


CASE REPORT

Intestinal obstruction due to ligament arising from the distal end of Meckel's diverticulum: A case report

Van Chuc Dang¹  | Phan Ninh Tran^{2,3} | Minh Canh Tran⁴ | Van Thuc Pham⁵ | Thi Tuyet Nga Nguyen⁶

¹Pediatric Department, Hai Phong University of Medicine and Pharmacy, Neonate Department of Haiphong Children's Hospital, Hai Phong, Vietnam

²Imaging Diagnosis Department, Vietnam National Hospital of Pediatrics, Hanoi, Vietnam

³Imaging Diagnosis Department, Thai Nguyen University of Medicine and Pharmacy, Thai Nguyen, Vietnam

⁴Pediatric Surgery Department, Hai Phong Children's Hospital, Haiphong, Vietnam

⁵Department of Pathophysiology–Allergy–Immunology, Hai Phong University of Medicine and Pharmacy, Hai Phong, Vietnam

⁶Imaging Diagnosis Department, Hai Phong Children's Hospital, Hai Phong, Vietnam

Correspondence

Van Chuc Dang, Head of Department of Pediatrics, Hai Phong University of Medicine and Pharmacy, 72A, Nguyen Binh Khiem, Ngo Quyen, Hai Phong, Vietnam.

Email: dvchuc@hpmu.edu.vn

Abstract

Intestinal obstruction due to ligament (fibrous band) arising from the top of Meckel's diverticulum is a rare cause. To date, in the world, only a few cases have been reported and there are not enough statistics on the incidence of this disease. This case presentation will help doctors working in the field of pediatric surgery or of pediatric imaging diagnosis have more experiences on diagnosis and treatment, and enrich the medical literature on this rare disease. We report a case of an 8-year-old boy with intestinal obstruction due to ligament arising from Meckel's diverticulum with complete data set such as clinical manifestations, imaging diagnosis (ultrasound, unprepared abdominal x-ray, computerized tomography scanner with contrast injection), surgical information, and histopathological findings. Intestinal obstruction due to the ligament arising from the apex of Meckel's diverticulum is an extremely rare disease and has asymptomatic imaging features so the preoperative diagnosis is only based on the indirect findings of computerized tomography scanner. The early diagnosis of an intestinal obstruction due to fibrous band can be made by using imaging methods such as ultrasound, unprepared abdominal x-ray, computerized tomography scanner with contrast injection, contributing to the prompt diagnosis in order to avoid serious complications including bowel necrosis, intestinal perforation, and perforated diverticulum.

KEYWORDS

Hai Phong Children's Hospital, ligament, Meckel's diverticulum, obstruction

1 | INTRODUCTION

Meckel's diverticulum is a common congenital malformation of the small intestine. However, it is very difficult to be diagnosed except for the presence of its complications. Complications related to Meckel's diverticulum include hemorrhage, intestinal obstruction, and diverticulitis.¹

The small intestinal obstruction due to ligaments (fibrous bands) starting from the Meckel's diverticulum is a really rare cause.^{1,2} In the past, the preoperative diagnosis of Meckel's diverticulum was very difficult, but today thanks to technical advances and qualifications of doctors in the field of imaging diagnosis, its preoperative diagnosis has become much easier, contributing to the prompt

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diagnosis to avoid its serious complications. Similarly, the early detection based on imaging diagnosis methods and prompt surgical intervention provide a good prognosis for patients. In this study, we present a case of an 8-year old boy with an intestinal obstruction due to ligaments deriving from the Meckel's diverticulum with a comprehensive data set of clinical course, imaging diagnosis, (ultrasound, unprepared abdomen x-ray, computerized tomography scanner with contrast injection), histopathologic descriptions, and surgical information. The research results will provide precious experience for doctors, especially young ones in the diagnosis and treatment for one of the emergency abdominal diseases in children.

2 | RESEARCH METHOD

A case report study was conducted in April 2022 at Hai Phong Children's Hospital, Vietnam.

