mesenteric pseudocyst, is necessary. A comprehensive understanding of Meckel's diverticulum's embryological, clinical, pathologic, and radiologic features is crucial for early and accurate diagnosis.

Acknowledgment

I would like to thank Peco Lavcanovski, an art designer, for his valuable contribution in creating the hand-drawn illustrations for Figure **1** and part of Figure **4** located at the top right, which clearly depicts the surgical incision location.

Statement of Ethics

Written informed consent was obtained from the patient.

Ethical Approval

Ethical approval was not required according to hospital policies. Ethical approval for this study was exempted by the Clinical Hospital Committee according to the hospital's policies. As per the guidelines, ethical approval was not required for this type of study, and thus no decision number or specific date was issued.

Patient Informed Consent Statement

Written informed consent was obtained from the patient for the publication of this case and any accompanying images. All identifying data from the images were deleted to ensure patient confidentiality.

Conflict of Interest

The authors declare that there is no conflict of interest.

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Author Contribution

Stefan Talev (main surgery operator) provided therapeutic intervention and supervision, contributed to conception, literature reviews, and writing of the abstract. Maja Avramovska contributed in writing of the manuscript, introduction and discussion, realizing of idea, Corel draw and Photoshop editing, spelling and grammar. Petar Avramovski, corresponding author, the main coordinator of this manuscript, contributed to design, conception, literature review and writing of the manuscript, critical review, review and revision of the manuscript. Zorica Nikleski, provided English language revision, included refining the text for natural language flow, correcting spelling and grammatical errors, and enhancing overall readability. Tamara Ivkovska was histopathology analyzation, interpretation of histopathology images, and discussion for histopathology. Biljana Taleva was surgery consultant, looking for the references, interpretation of surgery procedure, control of discussion, and supervision. Kosta Sotiroski contributed in editing, spelling, grammar, literature review, critical review and supervision of the manuscript. Vesna Siklovska contributed as radiologist in reading, analyzing and interpreting of CT images, performing and detecting all image procedures, before and after chirurgic intervention. Irena Trajcevska checked and revised all radiology findings, contributed in analyzing CT images, and post-processing edition of images. Aleksandra Servini described the surgery technique, wrote diagnostic findings and discussion part, contributed to interpreting CT images. All the authors agreed on the final manuscript.

Data Sharing Statement

The data supporting the findings of this case report are included in the manuscript. Due to the sensitive nature of patient information, additional data will not be made publicly available to protect patient confidentiality. Any specific data requests will be considered on a case-by-case basis, subject to ethical considerations and privacy concerns.

Artificial Intelligence (AI) Disclosure Statement

AI-unassisted work.

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