3 | CASE PRESENTATION

An 8-year-old boy having crampy and intermittent abdominal pain vomited in the morning. Therefore, he was taken to the emergency room of our hospital. On admission, we found that he was healthy in his antecedent and had no history of operation. The patient had severe and intermittent pain in the left abdomen, around the umbilicus, vomited a lot with food and fluid particularly after eating, and exhibited no bowel movement. On physical examination, we found that the patient was conscious, his abdomen was moderately distended, his right iliac fossa was in pain when pressed, his abdominal reaction was negative, and he had no fever. His blood test showed elevated white blood cell count (12.7 g/L); other blood tests gained normal values.

Abdominal ultrasound showed that intestinal loops in the right iliac fossa were dilated 28 mm, thin wall, and reduced peristalsis. It is difficult to detect the transition of small and large bowels, fluid among intestinal loops was found, the thickest part was 14 mm in size. The appendix was 5.8 mm in diameter, filled with air in its lumen, and there was no fat infiltration around it. These abdominal ultrasound findings were suggestive of intestinal obstruction.

Unprepared abdomen x-ray showed that air fluid levels were concentrated in the middle of the abdomen, high air dome, narrowed base, and no air in the rectum, suggesting an intestinal ileus (Figure 1).

Computerized tomography scanner with contrast injection showed that the small bowel loops were dilated 31 mm and contained feces. In the iliac fossa, an intact headed structure at the jejunum part was suspected to be Meckel's diverticulum that was filled with fluid, but

was not infiltrated by fat around it. At the transition of the small and large bowel next to Meckel's diverticulum, above intestinal loops were dilated while below intestinal loops collapsed. Fluid was found among intestinal loops and at the pouch of Douglas. The appendix was normal. These imaging findings suggested an intestinal obstruction due to fibrous band arising from the distal apex of Meckel's diverticulum (Figure 2).

Laparoscopic surgery revealed jejunal obstruction at the right iliac fossa due to fibrous bands starting from the top of Meckel's diverticulum and adhering to the posterior wall of the abdomen, causing the strangulation of several ileum loops without ischemia or small bowel necrosis. Both ligament (fibrous bands) and Meckel's diverticulum were operated at the same time, thus liberating the obstructed intestinal loop (Figure 3). The diverticulum was affirmed to be Meckel's diverticulum through histopathologic findings.

On histopathological specimen cut from a hematoxylin-eosin stained sample, the diverticulum was congested and bleeding. The mucosa was composed of single columnar glands, filled with mucosa that was infiltrated by chronically inflammatory cells, the lesions spread to the submucosa (Figure 4). The pediatric patient was discharged from the hospital at postoperative day 8 in healthy condition.

4 | DISCUSSION

Meckel's diverticulum was first named after Johann Friedrich Meckel, who described for the first time its features of embryonic origin in 1809. This is a congenital

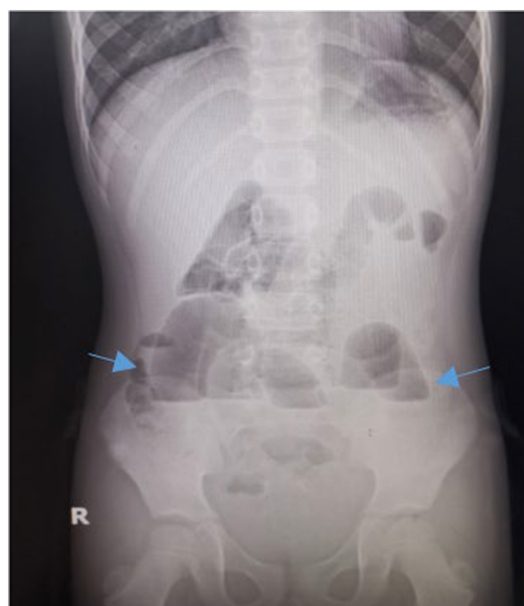


FIGURE 1 Unprepared abdomen x-ray: air fluid level (blue arrow).

FIGURE 2 Computerized tomography with contrast injection: (A) Diverticulum (blue arrow); transition (orange arrow). (B) Appendix (blue arrow); intestinal loops were dilated and filled with feces (orange arrow).

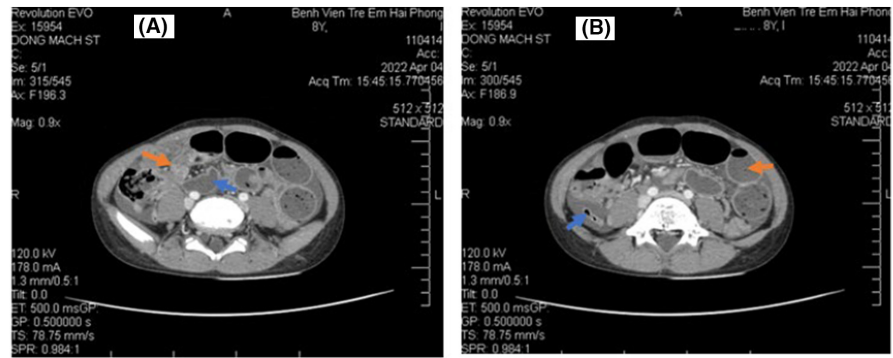


FIGURE 3 The images during laparoscopic surgery. (A) Ligament (fibrous bands) (blue arrow); intestinal loop strangulated (white arrow). (B) The image of Meckel's diverticulum after removing the ligament (green arrow).

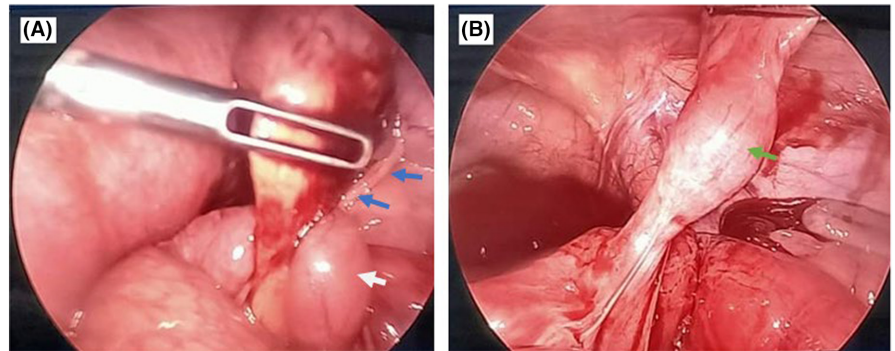
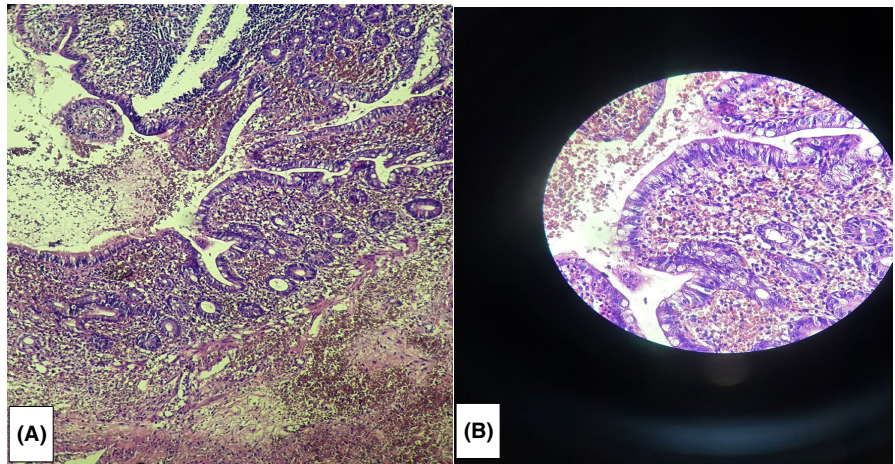


FIGURE 4 Histopathological findings of chronic and hemorrhagic Meckel's diverticulitis. (A) Chronic and hemorrhagic Meckel's diverticulitis on HE 10 \times . (B) Chronic and hemorrhagic Meckel's diverticulitis on HE 40 \times .



malformation of the intestine accounting for 1%–3% of entire population with a male/female ratio of 2:1.^{1,2} Meckel's diverticulum is a remnant of the yolk sac (umbilical intestinal duct). This canal will disappear at the seventh week of pregnancy, but this process occurs incompletely, and the yolk sac will leave abnormal remnants such as umbilical intestinal cyst, intestinal umbilical cord, intact intestinal canal and Meckel's diverticulum. Among them, Meckel's diverticulum is the most frequently encountered, representing approximately 90% (Figure 5).

The common complications of Meckel's diverticulum include hemorrhage, intestinal obstruction, and diverticular inflammation.¹ Diverticular hemorrhage often peaks in children less than 2 years old while intestinal

obstruction occurs the most in older children or adults.³ The causes of intestinal obstruction due to Meckel's diverticulum can be^{4,5}:

1. Intestinal volvulus around the Meckel's diverticulum with fibrous cord.
2. Adhesion (diverticular fibrous cord as an adherent cord or diverticulitis causing intestinal adhesions).
3. Intestinal intussusception due to Meckel's diverticulum entering the lumen or because the diverticulum may be inverted into the lumen of ileum when mesenteric fat of the diverticulum is pulled in.
4. Inside hernia passes between the blood vessels supplying the diverticulum and the mesentery.

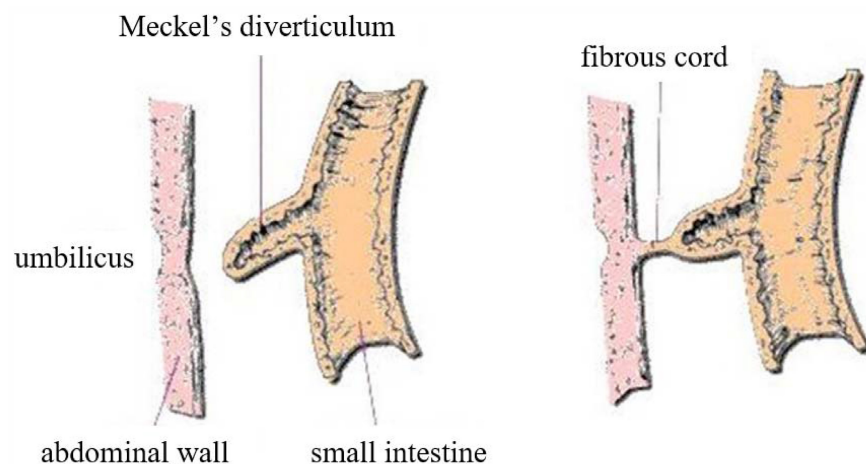


FIGURE 5 The illustration of Meckel's diverticulum and fibrous cord.

5. Because the distal end of the Meckel's diverticulum is long and vivid, it can herniate into any segment of the abdomen such as inguinal duct (Littre's hernia), femoral canal (De Garengeot), umbilicus (Spigelian hernia). (An aponeurotic fascia pushes through a hole in the junction of the linea semilunaris and the arcuate line.)
6. Due to Meckel diverticulum's adhesion to the posterior wall of the abdomen.
7. Due to fibrous band of the diverticulum connecting to the umbilicus or the mesentery or the posterior wall of the abdomen or due to the distal end of Meckel's diverticulum adhering to the mesentery.

An intestinal obstruction due to fibrous bands of the diverticulum is a very rare cause. The yolk sac is nourished by two arteries. When one of the two arteries is degenerated, the yolk sac will be atrophic, and the remaining artery will develop into the superior mesenteric artery. When one of the two arteries of the yolk sac is not degenerated, this artery will develop into fibrous bands covering the greater omentum or the fibrous bands of the diverticulum (ligament). These fibrous bands often elongate from the top of Meckel's diverticulum to the bowel mesentery or the posterior wall of the abdomen and cause an intestinal obstruction.⁶

Similarly, in our case, the obstruction is caused by the entrapment of the loop of the ileum due to fibrous bands (ligament) arising from the apex of Meckel's diverticulum and adhering to the posterior abdominal wall.

Today, many imaging diagnosis methods are used to diagnose Meckel's diverticulum.^{4,7,8} For instance, on ultrasound, in the lower right quadrant, an intestinal loop-like structure with thin or thick wall, similar to that of the inflammation situation can be seen. This structure has a distal end and the other end connected to the intestine and is fully filled with air or fluid. A peripheral fatty infiltration, a diverticular-intestinal intussusception or an intestinal obstruction or much air in the abdominal cavity

can be observed. A plain x-ray of unprepared abdomen is worthless in the diagnosis of Meckel's diverticulum, but stones, air fluid levels (intestinal obstruction), or free air (diverticular perforation) can be seen. Computerized tomography scanner with contrast injection can be used in case of uncomplicated Meckel's diverticulum that is difficult to differentiate with normal intestine. However, Meckel's diverticulum shows a structure being fully filled with air fluid, having a terminal end and another end continuing with the intestine. The high incidence of Meckel's diverticulum was found in the case of its complication.³ Complications of Meckel's diverticulum are as follows: inflammation or obstruction, diverticular-intestinal intussusception intestinal ischemia, intestinal necrosis, fecal stone or foreign body in Meckel's diverticulum, cancerous mass, free air in the abdominal cavity in the case of diverticular perforation, free fluid in the abdominal cavity.

Apart from those above mentioned methods, there are other less often used imaging diagnosis methods, such as x-ray of the abdomen, magnetic resonance imaging, single-photon emission computerized tomography scan, digital subtraction angiography, and 99m-technetium.

Among patients who were accidentally found to have Meckel's diverticulum on imaging diagnosis without complications, the problem of diverticulectomy is still controversial. For those with complicated Meckel's diverticulum, the treatment principle is the medical resuscitation and laparoscopic or open surgery to remove Meckel's diverticulum, fibrous bands (if having), and release the strangulated intestinal part. When diagnosed promptly, the prognosis of Meckel's diverticulum will be pretty good and the mortality only occupies 1%.⁵

5 | CONCLUSION

The preoperative diagnosis of Meckel's diverticulum and its complications are very difficult because clinical signs and

symptoms are very similar to that of abdominal emergencies. However, due to technical advances and doctors' qualifications in the field of imaging diagnosis, the preoperative diagnosis of Meckel's diverticulum becomes easier, contributing to the prompt diagnosis and avoiding severe complications. The diagnosis of intestinal obstruction due to Meckel's diverticulum is mainly based on indirect signs or symptoms on the computerized tomography scanner such as Meckel's diverticulum picture, the transition next to Meckel's diverticulum, and no other causes of intestinal obstruction.

AUTHOR CONTRIBUTIONS

Van Chuc Dang: Conceptualization; formal analysis; investigation; methodology; project administration; supervision; validation; writing – original draft; writing – review and editing. **Phan Ninh Tran:** Data curation; formal analysis. **Minh Canh Tran:** Data curation; formal analysis. **Van Thuc Pham:** Conceptualization; methodology. **Thi Tuyet Nga Nguyen:** Data curation; formal analysis; methodology.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

Data will be available upon requested.

ETHICS STATEMENT

Approval for the study was obtained from the Medical Ethics Council of Haiphong University of Medicine and Pharmacy, and informed consent was obtained according to the Declaration of Helsinki.

CONSENT

Written informed consent was obtained from the patient's family to publish this case report and relating images.

ORCID

Van Chuc Dang  <https://orcid.org/0000-0001-9855-9029>

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